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NATIONAL
LABORATORY**

MARTIN MARIETTA

**ORNL Characterization of
Heavy-Section Steel Technology
Program Plates 01, 02, and 03**

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ORNL CHARACTERIZATION OF HEAVY-SECTION STEEL TECHNOLOGY
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FOREWORD

The work reported here was performed at Oak Ridge National Laboratory (ORNL) under the Heavy-Section Steel Technology Program, C. E. Pugh, Program Manager. The program is sponsored by the Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission (NRC). The technical monitor for the NRC is Milton Vagins.

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ABSTRACT

Charpy V-notch impact, tensile, and drop-weight data are presented for three 305-mm-thick (12-in.) A 533 grade B class 1 steel plates. The effects of specimen size and orientation were examined as well as the variation of properties between different plate locations and depths. Some observations based on data obtained from an instrumented Charpy testing machine are also presented.

INTRODUCTION

With the emergence of nuclear reactors as major heat sources, the U.S. electrical power industry recognized the potential of nuclear reactor systems for power generation. The two major systems that have evolved to commercial status in the United States are the boiling-water reactor (BWR) system and the pressurized-water reactor (PWR) system. Concurrent with the growth of the nuclear industry has been the increase in size of the plants themselves. This increase has resulted mainly from scaling up small systems with some modifications in pressures and operating temperatures. As a consequence, the pressure vessels of the systems have increased in diameter and thickness. The thickness of the plate for fabricating some larger pressurized water vessels approaches 305 mm (12 in.), with diameters from 4.3 to 4.9 m (14-16 ft). The typical vessel operating temperature is 288°C (550°F). Pressures range upward to around 13.8 MPa (2000 psi) for the PWR systems, whereas BWR system vessels are designed for about half that pressure. The steel plate most frequently used to fabricate these reactor vessels is A 533 grade B class 1 steel. One objective of the Heavy-Section Steel Technology (HSST) Program is to determine what information small laboratory specimens reveal about the behavior of thick-section plate.

The investigation reported herein is limited to the tensile, Charpy V-notch impact, and drop-weight properties measured by ORNL for the quenched and tempered 305-mm-thick (12-in.) ASTM A 533 grade B class 1 carbon steel plates purchased on behalf of the HSST Program.

*Retired.

MATERIAL DESCRIPTION

The materials investigated in this study were the ASTM A 533 grade B class 1 305-mm-thick plates designated as plates 01, 02, and 03 in the HSST Program. Their fabrication histories are thoroughly documented in other reports.^{1,2} All three plates were melted and processed to final product form by Lukens Steel Company.

Plates 01 and 02 measured 3.05 m (10 ft) wide by 6.61 m (21.7 ft) long by 305 mm (12 in.) thick and received their final heat treatment at Combustion Engineering, Inc. Both plates were edge quenched after austenitizing. The check analyses from Lukens and their heat treatment at Combustion Engineering are given in Tables 1 and 2, respectively. Lukens was permitted to use its DATA-TRAK testing method³ to perform prequalification tests on the "as-rolled" plates 01 and 02 to assure that both plates would meet the ASTM A 533 grade B class 1 tensile properties after heat treatment by Combustion Engineering. This method was used in lieu of the "3T" test specified in A-533-67. The results from the Combustion Engineering qualification tests are presented in Table 3.

Plate 03 measured 3.05 m (10 ft) wide by 6.10 m (20.0 ft) long by 305 mm (12 in.) thick. This plate was flat quenched and received its final heat treatment at Lukens Steel. The check analyses for the plate and the heat treatment are also described in Tables 1 and 2. The qualification tests by Lukens after heat treatment were more detailed and are presented in Tables 4 and 5. Removal of the coupons for these tests by flame cutting was the reason for the additional stress relief at 552°C (1025°F) indicated in Table 2 for this plate. The through-thickness variation of the chemical compositions for all three plates is given in Table 6 together with the chemical composition requirements for ASTM A 533-67 grade B steel. The chemical analyses given in Table 6 were performed at ORNL on material from the plate sections listed. The location of the plate sections to be discussed are shown in Fig. 1. The maximum carbon level permitted in the heat analysis appears to have been exceeded at various depths in the product analysis made in all three plates. Further, the maximum nickel allowed was either equaled or exceeded in the plate section 01K region.

Table 1. Composition of 305-mm-thick (12-in.) ASTM A 533 grade B class 1 steel plates

Plate	Check analysis ^a (wt %)									
	C	Mn	P	S	Si	Ni	Mo	Cr	Cu	Al
01	0.22	1.48	0.012	0.018	0.25	0.68	0.52			
02	0.24	1.42	0.010	0.017	0.22	0.70	0.50	0.12 ^a	0.14 ^a	
03	0.20	1.26	0.011	0.018	0.25	0.56	0.45	0.10	0.12	0.034

^aORNL analyses.

Table 2. Heat treatment of 305-mm-thick (12-in.) ASTM A 533 grade B class 1 steel plates

Plate	Step	Heat treatment			
		Temperature ^a		Time (h)	Cooling
		(°C)	(°F)		
01	Normalize	927	1700	4	Air cool
	Austenitize and quench	871	1600	4	Water quench (edge)
	Temper	663	1225	4	Furnace cool
	Stress relief	621	1150	40	Furnace cool
02	Normalize	913	1675	4	Air cool
	Austenitize and quench	871	1600	4	Water quench (edge)
	Temper	663	1225	4	Furnace cool
	Stress relief	621	1150	40	Furnace cool
03	Normalize	913	1675	12	Air cool
	Austenitize and quench	857	1575	12	Water quench (flat)
	Temper	663	1225	18	Furnace cool
	Stress relief	607	1125	40	Furnace cool
	Stress relief	552	1025	12	Furnace cool

^a14°C (25°F).

Table 3. Results of plate qualification tests performed by Combustion Engineering on HSST plates 01 and 02

Plate	Lukens heat	Strength [MPa (ksi)]		Elongation (%)
		Yield	Ultimate tensile	
01	A1008-1	483 (70)	645-655 (93.6-95.0)	27
02	A1195-1	517 (75)	672-679 (97.5-98.5)	24
Spec. ^a		>344 (50)	552-689 (80-100)	>18.0

^aTensile specification for ASTM A 533 grade B class 1 steel.

Table 4. Room temperature tensile results of plate qualification tests performed by Lukens on HSST plate 03

Location in ingot	Through-gage location (t)	Specimen orientation ^a	Strength [MPa (ksi)]		Elongation (%)	Reduction of area (%)
			Yield	Ultimate tensile		
Top	Top 1/4	R	470 (68.2)	632 (91.8)	23	71.2
Top	Top 1/4	R	475 (69.0)	637 (92.5)	24	69.6
Top	Top 1/4	W	475 (68.9)	637 (92.5)	23	73.4
Bottom	Top 1/4	R	462 (67.1)	603 (87.5)	25	68
Bottom	Top 1/4	R	445 (64.6)	603 (87.5)	26	68
Bottom	Top 1/4	W	446 (64.8)	603 (87.5)	26	75
Bottom	Top 1/4	W	442 (64.2)	599 (87.0)	26	71
Top	Bottom 1/4	R	479 (69.5)	641 (93.0)	23	69.4
Top	Bottom 1/4	R	478 (69.4)	638 (92.6)	23	69.4
Top	Bottom 1/4	W	477 (69.3)	641 (93.0)	21	79.7
Top	Bottom 1/4	W	476 (69.1)	635 (92.1)	21	73.9
Bottom	Bottom 1/4	R	438 (63.6)	597 (86.6)	26	66.2
Bottom	Bottom 1/4	R	440 (63.8)	593 (86.1)	26	67.2
Bottom	Bottom 1/4	W	449 (65.2)	604 (87.6)	26	60.4
Bottom	Bottom 1/4	W	454 (66.0)	606 (88.0)	24	62.5

^aR, rolling direction; W, width direction.

Table 5. Charpy V-notch impact and drop-weight nil-ductility temperature (NDT) results of qualification tests performed by Lukens on HSST plate 03

Location in ingot	Through-gage location (t)	Specimen orientation	Charpy energy at -12°C (10°F) [J (ft-lb)]		41-J (30-ft-lb) Charpy transition temperature		Actual NDT determined by P-2 drop-weight specimens ^a		Energy at NDT		Temperature [°C (°F)] at lateral expansion	
			Mean	Range								
					(°C)	(°F)	(°C)	(°F)	(J)	(ft-lb)	0.38 mm (15 mils)	0.76 mm (30 mils)
Top	Top 1/4	Rolling Width	68 (50)	68-69 (90-51)	-20	-4	-20	0	43	32	-36 (-33)	-17 (1)
			53 (39)	53-54 (39-40)	-23	-10			47	35	-37 (-34)	-18 (0)
Top	Bottom 1/4	Rolling Width	35 (47)	41-54 (30-40)	-17	+2	-30	-20	23	17	-28 (-19)	-11 (12)
			38 (28)	31-46 (23-34)	-9	+16			23	17	-32 (-25)	-4 (25)
Bottom	Top 1/4	Rolling Width	39 (29)	20-54 (15-40)	-12	+11	-25	-10	19	14	-23 (-10)	-11 (13)
			30 (22)	27-34 (20-25)	-4	+24			24	18	-25 (-13)	-2 (28)
Bottom	Bottom 1/4	Rolling Width	52 (38)	38-61 (28-45)	-17	+2	-25	-10	22	16	-23 (-10)	-13 (9)
			37 (27)	34-41 (25-30)	-10	+14			23	17	-29 (-20)	-9 (15)

SPECIMEN LOCATION AND ORIENTATION

The location of a point in any HSST Program plate, plate section, or specimen can be described in terms of an x-y-z (Cartesian) coordinate system having its origin at one of the corners of the parent plate. The origins for the plates studied are shown in Fig. 1. The coordinate system

Table 6. Chemical constituents of 305-mm-thick (12-in.) HSST plates

Plate section	Depth in plate ^a (t)	Composition (wt %)									
		C	Mn	P	S	Si	Ni	Mo	H	N	O
01K	0	0.23	1.43	0.012	0.013	0.24	0.81	0.55	<0.0001	0.0072	0.0015
	1/8	0.22	1.41	0.010	0.014	0.23	0.83	0.52	0.0002	0.0072	0.0018
	1/4	0.23	1.44	0.010	0.015	0.23	0.84	0.54	0.0001	0.0075	0.0022
	3/8	0.23	1.45	0.015	0.012	0.24	0.77	0.56	0.0002	0.0074	0.0016
	1/2	0.26	1.24	0.021	0.012	0.24	0.73	0.55	0.0002	0.0080	0.0006
	5/8	0.26	1.18	0.017	0.013	0.23	0.74	0.56	0.0002	0.0082	0.0006
	3/4	0.26	1.38	0.021	0.014	0.23	0.84	0.53	0.0001	0.0076	0.0011
	7/8	0.24	1.30	0.016	0.014	0.23	0.80	0.53	0.0002	0.0074	0.0038
	1	0.24	1.37	0.015	0.013	0.23	0.81	0.54	0.0002	0.0069	0.053
01MU	0	0.23	1.44	0.014	0.014	0.26	0.67	0.54	0.0002	0.0084	0.0009
	1/4	0.23	1.39	0.010	0.012	0.26	0.68	0.53	0.0002	0.0075	0.0015
	1/2	0.20	1.38	0.010	0.011	0.22	0.67	0.52	0.0003	0.0070	0.0001
02FB	0	0.27	1.50	0.013	0.014	0.21	0.72	0.50	0.0002	0.0095	0.0034
	1/4	0.27	1.49	0.013	0.013	0.21	0.64	0.50	0.0002	0.0095	0.0007
	1/2	0.26	1.48	0.012	0.012	0.23	0.64	0.49	0.0003	0.0095	0.0048
03E	0	0.26	1.33	0.011	0.016	0.24	0.65	0.51	0.0003	0.0072	0.0012
	1/4	0.26	1.36	0.011	0.015	0.26	0.62	0.52	0.0004	0.0070	0.0009
	1/2	0.25	1.27	0.010	0.020	0.28	0.70	0.49	0.0003	0.0069	0.0025
	3/4	0.26	1.37	0.010	0.019	0.25	0.62	0.43	0.0004	0.0070	0.0016
	1	0.25	1.41	0.010	0.016	0.28	0.61	0.50	0.0003	0.0075	0.0012
Spec. ^b		<0.25	1.10— 1.55	<0.035	<0.040	0.13— 0.32	0.37— 0.73	0.41— 0.64			

^aFraction of thickness.^bComposition specification for ASTM A 533 grade B steel.

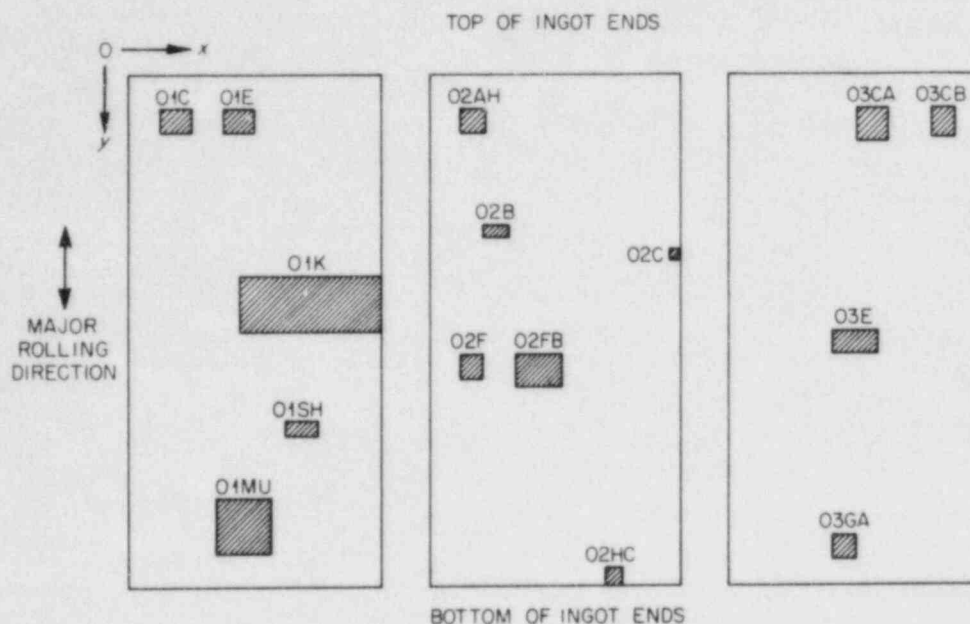


Fig. 1. Test locations in HSST plates.

axes are assigned so the y axis is parallel to the principal rolling direction and the x axis transverse. The thickness is measured along the z axis from the upper or top surface. A further detailed description may be found⁴ in HSST Program Technical or Programmatic Manuscript 1.

The coordinates are expressed in inches and eighths of an inch from the appropriate zero plane; and, by definition, the coordinates of all points carry a positive sign. The first three digits following each axis designation indicate whole inches, and the fourth digit denotes additional eighths of an inch. For example, X012-3 means 12 $\frac{3}{8}$ in. (314 mm) from the origin in the parent plate in the x direction.

Specimen orientation in the coordinate system is reported by placing an N in parentheses after the appropriate axis coordinate; for example, Y012-3 (N) indicates a longitudinal specimen and X012-3 (N) indicates a transverse specimen. Charpy specimens were notched perpendicular and parallel to the plate surface or z plane, so the fracture propagated in either the positive x , y , or z direction.

In reporting the test results, a widely used system of specifying specimen orientation in plate materials was adopted. It relates the principal directions in the original plate to the specimen fracture plane and direction of fracture propagation. The three principal directions in the original plate are designated by (1) R, the principal rolling direction; (2) W, the width direction, perpendicular to the R direction and parallel to the plate surface; and (3) T, the thickness direction, perpendicular to the surface of the plate.

A combination of two of these symbols specifies specimen orientation for most tests. The first symbol indicates the normal to the fracture plane, which is usually the major axis of the specimen, and the second symbol indicates the direction of fracture. Figure 2 illustrates this method for the specimens tested. The symbol for the normal to the fracture plane is sufficient to define the specimen orientation in the uniaxial tension tests.

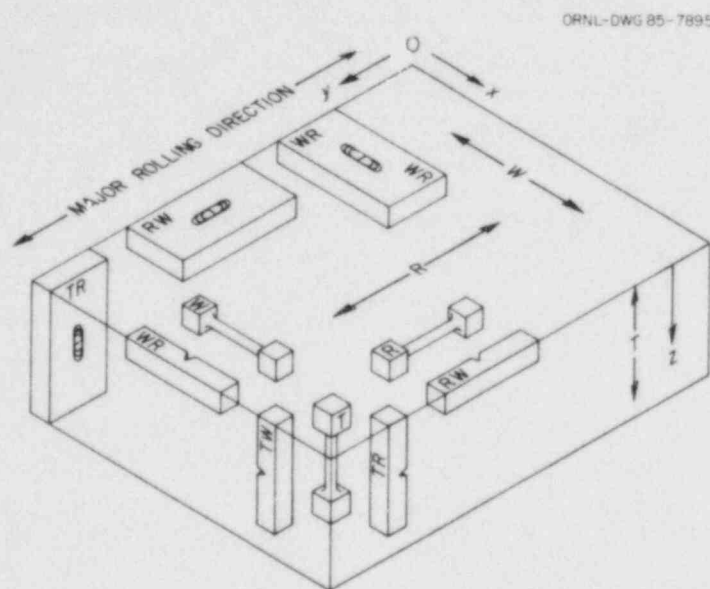
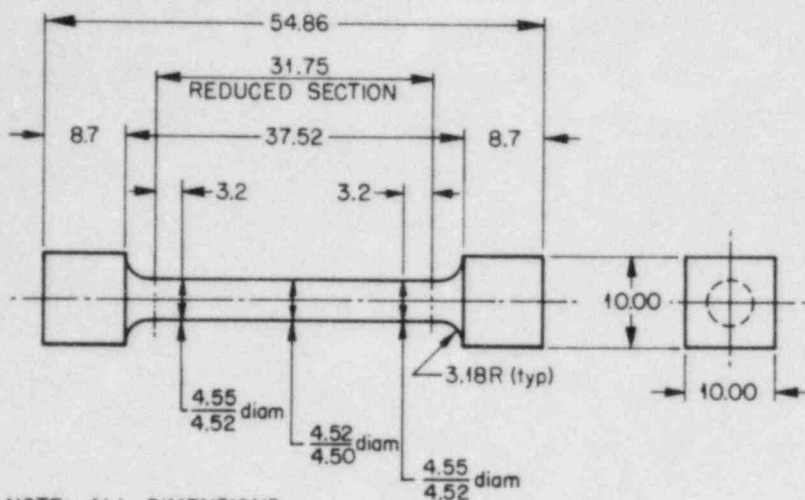


Fig. 2. Specimen orientation and nomenclature for HSST plates.

EXPERIMENTAL PROCEDURE

TENSION TESTING

Tensile tests were conducted in accordance with the requirements of ASTM Standard Method A 370-74 (ref. 5). Two sizes of specimens were used: the standard 12.8-mm-diam-gage (0.505-in.) round tensile test specimen with a 51-mm (2.0-in.) gage length and threaded ends conforming to ASTM specimen 1 (ref. 5) and a subsize tensile specimen. The subsize specimen was held in slotted grips, which applied most of the load on the smooth fillets at the ends of the gage section. Because the subsize specimen was used in irradiation experiments,⁶ the specimen design (Fig. 3) took into account requirements dictated by the irradiation capsule design, hot-cell handling, and ease of insertion into grips. This resulted in the use of the standard Charpy specimen blank for both notching and conversion to a miniature tensile specimen. The miniature tensile specimen, 4.52-mm-diam (0.178-in.) gage by 31.7-mm (1.25-in.) gage length, has a ratio of gage length to diameter (L/D) of 7; the standard specimen ratio is 4. The total elongation and total strain for $L/D = 7$ may be converted to a ratio of 4 by the following expression, which is derived in detail in Appendix A:



NOTE: ALL DIMENSIONS
IN MILLIMETERS

Fig. 3. Subsize tensile specimen machining detail.

$$e_{T,4} = 1.75e_{T,7} - 0.75e_{U,7} , \quad (1)$$

where

$e_{T,4}$ = total elongation for $L/D = 4$,
 $e_{T,7}$ = total elongation for $L/D = 7$, and
 $e_{U,7}$ = uniform elongation for $L/D = 7$.

The standard 12.7-mm-diam round tensile specimens were tested at two sites: ORNL and the Pittsburgh Testing Laboratories.

CHARPY IMPACT TESTING

Charpy V-notch impact tests were conducted in accordance with the requirements of ASTM Standard Method E 23-72 (ref. 5) on a Baldwin model S11C 325-J (240-ft-lb) impact tester meeting the supplementary requirements of paragraph 6 of ASTM E 23. The test specimen was the Charpy V-notch (ASTM type A).⁵ The impact machine was equipped with a specimen-conditioning chamber containing carbon electrodes for resistance heating, a liquid nitrogen manifold for cooling, and a spring-loaded contact thermocouple for temperature measurement. Specimens were transferred from the anvil to the temperature-conditioning chamber and back by a pneumatic piston. The specimen was located in the exact test position by three pneumatic pistons, which were activated by the retracting piston. About 3 s elapsed between removal from the temperature conditioning chamber and impact.

In addition to automating the Charpy machine, we equipped the striker with a strain gage bridge coupled to an oscilloscope and camera. The

setup allowed the load-time phenomenon to be recorded during specimen fracture for subsequent analysis. The strain gage bridge was calibrated statically in a special setup on an Instron tensile machine.

DROP-WEIGHT TESTING

Drop-weight tests were conducted in accordance with the requirements of ASTM Standard Method E 208-69 (ref. 7). Three sizes of specimens were used (ASTM types P1, P2, and P3). The drop-weight machine had a 34-kg (75-lb) weight and a maximum drop height of 5.5 m (18 ft).

The midthickness of the nonsurface drop-weight specimen $[(1/8)t$ through $(7/8)t$] was at the indicated depth in the plate with the tension surface of the specimen facing the nearer original plate surface. The tension surface of the surface specimens was the original plate surface; however, in some surface specimens an uneven plate surface was leveled by machining off less than 1.6 mm (1/16 in.).

TEST RESULTS AND DISCUSSION

TENSILE AND HARDNESS

A summary of the tensile testing of HSST plates 01, 02, and 03 is outlined in Table 7. Included are the location in the plate, the depth

Table 7. Summary of location, depth, orientation, and size of tensile specimens tested at 24, 232, 288, and 343°C

Plate section	Specimen size ^a	Specimen depth location and orientation ^b								
		0	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
01C	B	R-W		R-W		R-W		R-W		R-W
01E	A	R ^c		R ^c						
01K	A	R ^c -W	R ^c	R ^c -W-T ^c	R ^c -T ^d	R ^c -W	R ^c	R ^c -T ^c	R ^c -W	R ^c -W
	B	R-W		R-W-T	R ^d -W	R-W-T	R-W	T	R-W	R-W
01MU	A	R-W ^d		R-W ^c -T ^c		R-W ^c				
01SH	A			R						R
	B									R ^d
02AH	B	R-W		R-W						
02F	B	R-W		R-W						
02FB	A	R-W ^c		R-W ^c -T ^c		R-W ^c				
	B				R					
02HC	B	R-W		R-W		R-W		R-W		R-W
03CA	B	R-W		R-W						
03CB	B	R-W		R-W						
03E	A	R-W ^c		R-W ^c -T ^c		R-W ^c		R		R
03GA	B	R-W		R-W						

^aA denotes 12.8-mm-diam (0.505-in.) specimen; B denotes 4.52-mm-diam (0.178-in.) specimen.

^bEach letter denotes a specimen orientation (e.g., R-W-T denotes rolling direction, width, and thickness orientations); numbers above columns denote fraction of plate thickness.

^cSpecimens tested at room temperature and 288°C (550°F) only.

^dSpecimens tested at room temperature only.

and orientation, the specimen size, and the test temperature. The tensile test results from each specimen tested and the specimen coordinates are listed in Tables A.1 through A.4 of Appendix A. Included in these tables are the results from the 12.8-mm-diam-gage (0.505-in.) standard specimen, Tables A.1 and A.2, and from the 4.52-mm-gage-diam (0.178-in.) miniature specimen, Tables A.3 and A.4. The properties listed are the yield (lower or 0.2% offset) and ultimate strengths, elongations (uniform and total), and the reduction of area. Three plate orientations were investigated; the rolling direction (R), transverse to the rolling direction (W), and perpendicular to the plate surfaces (T). Four standard temperatures were used; 24, 232, 288, and 343°C (75, 450, 550, and 650°F); limited testing was done at other temperatures. Because of the multitude of tensile data, the strength results (yield and ultimate) are used as indices for comparison. In addition to determining the tensile properties over and through the three plates, data were also obtained to assess the variation of tensile properties with distance from the edge of plate 01. These data are presented in Table A.5 and the coordinates in Table A.6.

The yield and ultimate strengths at room temperature are compared at $(1/4)t$ intervals in Tables 8 and 9, respectively, for three orientations. Comparison of the results from the standard and miniature specimens shows small differences in strength at the $(1/4)t$ through $(3/4)t$ depths but greater differences at and near the surfaces. The larger differences are probably not size effects but are due to local variations in the plate in these regions. The total elongation from the miniature specimens, Table A.3, is lower than that from the standard specimens, Table A.1, because of the difference in the ratios of gage length to diameter for each specimen. If a correction is made [Eq. (1)], the total elongations of the miniature specimens appear to be the same as those for the standard specimens.

The strength properties in the longitudinal (R) and transverse (W) orientations of the three plates also show small differences and can be considered to be identical with the exception of the 01C region (see Fig. 1), where the data from the $1t$ level (back surface) show a significant difference. After reexamining the data for the $1t$ level, we believed that additional data from R-oriented specimens would have reduced this difference. Although the strength and elongation data from all three plates show little sensitivity to specimen orientation parallel to the plate surface, the reduction of area values from the longitudinal (R) orientation are higher than those from the transverse (W) direction.

The through-thickness strength sampling at location 01K from Tables 8 and 9 is shown in Fig. 4. Yield and ultimate strength results show little variation over the central 150 to 200 mm (6-8 in.) of plate thickness. Within the 50 mm (2 in.) near the plate surface, the strength increases as the surface is approached. The elongation and reduction of area values showed no significant variation with depth. The differences in strength properties are primarily due to differences in microstructure resulting from more rapid cooling near the plate surface. The cooling rate at 25 mm (1 in.) from the surface was 167°C/min (300°F/min) at 538°C (1000°F); at

Table 8. Variation of yield strength in HSST plates 01, 02, and 03,
ASTM A 533 grade B class 1 steel

Plate section	Orientation	Yield strength at various depths [MPa (ksi)]				
		0t	1t	(1/4)t	(3/4)t	(1/2)t
01C	R ^a	503 (73.0)	465 (67.4)	442 (64.1)	430 (62.4)	458 (66.4)
	W ^a	514 (74.6)	490 (71.0)	449 (65.1)	437 (63.4)	462 (67.0)
01E	R ^b	556 (80.6)		476 (69.0)		
01K	R ^b	545 (79.1)	517 (75.0)	472 (68.5)	456 (66.2)	459 (66.6)
	R ^a	551 (79.9)	536 (77.7)	475 (68.9)		464 (67.3)
	W ^b	552 (80.0)	524 (76.0)	475 (68.9)		463 (67.1)
	W ^a	547 (79.4)	538 (78.1)	476 (69.0)		465 (67.5)
	T ^b			468 (67.9)	458 (66.4)	
	T ^a			470 (68.1)	458 (66.4)	460 (66.7)
01MU	R ^b	503 (73.0)		431 (62.5)		403 (58.4)
	W ^b	503 (73.0)		423 (61.3)		400 (58.0)
	T ^b			411 (59.6)		
01SH	R ^b		410 (59.4)	445 (64.6)		
	R ^a		388 (56.3)			
02AH	R ^a	562 (81.5)		474 (68.7)		
	W ^a	558 (80.9)		472 (68.4)		
02F	R ^a	558 (80.9)		479 (69.5)		
	W ^a	549 (79.6)		481 (69.9)		
02FB	R ^b	558 (80.9)		481 (69.8)		470 (68.2)
	W ^b	556 (80.6)		476 (69.1)		475 (68.9)
	T ^b			476 (69.0)		
02HC	R ^a	553 (80.2)	508 (73.7)	450 (65.3)	445 (64.6)	426 (61.8)
	W ^a	554 (80.3)	507 (73.6)	443 (64.3)	444 (64.4)	435 (63.1)
03CA	R ^a	544 (78.9)		454 (65.9)		
	W ^a	543 (78.8)		453 (65.7)		
03CB	R ^a	520 (75.4)		449 (65.1)		
	W ^a	522 (75.7)		439 (63.7)		
03E	R ^b	544 (78.9)	527 (76.4)	463 (67.1)	459 (66.5)	453 (65.7)
	W ^b	541 (78.4)		458 (66.4)		445 (64.6)
	T ^b			456 (66.1)		
03GA	R ^a	518 (75.2)		445 (64.5)		
	W ^a	514 (74.6)		427 (62.0)		

^aData from 4.52-mm-gage-diam (0.178-in.) specimens at a strain rate of 0.016/min.

^bData from standard 12.7-mm-gage-diam (0.500-in.) specimens at a strain rate of 0.022/min.

Table 9. Variation of ultimate strength in HSST plates 01, 02, and 03, ASTM A 533 grade B class 1 steel

Plate section	Orientation	Ultimate strength at various depths [MPa (ksi)]				
		0t	1t	(1/4)t	(3/4)t	(1/2)t
01C	R ^a	623 (90.3)	600 (87.0)	591 (85.7)	578 (83.9)	609 (88.4)
	W ^a	631 (91.5)	621 (90.1)	596 (86.5)	586 (85.0)	612 (88.8)
01E	R ^a	672 (97.4)		623 (90.3)		
01K	R ^b	674 (97.8)	645 (93.6)	625 (90.7)	611 (88.6)	616 (89.3)
	R ^a	663 (96.2)	650 (94.3)	623 (90.4)		621 (90.0)
	W ^b	675 (97.9)	640 (92.8)	625 (90.6)		601 (87.1)
	W ^a	672 (97.4)	652 (94.5)	625 (90.7)		615 (89.2)
	T ^b			625 (90.6)	612 (88.8)	
	T ^a			619 (89.8)	607 (88.0)	603 (87.4)
01MU	R ^b	630 (91.4)		589 (85.4)		548 (79.5)
	W ^b	632 (91.7)		572 (82.9)		547 (79.3)
	T ^b			563 (81.7)		
01SH	R ^b		591 (85.7)	594 (86.1)		
	R ^a		605 (87.8)			
02AH	R ^a	668 (96.9)		623 (90.3)		
	W ^a	665 (96.4)		622 (90.2)		
02F	R ^a	665 (96.5)		632 (91.7)		
	W ^a	669 (97.1)		629 (91.3)		
02FB	R ^b	669 (97.0)		628 (91.1)		616 (89.3)
	W ^b	669 (97.1)		629 (91.2)		620 (89.9)
	T ^b			627 (91.0)		
02HC	R ^a	661 (95.8)	620 (89.9)	592 (85.9)	592 (85.8)	568 (82.4)
	W ^a	661 (95.8)	621 (90.1)	587 (85.1)	587 (85.1)	574 (83.2)
03CA	R ^a	658 (95.4)		608 (88.2)		
	W ^a	657 (95.3)		616 (89.3)		
03CB	R ^a	634 (91.9)		603 (87.5)		
	W ^a	638 (92.6)		598 (86.7)		
03E	R ^b	669 (97.1)	664 (96.3)	623 (90.4)	621 (90.1)	612 (88.7)
	W ^b	670 (97.2)		625 (90.6)		611 (88.6)
	T ^b			620 (89.9)		
03GA	R ^a	659 (95.6)		593 (86.0)		
	W ^a	630 (91.4)		578 (83.9)		

^aData from 4.52-mm-gage-diam (0.178-in.) specimens at a strain rate of 0.016/min.

^bData from standard 12.7-mm-gage-diam (0.500-in.) specimens at a strain rate of 0.022/min.

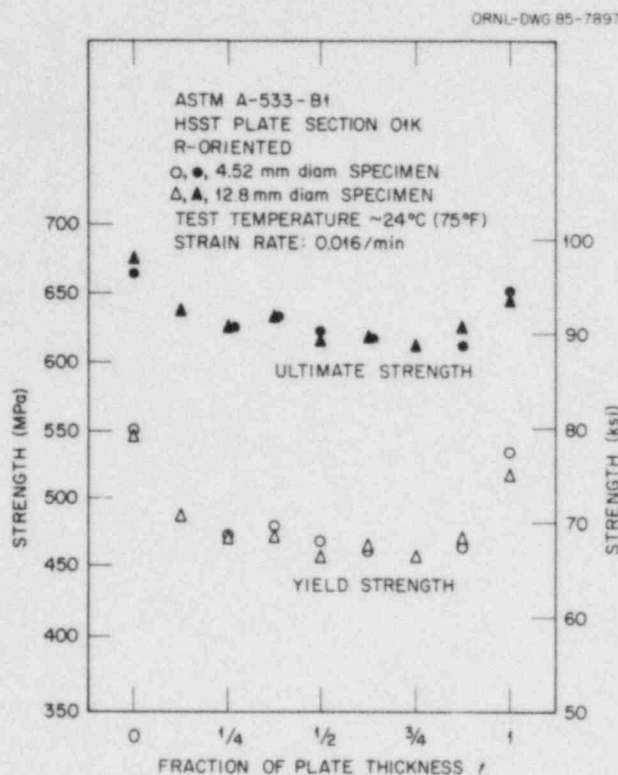


Fig. 4. Variation of through-thickness tensile strength from HSST plate 01.

midthickness, 152 mm (6 in.) depth, it was 16.7°C/min (30°F/min) at 538°C (1000°F). These cooling rates were measured in HSST plate 02, which was heat treated by the same procedure as plate 01 (ref. 1). Similar through-thickness comparisons were made at the 01C, 02HC, and 03E locations. All showed the same type of distribution, although the strength values for plate 02 appear to be somewhat lower through the central thickness portion. The elongation values also appear to be lower for plate 02. This decrease is probably due to the combined effect of the high inclusion content of the steel at midthickness and the fact that the standard specimen cross section of the 01K and 03E specimens is eight times greater than for the 02HC specimens. The tensile properties obtained for the central regions (01K, 02FB, and 03E) of the three plates are very similar. Ductility (elongation and reduction of area) values are often lower near the midthickness for reasons previously noted. Strengths for the top of the ingot end of the plate (section 01E) are about the same as for the center of the plate, both at the surface and (1/4) t depth. The strength values in plate section 01MU were significantly lower and elongations higher than for the central regions. Composition data (Table 6) indicate a lower nickel content in section 01MU than in section 01K, which may be the cause of the lower strength; however, compared with locations 02FB and 03E, the nickel content of 01MU is very nearly the same but the carbon content of

01MU is lower. Thus, the carbon content may explain the strength difference between 01MU and sections 02FB and 03E. Low tensile values were also obtained in section 01SH. A limited amount of material was available for 01SH at $(1/4)t$ and $1t$. The $(1/4)t$ strengths are intermediate between those from 01K and 01MU; however, the $1t$ (back surface) showed strengths well below any found near the surface elsewhere in plate 01. The distribution of yield strengths at various locations and depths in HSST plate 01 were shown in Fig. 5. Randall⁸ also reported low yield strengths of about 352 and 414 MPa (51 and 60 ksi) from $(3/4)t$ specimens in an area near 01MU (see dashed areas in Fig. 5). Therefore, from the data available, the strength appears to decrease as the bottom of the plate is approached and "soft spots" can occur with yield strengths 103 MPa (15 ksi) lower than those for other regions of the plate. These differences did not occur in notch impact results.

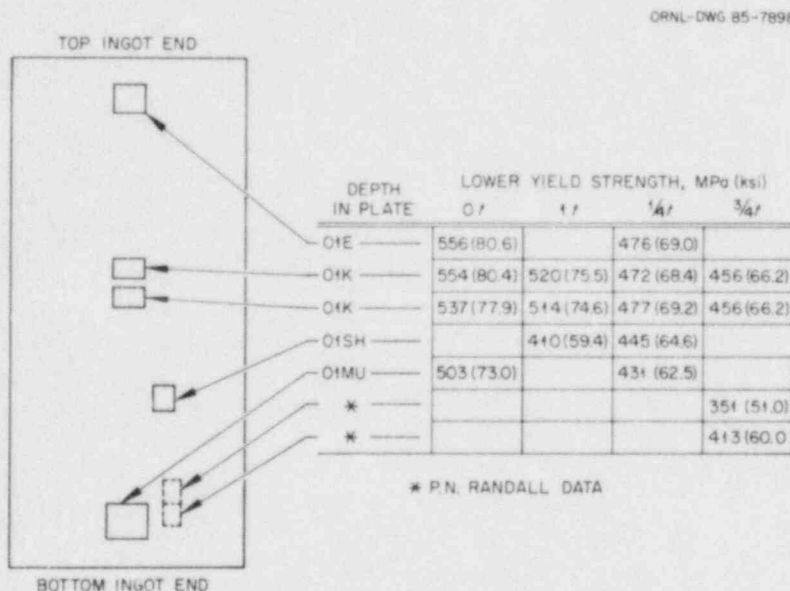


Fig. 5. Test locations in HSST plate 01. Data from Randall are from *Gross Strain Measure of Fracture Toughness of Steels*, HSSTP-TR-3, TRW Systems Group, Redondo Beach, Calif., Nov. 1, 1969.

The 01C region exhibits lower yield strengths than does nearby 01E or central 01K at both the front ($0t$) and back ($1t$) surfaces and at the $(1/4)t$ and $(3/4)t$ thickness levels but equal yield strengths at midlevel. In contrast, 01C yield strengths are equivalent to 01MU yield strengths at both surfaces and at $(1/4)t$ and $(3/4)t$ but higher at the midthickness.

The distribution of yield and ultimate strengths at room temperature near the edges of plate 01 and near midlength ($y = 115-3$ and $117-6$) are shown in Figs. 6 and 7. Figure 6 shows the variation from the X000 edge at three thickness levels [0.05 , $(1/4)t$, and $(1/2)t$], and Fig. 7 shows the

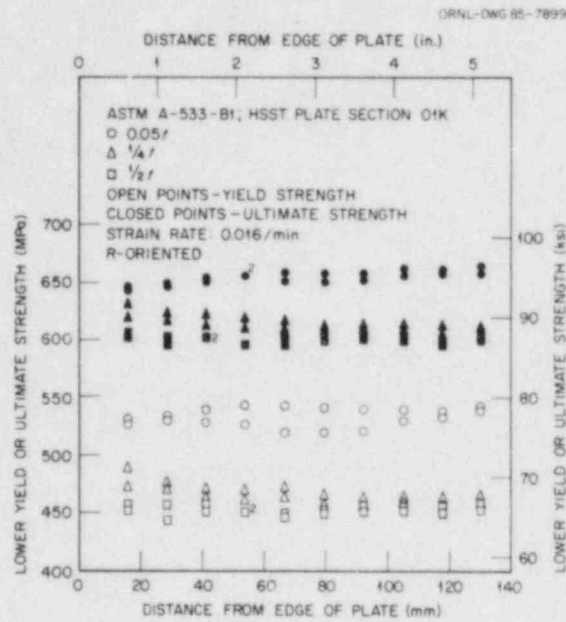


Fig. 6. Variation of tensile strength with distance from near edge of HSST plate 01 at room temperature.

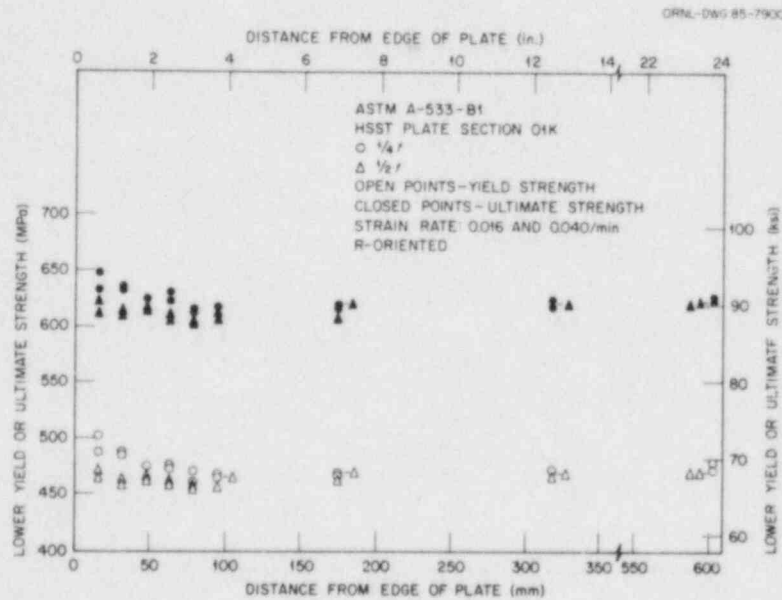


Fig. 7. Variation of tensile strength with distance from far edge of HSST plate 01 at room temperature.

variation for the same plate length, y coordinate, but from the opposite edge of the plate (X120-6). In both cases the tensile properties appear to reach fairly stable values at 100 mm ($\frac{4}{16}$ in.) from the edge. At the central depths, $(1/4)t$ and $(1/2)t$, the strengths decrease with distance from the edge of the plate, and the elongations remain generally unchanged. At the surface level, the strengths increase slightly with distance from the edge, and the elongations do not vary.

The variation of tensile properties with temperature at the $(1/4)t$ level of section 01K is shown in Fig. 8 over the range -45.6 to 343°C (-50 to 650°F). Minimums are indicated at about 177°C (350°F) for the ultimate strength and total elongation and at about 232°C (450°F) for the yield stress. The reduction of area appears to reach a maximum near 66°C (150°F).

Results of a through-thickness hardness traverse of HSST plate 01 are listed in Table 10. These data show a surface-to-surface distribution similar to that of the strength properties shown in Fig. 4.

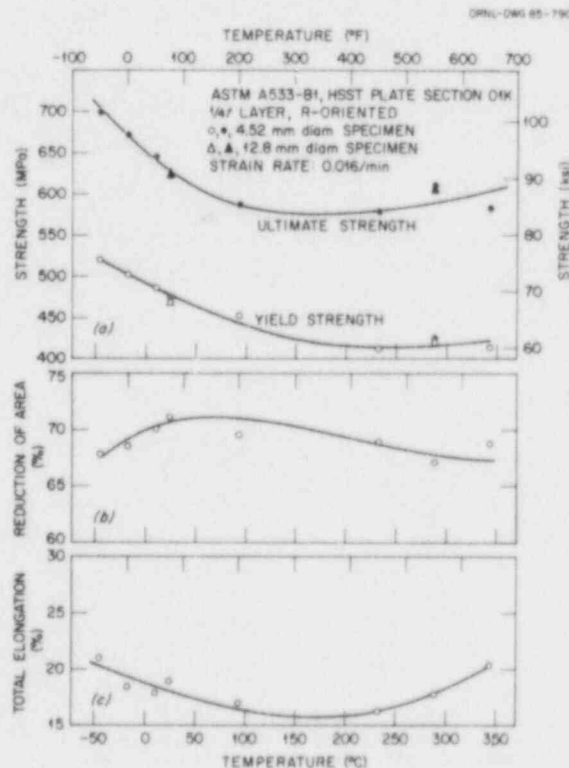


Fig. 8. Variation of tensile properties with temperature for HSST plate 01. (a) Strength. (b) Reduction of area. (c) Total elongation.

Table 10. Results of hardness traverse of HSST plate 01

Depth		Hardness ^a (R _B)	Mean deviation
(mm)	(in.)		
10	3/8	95.5	0.7
38	1 1/2	92.4	0.6
76	3	92.2	0.5
108	4 1/4	92.0	0.8
152	6	91.5	1.0
191	7 1/2	91.2	0.6
229	9	92.0	0.7
267	10 1/2	92.2	0.8
295	11 5/8	93.5	0.9

^aAverage of results of 15 tests.

CHARPY V-NOTCH IMPACT

The Charpy V-notch impact testing of HSST plates 01, 02, and 03 is outlined in Table 11. Included are the location in the plate, the depth,

Table 11. Summary of location, depth, and orientation of impact-tested Charpy-V specimens

(Each pair of letters denotes specimen axis orientation followed by fracture direction; R, rolling direction; W, width; T, thickness)

Plate section	Specimen orientations for each depth								
	0t	(1/8)t	(1/4)t	(3/8)t	(1/2)t	(5/8)t	(3/4)t	(7/8)t	1t
01C	RW-WR		RW-WR		RW-WR		RW-WR		RW-WR
01E	RW		RW						
01K	RW-WR	RW	RW-WR-TW	RW-WR RT	RW-WR TW	RW-WR	TW	RW-WR	RW-WR
01MU	RW-WR		RW-WR-TR		RW-WR				
01SH			RW						RW
02AH	RW-WR		RW-WR						
02B					WR				
02C					WR				
02F	RW-WR		RW-WR						
02FB	RW-WR		RW-WR-TR	RW	RW-WR				
02HC	RW-WR		RW-WR		RW-WR		RW-WR		RW-WR
03CA	RW-WR		RW-WR						
03CB	RW-WR		RW-WR						
03E	RW-WR		RW-WR-TR		RW-WR		RW-WR		RW-WR
03GA	RW-WR		RW-WR						

and specimen orientation. The test temperature, energy absorbed, fracture appearance, lateral expansion, and plate coordinates for each specimen tested are listed in Table B.1 of Appendix B. Two specimen orientations parallel to the plate surface were used, the rolling or longitudinal direction (RW) and transverse to the rolling direction (WR), and two specimen orientations perpendicular to the plate surface were used (TW and TR) (see Fig. 2). The results from these tests are summarized in Table 12.

The multitude of data and the resultant number of curves made it necessary to select an energy level as a "fix" in describing the position of the transition regime of the energy-temperature curve. The initial studies indicated a drop-weight nil-ductility temperature (NDT)-Charpy-V correlation energy of 44 J (32 ft-lb) Charpy energy. This value was later rounded to 41 J (30 ft-lb), which is the correlation energy widely used in the literature in reporting Charpy transition temperatures for nuclear pressure vessel steels and welds. Although both the 41-J and the 44-J energy levels were used, the drop-weight NDT-Charpy-V correlation energy varied over a considerable range, from 11 to 71 J (8-52 ft-lb), depending on plate depth. The NDT-Charpy-V correlations for HSST plates 01, 02, and 03 are compared in Table 13. The correlations were derived by locating the energy corresponding to the NDT on the appropriate energy-temperature curve. These results were then averaged for the three plates in Table 14, where the two surfaces were considered equivalent, the $(1/8)t$ and $(7/8)t$ were considered equivalent, and the $(1/4)t$ through $(3/4)t$ were considered equivalent.

A typical example of the relationship between the three specimen orientations (RW, WR, and TW) is illustrated in Fig. 9, which shows results from HSST plate 02 at the $(1/4)t$ depth. The major effect of specimen orientation was to lower fracture energies in the ductile portion of the energy-temperature curve (ductile upper shelf) for the transverse and perpendicular orientations.

Another typical example of the variation of impact properties is that with distance from the surface of the 305-mm-thick plate, shown in Fig. 10, which shows the results from HSST plate 02 at the surface, quarter thickness, and midthickness. The major effects in this case were a lower ductile upper shelf and a lower transition temperature for the surface specimens and practically no difference between the $(1/4)t$ and $(1/2)t$ specimens. The lower transition temperatures of the surface specimens were a result of the higher cooling rates near the surface of the plate during quenching.

The variation of Charpy V-notch impact energy at fixed temperatures was examined to determine the degree of scatter associated with the Charpy impact test. Specimens (RW oriented) were taken from the $(1/8)t$ depth level of plate section 01K and tested. We conducted 30 tests at -40°C (-40°F) and 10 tests at each of three additional temperatures: -6.7 , 21, and 177°C (20, 70, and 350°F). The test temperatures represented the NDT (-40°C), mid-transition (-6.7°C), transition regime (21°C), and the ductile upper shelf (177°C). These data are recorded in Table B.1 of Appendix B, and a

Table 12. Variation of Charpy V-notch impact properties of HSST plates 01, 02, and 03

Plate section	Depth in plate (t)	RW oriented				WR oriented				Miscellaneous oriented				
		Transition ^a temperature		Ductile ^b shelf energy		Transition ^a temperature		Ductile ^b shelf energy		Orientation	Transition ^a temperature		Ductile ^b shelf energy	
		(°C)	(°F)	(J)	(ft-lb)	(°C)	(°F)	(J)	(ft-lb)		(°C)	(°F)	(J)	(ft-lb)
01C	0	-90	-130	165	122	-76	-105	136	103					
	1/4	-15	5	176	130 ^c	-9	15	149	110 ^c					
	1/2	-4	25	157	116 ^c	4	40	133	98 ^c					
	3/4	-15	5	169	125	-4	25	140	103 ^c					
	1	-87	-125	169	125	-73	-100	144	106 ^c					
01E	0	-98	-145	157	116 ^c									
	1/4	-18	0	169	125 ^c									
01K	0	-98	-145	154	114	-76	-105	117	86					
	1/8	-32	-25	165	122									
	1/4	-21	-5	163	120	-7	20	132	97	TW	4	40	115	85
	1/3									RT	-26	-15	163	120
	3/8	-7	20	152	112	-1	30	122	90					
	1/2	-12	10	160	118 ^d	10	50	115	90 ^d	TW	35	95	68	50
	5/8	-7	20	163	120	4	40	125	92					
	3/4									TW	2	35	108	80
	7/8	-7	20	160	118	4	40	141	104					
	1	-93	-135	149	110	-84	-120	127	94 ^c					
01MU	0	-82	-115	169	125	-65	-85	126	93					
	1/4	-4	25	184	136	-4	25	149	110 ^c	TR	10	50	108	80 ^c
	1/2	-1	30	175	129	4	40	136	100					
01SH	1/4	-15	5	171	126 ^c									
	1	-82	-115	174	128 ^c									
02AH	0	-104	-155	157	116	-82	-115	136	100 ^c					
	1/4	-18	0	163	120 ^c	-12	10	142	105 ^c					
02B	1/2					13	55	125	92					
02C	1/2					13	55	113	83 ^c					

Table 12. (continued)

Plate section	Depth in plate (t)	RW oriented				WR oriented				Miscellaneous oriented					
		Transition ^a temperature		Ductile ^b shelf energy		Transition ^a temperature		Ductile ^b shelf energy		Orientation	Transition ^a temperature		Ductile ^b shelf energy		
		(°C)	(°F)	(J)	(ft-lb)	(°C)	(°F)	(J)	(ft-lb)		(°C)	(°F)	(J)	(ft-lb)	
02F	0 1/4	-109 -21	-165 -5	159 161	117 119 ^c	-87 -12	-125 10	132 134	97 99 ^c						
02FB	0 1/4 3/8 1/2	-87 -7 4 -1	-125 20 40 30	142 156 155 161	105 115 ^c 114 119 ^c	-76 -7 13	-100 20 55	117 132 123	86 ^d 97 96 ^c	TR	10	50	113	83 ^d	
02HC	0 1/4 1/2 3/4 1	-101 -21 -18 -18 -93	-150 -5 0 0 -135	165 172 164 178 169	122 ^d 127 121 ^c 131 ^c 125 ^c	-82 -7 -18 -9 -79	-115 20 0 15 -110	122 136 146 145 134	92 ^c 100 108 ^c 107 99 ^c						
03CA	0 1/4	-98 -9	-145 15	152 160	112 118 ^c	-87 -1	-125 30	111 134	82 99 ^c						
03CB	0 1/4	-109 -9	-165 15	159 163	117 ^c 120 ^c	-93 -4	-135 25	127 129	94 ^c 95						
03E	0 1/4 1/2 3/4 1	-90 -1 2 -4 -82	-130 30 35 25 -115	160 168 168 164 160	118 ^d 124 ^c 124 ^d 121 ^c 118 ^d	-71 4 10 -1 -76	-95 40 50 30 -105	122 126 126 132 114	90 ^c 93 93 ^c 98 ^c 84 ^d	TR	16	60	110	81	
03GA	0 1/4	-93 -1	-135 30	164 165	122 ^c 122 ^c	-79 -1	-110 30	121 140	89 ^c 103 ^c						

^aTransition temperature at 41 J (30 ft-lb).^bAverage maximum energy.^cShelf energy decreasing at highest test temperature.^dShelf energy increasing at highest test temperature.

Table 13. Correlation of Charpy V-notch impact energy
and drop-weight nil-ductility temperature (NDT)
for HSST plates 01, 02, and 03

Plate section	Depth in plate (t)	Orientation	Drop-weight NDT ^a		Charpy NDT correlation energy	
			(°C)	(°F)	(J)	(ft-lb)
01K	0	RW	-73	-100	70	52
		WR	-79	-110	38	28
	1/8	RW	-18	0	60	44
	1/4	RW	-23	-10	34	25
		WR	-18	0	27	20
		TR	-12	10 ^b	27	20 ^c
	3/8	RW	-7	20	42	31
		WR	-12	10	33	24
	1/2	RW	-12	10	38	28
		WR	-18	0	16	12
	5/8	RW	-12	10	33	24
		WR	-7	20 ^d	33	24
	7/8	RW	-29	-20	14	10
	1	RW	-79	-110	54	40
		WR	-62	-80 ^d	61	45
01MU	0	WR	-73	-100	35	26
	1/4	WR	-18	0	23	17
	1/2	WR	-23	-10	24	10
02FB	0	WR	-73	-100	43	32
	1/4	WR	-18	0	27	20
	1/2	WR	-18	0	11	8
03E	0	WR	-77	-107	34	25
	1/4	WR	-12	10	22	16
	1/2	WR	-12	10	14	10
	3/4	WR	-12	10	27	20
	1	WR	-77	-107	45	33

^aData from P-3 specimen unless otherwise specified.
The specimen types are described in ASTM E 208.

^bData from P-2 specimen.

^cTW-oriented Charpy specimen.

^dData from P-1 specimen.

Table 14. Average Charpy V-notch impact energies of HSST plates 01, 02, and 03 at the drop-weight nil-ductility temperature

Orientation	Energy [J (ft-lb)]		
	0t and 1t specimens (surface)	(1/8)t and (7/8)t specimens	(1/4)t through (3/4)t specimens
RW	62 (46)	37 (27)	37 (27)
WR	42 (31)		22 (16)
TR			27 (20)

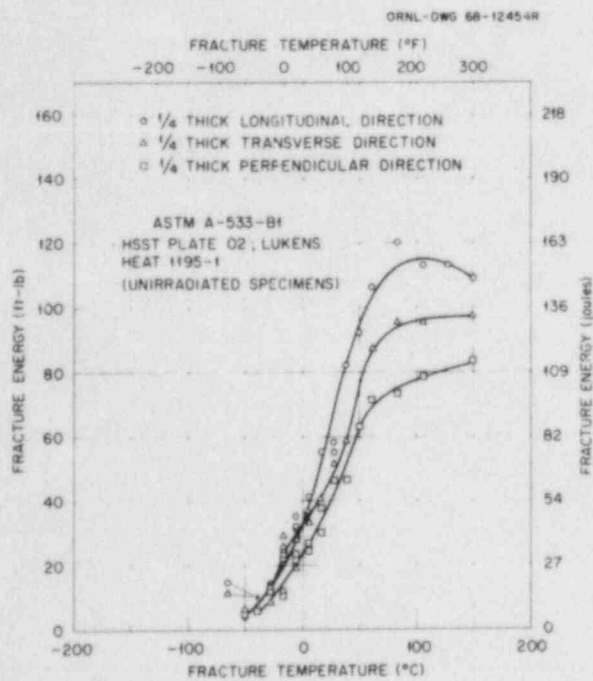


Fig. 9. Charpy V-notch impact test results for three specimen orientations at (1/4)t level in HSST plate 02.

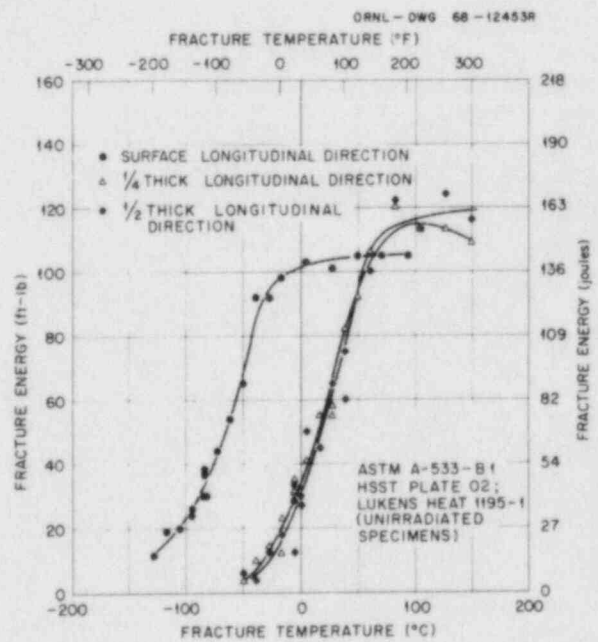


Fig. 10. Charpy V-notch impact test results for specimens from three depth levels in HSST plate 02.

statistical summary is listed in Table 15. The greatest scatter occurs at -40°C near the NDT, where the energy spread obtained could cause a deviation of 17 to 19°C ($30-35^{\circ}\text{F}$) from the average energy-temperature curve. The scatter decreases with increasing test temperature and higher energies. A similar investigation at a depth where the properties were more uniform was not performed.

Table 15. Variation of Charpy V-notch impact data at the $(1/8)t$ level in RW-oriented specimens from HSST plate 01

Number of tests	Temperature		Fracture energies [J (ft-lb)]				Deviation from average curve [$^{\circ}\text{C}$ ($^{\circ}\text{F}$)]	
	($^{\circ}\text{C}$)	($^{\circ}\text{F}$)	Maximum	Minimum	Average	Mean deviation (\pm)	Maximum energy ^a	Minimum energy ^b
30	-40	-40	54 (40)	14 (10)	31 (23)	12 (9)	19 (35)	17 (30)
10	-7	20	87 (64)	62 (46)	75 (55)	8 (6)	10 (18)	8 (15)
10	21	70	118 (87)	95 (70)	107 (79)	7 (5)	4 (8)	11 (20)
10	177	350	165 (122)	160 (118)	163 (120)	1 (1)		

^aDecrease in temperature.

^bIncrease in temperature.

The variation in toughness with proximity to the edge of the quenched-and-tempered plate was examined in the 01K region (see Fig. 1) of HSST plate 01, near midlength of the plate. We used RW-oriented specimens from the near surface ($0.03t$), $(1/4)t$, and $(1/2)t$ depth levels. The data are listed in Table B.2, and additional data are found in Table B.1. The variation of the Charpy V-notch transition temperature at 44 J (32 ft-lb) with distance from the edge of the plate for the X000 edge and the opposite edge, X120-6, is listed in Table 16 and shown in Fig. 11. A reduction in transition temperature begins at about 100 to 150 mm (4-6 in.) from the edge of the plate and increases as the edge is approached. This indicates a shift of the energy-temperature curve to lower temperatures and a general improvement in toughness. The lower transition temperatures near the surfaces are the result of the higher cooling rate during quenching.

The variation in toughness with depth was also examined in the central regions of 305-mm-thick HSST plates 01, 02, and 03 (plate sections 01K, 02FB, and 03E). Results from RW-oriented specimens using the 41-J (30-ft-lb) energy level as a criterion are listed in Table 12 and presented in Fig. 12. All three plates show similar rapid increases in the transition temperatures between the surface and $(1/4)t$; however, plates 02 and 03 appear to exhibit poorer toughnesses than plate 01 in the central depths.

Table 16. Variation of Charpy V-notch impact test results with distance from edge of HSST plate 01

Distance from edge of plate,		Depth and Charpy-V transition temperature [°C (°F)] at 44 J (32 ft-lb)			
(mm)	(in.)	0.03t	0.25t	0.50t	
From X000 edge					
12	0.05	-107 (-160)	-37 (-35)	-29	(-20)
25	1.0	-101 (-150)	-37 (-35)	-23	(-10)
38	1.5	-101 (-150)	-29 (-20)	-18	(0)
51	2.0	-98 (-145)	-26 (-15)	-18	(0)
63	2.5	-98 (-145)	-26 (-15)	-18	(0)
76	3.0	-98 (-145)	-21 (-5)	-18	(0)
89	3.5	-98 (-145)	-21 (-5)	-15	(5)
102	4.0	-98 (-145)	-21 (-5)	-15	(5)
114	4.5	-98 (-145)	-21 (-5)	-15	(5)
127	5.0	-98 (-145)	-18 (0)	-12	(10)
From X120-6 edge					
19	0.75	-101 (-150)	-51 (-60)	-37	(-35)
36	1.4	-98 (-145)	-40 (-40)	-29	(-20)
51	2.0	-96 (-140)	-34 (-30)	-20	(-5)
66	2.6	-98 (-145)			
81	3.2	-98 (-145)			
99	3.9		-26 (-15)	-23	(-10)
178	7	-101 (-150)	-21 (-5)	-18	(0)
320	12.6		-18 (0)	-6.7	(20)
607	23.9		-23 (-10)	-6.7	(20)

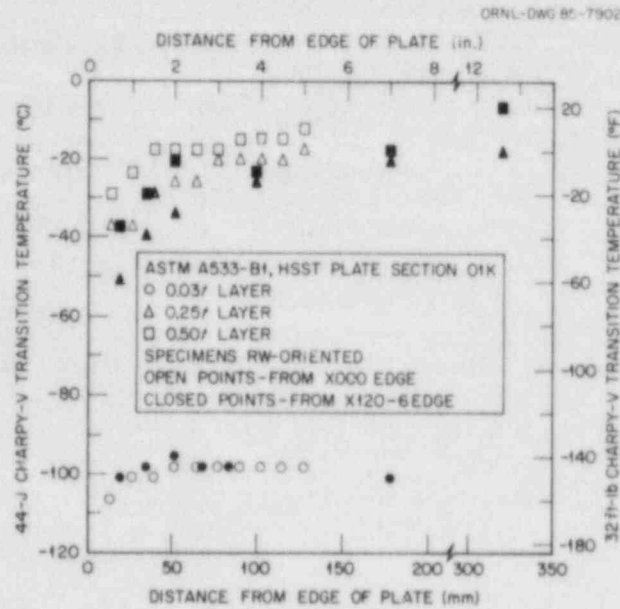


Fig. 11. Variation of Charpy V-notch impact test results with distance from edge of HSST plate 01.

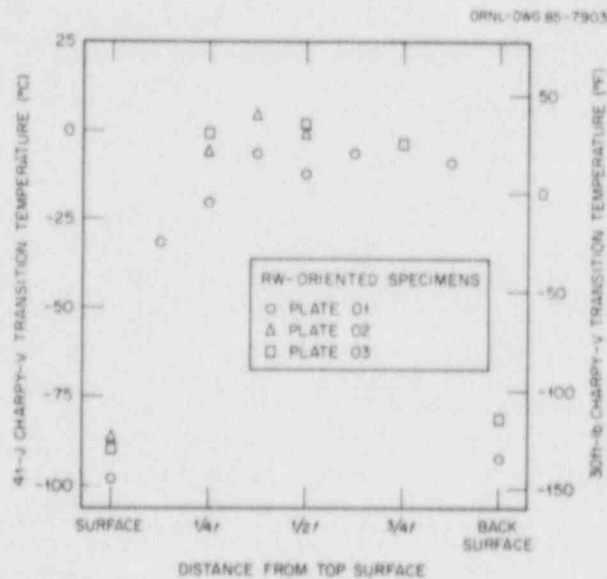


Fig. 12. Variation of Charpy V-notch transition temperature with distance from top surface of HSST plates 01, 02, and 03 at the 41-J (30-ft-lb) energy level.

A cursory examination was also made to determine the method in which fracture propagates from the notch root in a standard Charpy V-notch test. The fracture face of a Charpy V-notch impact specimen tested at -6.7°C (20°F) was examined in a scanning electron microscope (Fig. 13) to determine whether a ductile tear at the root of the notch changes directly to cleavage during impact testing at the NDT. The specimen had initiated fast fracture at a deflection of 2.03 mm (0.080 in.) and showed shear failure extending less than 0.13 mm (0.005 in.) from the notch root. The shear failure may have preceded the fast cleavage fracture. However, the cleavage failure originated at about 0.51 mm (0.020 in.) from the notch root and spread both away from and toward the notch. As may be seen, the cleavage failure proceeded about 0.13 mm toward the notch, and then there was a region of dimpled rupture. The rupture in this region from 0.10 to 0.38 mm (0.004–0.015 in.) from the notch root looked like ductile rupture in a smooth tensile bar. Therefore, for these test conditions, it appears that the cleavage failure originated within the material ahead of the notch tip and not at the tip of a ductile tear.

INSTRUMENTED CHARPY IMPACT TESTING

The variation of load with time during the impact test was recorded by use of a strain gage bridge attached to the Charpy machine striker. The system has been improved considerably since these data were obtained, especially in sensitivity and method of recording. Typical oscilloscope load-time records from a series of RW-oriented Charpy V-notch specimens of plate section 01K at the $(1/4)t$ depth are shown in Fig. 14. They reflect the decreased yield strength and increased ductility indicated by the delay of fast fracture as the test temperature was increased until fracture occurred entirely by ductile tearing at the upper-shelf temperatures. Fracture load parameters (such as general yield, maximum, fast fracture initiation, and fast fracture arrest loads) were obtained for various temperatures from these load-time traces and the results are presented in Fig. 15 and in Table C.1 of Appendix C. The initiation of fracture (pop-in) after maximum load (see Fig. 15) [10°C (50°F) test temperature] is represented by the temperature above which separate maximum and initiation of fast fracture values are obtained. At lower test temperatures [-62 through -1°C (-80 through 30°F)], the fast fracture initiation load was the highest load attained (see Fig. 14). The arrest of fast fracture load is the load at which fast fracture was stopped in the Charpy specimen when it was subjected to a strain rate imposed by the Charpy machine hammer at 5.2 m/s (17 fps). When fast fracture ceases and failure is entirely by ductile tearing, the difference between the fast fracture initiation and arrest loads will equal zero. The difference between these loads has been used to develop a method for determining the onset of the upper shelf.⁹

The energies before and after fast fracture, energy to maximum load, total energy, and the deflections to fast fracture and maximum load were also obtained from the same data. The results are shown in Fig. 16 and listed in Table C.1. The total energy is the sum of the energies before

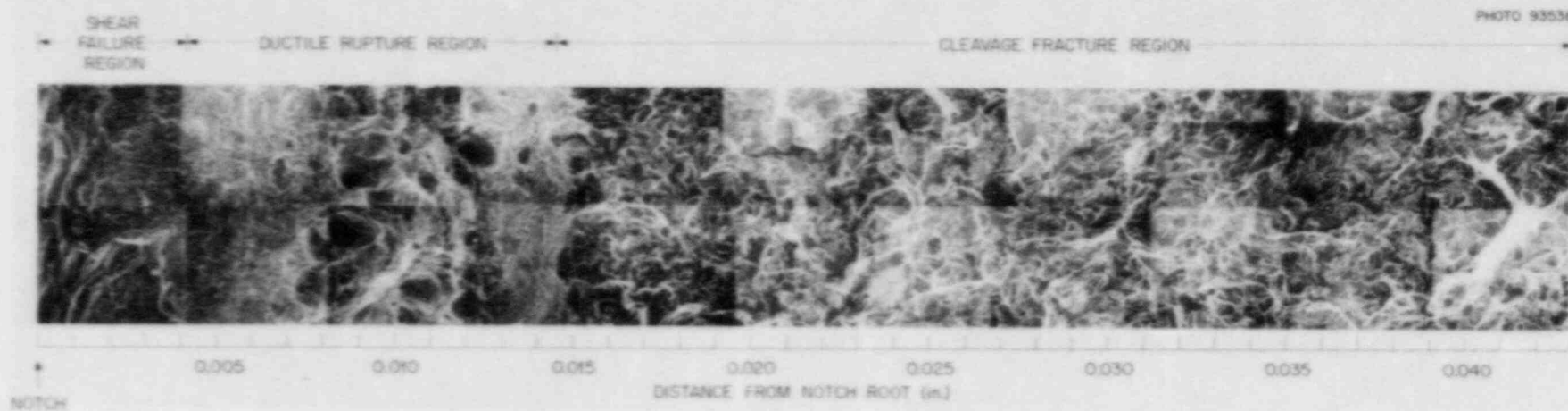


Fig. 13. Scanning electron micrographs of Charpy V-notch impact specimen 02FB-7898 [(1/4)t)]. Test temperature, -6.7°C (20°F); fracture energy, 42.8 J (31.5 ft-lb).

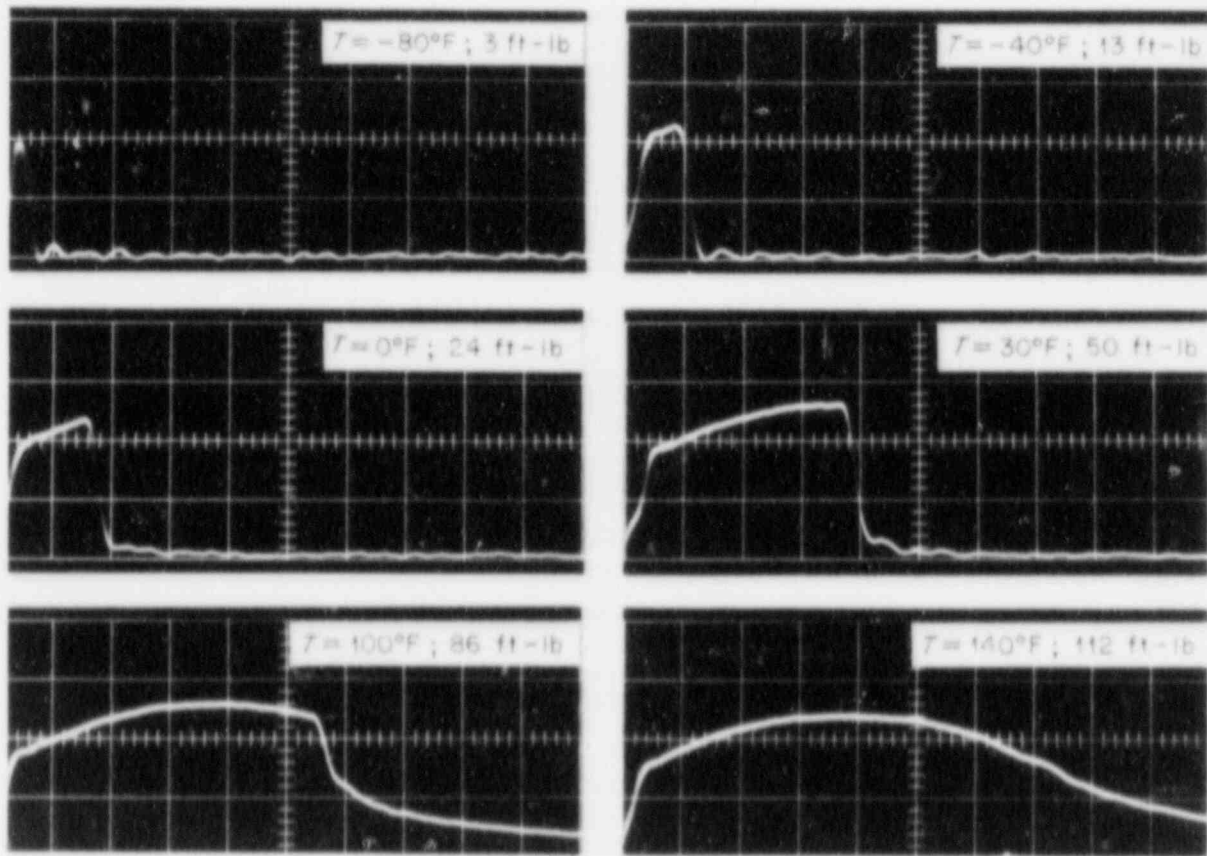


Fig. 14. Typical load-time records from instrumented Charpy V-notch impact tests on HSST plate 01, $(1/4)t$ level, RW orientation. Temperature and energies are -62°C , 4 J; -40°C , 18 J; -18°C , 33 J; -1°C , 68 J; 38°C , 117 J; and 60°C , 152 J.

and after fast fracture or the sum of the energies before and after maximum load. The temperature at which fast fracture initiates at maximum load is the intersection of the energy before fast fracture and the energy to maximum load curves. The energy required to fracture the specimen after fast fracture initiates indicates that a significant amount of work is done on the specimen, even at low temperatures (lower end of the total energy curve). This seems reasonable from fracture appearance data.

At the drop-weight NDT (noted in Figs. 15 and 16), fast fracture in the Charpy-V specimen initiates after general yielding, under rising load conditions (load initiation of fast fracture is maximum load), and at a specimen deflection of about 0.8 mm.

DROP WEIGHT

The individual drop-weight data from sections in plates 01, 02, and 03 are presented in Table D.1 of Appendix D. Two orientations were

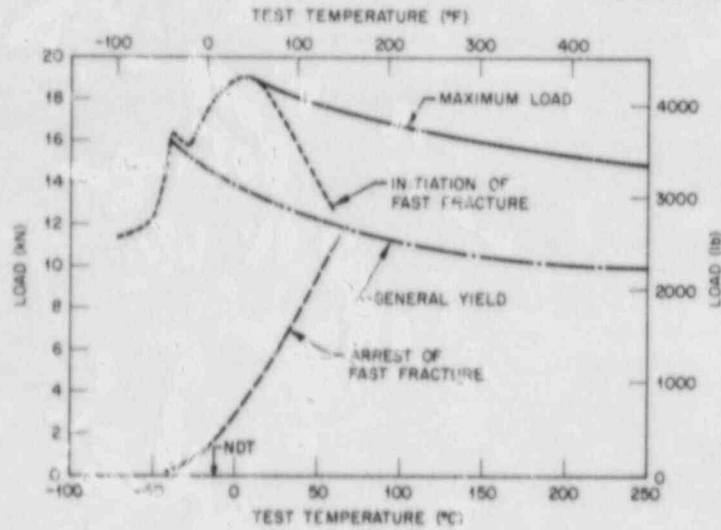


Fig. 15. Effect of temperature on various fracture load parameters determined in instrumented Charpy V-notch tests on HSST plate 01, RW orientation.

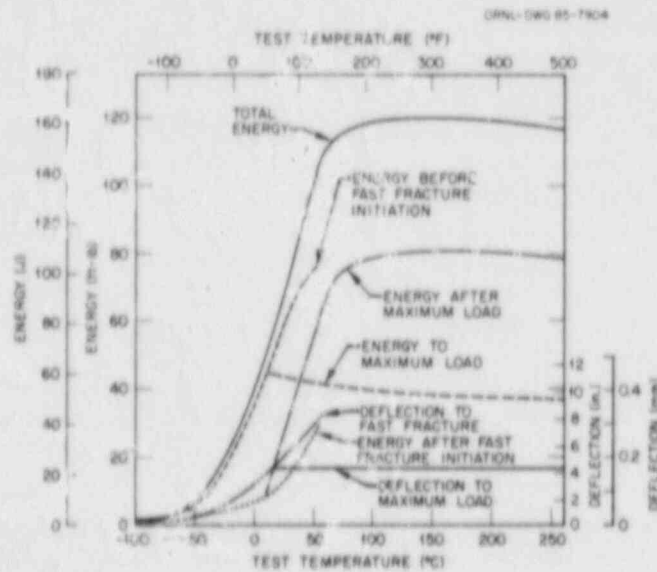


Fig. 16. Effect of temperature on various energy parameters determined in instrumented Charpy V-notch tests on HSST plate 01, RW orientation.

examined, RW and WR. Midthickness of nonsurface drop-weight specimens $[(1/8)t$ to $(7/8)t$] was at the indicated depth in the plate with the tension surface toward the nearer plate surface. The tension surface of $0t$ and $1t$ drop-weight specimens was the original plate surface. In some cases, the plate surface was uneven and required leveling, usually less than 0.16 mm (1/16 in.); however, the NDTs change very rapidly in this region, accounting for the variation in some of the surface results.

Specimen tests in excess of the minimum requirements of ASTM E 208, two "no-break" tests 5.5°C (10°F) above a "break" test, were conducted to provide some information on the precision of the NDT determination in A 533 grade B class 1 steel. These additional tests often resulted in "breaks" at a temperature above a previously determined NDT. For example, the P-1 type specimen in plate section 01K at a depth of $(3/4)t$ and with a WR orientation (Table D.1) when tested at -1.1°C (30°F) resulted in a "break" in one specimen out of six, while two out of six specimens tested at -6.7°C (20°F) resulted in a "break." In this case, an NDT of -1.1°C (30°F) was chosen. This situation presented a problem in interpretation and in a few cases a shortage of specimens before the requirements of E 208 could be met.

The NDT results are summarized in Table 17. The variation of results from WR- and RW-oriented P-3 drop-weight specimens of plate sections 01K, 02FB, and 03E with depth in the plate is shown in Fig. 17. These plates in the WR and RW orientations (Table 17) at common depth locations differ up to 11°C (20°F) in NDT. This is within the variation expected of this type test.

A review of data from the central region $[(1/4)t$ to $(3/4)t$] of plate section 01K indicates that the largest specimen, type P-1, may provide slightly higher NDT. Results from this specimen size for all orientations ranged from -18 to -1.1°C (0 to 30°F) with -6.7°C (20°F) being the most common, while the results from types P-2 and P-3 ranged from -6.7 to -28°C (-20 to $+20^{\circ}\text{F}$), with -12°C (10°F) being the most common NDT.

SUMMARY

Three 305-mm-thick (12-in.) A 533 grade B class 1 steel plates, HSST 01, 02, and 03, were examined by use of standard 12.8-mm and miniature 4.52-mm gage diameter tensile, standard Charpy V-notch, and drop-weight specimens to determine their mechanical properties. Each specimen was identified in a coordinate system adopted to provide the location, orientation, and direction of crack propagation in each plate. Tensile, Charpy-V impact, and drop-weight NDT data were obtained for various locations and depths in each plate and at several temperatures. These data were then compared, and the results are summarized in the following sections.

Table 17. Drop-weight nil-ductility temperatures
(NDTs) for 305-mm-thick (12-in.) HSST plates

Plate section	Depth in plate (<i>t</i>)	Orientation	Drop-weight NDT ^a [°C (°F)]		
			Specimen P-1	Specimen P-2	Specimen P-3
01E	0	WR			-79 (-110)
	1/4	WR			-34 (-30)
01K	0	RW	-68 (-90)	-46 (-50)	-73 (-100)
		WR	-62 (-80)	-57 (-70)	-79 (-110) ^b
	1/8	RW		-12 (10)	-18 (0)
	1/4	RW	-18 (0)	-12 (10) ^b	-23 (-10)
		WR	-7 (20)	-18 (0)	-18 (0)
		TR		-12 (10)	
		RW	-7 (20)	-18 (0)	-7 (20) ^b
	3/8	WR	-7 (20)	-12 (10)	-12 (10) ^b
		RW	-7 (20)	-12 (10)	-12 (10)
	1/2	WR	-18 (0)	-12 (10)	-18 (0)
		RW	-1 (30)	-18 (0)	-12 (10)
	5/8	WR	-7 (20)		
		RW	-7 (20)	-12 (10)	-29 (-20) ^b
	3/4	WR	-1 (30)		
		RW		-62 (-80)	-29 (-20)
	7/8	RW	-68 (-90)	-73 (-100) ^b	-79 (-110) ^b
	1	WR	-62 (-80)		
01MU	0	WR			-73 (-100) ^b
	1/4	WR			-18 (0) ^b
	1/2	WR			-23 (-10) ^b
02FB	0	WR			-73 (-100)
	1/4	WR			-18 (0) ^b
	1/2	WR			-18 (0) ^b
	3/4	WR			-23 (-10)
03E	0	WR			-77 (-107)
	1/4	WR			-12 (10) ^b
	1/2	WR			-12 (10)
	3/4	WR			-12 (10)
	1	WR			-17 (-107)

^aNDT is defined as lowest temperature above which at least two "no breaks" are obtained. Specimen types are defined in ASTM E 208.

^bNDT criteria not met due to insufficient number of specimens.

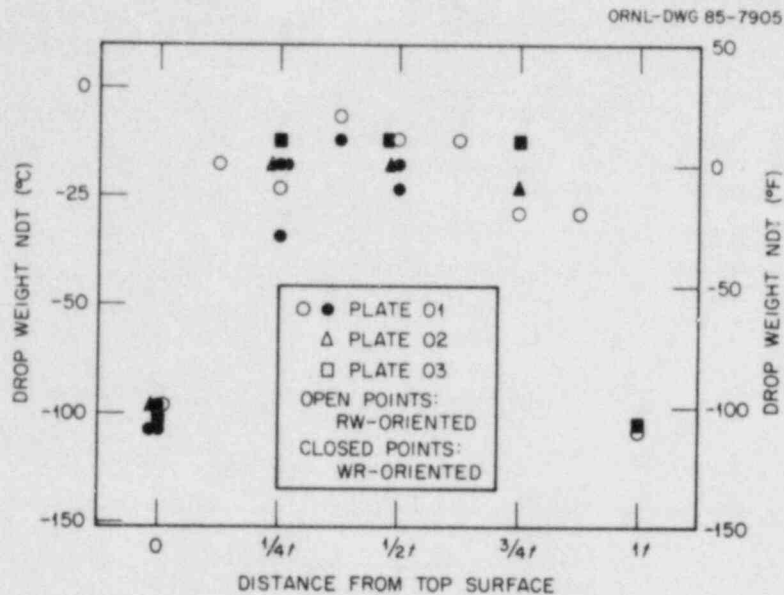


Fig. 17. Variation of drop-weight nil-ductility temperature with distance from the top surface of 305-mm-thick (12-in.) HSST plates 01, 02, and 03 determined with P-3 specimens.

SPECIMEN SIZE

Strength values from the standard and miniature tensile specimens differed little. Elongation values were also essentially equal after adjustment was made for the difference in gage length-to-diameter ratios. An equation is presented to assist in making the adjustment.

The NDT data from three sizes of drop-weight specimens indicate that the largest specimen (P-1) may provide slightly higher values (about 5°C) than the two smaller sizes.

SPECIMEN ORIENTATION

Tensile strengths and elongations show little sensitivity to orientations parallel to the plate surfaces (R and W) but were lower when oriented perpendicular to the plate surface (T). Reduction of area values were higher in the rolling (R) direction than transverse to the rolling direction (W).

Charpy V-notch upper-shelf impact values were highest for longitudinal (RW) oriented specimens and progressively lower for the transverse (WR) and through-thickness (TR and TW) orientations.

Limited drop-weight data for comparison indicated no difference in results from either orientation (RW and WR) when the variation in results is considered. Problems involved in the interpretation of results were discussed.

THROUGH-THICKNESS VARIATION

The results from the three specimens (tensile, Charpy-V, and drop-weight) oriented parallel to the plate surfaces (R, W, RW, and WR) all indicate rapid property changes in the depths between the plate surfaces and the $(1/8)t$ and $(7/8)t$ depths (Fig. 18). Little change in properties was observed in the central thickness, $(1/4)t$ through $(3/4)t$, region.

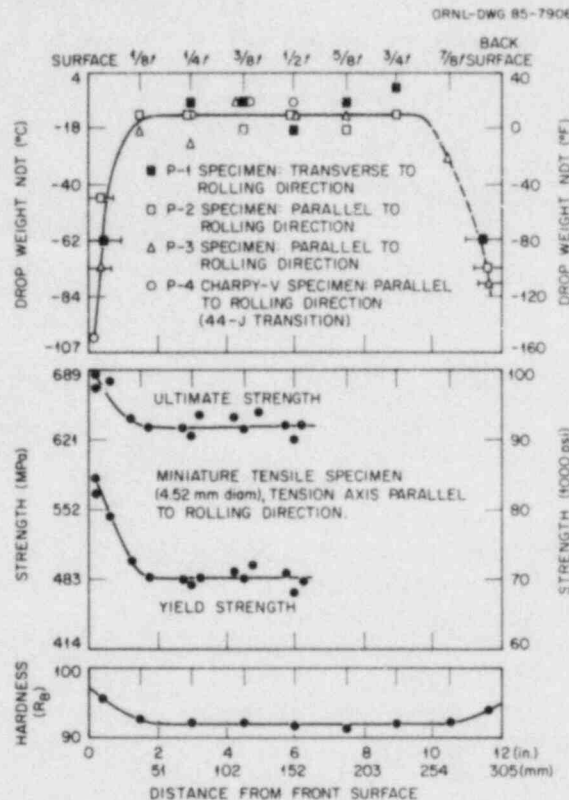


Fig. 18. Variation with depth in plate of representative mechanical properties for central region of 3.05 m × 6.10 m × 305 mm (10 ft × 20 ft × 12 in.) plate of ASTM A 533 grade B class 1 steel.

Strength and hardness values increased as the surfaces were approached from the $(1/4)t$ or $(3/4)t$; however, the Charpy-V transition at the 41-J (30-ft-lb) energy level and the drop-weight NDT decreased.

EDGE EFFECTS

Strength values decrease and Charpy-V transition temperatures at the 41-J energy level increase with distance from the quenched edge of the plate. The increase (or decrease) occurred in the 100- to 150-mm (4-6-in.) region adjacent to the plate edge at midlength of plate 01.

TENSILE RESULTS

1. All three plates were well within the required values in the ASTM specifications. Yield strengths ranged from 386 to 552 MPa (56-80 ksi) and ultimate strengths from 552 to 676 MPa (80-98 ksi) at room temperature. These values satisfy the 345 MPa (50 ksi) minimum yield strength and the 550 to 690 MPa (80-100 ksi) range in ultimate strength required for class 1 tensile properties. The lower values were usually obtained at the $(1/2)t$ depth.
2. Where comparable, plate 02 indicated higher tensile values than plates 01 and 03.
3. Plate 03 results appeared more uniform over the plate than those from plates 02 and 01.
4. Tensile properties at the central region of all three plates are similar.
5. Tensile strength values at the bottom of the ingot ends of the plates were lower than the central or top ingot end values.
6. Tensile strength was lower at the $(3/4)t$ and $1t$ thickness levels than at the $0t$ and $(1/4)t$ levels.
7. The strength of the plates was generally lower at the $(1/2)t$ level because of the higher inclusion content.
8. Areas were located in which the tensile properties were considerably lower than those in the surrounding regions. Charpy-V impact results did not indicate similar low values in these areas.
9. The tensile properties at the corners of the plates were lower than those at the more central regions.
10. Tensile strength and elongation values in the test temperature range -46 to 343°C (-50 to 650°F) appear to reach minimum values near 177°C (350°F) and maximum values at -46°C (-50°F). Reduction of area values reached a maximum near 66°C (150°F).
11. Tensile values were highest within 50 mm (2 in.) of the plate surfaces and were uniform over the central 200 mm (8 in.). Hardness and drop-weight results responded similarly, as shown in Fig. 18.

CHARPY-V IMPACT RESULTS

1. The temperatures at which the plates absorbed 41 J (30 ft-lb) energy were lowest at the surface and highest at mid-depth in the plate.
2. Upper-shelf values were lowest for the surfaces and highest for the central depths of the plate.
3. Plates 02 and 03 exhibited higher transition temperatures than plate 01.
4. The drop-weight NDT-Charpy-V correlation energies varied from 11 to 71 J (8-52 ft-lb) and depended upon plate depth. The higher correlation energies occurred at the surfaces, and the lower correlation energies generally occurred at midthickness.

CHARPY-V DATA SCATTER

The scatter of Charpy-V energy data appears to decrease with increasing test temperature and higher energy values. The greatest scatter was observed near the NDT and the least at temperatures where the material exhibited 100% shear fractures (Charpy upper shelf).

FRACTURE PROPAGATION IN CHARPY-V IMPACT SPECIMENS

Scanning electron microscope examination of the fracture surface of a Charpy V-notch specimen tested at -6.7°C (20°F) indicates that cleavage fracture originates within the specimen ahead of the notch and not at the tip of a ductile tear.

INSTRUMENTED CHARPY RESULTS

Instrumented Charpy data obtained during the impact testing were used to determine the load and energy distribution as a function of temperature. The results reflected the decrease in yield stress and increase in ductility with increasing temperature until fracture occurs entirely by ductile tearing (upper shelf). The use of an instrumented test permits the identification of the onset of the Charpy upper shelf without the need for a subjective interpretation of a fracture surface.

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Appendix A

TENSILE ELONGATION CALCULATION AND DATA

Editor's note:

The tables in this appendix were prepared before ORNL's adoption of the SI system of units, and they are reproduced as is to avoid further delay of this report.

Appendix A

TENSILE ELONGATION CALCULATION AND DATA

Calculation for the correction of subsized tensile specimen elongation or strain values from a specimen gage length-to-diameter ratio (L/D) of 7 to values for a specimen ratio of 4:

For the subsize tensile specimen with $L/D = 7$:

$$\Delta l_{T,7} = \Delta l_{U,7} + \Delta l_{N,7} ,$$

$$e_{T,7} = e_{U,7} + (\Delta l_{N,7}/L_7) ,$$

Therefore,

$$\Delta l_{N,7} = L_7(e_{T,7} - e_{U,7}) ,$$

where

D = minimum gage diameter,
 e = percent elongation or strain,
 L = gage length,
 Δl = elongation,
 N = necking,
 T = total,
 U = uniform,
 7 = values for $L/D = 7$, and
 4 = values for $L/D = 4$.

For $L/D = 4$,

$$e_{T,4} = e_{U,4} + (\Delta l_{N,4}/L_4) .$$

Also, for a given gage diameter the necking region would be confined to the same local region and the uniform strain would be the same for either L/D ratio. Therefore,

$$\Delta l_{N,7} = \Delta l_{N,4} ,$$

and

$$e_{U,7} = e_{U,4} .$$

Substituting in Eqs. (1) and (2) and combining:

$$\begin{aligned} e_{T,4} &= e_{U,7} + (1/L_4)[L_7(e_{T,7} - e_{U,7})] \\ &= (L_7/L_4)e_{T,7} + [1 - (L_7/L_4)e_{U,7}] . \end{aligned}$$

Also, for the same diameter,

$$L_7/L_4 = 7/4 .$$

Therefore,

$$e_{T,4} = 1.75e_{T,7} - 0.75e_{U,7} .$$

Table A.1. Tensile properties of 305-mm-thick (12-in.) HSST plates 01, 02, and 03 from ASTM standard 12.8-mm-gage-diam (0.505-in.) specimens at a strain rate of 0.022/min

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
Plate section 01E							
Surface layer, R orientation							
01E-2000 ^c	24	75	84.6	80.1	97.4	25.3	70.5
2001 ^c	288	550		72.2	97.7	24.0	65.3
2002 ^c	24	75	84.1	80.8	97.3	26.1	69.4
2003 ^c	288	550		72.4	96.7	22.8	62.6
2004 ^c	24	75	86.2	81.2	97.6	25.3	70.9
1/4t layer, R orientation							
01E-2005 ^c	24	75	71.7	68.8	90.3	25.5	67.2
2006 ^c	288	550		62.3	88.9	22.0	62.7
2007 ^c	24	75	72.8	68.8	90.1	25.8	67.7
2008 ^c	288	550		61.4	88.4	23.7	63.3
2009 ^c	24	75	71.9	69.1	90.4	25.8	69.0
Plate section 01K							
Surface layer, R orientation							
01K-6188	24	75	84.6	80.4	98.1	26.0	71.0
6197	288	550		72.3	96.2	21.5	50.4
6210	24	75	78.6	77.9	97.6	25.0	67.9
6219	288	550		70.8	95.7	23.5	62.0
Surface layer, W orientation							
01K-6228 ^c	24	75	75.9	73.9	94.1	23.8	68.2
6229 ^c	24	75	83.4	81.9	97.9	24.4	69.0
6894	24	75	80.4	79.8	98.1	26.5	67.5
6895	24	75	81.7	78.4	97.8	26.0	67.7
6896	232	450	71.4	71.4	92.1	23.5	64.7
6899	232	450		68.9	90.5	23.5	65.4
6902	288	550		71.1	95.9	25.0	61.0
6905	288	550		68.9	93.3	24.0	63.5
6908	343	650		68.3	90.1	21.0	46.3
6911	343	650		67.8	90.4	24.0	54.8
1/3t layer, R orientation							
01K-6189	24	75	72.2	70.7	92.5	25.5	69.6
6198	288	550		64.0	90.5	24.0	64.2
6211	24	75	72.0	70.0	91.9	26.0	70.0
6220	288	550		63.4	90.0	23.0	61.4

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
1/4t Layer, R orientation							
01K-6190	24	75	69.1	68.0	90.5	25.5	68.3
6199	288	550		61.0	87.9	23.0	60.7
6212	24	75		69.1	91.0	26.0	68.0
6221	288	550		61.4	88.7	23.0	60.4
1/4t Layer, W orientation							
01K-6914	24	75	69.0	68.9	90.8	26.0	65.4
6915	24	75	70.0	68.2	90.6	25.5	64.2
6916	232	450	61.3	60.1	84.9	22.5	58.9
6917	232	450	61.4	60.5	85.1	22.5	60.0
6918	288	550		60.6	88.4	22.5	53.7
6919	288	550		60.9	88.4	24.0	59.4
6920	343	650		58.7	84.3	25.5	63.3
6921	343	650		59.4	85.2	26.0	60.0
6238 ^c	24	75	72.4	69.6	90.5	25.4	63.3
6239 ^c	24	75	71.4	68.9	90.7	25.9	67.2
1/4t Layer, T orientation							
01K-6206	24	75	70.4	67.9	90.6	22.5	57.6
6207	288	550		61.6	87.8	21.0	57.5
3/8t Layer, R orientation							
01K-6191	24	75	68.8	68.6	91.3	26.0	39.8
6200	288	550		61.5	89.3	22.0	54.2
6213	24	75	71.7	68.9	92.3	25.0	65.7
6222	288	550		62.1	90.0	22.5	59.3
3/8t Layer, T orientation							
01K-6244 ^c	24	75	72.5	70.7	92.4	24.7	62.6
6245 ^c	24	75	70.6	69.9	91.5	21.1	59.6
1/2t Layer, R orientation							
01K-6192	24	75	69.2	67.4	89.9	25.0	63.5
6201	288	550		60.1	87.3	21.0	51.5
6214	24	75	68.9	65.9	88.8	25.5	63.8
6223	288	550		58.6	86.0	21.5	53.2
1/2t Layer, W orientation							
01K-6946	24	75	67.8	66.9	84.7	11.0	25.4
6949	24	75	67.8	67.4	89.6	24.5	51.9
6952	232	450		61.4	83.4	13.0	27.2
6955	288	550		60.0	86.5	15.0	35.4
6958	288	550		59.6	87.0	17.0	36.2
6961	343	650		58.1	82.7	17.0	32.8

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
5/8t layer, R orientation							
01K-6193	24	75	67.7	67.4	88.9	25.0	68.3
6202	288	550		61.3	88.3	23.0	58.9
6215	24	75	69.9	67.6	90.3	25.5	64.7
6224	288	550		59.9	87.6	22.0	56.2
3/4t layer, R orientation							
01K-6194	24	75	69.3	66.1	88.7	26.0	66.7
6203	288	550		59.0	86.7	23.0	64.2
6216	24	75		66.4	88.6	26.0	68.1
6225	288	550		59.9	86.0	24.0	64.2
3/4t layer, T orientation							
01K-6208	24	75		66.4	88.8	23.5	58.1
6209	288	550		60.0	86.2	21.0	51.8
7/8t layer, R orientation							
01K-6195	24	75	69.9	68.9	91.1	27.0	70.8
6204	288	550		62.1	89.3	23.5	66.8
6217	24	75	70.6	68.1	89.8	25.5	71.0
6226	288	550		60.6	88.1	23.5	65.7
7/8t layer, W orientation							
01K-6834	24	75	67.8	66.8	88.8	26.5	65.2
6835	24	75	69.6	66.8	88.8	26.0	62.8
6836	232	450	59.9	58.9	83.1	22.5	63.4
6838	288	550		59.4	86.9	22.0	58.9
6839	343	650		57.4	83.4	26.5	60.4
1t layer, R orientation							
01K-6196	24	75	80.0	75.5	94.6	27.0	71.0
6205	288	550		66.9	92.4	24.0	63.3
6218	24	75	79.8	74.6	92.7	28.0	71.1
6227	288	550		65.9	91.4	25.0	65.9
1t layer, W orientation							
01K-6868	24	75	80.3	75.9	91.6	27.5	67.7
6869	24	75	80.9	76.1	94.1	27.5	68.4
6870	232	450	68.3	67.3	88.8	29.0	66.0
6871	288	550		68.1	92.3	24.5	63.3
6872	288	550		67.4	92.4	25.0	63.3
6873	343	650		64.8	87.7	26.5	65.6

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
Plate section 01SH							
1/4t layer, R orientation							
OIM-6604	24	75	66.1	64.6	86.1	29.1	68.8
6605	232	450	56.9	56.4	81.4	21.5	62.6
6606	288	550		57.4	85.0	23.3	63.3
6607	343	650		56.3	82.9	26.5	64.8
6608	24	75	67.3	64.8	86.0	28.7	69.1
6609	233	450	57.1	56.8	80.4	27.2	65.3
6610	288	550		57.9	83.9	22.8	64.7
6611	343	650		56.1	82.9	27.6	65.2
6612	24	75	67.3	64.3	86.2	27.2	68.7
6613	232	450		57.1	80.3	25.0	68.3
6614	288	550	56.7	55.9	84.0	24.0	64.2
6615	343	650		56.1	82.5	27.5	66.9
1t layer, R orientation							
OIM-6616	24	75	60.1	58.6	85.9	33.5	72.0
6617	232	450	55.0	54.0	79.0	28.3	69.6
6618	288	550	55.8	52.8	85.7	30.4	69.2
6619	343	650		53.4	85.7	27.6	58.8
6620	24	75	60.9	59.4	85.7	32.0	71.1
6621	232	450	54.9	54.4	78.9	29.6	70.6
6622	288	550	55.9	54.9	83.2	25.0	65.7
6623	343	650		54.2	84.4	27.5	65.2
6624	24	75	61.9	59.9	85.5	33.0	71.0
6625	232	450		55.3	78.6	28.9	71.1
6626	288	550	55.8	53.3	82.0	26.2	68.6
6627	343	650		54.1	83.4	27.2	68.0
Plate section 01MU							
Surface layer, R orientation							
OIM-6480	24	75	75.2	73.7	91.7	29.0	72.1
6481	24	75	76.7	73.8	91.7	29.0	72.3
6482	232	450	64.9	64.1	85.8	25.5	69.9
6483	232	450	64.7	63.1	85.0	26.5	70.3
6484	288	550		65.2	91.3	26.0	58.3
6485	288	550		64.9	91.3	26.0	62.8
6486	343	650		62.3	86.4	28.5	69.9
6487	343	650		61.5	86.1	28.5	68.6
8373 ^c	24	75	77.4	72.4	90.9	27.4	70.6

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
Surface layer, R orientation (continued)							
OIM-8374 ^c	232	450	65.8	64.3	84.9	24.5	69.6
8375 ^c	288	550	64.4	62.3	89.1	22.5	67.1
8376 ^c	343	650		62.1	87.3	25.5	62.6
8377 ^c	288	550	64.2	62.1	89.5	23.5	67.2
8378 ^c	24	75	75.4	71.9	90.8	27.0	71.6
8379 ^c	24	75	76.3	73.2	91.9	27.0	70.9
8380 ^c	232	450	65.3	64.3	86.5	24.5	69.9
8381 ^c	288	550	64.3	62.8	90.2	23.1	68.2
8382 ^c	343	650		62.7	87.1	25.3	68.7
8383 ^c	343	650		62.9	88.1	26.0	70.2
8384 ^c	232	450		63.9	85.9	23.5	69.8
Surface layer, W orientation							
OIM-6504	24	75	77.5	73.2	91.5	29.5	69.2
6507	24	75	76.2	72.9	92.0	29.5	67.1
6512	288	550		64.9	90.4	26.0	61.4
6515	288	550		64.9	90.3	25.5	64.2
1/4t layer, R orientation							
OIM-6488	24	75	62.0	61.6	83.2	29.5	70.4
6489	24	75	62.4	61.6	89.9	29.0	67.8
6490	232	450	54.6	53.4	77.3	25.0	65.7
6491	232	450	54.8	53.9	77.4	25.0	65.9
6492	288	550		55.1	81.1	25.0	63.8
6493	288	550		55.0	80.6	24.0	63.3
6494	343	650		52.9	78.8	27.5	65.7
6495	343	650		52.6	78.9	26.5	61.1
8385	24	75	65.8	63.4	85.0	27.1	69.4
8386 ^a	232	450	55.7		79.3	23.4	66.7
8387 ^c	288	550	57.2		82.9	23.2	66.1
8388 ^c	343	650	54.8		82.1	24.6	58.9
8389 ^c	288	550	56.3	54.0	82.3	23.2	64.6
8390 ^c	24	75	67.3	63.3	84.7	26.8	69.1
8391 ^c	24	75	64.1	62.8	84.0	26.8	69.1
8392 ^c	232	450	55.1		78.5	23.5	66.0
8393 ^c	288	550	55.0	54.0	81.5	22.2	64.5
8394 ^c	343	650	54.9		80.7	25.0	61.8
8395 ^c	343	650	54.5		80.9	24.6	61.2
8396 ^c	232	450	55.6	55.1	77.7	23.4	66.9

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
1/4t layer, W orientation							
OIM-6505	24	75	62.1	61.5	82.6	29.5	66.4
6508	24	75		61.1	83.2	28.5	62.6
6513	288	550		55.0	80.7	23.0	58.8
6516	288	550		54.3	80.9	24.0	56.8
1/4t layer, T orientation							
OIM-6510	24	75	60.1	59.6	81.7	23.0	54.5
6518	288	550		54.8	78.2	17.5	45.8
6519	288	550		54.0	78.0	12.5	35.7
1/2t layer, R orientation							
OIM-6496	24	75	58.6	58.3	79.4	34.0	69.9
6497	24	75	60.0	58.5	79.7	29.5	69.4
6498	232	450	52.3	50.8	74.4	25.0	65.2
6499	232	450	52.4	50.5	74.2	26.0	65.1
6500	288	550		51.3	75.6	14.7	37.9
6501	288	550		52.0	77.9	26.0	62.3
6502	343	650		50.0	75.8	22.0	47.5
6503	343	650		49.9	75.9	27.0	65.9
1/2t layer, W orientation							
OIM-6506	24	75	60.8	57.9	79.2	29.5	64.5
6509	24	75	59.9	58.1	79.4	28.0	62.3
6514	288	550		52.0	77.3	23.0	57.6
6517	288	550		50.9	77.4	22.5	51.0
Plate section 02FB							
Surface layer, R orientation							
02FB-6440 ^c	24	75	85.8	80.9	97.0	29.0	69.9
6441 ^c	24	75	85.8	81.0	97.0	29.2	69.5
6442 ^c	232	450	71.8	70.9	91.2	23.8	67.9
6443 ^c	232	450	71.3	70.3	92.3	23.8	66.8
6444 ^c	288	550		70.9	96.6	23.8	58.6
6445 ^c	288	550		70.8	96.3	23.8	61.1
6446 ^c	343	650		68.4	91.8	25.0	65.9
6447 ^c	343	650		67.9	91.4	28.0	64.0
Surface layer, W orientation							
02FB-6467 ^c	24	75	87.5	80.4	97.1	28.4	66.6
6468 ^c	24	75	86.9	80.9	97.1	28.4	66.6
6472 ^c	288	550		70.9	96.5	23.8	58.3
6475 ^c	288	550		70.7	95.9	19.2	40.7

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
1/4t layer, R orientation							
02FB-6448 ^c	24	75	72.3	69.9	91.1	26.0	67.9
6449 ^c	24	75	72.1	69.8	91.2	26.0	65.6
6450 ^c	232	450	61.4	61.0	86.4	25.0	66.8
6451 ^c	232	450	61.5	61.2	86.2	23.4	66.8
6452 ^c	288	550		61.9	89.9	23.5	61.6
6453 ^c	288	550		62.4	89.8	23.5	55.7
6454 ^c	343	650		60.4	87.6	27.6	62.6
6455 ^c	343	650		60.9	87.3	27.0	61.6
1/4t layer, W orientation							
02FB-6464 ^c	24	75	71.8	69.1	91.0	26.5	63.0
6465 ^c	24	75	71.4	69.2	91.4	24.6	60.8
6473 ^c	288	550		62.4	89.9	19.2	42.5
6476 ^c	288	550		62.4	90.4	23.0	56.5
1/4t layer, T orientation							
02FB-6470 ^c	24	75	71.1	69.0	91.1	23.8	57.3
6471 ^c	288	550		62.9	88.9	19.0	45.7
6478 ^c	24	75	70.4	69.0	91.0	23.2	50.5
6479 ^c	288	550		63.2	90.0	21.0	51.6
1/2t layer, R orientation							
02FB-6456 ^c	24	75	68.3	67.9	89.2	23.5	51.7
6457 ^c	24	75	69.5	68.6	89.4	25.2	56.8
6458 ^c	232	450	60.2	59.9	84.8	22.2	51.7
6459 ^c	288	550		62.4	88.9	21.2	48.6
6460 ^c	288	550		61.4	87.7	21.0	48.0
6461 ^c	343	650		59.9	85.7	23.5	41.3
1/2t layer, W orientation							
02FB-6466 ^c	24	75	68.7	67.7	88.5	13.6	25.8
6469 ^c	24	75		70.2	91.3	19.8	38.1
6474 ^c	288	550		62.4	87.7	19.8	43.4
6477 ^c	288	550		61.9	84.2	9.2	21.6
Plate section 03E							
Surface Layer, R orientation							
03E-2000	24	75	81.9	73.7	97.1	26.5	73.1
2001	24	75	84.4	79.2	97.2	26.5	70.9
2002	232	450	70.6	69.1	89.9	23.0	69.5
2003	232	450	70.7	69.1	90.7	22.5	68.3
2004	288	550		68.8	93.7	24.0	66.1
2005	288	550		69.0	93.4	24.0	67.9
2006	343	650		64.4	89.0	26.5	71.4
2007	343	650		65.3	89.0	29.0	71.3

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
Surface layer, W orientation							
03E-2024	24	75	80.7	78.6	96.9	25.0	67.4
2027	24	75	82.5	78.2	97.5	25.0	67.1
2032	288	550		68.8	93.5	22.0	58.9
2035	288	550		68.3	93.5	23.0	63.1
1/4t layer, R orientation							
03E-2008	24	75	67.4	66.9	90.6	25.0	67.7
2009	24	75	67.6	67.4	90.3	25.0	68.2
2010	232	450	60.1	59.3	83.3	23.0	65.9
2011	232	450	60.1	59.3	83.8	22.5	65.1
2012	288	550		59.5	86.5	23.5	63.9
2013	288	550		60.3	86.0	22.5	61.8
2014	343	650		58.1	84.0	25.0	66.1
2015	343	650		58.2	83.6	26.0	67.1
1/4t layer, W orientation							
03E-2025	24	75	67.9	66.3	90.6	24.5	63.0
2028	24	75	66.7	66.5	90.7	23.5	63.0
2033	288	550		60.4	86.4	21.5	57.5
2036	288	550		60.4	86.4	19.5	55.2
1/4t layer, T orientation							
03E-2030	24	75	66.5	66.3	90.2	22.5	48.4
2031	24	75	67.6	66.0	89.7	24.0	55.0
2038	288	550		60.2	85.6	18.5	46.9
2039	288	550		60.1	86.6	22.5	63.1
1/2t layer, R orientation							
03E-2016	24	75	65.9	65.5	88.8	22.5	54.8
2017	24	75	65.9	65.9	88.6	22.5	56.2
2018	232	450		60.9	82.1	21.5	56.3
2019	232	450		61.4	81.7	21.5	58.9
2020	288	550		58.2	84.1	23.0	57.0
2021	288	550		59.4	83.8	18.0	51.7
2022	343	650		56.4	82.0	23.5	54.9
2023	343	650		56.9	82.3	22.5	50.4
1/2t layer, W orientation							
03E-2026	24	75	64.6	63.9	88.8	22.0	52.1
2029	24	75	67.4	65.4	88.4	20.5	47.8
2034	288	550		59.4	84.5	19.5	48.6
2037	288	550		59.4	84.4	19.5	49.2

Table A.1. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Total elongation ^b (%)	Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate		
3/4t layer, R orientation							
03E-2058		75	68.2	67.2	90.1	25.0	65.2
2059		75	67.1	65.9	90.1	25.0	67.0
2060		450	59.7	58.9	83.5	22.5	65.7
2061		450	59.5	58.9	83.0	22.5	64.3
2062		550		60.5	86.0	22.5	62.8
2063		550		59.5	84.8	18.5	50.4
2064		650		57.4	84.0	26.0	63.8
2065		650		58.3	84.0	26.0	65.9
1t layer, R orientation							
03E-2066		75	79.0	76.4	96.1	27.0	70.8
2067		75	76.5	76.5	96.6	26.5	70.6
2068		450	68.6	67.3	88.5	23.5	69.9
2069		450	68.6	68.1	89.0	23.5	67.4
2070		550		67.1	92.7	23.5	66.9
2071		550		67.1	92.5	23.5	67.9
2072		650		64.2	87.8	26.0	71.3
2073		650		63.6	88.2	28.0	69.1

^aLower yield strength when upper yield stress is listed; 0.2% offset stress when yield stress is not reported. To convert to metric units (MPa), 1 ksi = 6.895 MPa.

^bTotal elongation in 51 mm (2 in.) gage length; ratio of gage length to diameter (L/D) of 4.

^cSpecimens tested at ORNL; remainder tested by Pittsburgh Testing Laboratories.

Table A.2. Coordinates for ASTM standard
12.8-mm-gage-diam (0.505-in.)
tensile specimens

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 01E</i>			
<i>Surface layer, R orientation</i>			
01E-2000	051-2	023-1(N)	000-3
2001	052-1	023-1(N)	000-3
2002	053-0	023-1(N)	000-3
2003	053-7	023-1(N)	000-3
2004	054-6	023-1(N)	000-3
<i>1/4t layer, R orientation</i>			
01E-2005	051-2	023-1(N)	003-0
2006	052-1	023-1(N)	003-0
2007	053-0	023-1(N)	003-0
2008	053-7	023-1(N)	003-0
2009	054-6	023-1(N)	003-0
<i>Plate Section 01K</i>			
<i>Surface layer, R orientation</i>			
01K-6188	053-6	107-4(N)	000-3
6197	055-0	107-4(N)	000-3
6210	053-6	125-4(N)	000-3
6219	055-0	125-4(N)	000-3
<i>Surface layer, W orientation</i>			
01K-6228	085-2(N)	109-4	000-3
6229	093-2(N)	112-2	000-3
6894	063-4(N)	113-1	000-3
6895	071-4(N)	115-7	000-3
6896	063-4(N)	117-1	000-3
6899	071-4(N)	119-7	000-3
6902	063-4(N)	120-7	000-3
6905	071-4(N)	123-5	000-3
6908	063-4(N)	124-5	000-3
6911	071-4(N)	127-3	000-3
<i>1/8t layer, R orientation</i>			
01K-6189	053-6	107-4(N)	001-4
6198	055-0	107-4(N)	001-4
6211	053-6	125-4(N)	001-4
6220	055-0	125-4(N)	001-4

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, R orientation</i>			
01K-6190	053-6	107-4(N)	003-0
6199	055-0	107-4(N)	003-0
6212	053-6	125-4(N)	003-0
622	055-0	125-4(N)	003-0
<i>1/4t layer, W orientation</i>			
01K-6914	063-4(N)	105-5	003-0
6915	071-4(N)	108-3	003-0
6916	063-4(N)	109-3	003-0
6917	071-4(N)	112-1	003-0
6913	063-4(N)	113-1	003-0
6919	071-4(N)	115-7	003-0
6920	063-4(N)	117-1	003-0
6921	071-4(N)	119-7	003-0
6238	085-2(N)	105-6	003-0
6239	093-2(N)	108-4	003-0
<i>1/4t layer, T orientation</i>			
01K-6206	053-6	111-1	002-7(N)
6207	055-0	111-1	002-7(N)
<i>3/8t layer, R orientation</i>			
01K-6191	053-6	107-4(N)	004-4
6200	055-0	107-4(N)	004-4
6213	053-6	125-4(N)	004-4
6222	055-0	125-4(N)	004-4
<i>3/8t layer, T orientation</i>			
01K-6244	085-2(N)	109-4	004-4
6245	093-2(N)	112-2	004-4
<i>1/2t layer, R orientation</i>			
01K-6192	053-6	107-4(N)	006-0
6201	055-0	107-4(N)	006-0
6214	053-6	125-4(N)	006-0
6223	055-0	125-4(N)	006-0
<i>1/2t layer, W orientation</i>			
01K-6946	063-4(N)	105-5	006-0
6949	071-4(N)	108-3	006-0
6952	063-4(N)	109-3	006-0
6955	071-4(N)	112-1	006-0
6958	063-4(N)	113-1	006-0
6961	071-4(N)	115-7	006-0

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>5/8t layer, R orientation</i>			
01K-6193	053-6	107-4(N)	007-4
6202	055-0	107-4(N)	007-4
6215	053-6	125-4(N)	007-4
6224	055-0	125-4(N)	007-4
<i>3/4t layer, R orientation</i>			
01K-6194	053-6	107-4(N)	009-0
6203	055-0	107-4(N)	009-0
6216	053-6	125-4(N)	009-0
6225	055-0	125-4(N)	009-0
<i>3/4t layer, T orientation</i>			
01K-6208	053-6	111-1	009-1(N)
6209	055-0	111-1	009-1(N)
<i>7/8t layer, R orientation</i>			
01K-6195	053-6	107-4(N)	010-4
6204	055-0	107-4(N)	010-4
6217	053-6	125-4(N)	010-4
6226	055-0	125-4(N)	010-4
<i>7/8t layer, W orientation</i>			
01K-6834	085-0(N)	113-2	010-0
6835	085-0(N)	114-2	010-0
6836	093-4(N)	116-0	010-0
6838	085-0(N)	117-0	010-0
6839	085-0(N)	118-0	010-0
<i>1t layer, R orientation</i>			
01K-6196	053-6	107-4(N)	011-5
6205	055-0	107-4(N)	011-5
6218	053-6	125-4(N)	011-5
6227	055-0	125-4(N)	011-5
<i>1t layer, W orientation</i>			
01K-6868	085-0(N)	116-0	011-5
6869	085-0(N)	115-0	011-5
6870	093-4(N)	113-2	011-5
6871	093-4(N)	114-2	011-5
6872	085-0(N)	119-6	011-5
6873	085-0(N)	118-6	011-5

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 01SH</i>			
<i>1/4t layer, R orientation</i>			
01M-6604	072-5	172-6(N)	003-0
6605	073-4	172-6(N)	003-0
6606	074-3	172-6(N)	003-0
6607	075-2	172-6(N)	003-0
6608	076-1	172-6(N)	003-0
6609	077-0	172-6(N)	003-0
6610	077-7	172-6(N)	003-0
6611	078-6	172-6(N)	003-0
6612	079-5	172-6(N)	003-0
6613	080-4	172-6(N)	003-0
6614	081-3	172-6(N)	003-0
6615	082-2	172-6(N)	003-0
<i>1t layer, R orientation</i>			
01M-6616	072-5	172-6(N)	011-5
6617	073-4	172-6(N)	011-5
6618	074-3	172-6(N)	011-5
6619	075-2	172-6(N)	011-5
6620	076-1	172-6(N)	011-5
6621	077-0	172-6(N)	011-5
6622	077-7	172-6(N)	011-5
6623	078-6	172-6(N)	011-5
6624	079-5	172-6(N)	011-5
6625	080-4	172-6(N)	011-5
6626	081-3	172-6(N)	011-5
6627	082-2	172-6(N)	011-5
<i>Plate section 01MU</i>			
<i>Surface layer, R orientation</i>			
01M-6480	054-5	237-6(N)	000-3
6481	055-4	237-6(N)	000-3
6482	056-3	237-6(N)	000-3
6483	057-2	237-6(N)	000-3
6484	054-5	243-2(N)	000-3
6485	055-4	243-2(N)	000-3
6486	056-3	243-2(N)	000-3
6487	057-2	243-2(N)	000-3
8373	044-3	226-0(N)	000-3
8374	045-2	226-0(N)	000-3
8375	046-1	226-0(N)	000-3
8376	047-0	226-0(N)	000-3

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Surface Layer, R orientation (continued)</i>			
01M-8377	047-7	226-0(N)	000-3
8373	048-6	226-0(N)	000-3
8379	044-3	231-6(N)	000-3
8380	045-2	231-6(N)	000-3
8381	046-1	231-6(N)	000-3
8382	047-0	231-6(N)	000-3
8383	047-7	231-6(N)	000-3
8384	048-6	231-6(N)	000-3
<i>Surface Layer, W orientation</i>			
01M-6504	061-5(N)	239-7	000-3
6507	061-5(N)	238-7	000-3
6512	061-5(N)	242-1	000-3
6515	061-5(N)	241-1	000-3
<i>1/4t Layer, R orientation</i>			
01M-6488	054-5	237-6(N)	003-0
6489	055-4	237-6(N)	003-0
6490	056-3	237-6(N)	003-0
6491	057-2	237-6(N)	003-0
6492	054-5	243-2(N)	003-0
6493	055-4	243-2(N)	003-0
6494	056-3	243-2(N)	003-0
6495	057-2	243-2(N)	003-0
8385	044-3	226-0(N)	003-0
8386	045-2	226-0(N)	003-0
8387	046-1	226-0(N)	003-0
8388	047-0	226-0(N)	003-0
8389	047-7	226-0(N)	003-0
8390	048-6	226-0(N)	003-0
8391	044-3	231-6(N)	003-0
8392	045-2	231-6(N)	003-0
8393	046-1	231-6(N)	003-0
8394	047-0	231-6(N)	003-0
8395	047-7	231-6(N)	003-0
8396	048-6	231-6(N)	003-0
<i>1/4t Layer, W orientation</i>			
01M-6505	061-5(N)	239-7	003-0
6508	061-5(N)	238-7	003-0
6513	061-5(N)	242-1	003-0
6516	061-5(N)	241-1	003-0

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, T orientation</i>			
01M-6510	058-4	238-7	003-0(N)
6518	058-4	241-1	003-0(N)
6519	058-4	242-1	003-0(N)
<i>1/2t layer, R orientation</i>			
01M-6496	054-5	237-6(N)	006-0
6497	055-4	237-6(N)	006-0
6498	056-3	237-6(N)	006-0
6499	057-2	237-6(N)	006-0
6500	054-5	243-2(N)	006-0
6501	055-4	243-2(N)	006-0
6502	056-3	243-2(N)	006-0
6503	057-2	243-2(N)	006-0
<i>1/2t layer, W orientation</i>			
01M-6506	061-5(N)	239-7	006-0
6509	061-5(N)	238-7	006-0
6514	061-5(N)	242-1	006-0
6517	061-5(N)	241-1	006-0
<i>Plate section 02FB</i>			
<i>Surface layer, R orientation</i>			
02FB-6440	058-2	139-2(N)	000-3
6441	059-1	139-2(N)	000-3
6442	060-0	139-2(N)	000-3
6443	060-7	139-2(N)	000-3
6444	058-2	144-6(N)	000-3
6445	059-1	144-6(N)	000-3
6446	060-0	144-6(N)	000-3
6447	060-7	144-6(N)	000-3
<i>Surface layer, W orientation</i>			
02FB-6467	065-2(N)	140-3	000-3
6468	065-2(N)	141-3	000-3
6472	065-2(N)	143-5	000-3
6475	065-2(N)	142-5	000-3
<i>1/4t layer, R orientation</i>			
02FB-6448	058-2	139-2(N)	003-0
6449	059-1	139-2(N)	003-0
6450	060-0	139-2(N)	003-0
6451	060-7	139-2(N)	003-0
6152	058-2	144-6(N)	003-0
6153	059-1	144-6(N)	003-0
6154	060-0	144-6(N)	003-0
6155	060-7	144-6(N)	003-0

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, W orientation</i>			
02FB-6464	065-2(N)	140-3	003-0
6465	065-2(N)	141-3	003-0
6473	065-2(N)	143-5	003-0
7476	065-2(N)	142-5	003-0
<i>1/4t layer, T orientation</i>			
02FB-6470	062-1	140-3	003-0(N)
6471	062-1	141-3	003-0(N)
6478	062-1	142-5	003-0(N)
6479	062-1	143-5	003-0(N)
<i>1/2t layer, R orientation</i>			
02FB-6456	058-2	139-2(N)	006-0
6457	059-1	139-2(N)	006-0
6458	060-0	139-2(N)	006-0
6459	060-7	139-2(N)	006-0
6460	058-2	144-6(N)	006-0
6461	059-1	144-6(N)	006-0
<i>1/2t layer, W orientation</i>			
02FB-6466	065-2(N)	141-3	006-0
6469	065-2(N)	140-3	006-0
6474	065-2(N)	143-5	006-0
6477	065-2(N)	142-7	006-0
<i>Plate section 03E</i>			
<i>Surface layer, R orientation</i>			
03E-2000	058-1	123-0(N)	000-3
2001	059-0	123-0(N)	000-3
2002	059-7	123-0(N)	000-3
2003	060-6	123-0(N)	000-3
2004	058-1	128-4(N)	000-3
2005	059-0	128-4(N)	000-3
2006	059-7	128-4(N)	000-3
2007	060-6	128-4(N)	000-3
<i>Surface layer, W orientation</i>			
03E-2024	065-1(N)	125-1	000-3
2027	065-1(N)	124-1	000-3
2032	065-1(N)	127-3	000-3
2035	065-1(N)	126-3	000-3

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, R orientation</i>			
03E-2008	058-1	123-0(N)	003-0
2009	059-0	123-0(N)	003-0
2010	059-7	123-0(N)	003-0
2011	060-6	123-0(N)	003-0
2012	058-1	128-4(N)	003-0
2013	059-0	128-4(N)	003-0
2014	059-7	128-4(N)	003-0
2015	060-6	128-4(N)	003-0
<i>1/4t layer, W orientation</i>			
03E-2025	065-1(N)	125-1	003-0
2028	065-1(N)	124-1	003-0
2033	065-1(N)	127-3	003-0
2036	065-1(N)	126-3	003-0
<i>1/4t layer, R orientation</i>			
03E-2030	062-0	124-1	003-0(N)
2031	062-0	125-1	003-0(N)
2038	062-0	126-3	003-0(N)
2039	062-0	127-3	003-0(N)
<i>1/2t layer, R orientation</i>			
03E-2016	058-1	123-0(N)	006-0
2017	059-0	123-0(N)	006-0
2013	059-7	123-0(N)	006-0
2019	060-6	123-0(N)	006-0
2020	058-1	128-4(N)	006-0
2021	059-0	128-4(N)	006-0
2022	059-7	128-4(N)	006-0
2023	060-6	128-4(N)	006-0
<i>1/2t layer, W orientation</i>			
03E-2026	065-1(N)	125-1	006-0
2029	065-1(N)	124-1	006-0
2034	065-1(N)	127-3	006-0
2037	065-1(N)	126-3	006-0
<i>3/4t layer, R orientation</i>			
03E-2058	058-1	123-0(N)	000-9
2059	059-0	123-0(N)	000-9
2060	059-7	123-0(N)	000-9
2061	060-6	123-0(N)	000-9
2062	058-1	128-4(N)	000-9
2063	059-0	128-4(N)	000-9
2064	059-7	128-4(N)	000-9
2065	060-6	128-4(N)	000-9

Table A.2. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1st layer, R orientation</i>			
03E-2066	058-1	123-0(N)	011-5
2067	059-0	123-0(N)	011-5
2068	059-7	123-0(N)	011-5
2069	060-6	123-0(N)	011-5
2070	058-1	128-4(N)	011-5
2071	059-0	128-4(N)	011-5
2072	059-7	128-4(N)	011-5
2073	060-6	128-4(N)	011-5

Table A.3. Tensile properties of 305-mm-thick (12-in.) HSST plates 01, 02, and 03 from miniature 4.52-mm-gage-diam (0.178-in.) specimens at a strain rate of 0.016/min

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Plate section 01C									
Surface layer, R orientation									
01C-2000	22	71		72.8	90.9	1.6	11.7	21.5	75.0
2001	232	450	63.8	61.2	81.3		7.9	11.5	36.7
2002	288	550		60.6	83.2		9.4	16.7	69.9
2003	343	650		59.6	84.4	0.2	10.6	20.8	71.8
2006	22	71		73.2	89.7	1.3	9.5	15.6	
2007	232	450	64.6	62.2	83.6		10.2	18.1	72.0
2008	288	550	63.4	59.3	89.1		11.6	20.0	69.5
2009	343	650		60.0	84.7		12.3	22.8	72.7
Surface layer, W orientation									
01C-2012	22	72	75.5	74.7	91.7	1.8	11.6	21.8	72.0
2013	232	450	66.5	64.9	87.2		9.4	17.6	69.9
2014	288	550	66.2	65.8	92.3	0.2	11.4	19.6	68.7
2015	22	72	78.4	74.5	91.4	1.6	14.7	31.0	71.6
2016	232	450		64.8	85.8			17.1	69.4
2017	288	550	65.4	61.5	90.8	0.1	10.4	17.7	66.2
2018	343	650		62.9	86.8		10.0	19.7	68.0
2021	343	650		62.1	82.2		10.3	19.2	68.6
1/4t layer, R orientation									
01C-2024	23	73	65.9	64.3	85.7	1.0	10.6	20.2	72.4
2025	232	450		56.1	80.1		8.7	15.4	64.5
2026	288	550		57.2	84.2		10.2	17.6	66.2
2027	343	650		54.9	81.3		11.3	21.5	69.5
2030	23	73		63.9	85.8	1.0	10.8	20.1	72.5
2031	232	450		55.5	80.5		9.0	17.1	69.2
2032	288	550		57.2	84.8		10.4	17.7	64.9
2033	343	650		55.4	81.9		11.6	20.4	64.7
1/4t layer, W orientation									
01C-2036	23	73	66.4	65.2	86.5	1.0	11.2	19.8	68.7
2037	232	450	56.9	56.5	80.5		7.8	14.8	66.8
2038	288	550		58.7	85.9		10.2	17.0	62.2
2039	23	73	67.4	65.0	86.5	1.1	10.5	19.1	71.8
2040	232	450	56.9	56.1	80.5		7.6	15.1	67.3
2041	288	550		58.6	86.6		10.5	17.4	62.6
2042	343	650		55.8	82.3		11.2	20.9	64.9
2045	343	650		56.7	82.9		9.4	19.6	61.2

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/2t layer, R orientation									
OIC-2048	23	73	70.6	65.7	87.9	1.1	10.3	20.2	70.4
2049	232	450	57.7	56.9	82.1		9.2	16.7	66.3
2050	288	550		59.1	88.4		11.3	17.4	55.9
2051	343	650		57.8	84.6		10.1	20.6	63.2
2055	22	72	68.4	67.2	89.0	0.9	10.9	19.3	71.1
2056	232	450	58.7	57.0	83.4		8.7	15.7	67.6
2057	288	550		59.9	89.2		10.7	17.5	64.1
2058	343	650		57.3	84.5		10.9	19.1	64.4
1/2t layer, W orientation									
OIC-2060	23	73	67.3	66.5	88.7	1.0	10.8	18.8	70.6
2061	232	450		59.2	84.1		8.7	15.6	64.4
2062	288	550		61.0	90.1		10.6	18.3	64.4
2063	23	73	67.9	67.5	88.9	1.0	9.8	18.6	69.2
2064	232	450		58.8	84.0		9.3	15.9	62.2
2065	288	550		60.3	89.2		10.0	17.2	62.1
2066	343	650		58.3	84.5		10.9	20.5	64.7
2069	343	650		58.7	85.3		11.4	21.1	60.5
3/4t layer, R orientation									
OIC-2072	23	73	64.3	62.2	83.9	1.1	11.7	20.2	72.4
2073	232	450	55.4	54.3	78.8		9.3	16.8	71.7
2074	288	550		56.0	84.4		10.6	18.6	68.2
2075	343	650		53.7	80.5		10.5	19.9	71.0
2078	23	73		62.6	84.0	1.1	11.9	21.3	72.1
2079	232	450	55.4	54.8	79.8		10.0	17.6	71.2
2080	288	550		56.7	84.4		10.1	17.6	66.9
2081	343	650		54.6	81.5		10.9	19.6	68.4
3/4t layer, W orientation									
OIC-2084	23	73		63.6	85.3	1.0	12.1	20.5	69.8
2085	232	450	60.2	59.2	85.3		8.8	15.5	63.4
2086	288	550		57.6	85.5		9.5	16.8	64.1
2087	23	73	64.1	63.3	84.7	1.0	11.2	19.9	71.6
2088	232	450		56.2	80.7		8.0	15.9	66.1
2089	288	550		57.4	84.7		10.0	17.7	66.1
2090	343	650		56.2	82.5		11.2	18.8	68.1
2093	343	650		52.2	81.3		9.9	18.1	66.2

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1t layer, R orientation									
O1C-2096	22	71	70.4	65.6	85.8	1.2	13.8	24.7	75.4
2097	232	450		56.3	80.3		11.4	19.4	73.5
2098	288	550	58.3	53.4	86.7		13.0	20.8	68.0
2099	343	650	54.9	54.5	85.2			21.8	69.8
2102	22	71	72.8	69.2	88.2	1.8	12.9	22.5	74.6
2103	232	450		58.2	80.8		11.6	19.9	74.3
2104	288	550	60.3	55.8	87.0	0.8	11.5	19.2	69.5
2105	343	650	56.7	56.5	83.7	0.3		15.4	71.4
1t layer, W orientation									
O1C-2108	22	71		71.5	90.5	1.3	11.5	20.0	73.6
2109	232	450		61.0	84.1		9.3	17.1	69.3
2110	288	550		63.4	89.9		10.3	17.5	64.1
2111	22	72		70.5	89.8	1.2	11.5	20.7	74.0
2112	232	450	63.8	61.6	83.3		9.2	16.6	72.7
2113	288	550		62.7	90.1	0.2	10.8	18.6	68.0
2114	343	650		57.9	83.3			21.4	67.4
2117	343	650	57.4	57.2	83.0	0.2	11.9	20.8	67.0
Plate section O1K									
Surface layer, R orientation									
O1K-6254	24	75	82.0	81.2	96.4	1.6	13.2	23.1	71.8
6279	24	75	82.5	79.4	94.7	1.7	13.3	24.9	74.0
6285	24	75	81.3	78.5	95.4	1.5	13.4	24.9	73.1
6286	24	75	80.4	78.4	94.7	1.6	12.6	25.2	
6287	24	75	82.1	79.3	94.5	1.6	13.7	25.2	74.1
6288	24	75	79.6	79.2	95.5	1.4	13.0	24.8	73.4
6289	24	75	79.8	78.6	94.6	1.6	13.4	25.6	73.0
6290	24	75	85.4	81.3	96.5	1.3	12.9	23.8	73.9
6315	24	75	82.6	78.9	94.7	1.6	13.1	22.8	73.8
6321	24	75	83.0	78.6	94.5	1.7	12.6	22.2	73.6
6322	24	75	79.6	78.4	94.1	1.6	14.1	24.0	72.8
6689	24	75	75.7	75.5	95.5	1.0	10.0	19.2	74.2
6690	24	75	78.5	78.1	97.5	1.0	9.6	20.5	71.8
6705	24	75	80.4	79.8	98.2	1.4	10.2	19.3	68.3
6706	24	75	85.9	82.5	98.0	1.5	11.5	22.4	72.7
6234	24	75	85.0	82.4	98.3	1.0	9.4	18.9	69.6
6235	24	75	86.8	82.3	98.4	1.2	9.0	18.5	71.5
6878	24	75	83.1	82.1	97.6	1.6	10.5	20.7	73.2
6886	24	75	84.0	83.0	98.1	1.6	11.5	20.7	70.4

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Surface layer, R orientation (continued)									
01K-8189	232	450	72.0	70.4	91.0		9.9	18.0	70.9
8190	288	550		72.3	96.3		10.9	19.6	69.8
8191	343	650		69.1	90.2		9.9	23.0	71.4
8192	232	450		70.9	90.9		9.8	17.6	70.4
8193	288	550		72.2	96.8		10.4	19.9	67.8
8194	343	650		68.7	89.8		10.5	21.8	71.1
Surface layer, W orientation									
01K-6230	21	70	77.0	75.6	96.2	0.5	8.5	16.9	68.3
6231	24	75	87.0	83.2	98.7	1.0	9.2	19.4	71.2
6232	232	450	72.6	71.6	92.2		8.8	15.1	64.2
6233	288	550		73.0	96.7		10.1	18.1	63.8
6897	343	650		68.6	90.8		9.5	20.1	65.9
6898	232	450		70.7	93.5		9.0	16.2	64.8
6900	288	550		72.0	97.2		9.7	17.4	65.1
6901	343	650		68.3	90.8		9.6	19.7	70.1
0.23 and 0.27t layers, R orientation									
01K-8549	-46	-50		75.4	102.0	1.0	10.7	19.9	68.8
8550	-46	-50		75.8	101.0	1.1	11.5	22.1	67.1
8551	-18	0		73.6	98.3	0.9	10.1	19.6	67.5
8552	-18	0		72.3	96.6	0.9	8.5	17.4	69.7
8561	10	50	71.1	70.3	93.2	0.8	9.0	18.2	69.9
8562	10	50		70.9	94.3	0.8	9.3	17.6	70.4
8563	93	200		65.4	85.0	0.8	8.0	16.0	68.5
8564	93	200		66.0	85.5	0.7	8.6	18.0	70.7
1/4t layer, R orientation									
01K-6070	24	75	69.5	68.9	90.6	1.0	10.0	18.9	70.6
6242	24	75	71.1	69.5	91.2	0.8	8.6	17.4	69.7
6243	24	75	69.8	69.2	90.9	0.8	9.7	20.3	72.4
6745	25	77	69.5	68.6	90.1	0.8	9.5	18.0	69.8
6750	25	77	70.9	68.5	89.9	0.9	10.0	19.7	69.4
6769	25	77		68.1	89.7	1.0	9.3	17.6	69.6
6770	25	77	70.0	68.5	90.3	0.9	10.3	19.1	68.1
6775	232	450		59.5	84.3		8.7	16.5	69.5
6776	288	550		61.5	88.8		10.6	18.1	67.0
6777	343	650		60.0	85.1		10.2	21.0	68.0
6778	232	450		60.1	84.2		8.7	16.1	68.4
6779	288	550		61.5	88.8		10.8	17.6	67.4
6780	343	650		60.3	84.7		9.6	20.0	69.7

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/4t layer, W orientation									
01K-6240	24	75	71.3	68.9	90.7	0.8	8.9	16.7	64.7
6241	24	75	70.7	69.1	90.8	0.8	9.7	18.1	66.4
6722	232	450		60.4	86.2		9.9	17.1	64.0
6723	343	650		60.9	86.1		10.3	16.0	51.7
6724	288	550		62.3	89.5		10.2	17.1	60.3
6725	288	550		62.7	90.3		11.0	18.5	61.9
1/4t layer, T orientation									
01K-6152	25	77		68.4	89.6		10.1	16.0	49.9
6153	25	77		67.8	90.1		10.6	16.2	46.3
6154	232	450		59.9	84.1		8.8	13.6	43.0
6155	288	550		60.6	87.0		10.3	16.2	56.6
6164	343	650		59.6	85.0		16.1	12.4	38.0
6165	232	450		60.1	84.0		8.6	14.3	53.7
6166	288	550		57.7	82.9		10.1	15.6	57.5
6167	343	650		60.3	84.7		9.9	17.7	55.3
3/8t layer, R orientation									
01K-6250	24	75	71.4	70.0	91.9	0.6	9.0	17.4	68.3
6251	24	75	71.3	69.5	91.3	0.8	8.9	18.2	67.0
3/8t layer, W orientation									
01K-6246	24	75	70.1	69.5	91.8	0.6	8.9	16.3	65.3
6247	24	75	71.5	69.3	91.1	0.9	9.4	18.7	68.1
6248	288	550		63.7	91.2		8.8	15.3	59.3
6249	343	650		71.4	86.8		9.2	13.0	42.2
1/2t layer, R orientation									
01K-6112	24	75		68.1	89.8	0.3	8.3	17.4	71.1
6113	24	75	68.2	67.8	90.1	0.4	9.9	18.8	70.9
6118	232	450		60.7	84.2		8.7	15.9	67.7
6119	288	550		61.6	89.4		9.1	16.6	65.8
6120	343	650		59.5	85.9		10.3	19.8	67.2
6121	232	450		62.1	86.0		7.7	14.4	66.4
6122	288	550		62.2	90.2		10.0	17.9	65.1
6123	343	650		60.2	85.4		9.3	17.3	62.3

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/2t layer, W orientation									
01K-6950	25	77	69.5	67.7	89.7	0.7	9.8	16.8	57.1
6951	25	77	67.5	67.3	88.7	0.8	9.3	13.6	46.3
6953	232	450		60.1	83.3		8.3	14.3	61.7
6954	288	550		61.0	87.7		10.9	15.8	40.3
6956	343	650		59.1	84.0		9.9	17.2	60.7
6957	232	450		60.1	77.2		3.7	6.2	33.4
6959	288	550		60.5	87.8		9.4	14.0	37.6
6960	343	650		58.2	82.7		8.4	11.3	26.0
1/2t layer, T orientation									
01K-6156	25	77	68.1	67.1	87.6	0.7	9.1	10.1	32.2
6157	25	77	68.3	66.4	87.2	0.5	9.6	13.1	27.6
6158	232	450		58.7	67.8		1.9	2.3	24.6
6159	288	550		60.3	84.7		7.7	10.0	23.2
6168	343	650		59.2	80.9		5.7	6.3	22.3
6169	232	450		59.1	80.0		5.5	7.1	21.3
6170	288	550		59.9	76.0		3.0	4.9	25.6
6171	343	650		53.4	75.1		3.1	3.3	19.2
5/8t layer, R orientation									
01K-6964	25	77	68.1	66.6	88.9	0.7	10.1	19.0	69.2
6965	25	77	67.7	67.5	89.5	0.7	10.4	20.1	70.1
6966	232	450		59.5	84.5		9.8	17.2	66.7
6967	288	550		61.3	88.8		10.3	18.1	65.3
6968	343	650		59.3	84.6		11.0	20.9	66.6
6969	232	450		58.5	83.2		8.5	16.6	69.1
6970	288	550		60.1	87.5		11.1	18.8	68.4
6971	343	650		58.1	82.5		10.8	21.0	67.8
5/8t layer, W orientation									
01K-6972	25	77		67.7	89.5	0.9	10.7	20.0	63.4
6973	25	77		67.5	88.9	0.9	10.7	20.0	67.7
6974	232	450		58.1	82.9		9.2	16.5	65.5
6975	288	550		60.6	87.6		10.3	17.2	61.3
6984	343	650		59.5	84.5		8.6	17.3	67.7
6985	232	450		59.7	82.9		7.8	15.2	67.0
6986	288	550		60.6	89.1		9.2	15.9	60.4
6987	343	650		59.0	84.4		10.8	19.8	63.1

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
3/4t layer, T orientation									
OIK-6160	25	77	67.1	66.2	87.9	0.6	10.0	19.1	63.2
6161	25	77	67.8	66.7	88.1	0.8	10.9	19.9	56.3
6162	232	450		58.0	82.4		9.1	15.7	62.7
6163	288	550		59.6	85.8		9.7	16.4	62.7
6172	343	650		58.0	84.1		10.4	18.1	50.4
6173	232	450		59.0	82.8		8.6	12.6	32.2
6174	288	550		59.6	86.1		10.0	16.4	56.7
6175	343	650		58.4	83.4		11.1	18.6	50.7
7/8t layer, R orientation									
OIK-6810	25	77		67.7	88.9	1.0	10.6	19.8	70.4
6811	25	77	67.7	67.3	88.8	1.0	10.3	19.0	70.8
6812	232	450		60.1	83.6		8.4	15.5	68.8
6813	288	550		61.2	89.0		10.6	19.7	66.6
6814	343	650		59.7	85.1		10.0	19.2	68.0
6815	232	450	59.0	58.6	83.0		8.2	15.7	68.4
6816	288	550		60.9	88.8		10.7	17.1	63.7
6817	343	650		59.7	85.5		11.2	20.3	68.0
7/8t layer, W orientation									
OIK-6818	25	77		67.6	89.0	0.8	9.8	18.3	67.3
6819	25	77		67.6	89.0	0.9	10.4	19.7	
6820	232	450		58.5	83.3		9.2	15.1	59.8
6821	288	550		60.1	89.0		10.6	17.6	61.4
6830	343	650		59.1	84.6		10.4	19.4	64.3
6831	232	450		58.8	83.1		8.7	15.9	67.1
6832	288	550		60.1	87.4		10.4	17.7	61.4
6840	343	650		58.4	83.8		11.7	22.8	69.7
1t layer, R orientation									
OIK-6844	25	77	84.2	77.7	94.2	1.5	11.8	24.4	73.9
6845	25	77		77.8	94.1	1.4	11.5	21.7	73.8
6846	232	450		68.1	89.2		10.0	18.2	72.3
6847	288	550		68.7	93.6		12.3	20.9	67.9
6848	343	650		66.4	89.1		10.8	21.8	69.7
6849	232	450	68.1	68.0	89.3		10.0	18.1	71.5
6850	288	550		68.8	93.5		12.5	20.5	67.4
6851	343	650		66.6	89.4		11.0	22.1	72.4

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1t layer, W orientation									
O1K-6852	25	77	78.5	73.3	94.5	0.6	7.2	15.4	70.1
6853	25	77	79.1	77.9	94.6	1.4	11.6	22.3	68.7
6854	232	450	67.7	67.3	88.1		10.1	18.3	69.2
6855	288	550		68.1	92.2		10.7	14.2	34.2
6864	343	650		66.2	88.5		10.8	22.3	68.1
6865	232	450	68.7	68.1	89.2		10.4	18.2	68.2
6866	288	550		68.3	92.5		11.4	19.3	58.0
6867	343	650		65.7	88.1		11.9	21.9	67.8
Plate section 01SH									
1t layer, R orientation									
O1SH-8451	25	77		54.4	87.8		14.8	25.4	72.1
8452	25	77		58.3	87.8		13.6	24.3	72.8
Plate section 02AH									
Surface layer, R orientation									
O2AH-2000	23	74	84.3	81.4	96.8	1.5	9.8	19.4	71.4
2001	232	450	73.0	71.8	93.3		9.0	16.7	70.0
2002	288	550		73.2	98.4		10.8	13.9	68.2
2003	343	650		68.9	90.9		9.9	19.4	69.7
2006	23	74	83.3	81.6	97.0	1.5	9.3	19.5	70.7
2007	232	450	71.8	71.4	91.6		8.5	16.1	70.0
2008	288	550		71.3	97.4		10.7	18.9	68.4
2009	343	650		67.2	89.2		8.8	13.8	70.8
Surface layer, W orientation									
O2AH-2012	23	74	83.6	81.1	96.6	1.5	10.5	19.8	70.6
2013	232	450	72.1	71.1	92.3		9.8	17.4	66.1
2015	288	550		70.8	96.7		10.2	13.2	66.7
2016	343	650		67.4	89.6		9.4	19.1	66.7
2018	23	74	84.4	80.8	96.1	1.6	9.5	19.0	69.6
2019	232	450		71.0	92.0		9.3	16.5	65.8
2021	288	550		70.7	96.4		10.2	19.4	67.1
2022	343	650		68.2	90.1		10.0	19.9	66.1
1/4t layer, R orientation									
O2AH-2024	23	74	69.8	68.9	90.3	0.8	10.3	20.2	82.7
2025	232	450		61.1	84.5		7.5	14.1	66.7
2026	288	550		61.8	90.0		9.7	16.9	64.9
2027	343	650		61.0	85.9		8.9	18.0	69.3
2030	23	74	68.9	68.5	90.3	0.8	10.0	19.6	72.0
2031	232	450		60.8	86.0		9.1	16.5	67.7
2032	288	550		62.0	89.7		9.2	15.8	61.0
2033	343	650		60.3	85.3		9.5	18.8	65.9

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/4t layer, W orientation									
O2AH-2036	23	74	68.9	68.1	90.3	0.5	9.5	17.9	63.1
2037	232	450		61.0	86.5		8.4	15.1	63.7
2039	288	550		62.3	90.5		10.2	16.6	56.7
2040	343	650		60.8	86.0		9.1	17.2	64.3
2042	23	74	69.8	68.8	90.2	0.8	8.9	17.0	63.4
2043	232	450		61.4	86.6		8.0	14.9	65.0
2045	288	550		62.4	90.4		10.2	17.2	59.5
2046	343	650		61.0	85.5		8.8	16.7	63.0
Plate section O2FB									
3/8t layer, R orientation									
O2F-8000	25	77		73.1	96.2	0.8	8.9	17.2	66.2
8011	25	77		72.1	94.6	0.9	9.2	17.1	64.3
8022	25	77	72.5	71.7	94.2	0.8	8.5	16.6	71.1
8033	25	77	73.8	72.0	94.5	0.9	8.8	17.1	69.7
8036	25	77		68.0	90.5	0.7	10.3	19.8	68.9
8050	25	77	68.8	67.6	88.8	1.0	9.2	17.8	70.1
8070	25	77	69.8	68.4	90.5	0.8	8.9	17.5	69.9
8087	25	77	70.0	69.2	90.7	0.7	9.8	18.4	66.2
8088	25	77	69.0	68.2	90.3	0.8	9.8	18.8	68.3
8111	25	77		69.1	91.3	0.8	9.1	17.8	68.6
8139	25	77		68.8	90.0	0.9	10.2	18.9	68.5
8145	232	450		61.0	85.3		8.8	15.8	66.7
8146	232	450		61.4	85.3		8.6	15.6	67.4
8147	288	550		61.9	89.1		9.6	16.5	61.2
8148	288	550		61.9	89.4		9.3	16.5	64.7
8149	343	650		60.6	85.3		9.0	16.4	61.6
8150	343	650		60.3	85.1		9.8	17.6	60.1
Plate section O2F									
Surface layer, R orientation									
O2F-8453	24	75	82.1	81.3	97.2	1.6	10.7	21.1	73.2
8454	232	450	73.2	69.5	91.0		9.2	16.5	67.4
8455	288	550		68.7	94.3		11.7	21.0	69.1
8456	343	650		65.8	88.8		10.9	22.4	69.3
8459	24	75	83.4	80.5	95.8	1.7	10.4	21.0	70.2
8460	232	450	70.2	69.7	91.2		9.5	17.3	69.9
8461	288	550		69.3	95.1		11.5	20.0	66.2
8462	343	650		67.5	89.2		10.1	19.8	69.2

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Surface Layer, W orientation									
02F-8465	24	75	84.2	80.5	96.6	1.5	9.5	19.3	70.2
8466	232	450	70.6	70.2	91.2		9.7	17.1	67.5
8468	288	550		71.1	97.1		12.0	18.2	65.9
8469	343	650		67.9	90.2		9.6	19.5	68.4
8471	24	75		78.8	97.7	1.4	9.2	18.6	68.9
8472	232	450		68.4	91.6		8.1	15.6	66.6
8474	288	550		68.3	95.5		10.6	18.1	66.9
8475	343	650		65.3	89.0		9.0	18.1	63.9
1/4t Layer, R orientation									
02F-8477	24	75	70.0	69.4	91.7	0.5	9.5	17.0	66.9
8478	232	450		60.8	87.2		9.3	17.3	68.4
8479	288	550		62.3	89.9		9.7	17.3	67.0
8480	343	650		60.7	85.5		10.2	19.0	70.2
8483	24	75	70.5	69.7	91.8	0.8	9.6	18.5	69.0
8484	232	450		65.9	86.5		8.2	15.1	64.4
8485	288	550		62.1				19.1	63.7
8486	343	650		61.3	86.6		9.0	17.7	65.5
1/4t Layer, W orientation									
02F-8489	24	75	72.0	70.3	91.9	0.8	11.0	18.0	59.2
8490	232	450		60.8	86.0		8.1	15.2	64.8
8492	288	550		62.8	90.9		9.5	16.8	63.0
8493	343	650		60.2	86.5		10.2	19.0	63.6
8495	24	75	70.0	69.6	90.7	0.9	9.5	15.8	53.5
8496	232	450		61.4	86.2		8.4	15.2	60.7
8498	288	550		63.0	90.2		10.0	17.2	59.4
8499	343	650		60.8	86.2		9.2	17.3	64.0
Plate section 02HC									
Surface Layer, R orientation									
02HC-2000	24	75		80.4	95.7	1.7	10.7	20.6	72.1
2001	232	450	72.3	69.1	90.9		9.1	16.8	69.5
2002	288	550		68.7	95.5		10.7	18.7	67.3
2003	343	650		66.3	90.7		10.0	20.5	52.7
2006	24	75	85.6	80.0	95.9	1.7	10.6	21.1	72.6
2007	232	450	68.8	68.6	89.8		9.8	17.7	70.2
2008	288	550	68.6	68.4	94.4		10.9	19.0	67.7
2009	343	650		66.8	89.9		10.0	20.1	69.2

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Surface layer, W orientation									
02HC-2012	24	75	82.1	80.5	95.8	1.6	10.7	20.4	69.7
2013	232	450	70.7	68.7	90.9		9.7	17.4	66.7
2015	288	550		68.8	94.6		11.2	19.1	65.2
2016	343	650		66.3	89.2		11.0	20.9	65.7
2018	24	75	81.3	80.1	95.8	1.5	10.9	19.8	68.4
2019	232	450	69.1	68.9	90.4		10.0	17.8	67.8
2021	288	550	69.4	66.5	94.8		9.8	17.1	66.3
2022	343	650		67.0	89.3		10.3	19.5	65.4
1/4t layer, R orientation									
02HC-2024	24	75	66.4	65.8	86.3	0.9	11.5	20.0	71.3
2025	232	450		58.5	79.3		8.2	14.5	61.7
2026	288	550		58.0	84.3		9.4	13.7	65.9
2027	343	650		58.2	82.2		10.0	18.3	64.7
2030	24	75	65.3	64.9	85.5	0.9	11.4	20.8	69.6
2031	232	450		59.2	81.1		7.7	14.9	65.2
2032	288	550		59.3	85.4		9.8	15.6	52.5
2033	343	650		57.7	82.1		9.4	18.5	64.4
1/4t layer, W orientation									
02HC-2036	24	75	65.6	63.9	85.0	0.8	10.7	19.7	66.9
2037	232	450		57.7	80.5		8.8	15.2	60.0
2039	288	550		58.6	84.3		10.4	17.0	56.8
2040	343	650		57.3	81.1		9.8	18.0	58.8
2042	24	75	65.1	64.7	85.3	0.8	10.0	21.4	69.5
2043	232	450		58.0	80.3		8.3	14.6	61.0
2045	288	550		59.1	84.9		9.5	15.6	59.3
2046	343	650		58.2	81.8		10.7	17.6	58.3
1/2t layer, R orientation									
02HC-2048	24	75	62.8	61.6	82.2	1.0	10.2	20.7	73.6
2049	232	450		55.2	76.8		7.2	12.1	55.2
2050	288	550		56.3	82.2		8.5	15.7	66.6
2051	343	650		55.7	78.8		8.8	12.8	32.3
2054	24	75	63.8	62.0	82.6	0.9	11.4	22.1	70.7
2055	232	450		55.2	78.1		8.7	16.6	71.0
2056	288	550		57.0	81.9		8.2	14.8	61.7
2058	343	650		55.3	79.2		9.7	18.1	64.0

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/2t Layer, W orientation									
02HC-2060	24	75	63.2	62.8	82.7	0.7	10.3		
2061	232	450		55.4	77.4		8.6	14.4	58.1
2063	288	550		56.7	82.2		9.6	15.4	66.1
2064	343	650		54.5	76.9		7.0	8.4	27.5
2066	24	75	65.2	63.5	83.8	0.8	9.6	17.8	66.3
2067	232	450		55.3	77.2		7.7	11.7	45.2
2069	288	550		56.3	74.6		4.2	5.1	16.3
2070	343	650		56.2	79.2		10.3	14.2	34.4
3/4t Layer, R orientation									
02HC-2072	24	75	66.0	64.8	85.9	0.8	10.3	20.0	71.3
2073	232	450		56.0	79.7		8.7	16.4	67.8
2074	288	550		57.7	83.9		10.6	17.9	68.9
2075	343	650		56.0	80.1		10.5	20.2	69.6
2078	24	75		64.5	85.7	1.0	11.0	20.5	65.7
2079	232	450		56.4	79.5		8.6	15.8	68.2
2080	288	550		58.2	85.0		10.4	18.6	66.5
2081	343	650		56.3	80.5		9.8	18.6	67.6
3/4t Layer, W orientation									
02HC-2084	24	75		65.0	85.3	0.8	10.4	19.7	66.8
2085	232	450		56.5	79.5		8.6	15.5	54.0
2087	288	550		58.2	84.7		10.4	18.4	64.7
2088	343	650		55.6	80.4		10.7	18.6	56.3
2090	24	75		63.9	85.0	0.7	10.3		
2091	232	450		56.0	75.6		5.3	6.5	22.4
2093	288	550		58.1	83.6		8.9	16.2	61.9
2094	343	650		56.9	81.3		9.8	17.8	67.7
1t Layer, R orientation									
02HC-2096	24	75	80.8	73.9	90.1	1.7	12.5	22.4	67.7
2097	232	450		63.3	84.3		10.4	18.0	70.0
2098	288	550	63.8	60.5	89.1		11.3	19.6	68.5
2099	343	650		60.9	85.3		10.9	20.7	69.0
2102	24	75	75.3	73.5	89.8	1.7	11.6	21.8	71.5
2104	232	450		63.1	84.3		9.9	18.0	68.8
2105	288	550	64.2	60.3	90.0	0.5	11.3	19.3	68.3
2106	343	650		61.9	86.1		10.2	20.3	67.1

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1t layer, W orientation									
02HC-2108	24	75		73.7	89.8	1.7	12.2	20.8	61.7
2109	232	450		63.9	83.9		9.6	17.0	68.3
2111	288	550	64.4	61.3	90.2	0.3	10.7	16.6	50.9
2112	343	650		61.1	85.3		11.5	20.5	65.2
2114	24	75	76.1	73.6	90.5	1.6	11.9	21.9	70.8
2115	232	450	63.9	63.0	84.5		9.3	16.9	68.5
2117	288	550	65.5	60.8	90.2	0.7	11.2	19.5	65.8
2118	343	650		61.6	85.3		11.2	20.5	63.5
Plate section 03CA									
Surface layer, R orientation									
03CA-2024	24	75		78.9	95.4	1.5	10.0	19.3	73.3
2026	288	550		69.6	94.6		10.9	19.5	68.8
2027	343	650		67.4	89.7		9.1	18.7	72.7
Surface layer, W orientation									
03CA-2030	24	75		78.8	95.3	1.5	11.4	20.1	69.6
2031	232	450		69.5	91.2		8.6	15.7	68.5
2032	288	550		69.7	94.7		10.2	18.1	65.7
2033	343	650		67.0	89.3		10.3	20.9	70.6
1/4t layer, R orientation									
03CA-2036	24	75		65.9	88.2	0.7	9.2	18.2	70.0
2037	232	450		60.0	83.5		7.8	15.4	68.8
2038	288	550		61.6	88.4		9.8	17.3	65.7
2039	343	650		59.7	84.5		8.5	16.8	68.4
1/4t layer, W orientation									
03CA-2042	24	75		65.7	89.3	0.6	8.9	16.6	65.6
2043	232	450		60.1	83.8		7.2	14.2	68.7
2044	288	550		61.2	88.5		8.9	16.6	62.6
2045	343	650		59.7	84.1		9.9	19.6	69.8
Plate section 03CB									
Surface layer, R orientation									
03CB-2000	24	75	77.8	75.4	91.9	1.5	11.1	21.5	73.1
2001	232	450		65.4	87.4		10.1	18.1	71.5
2002	288	550		65.2	91.6		11.6	20.3	70.5
2003	343	650		62.5	85.5		10.6	22.2	57.5

Table A.3. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Surface layer, W orientation									
03CB-2006	24	75		75.7	92.6	1.6	10.5	20.3	70.3
2007	232	450		65.8	87.5		9.1	16.9	69.4
2008	288	550	66.6	66.1	93.0	0.1	9.4	17.0	66.6
2009	343	650		63.9	87.3		11.0	21.0	67.5
1/4t layer, R orientation									
03CB-2012	24	75		65.1	87.5	0.8	9.8	20.3	70.6
2013	232	450		57.3	81.4		8.1	15.6	69.2
2014	288	550		59.0	86.7		10.1	17.0	63.4
2015	343	650		58.2	85.3			20.8	70.5
1/4t layer, W orientation									
03CB-2018	24	75		63.7	86.7	0.5	9.2	17.3	67.0
2019	232	450		59.2	82.2		6.6	11.7	45.1
2020	288	550		59.9	88.0		9.3	16.4	65.3
2021	343	650		58.8	83.4		9.5	18.3	64.4
Plate section 03GA									
Surface layer, R orientation									
03GA-2002	24	75	77.7	75.2	95.6	1.4	10.6	19.6	72.7
2003	232	450		65.4	87.0		9.2	16.9	70.4
2004	288	550		66.5	92.8		11.3	19.7	72.1
2005	343	650		63.6	83.4		10.4	20.3	71.8
Surface layer, W orientation									
03GA-2008	24	75	79.0	74.6	91.4	1.6	10.3	19.2	70.4
2009	232	450	65.2	64.2	86.4		9.0	16.3	70.9
2010	288	550	65.7	64.9	92.0	0.3	11.9	19.7	67.6
2011	343	650		63.0	87.4		10.6	19.0	68.9
1/4t layer, R orientation									
03GA-2014	24	75	65.1	64.5	86.0	0.7	9.5	18.4	69.1
2015	232	450		56.3	79.2		7.5	14.9	67.2
2016	288	550		58.2	85.2		11.1	18.6	68.8
2017	343	650		56.9	82.1		9.6	18.3	64.7
1/4t layer, W orientation									
03GA-2020	24	75		62.0	83.9	0.7	10.6	19.2	67.4
2021	232	450		55.3	79.5		8.6	15.3	65.2
2022	288	550		57.9	84.4		9.2	16.6	64.6
2023	343	650		55.4	79.2		8.9	17.4	68.2

^aLower yield strength when upper yield is listed; 0.2% offset yield when upper yield strength is not reported. To convert to metric units (MPa), 1 ksi = 6.895 MPa.

^bTotal elongation in 31.75 mm (1.250 in.) gage length; ratio of gage length to diameter (L/D) of 7.

Table A.4. Coordinates for miniature 4.52-mm-gage-diam (0.178-in.) tensile specimens

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 01C</i>			
<i>Surface layer, R orientation</i>			
01C-2000	021-2	015-6(N)	000-2
2001	021-6	015-6(N)	000-2
2002	022-2	015-6(N)	000-2
2003	022-6	015-6(N)	000-2
2006	021-2	018-0(N)	000-2
2007	021-6	018-0(N)	000-2
2008	022-2	018-0(N)	000-2
2009	022-6	018-0(N)	000-2
<i>Surface layer, W orientation</i>			
01C-2012	016-1(N)	022-3	000-2
2013	016-1(N)	022-7	000-2
2014	016-1(N)	023-3	000-2
2015	018-3(N)	022-3	000-2
2016	018-3(N)	022-7	000-2
2017	018-3(N)	023-3	000-2
2018	020-5(N)	022-3	000-2
2021	023-0(N)	022-3	000-2
<i>1/4t layer, R orientation</i>			
01C-2024	021-2	015-6(N)	003-0
2025	021-6	015-6(N)	003-0
2026	022-2	015-6(N)	003-0
2027	022-6	015-6(N)	003-0
2030	021-2	018-0(N)	003-0
2031	021-6	018-0(N)	003-0
2032	022-2	018-0(N)	003-0
2033	022-6	018-0(N)	003-0
<i>1/4t layer, W orientation</i>			
01C-2036	016-1(N)	022-3	003-0
2037	016-1(N)	022-7	003-0
2038	016-1(N)	023-3	003-0
2039	018-3(N)	022-3	003-0
2040	018-3(N)	022-7	003-0
2041	018-3(N)	023-3	003-0
2042	020-5(N)	022-3	003-0
2045	023-0(N)	022-3	003-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/2t layer, R orientation</i>			
01C-2048	021-2	015-6(N)	006-0
2049	021-6	015-6(N)	006-0
2050	022-2	015-6(N)	006-0
2051	022-6	015-6(N)	006-0
2055	021-6	018-0(N)	006-0
2056	022-2	018-0(N)	006-0
2057	022-6	018-0(N)	006-0
2058	023-2	018-0(N)	006-0
<i>1/2t layer, W orientation</i>			
01C-2060	016-1(N)	022-3	006-0
2061	016-1(N)	022-7	006-0
2062	016-1(N)	023-3	006-0
2063	018-3(N)	022-3	006-0
2064	018-3(N)	022-7	006-0
2065	018-3(N)	023-3	006-0
2066	020-5(N)	022-3	006-0
2069	023-0(N)	022-3	006-0
<i>3/4t layer, R orientation</i>			
01C-2072	021-2	015-6(N)	009-0
2073	021-6	015-6(N)	009-0
2074	022-2	015-6(N)	009-0
2075	022-6	015-6(N)	009-0
2078	021-2	018-0(N)	009-0
2079	021-6	018-0(N)	009-0
2080	022-2	018-0(N)	009-0
2081	022-6	018-0(N)	009-0
<i>3/4t layer, W orientation</i>			
01C-2084	016-1(N)	022-3	009-0
2085	016-1(N)	022-7	009-0
2086	016-1(N)	023-3	009-0
2087	018-3(N)	022-3	009-0
2088	018-3(N)	022-7	009-0
2089	018-3(N)	023-3	009-0
2090	020-5(N)	022-3	009-0
2093	023-0(N)	022-3	009-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1t layer, R orientation</i>			
01C-2096	021-2	015-6(N)	011-6
2097	021-6	015-6(N)	011-6
2098	022-2	015-6 N)	011-6
2099	022-6	015-6(N)	011-6
2102	021-2	018-0(N)	011-6
2103	021-6	018-0(N)	011-6
2104	022-2	018-0(N)	011-6
2105	022-6	018-0(N)	011-6
<i>1t layer, W orientation</i>			
01C-2108	016-1(N)	022-3	011-6
2109	016-1(N)	022-7	011-6
2110	016-1(N)	023-3	011-6
2111	018-3(N)	022-3	011-6
2112	018-3(N)	022-7	011-6
2113	018-3(N)	023-3	011-6
2114	020-5(N)	022-3	011-6
2117	023-0(N)	022-3	011-6
<i>Plate section 01K</i>			
<i>Surface layer, R orientation</i>			
01K-6254	098-2	115-1(N)	000-2
6279	113-7	115-1(N)	000-2
6285	117-5	115-1(N)	000-2
6286	118-2	115-1(N)	000-2
6287	118-7	115-1(N)	000-2
6288	119-4	115-1(N)	000-2
6289	120-1	115-1(N)	000-2
6290	098-2	112-6(N)	000-2
6315	113-7	112-6(N)	000-2
6321	117-5	112-6(N)	000-2
6322	118-2	112-6(N)	000-2
6689	086-7	115-2(N)	000-3
6690	091-5	114-0(N)	000-3
6705	086-7	126-4(N)	000-3
6706	091-5	125-2(N)	000-3
6234	096-0	117-6(N)	000-3
6235	095-3	117-6(N)	000-3
6878	060-6	107-5(N)	000-3

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Surface Layer, R orientation (continued)</i>			
01K-6886	069-7	106-3(N)	000-3
8189	097-0	117-7(N)	000-2
8190	097-4	117-7(N)	000-2
8191	098-0	117-7(N)	000-2
8192	098-4	117-7(N)	000-2
8193	099-0	117-7(N)	000-2
8194	099-4	117-7(N)	000-2
<i>Surface Layer, W orientation</i>			
01K-6230	083-4(N)	112-3	000-3
6231	086-1(N)	112-3	000-3
6232	095-0(N)	109-3	000-3
6233	092-3(N)	109-3	000-3
6897	061-6(N)	120-0	000-3
6898	064-3(N)	120-0	000-3
6900	070-5(N)	117-0	000-3
6901	073-2(N)	117-0	000-3
<i>0.23 and 0.27t layers, R orientation</i>			
01K-8543	030-6	120-2(N)	002-6
8550	032-2	120-2(N)	002-6
8551	030-6	120-2(N)	003-2
8552	032-2	120-2(N)	003-2
8561	030-6	123-6(N)	002-6
8562	032-2	123-6(N)	002-6
8563	030-6	123-6(N)	003-2
8564	032-2	123-6(N)	003-2
<i>1/4t Layer, R orientation</i>			
01K-6070	118-7	117-7(N)	003-0
6242	082-4	111-4(N)	003-0
6243	083-1	111-4(N)	003-0
6745	086-7	119-0(N)	003-0
6750	091-5	117-6(N)	003-0
6769	086-7	122-6(N)	003-0
6770	091-5	121-4(N)	003-0
6775	094-6	121-4(N)	003-0
6776	095-3	121-4(N)	003-0
6777	096-0	121-4(N)	003-0
6778	082-4	126-4(N)	003-0
6779	083-1	126-4(N)	003-0
6780	083-6	126-4(N)	003-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, W orientation</i>			
01K-6240	083-4(N)	108-5	003-0
6241	086-1(N)	108-5	003-0
6722	083-4(N)	113-1	003-0
6723	083-4(N)	113-6	003-0
6724	086-1(N)	113-1	003-0
6725	086-1(N)	113-6	003-0
<i>1/4t layer, T orientation</i>			
01K-6152	053-5	112-1	003-0(N)
6153	053-5	112-6	003-0(N)
6154	053-5	113-3	003-0(N)
6155	053-5	114-0	003-0(N)
6164	054-3	112-1	003-0(N)
6165	054-3	112-6	003-0(N)
6166	054-3	113-3	003-0(N)
6167	054-3	114-0	003-0(N)
<i>3/8t layer, R orientation</i>			
01K-6250	096-0	115-2(N)	004-4
6251	095-3	115-2(N)	004-4
<i>3/8t layer, W orientation</i>			
01K-6246	083-4(N)	112-3	004-4
6247	086-1(N)	112-3	004-4
6248	095-0(N)	109-3	004-4
6249	092-3(N)	109-3	004-4
<i>1/2t layer, R orientation</i>			
01K-6112	108-2	117-7(N)	006-0
6113	108-2	115-1(N)	006-0
6118	110-1	117-1(N)	006-0
6119	110-1	115-1(N)	006-0
6120	110-6	117-7(N)	006-0
6121	110-6	115-1(N)	006-0
6122	111-3	117-7(N)	006-0
6123	111-3	115-1(N)	006-0
<i>1/2t layer, W orientation</i>			
01K-6950	070-5(N)	105-4	006-0
6951	073-2(N)	105-4	006-0
6953	061-6(N)	112-2	006-0
6954	064-3(N)	112-2	006-0
6956	070-5(N)	109-2	006-0
6957	073-2(N)	109-2	006-0
6959	061-6(N)	116-0	006-0
6960	064-3(N)	116-0	006-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/2t layer, T orientation</i>			
01K-6156	053-5	112-1	006-0(N)
6157	053-5	112-6	006-0(N)
6158	053-5	113-3	006-0(N)
6159	053-5	114-0	006-0(N)
6168	054-3	112-1	006-0(N)
6169	054-3	112-6	006-0(N)
6170	054-3	113-3	006-0(N)
6171	054-3	114-0	006-0(N)
<i>5/8t layer, R orientation</i>			
01K-6964	060-6	115-1(N)	007-4
6965	061-3	115-1(N)	007-4
6966	062-0	115-1(N)	007-4
6967	062-5	115-1(N)	007-4
6968	063-2	115-1(N)	007-4
6969	063-7	115-1(N)	007-4
6970	064-4	115-1(N)	007-4
6971	065-1	115-1(N)	007-4
<i>5/8t layer, W orientation</i>			
01K-6972	061-6(N)	113-0	007-4
6973	061-6(N)	113-5	007-4
6974	064-3(N)	113-0	007-4
6975	064-3(N)	113-5	007-4
6984	070-5(N)	115-3	007-4
6985	070-5(N)	116-0	007-4
6986	073-2(N)	115-3	007-4
6987	073-2(N)	116-0	007-4
<i>3/4t layer, T orientation</i>			
01K-6160	053-5	112-1	009-0(N)
6161	053-5	112-6	009-0(N)
6162	053-5	113-3	009-0(N)
6163	053-5	114-0	009-0(N)
6172	054-3	112-1	009-0(N)
6173	054-3	112-6	009-0(N)
6174	054-3	113-3	009-0(N)
6175	054-3	114-0	009-0(N)
<i>7/8t layer, R orientation</i>			
01K-6810	082-4	111-4(N)	010-0
6811	083-1	111-4(N)	010-0
6812	083-6	111-4(N)	010-0
6813	084-3	111-4(N)	010-0
6814	085-0	111-4(N)	010-0
6815	085-5	111-4(N)	010-0
6816	086-2	111-4(N)	010-0
6817	086-7	111-4(N)	010-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>7/8t layer, W orientation</i>			
01K-6818	083-4(N)	109-3	010-0
6819	083-4(N)	110-0	010-0
6820	086-1(N)	109-3	010-0
6821	086-1(N)	110-0	010-0
6830	092-3(N)	111-6	010-0
6831	092-3(N)	112-3	010-0
6832	095-0(N)	111-6	010-0
6840	083-4(N)	119-7	010-0
<i>1t layer, R orientation</i>			
01K-6844	082-4	110-2(N)	011-5
6845	083-1	110-2(N)	011-5
6846	083-6	110-2(N)	011-5
6847	084-3	110-2(N)	011-5
6848	085-0	110-2(N)	011-5
6849	085-5	110-2(N)	011-5
6850	086-2	110-2(N)	011-5
6851	086-7	110-2(N)	011-5
<i>1t layer, W orientation</i>			
01K-6852	083-4(N)	112-3	011-5
6853	083-4(N)	111-6	011-5
6854	086-1(N)	112-3	011-5
6855	086-1(N)	111-6	011-5
6864	092-3(N)	110-0	011-5
6865	092-3(N)	109-3	011-5
6866	095-0(N)	110-0	011-5
6867	095-0(N)	109-3	011-5
<i>Plate section 01SH</i>			
<i>1t layer, R orientation</i>			
01SH-8451	067-6	173-2(N)	011-5
8452	071-2	173-2(N)	011-5
<i>Plate section 02AH</i>			
<i>Surface layer, R orientation</i>			
02AH-2000	018-2	013-7(N)	000-2
2001	018-6	013-7(N)	000-2
2002	019-2	013-7(N)	000-2
2003	019-6	013-7(N)	000-2
2006	018-2	016-1(N)	000-2
2007	018-6	016-1(N)	000-2
2008	019-2	016-1(N)	000-2
2009	019-6	016-1(N)	000-2

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Surface layer, W orientation</i>			
02AH-2012	013-1(N)	020-4	000-2
2013	013-1(N)	021-0	000-2
2015	015-3(N)	020-4	000-2
2016	015-3(N)	021-0	000-2
2018	017-5(N)	020-4	000-2
2019	017-5(N)	021-0	000-2
2021	019-7(N)	020-4	000-2
2022	019-7(N)	021-0	000-2
<i>1/4t layer, R orientation</i>			
02AH-2024	018-2	013-7(N)	003-0
2025	018-6	013-7(N)	003-0
2026	019-2	013-7(N)	003-0
2027	019-6	013-7(N)	003-0
2030	018-2	016-1(N)	003-0
2031	018-6	016-1(N)	003-0
2032	019-2	016-1(N)	003-0
2033	019-6	016-1(N)	003-0
<i>1/4t layer, W orientation</i>			
02AH-2036	013-1(N)	020-4	003-0
2037	013-1(N)	021-0	003-0
2039	015-3(N)	020-4	003-0
2040	015-3(N)	021-0	003-0
2042	017-5(N)	020-4	003-0
2043	017-5(N)	021-0	003-0
2045	019-7(N)	020-4	003-0
2046	019-7(N)	021-0	003-0
<i>Plate section 02FB</i>			
<i>3/8t layer, R orientation</i>			
02FB-8000	053-0	154-1(N)	004-0
8011	058-4	154-1(N)	004-0
8022	064-0	154-1(N)	004-0
8033	069-4	154-1(N)	004-0
8036	045-0	149-1(N)	004-6
8050	052-0	149-1(N)	004-6
8070	062-0	149-1(N)	004-6
8087	070-4	149-1(N)	004-6
8088	045-0	151-5(N)	004-6
8111	056-4	151-5(N)	004-6
8139	070-4	151-5(N)	004-6
8145	047-4	154-1(N)	004-6
8146	048-0	154-1(N)	004-6

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>3/8t layer, R orientation (continued)</i>			
02FB-8147	048-4	154-1(N)	004-6
8148	049-0	154-1(N)	004-6
8149	049-4	154-1(N)	004-6
8150	050-0	154-1(N)	004-6
<i>Plate section 02F</i>			
<i>Surface layer, R orientation</i>			
02F-8453	018-2	138-7(N)	000-2
8454	018-6	138-7(N)	000-2
8455	019-2	138-7(N)	000-2
8456	019-6	138-7(N)	000-2
8459	018-2	141-1(N)	000-2
8460	018-6	141-1(N)	000-2
8461	019-2	141-1(N)	000-2
8462	019-6	141-1(N)	000-2
<i>Surface layer, W orientation</i>			
02F-8465	013-1(N)	145-4	000-2
8466	013-1(N)	146-0	000-2
8468	015-3(N)	145-4	000-2
8469	015-3(N)	146-0	000-2
8471	017-5(N)	145-4	000-2
8472	017-5(N)	146-0	000-2
8474	020-0(N)	145-4	000-2
8475	020-0(N)	146-0	000-2
<i>1/4t layer, R orientation</i>			
02F-8477	018-2	138-7(N)	003-0
8478	018-6	138-7(N)	003-0
8479	019-2	138-7(N)	003-0
8480	019-6	138-7(N)	003-0
8483	018-2	141-1(N)	003-0
8484	018-6	141-1(N)	003-0
8485	019-2	141-1(N)	003-0
8486	019-6	141-1(N)	003-0
<i>1/4t layer, W orientation</i>			
02F-8489	013-1(N)	145-4	003-0
8490	013-1(N)	146-0	003-0
8492	015-3(N)	145-4	003-0
8493	015-3(N)	146-0	003-0
8495	017-5(N)	145-4	003-0
8496	017-5(N)	146-0	003-0
8498	020-0(N)	145-4	003-0
8499	020-0(N)	146-0	003-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 02HC</i>			
<i>Surface layer, R orientation</i>			
02HC-2000	074-6	237-7(N)	000-2
2001	075-2	237-7(N)	000-2
2002	075-6	237-7(N)	000-2
2003	076-2	237-7(N)	000-2
2006	074-6	240-1(N)	000-2
2007	075-2	240-1(N)	000-2
2008	075-6	240-1(N)	000-2
2009	076-2	240-1(N)	000-2
<i>Surface layer, W orientation</i>			
02HC-2012	069-5(N)	244-4	000-2
2013	069-5(N)	245-0	000-2
2015	071-7(N)	244-4	000-2
2016	071-7(N)	245-0	000-2
2018	074-1(N)	244-4	000-2
2019	074-1(N)	245-0	000-2
2021	076-4(N)	244-4	000-2
2022	076-4(N)	245-0	000-2
<i>1/4t layer, R orientation</i>			
02HC-2024	074-6	237-7(N)	003-0
2025	075-2	237-7(N)	003-0
2026	075-6	237-7(N)	003-0
2027	076-2	237-7(N)	003-0
2030	074-6	240-1(N)	003-0
2031	075-2	240-1(N)	003-0
2032	075-6	240-1(N)	003-0
2033	076-2	240-1(N)	003-0
<i>1/4t layer, W orientation</i>			
02HC-2036	069-5(N)	244-4	003-0
2037	069-5(N)	245-0	003-0
2039	071-7(N)	244-4	003-0
2040	071-7(N)	245-0	003-0
2042	074-1(N)	244-4	003-0
2043	074-1(N)	245-0	003-0
2045	076-4(N)	244-4	003-0
2046	076-4(N)	245-0	003-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/2t layer, R orientation</i>			
02HC-2048	074-6	237-7(N)	006-0
2049	075-2	237-7(N)	006-0
2050	075-6	237-7(N)	006-0
2051	076-2	237-7(N)	006-0
2054	074-6	240-1(N)	006-0
2055	075-2	240-1(N)	006-0
2056	075-6	240-1(N)	006-0
2058	076-2	240-1(N)	006-0
<i>1/2t layer, W orientation</i>			
02HC-2060	069-5(N)	244-4	006-0
2061	069-5(N)	245-0	006-0
2063	071-7(N)	244-4	006-0
2064	071-7(N)	245-0	006-0
2066	074-1(N)	244-4	006-0
2067	074-1(N)	245-0	006-0
2069	076-4(N)	244-4	006-0
2070	076-4(N)	245-0	006-0
<i>3/4t layer, R orientation</i>			
02HC-2072	074-6	237-7(N)	009-0
2073	075-2	237-7(N)	009-0
2074	075-6	237-7(N)	009-0
2075	076-2	237-7(N)	009-0
2078	074-6	240-1(N)	009-0
2079	075-2	240-1(N)	009-0
2080	075-6	240-1(N)	009-0
2081	076-2	240-1(N)	009-0
<i>3/4t layer, W orientation</i>			
02HC-2084	069-5(N)	244-4	009-0
2085	069-5(N)	245-0	009-0
2087	071-7(N)	244-4	009-0
2088	071-7(N)	245-0	009-0
2090	074-1(N)	244-4	009-0
2091	074-1(N)	245-0	009-0
2093	076-4(N)	244-4	009-0
2094	076-4(N)	245-0	009-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1t layer, R orientation</i>			
02HC-2096	074-6	237-7(N)	011-6
2097	075-2	237-7(N)	011-6
2098	075-6	237-7(N)	011-6
2099	076-2	237-7(N)	011-6
2102	074-6	240-1(N)	011-6
2104	075-6	240-1(N)	011-6
2105	076-2	240-1(N)	011-6
2106	076-6	240-1(N)	011-6
<i>1t layer, W orientation</i>			
02HC-2108	069-5(N)	244-4	011-6
2109	069-5(N)	245-0	011-6
2111	071-7(N)	244-4	011-6
2112	071-7(N)	245-0	011-6
2114	074-1(N)	244-4	011-6
2115	074-1(N)	245-0	011-6
2117	076-4(N)	244-0	011-6
2118	076-4(N)	245-0	011-6
<i>Plate section 03CA</i>			
<i>Surface layer, R orientation</i>			
03CA-2024	061-4	019-5(N)	000-2
2025	062-0	019-5(N)	000-2
2026	062-4	019-5(N)	000-2
2027	063-0	019-5(N)	000-2
<i>Surface layer, W orientation</i>			
03CA-2030	056-3(N)	024-0	000-2
2031	056-3(N)	024-4	000-2
2032	056-3(N)	025-0	000-2
2033	058-5(N)	024-4	000-2
<i>1/4t layer, R orientation</i>			
03CA-2036	061-4	019-5(N)	003-0
2037	062-0	019-5(N)	003-0
2038	062-4	019-5(N)	003-0
2039	063-0	019-5(N)	003-0
<i>1/4t layer, W orientation</i>			
03CA-2042	056-3(N)	024-0	003-0
2043	056-3(N)	024-4	003-0
2044	056-3(N)	025-0	003-0
2045	058-5(N)	024-0	003-0

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 03CB</i>			
<i>Surface layer, R orientation</i>			
03CB-2000	104-0	020-5(N)	000-2
2001	104-4	020-5(N)	000-2
2002	105-0	020-5(N)	000-2
2003	105-4	020-5(N)	000-2
<i>Surface layer, W orientation</i>			
03CB-2006	098-7(N)	025-0	000-2
2007	098-7(N)	025-4	000-2
2008	098-7(N)	026-0	000-2
2009	101-1(N)	025-0	000-2
<i>1/4t layer, R orientation</i>			
03CB-2012	104-0	020-5(N)	003-0
2013	104-4	020-5(N)	003-0
2014	105-0	020-5(N)	003-0
2015	105-4	020-5(N)	003-0
<i>1/4t layer, W orientation</i>			
03CB-2018	098-7(N)	025-0	003-0
2019	098-7(N)	025-4	003-0
2020	098-7(N)	026-0	003-0
2021	101-1(N)	025-0	003-0
<i>Plate section 03GA</i>			
<i>Surface layer, R orientation</i>			
03GA-2002	054-0	219-7(N)	000-2
2003	054-4	219-7(N)	000-2
2004	055-0	219-7(N)	000-2
2005	055-4	219-7(N)	000-2
<i>Surface layer, W orientation</i>			
03GA-2008	048-7(N)	224-2	000-2
2009	048-7(N)	224-6	000-2
2010	048-7(N)	225-2	000-2
2011	051-1(N)	224-2	000-2

Table A.4. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t layer, R orientation</i>			
03GA-2014	054-0	219-7(N)	003-0
2015	054-4	219-7(N)	003-0
2016	055-0	219-7(N)	003-0
2017	055-4	219-7(N)	003-0
<i>1/4t layer, W orientation</i>			
03GA-2020	048-7(N)	224-2	003-0
2021	048-7(N)	224-6	003-0
2022	048-7(N)	225-2	003-0
2023	051-1(N)	224-2	003-0

Table A.5. Tensile properties of 305-mm-thick (12-in.) HSST plate 01K from miniature 4.52-mm-gage-diam (0.178-in.) specimens at a strain rate of 0.016/min

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
Plate section 01K									
Surface layer, R orientation									
01K-6520	24	75	77.2	76.6	93.3	1.6	12.1	22.4	75.0
6521	24	75	79.4	77.8	94.2	1.6	10.7	22.5	73.7
6522	24	75	80.3	78.5	95.0	1.6	11.7	24.4	75.2
6523	24	75	79.2	79.0	95.2	1.6	10.8	21.4	73.0
6524	24	75	80.3	78.9	95.7	1.2	11.0	21.4	74.8
6525	24	75	79.1	78.7	95.4	1.5	12.0	23.2	74.7
6526	24	75	78.8	78.4	95.6	1.6	11.0	22.4	74.3
6527	24	75	78.5	78.3	96.1	1.5	10.6	21.8	74.8
6528	24	75	78.4	78.2	96.0	1.4	10.5	23.0	75.6
6529	24	75	78.8	78.8	96.2	1.4	11.0	23.6	75.1
6530	24	75	77.7	77.3	93.8	1.7	11.7	22.0	74.1
6531	24	75	78.4	77.0	94.0	1.6	10.0	18.8	63.4
6532	24	75	78.9	76.9	94.6	1.3	10.2	21.0	74.2
6533	24	75	78.7	76.7	95.1	1.2	9.4	20.6	74.9
6534	24	75	77.3	75.5	94.4	1.1	9.7	20.5	75.6
6535	24	75	77.1	75.5	94.5	1.1	10.3	20.9	75.7
6536	24	75	77.2	75.6	94.6	1.2	10.2	20.6	75.0
6537	24	75	78.2	77.0	95.2	1.2	10.1	21.6	75.2
6538	24	75	78.8	77.5	95.7	1.5	11.0	22.0	74.2
6539	24	75	79.3	78.3	95.4	1.6	11.1	23.2	74.6
1/4t layer, R orientation									
01K-6000	24	75	70.7	68.5	90.2	1.0	8.9	17.6	71.3
6001	24	75	69.9	69.1	90.8	0.8	10.0	18.3	68.3
6036	24	75	69.8	68.6	90.3	0.9	10.0	18.8	69.7
6037	24	75	69.4	68.6	89.7	0.8	9.6	19.2	71.5
6054	24	75	69.7	68.1	89.2	0.8	10.7	22.1	72.4
6055	24	75		67.9	89.8	0.7	9.5	19.4	71.3
6064	24	75	69.1	67.5	89.2	0.9	10.2	21.4	73.2
6065	24	75	68.4	67.8	89.3	0.8	9.6	18.9	72.4
6066	28	83	68.7	66.9	88.9	1.0	8.6	17.0	
6067	29	84	68.7	68.1	89.3	0.9	9.0	18.3	
6068	24	76	70.5	68.7	90.1	0.9	9.7	19.8	72.8
6069	24	76	70.7	69.1	91.3	0.6	9.7	17.9	70.9
6072	24	76	70.7	70.3	91.8	0.6	9.3	18.6	72.8
6073	24	76	71.7	70.7	92.0	0.9	9.5	20.2	73.0
6074	24	75	71.9	70.7	91.8	0.9	8.7	17.7	74.2
6075	24	75	73.5	72.9	94.0	0.8	10.1	20.6	72.1

Table A.5. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/4t layer, R orientation (continued)									
01K-6540	24	75	69.4	68.9	89.9	1.0	10.2	20.9	74.8
6541	24	75		68.7	89.7	1.0	10.9	20.9	74.4
6542	24	75	67.9	67.7	88.9	0.9	9.9	20.7	73.8
6543	24	75	68.2	67.0	88.5	0.9	9.9	19.7	74.0
6544	24	75	67.7	67.7	88.7	0.9	10.2	22.2	73.7
6545	24	75	67.7	67.5	88.7	1.0	10.2	20.2	73.7
6546	24	75	67.7	67.2	88.9	0.9	10.0	20.5	73.4
6547	24	75	67.7	67.3	88.9	0.9	10.1	21.3	72.8
6548	24	75		67.5	88.8	0.8	10.7	21.5	72.5
6549	24	75	67.5	67.3	88.6	1.1	10.5	19.7	71.9
6550	24	75	71.6	71.0	91.9	1.1	10.4	20.2	73.1
6551	24	75	70.1	69.3	90.2	0.9	10.4	21.2	74.4
6552	24	75	69.2	68.6	90.1	1.0	10.6	21.1	73.0
6553	24	75	69.7	68.3	89.9	0.9	9.9	19.3	74.0
6554	24	75	68.7	68.5	89.7	1.0	10.7	22.6	73.9
6555	24	75	67.6	66.6	88.1	1.0	10.3	20.6	73.3
6556	24	75	68.7	66.4	88.2	1.0	9.5	18.8	73.9
6557	24	75		66.8	88.2	0.9	10.7	20.2	72.8
6558	24	75	67.5	66.4	87.8	1.0	8.8	18.6	73.2
6559	24	75		66.5	87.9	1.1	9.6	18.9	71.7
1/2t layer, R orientation									
01K-6077	23	73	69.6	68.2	90.1	0.8	9.4	18.0	72.2
6078	24	76	69.1	68.1	89.9	0.4	9.6	18.0	67.4
6112	24	75		68.1	89.8	0.3	8.3	17.4	71.1
6113	24	75	68.2	67.8	90.1	0.4	9.9	18.8	70.9
6130	24	75	68.3	67.3	88.2	0.9	8.5	17.0	71.2
6131	24	75	70.2	68.0	90.0	0.9	9.8	19.2	70.6
6140	24	75	68.2	67.4	89.0	0.9	9.2	17.4	71.3
6141	24	75	67.6	66.2	87.9	1.0	10.5	19.5	71.8
6142	29	84	68.6	66.5	87.5	1.0	10.2	20.4	
6143	24	75	67.9	65.9	87.1	1.0	10.6	20.3	
6144	24	76	67.4	67.0	88.5	0.8	10.0	19.5	71.2
6145	24	76	68.9	66.4	87.8	1.0	10.5	19.7	72.4
6146	24	75	69.6	67.6	89.0	0.8	9.2	18.3	72.4
6147	24	75	67.6	67.2	89.1	0.8	10.5	20.0	71.7
6148	24	76	69.4	66.3	88.3	1.0	9.1	18.7	72.2
6149	24	76	68.6	67.2	89.0	0.8	9.0	18.5	71.6
6150	24	75		68.2	90.1	0.9	9.7	18.9	73.7
6151	22	71	69.1	67.3	88.7	1.0	9.9	19.8	73.0

Table A.5. (continued)

Specimen	Temperature		Strength properties ^a (ksi)			Elongation ^b (%)			Reduction of area (%)
	(°C)	(°F)	Upper yield	Lower yield	Ultimate	Lüders	Uniform	Total	
1/2t layer, R orientation (continued)									
01K-6560	24	76		65.8	87.4	1.0	10.7	21.5	74.0
6561	24	76	66.2	64.6	86.4	1.0	10.5	20.5	74.1
6562	24	76		65.8	87.5	1.0	10.8	22.1	72.1
6563	24	76		65.4	86.5	0.9	11.0	21.2	73.4
6564	24	76		65.4	87.3	1.0	11.4	21.5	74.0
6565	24	76	66.8	66.0	87.4	1.0	10.6	20.5	72.1
6566	24	76	66.5	65.9	87.7	1.0	11.1	21.5	73.7
6567	24	76		66.4	87.5	1.1	10.2	19.2	72.8
6568	24	76	66.4	65.4	86.7	1.0	9.8	20.1	72.8
6569	24	76	67.7	66.0	87.8	1.0	10.6	19.6	74.0
6570	24	76		66.5	87.9	0.8	10.7	19.2	74.6
6571	24	76	66.8	66.4	87.5	1.0	10.4	21.1	74.2
6572	24	76		66.4	87.5	1.0	11.2	21.2	73.3
6573	24	76	67.4	65.6	86.9	1.0	10.0	19.6	73.7
6574	24	76	66.1	65.1	86.5	1.0	9.8	19.8	73.2
6575	24	76	68.1	65.8	87.0	1.0	10.2	19.3	73.1
7576	24	76	66.9	66.1	87.4	1.0	10.8	19.9	71.9
7577	24	76	67.2	65.8	87.3	0.9	10.7	21.0	73.9
7578	24	76	67.0	66.0	87.2	0.9	10.7	20.7	72.9
7579	24	76		66.4	87.4	1.0	10.1	20.4	73.2

^aLower yield strength when upper yield is listed; 0.2% offset yield when upper yield strength is not reported. To convert to metric units (MPa), 1 ksi = 6.895 MPa.

^bTotal elongation in 31.75 mm (1.250 in.) gage length; ratio of gage length to diameter (L/D) of 7.

Table A.6. Coordinates for miniature 4.52-mm-gage-diam (0.178-in.) tensile specimens used to determine edge effects

Specimen	Coordinates (in.)		
	X	Y	Z
<i>Plate section 01K</i>			
<i>Surface layer, R orientation</i>			
01K-6520	000-5	115-3(N)	000-3
6521	001-1	115-3(N)	000-3
6522	001-5	115-3(N)	000-3
6523	002-1	115-3(N)	000-3
6524	002-5	115-3(N)	000-3
6555	003-1	115-3(N)	000-3
6526	003-5	115-3(N)	000-3
6527	004-1	115-3(N)	000-3
6528	004-5	115-3(N)	000-3
6529	005-1	115-3(N)	000-3
6530	000-5	117-6(N)	000-3
6531	001-1	117-6(N)	000-3
6532	001-5	117-6(N)	000-3
6533	002-1	117-6(N)	000-3
6534	002-5	117-6(N)	000-3
6535	003-1	117-6(N)	000-3
6536	003-5	117-6(N)	000-3
6537	004-1	117-6(N)	000-3
6538	004-5	117-6(N)	000-3
6539	005-1	117-6(N)	000-3
<i>1/4t layer, R orientation</i>			
01K-6000	097-0	117-7(N)	003-0
6001	097-0	117-7(N)	003-0
6036	108-2	117-7(N)	003-0
6037	108-2	115-1(N)	003-0
6054	113-7	117-7(N)	003-0
6055	113-7	115-1(N)	003-0
6064	117-0	117-7(N)	003-0
6065	117-0	115-1(N)	003-0
6066	117-5	117-7(N)	003-0
6067	117-5	115-1(N)	003-0
6068	118-2	117-7(N)	003-0
6069	118-2	115-1(N)	003-0
6072	119-4	117-7(N)	003-0
6073	119-4	115-1(N)	003-0
6074	120-1	117-7(N)	003-0
6075	120-1	115-1(N)	003-0

Table A.6. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/4t Layer, R orientation (continued)</i>			
01K-6540	000-5	115-3(N)	000-3
6541	001-1	115-3(N)	000-3
6542	001-5	115-3(N)	000-3
6543	002-1	115-3(N)	000-3
6544	002-5	115-3(N)	000-3
6545	003-1	115-3(N)	000-3
6546	003-5	115-3(N)	000-3
6547	004-1	115-3(N)	000-3
6548	004-5	115-3(N)	000-3
6549	005-1	115-3(N)	000-3
6550	000-5	117-6(N)	000-3
6551	001-1	117-6(N)	000-3
6552	001-5	117-6(N)	000-3
6553	002-1	117-6(N)	000-3
6554	002-5	117-6(N)	000-3
6555	003-1	117-6(N)	000-3
6556	003-5	117-6(N)	000-3
6557	004-1	117-6(N)	000-3
6558	004-5	117-6(N)	000-3
6559	005-1	117-6(N)	000-3
<i>1/2t Layer, R orientation</i>			
01K-6077	097-0	115-1(N)	006-0
6078	097-0	117-7(N)	006-0
6112	108-2	117-7(N)	006-0
6113	108-2	115-1(N)	006-0
6130	113-7	117-1(N)	006-0
6031	113-7	115-1(N)	006-0
6040	117-0	117-7(N)	006-0
6041	117-0	115-1(N)	006-0
6042	117-5	117-7(N)	006-0
6043	117-5	115-1(N)	006-0
6044	118-2	117-7(N)	006-0
6045	118-2	115-1(N)	006-0
6046	118-7	117-7(N)	006-0
6047	118-7	115-1(N)	006-0
6048	119-4	117-7(N)	006-0
6049	119-4	115-1(N)	006-0
6050	120-1	117-1(N)	006-0
6051	120-1	115-1(N)	006-0

Table A.6. (continued)

Specimen	Coordinates (in.)		
	X	Y	Z
<i>1/2t layer, R orientation (continued)</i>			
01K-6560	000-5	115-3(N)	006-0
6561	001-1	115-3(N)	006-0
6562	001-5	115-3(N)	006-0
6563	002-1	115-3(N)	006-0
6564	002-5	115-3(N)	006-0
6565	003-1	115-3(N)	006-0
6566	003-5	115-3(N)	006-0
6567	004-1	115-3(N)	006-0
6568	004-5	115-3(N)	006-0
6569	005-1	115-3(N)	006-0
6570	000-5	117-6(N)	006-0
6571	001-1	117-6(N)	006-0
6572	001-5	117-6(N)	006-0
6573	002-1	117-6(N)	006-0
6574	002-5	117-6(N)	006-0
6575	003-1	117-6(N)	006-0
6576	003-5	117-6(N)	006-0
6577	004-1	117-6(N)	006-0
6578	004-5	117-6(N)	006-0
6579	005-1	117-6(N)	006-0

Appendix B

CHARPY V-NOTCH DATA

Editor's note:

The tables in this appendix were prepared before ORNL's adoption of the SI system of units, and they are reproduced as is to avoid further delay of this report. To convert foot-pounds to joules, multiply by 1.3558; to convert inches to millimeters, multiply by 25.4.

Table B.1. Charpy V-notch impact properties of 305-mm-thick (12-in.) HSST plates 01, 02, and 03

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Plate section 01C								
Surface layer, RW orientation								
01C-1000	149	300	120	100	0.069	015-1	015-6(N)	000-2
1001	121	250	127	100	0.079	015-5	015-6(N)	000-2
1002	93	200	102	100	0.074	016-1	015-6(N)	000-2
1003	66	150	125	100	0.080	016-5	015-6(N)	000-2
1004	38	100	111	100	0.071	017-1	015-6(N)	000-2
1005	10	50	112	100	0.075	017-5	015-6(N)	000-2
1006	-18	0	87	99.5	0.063	018-1	015-6(N)	000-2
1007	-46	-50	70	50	0.051	018-5	015-6(N)	000-2
1008	-73	-100	44	10	0.030	019-1	015-6(N)	000-2
1009	-101	-150	31	0	0.017	019-5	015-6(N)	000-2
1010	-129	-200	15	0	0.008	020-1	015-6(N)	000-2
1011	-157	-250	5.5	0	0.000	020-5	015-6(N)	000-2
1012	232	450	124	100	0.076	015-1	018-0(N)	000-2
1013	204	400	122	100	0.084	015-5	018-0(N)	000-2
1014	177	350	123	100	0.080	016-1	018-0(N)	000-2
1015	93	200	132	100	0.081	016-5	018-0(N)	000-2
1016	-59	-75	54	20	0.041	017-1	018-0(N)	000-2
1017	-87	-125	28	0	0.017	017-5	018-0(N)	000-2
1018	-87	-125	11	0	0.010	018-1	018-0(N)	000-2
1019	-101	-150	11	0	0.005	018-5	018-0(N)	000-2
1020	-115	-175	7	0	0.001	019-1	018-0(N)	000-2
1021	-115	-175	6	0	0.000	019-5	018-0(N)	000-2
1022	-143	225	4	0	0.000	020-1	018-0(N)	000-2
1023	-73	-100	47	10	0.036	020-5	018-0(N)	000-2
Surface layer, WR orientation								
01C-1024	121	250	92	100	0.070	016-1(N)	019-2	000-2
1025	66	150	98	100	0.067	016-1(N)	019-6	000-2
1026	10	50	96	100	0.072	016-1(N)	020-2	000-2
1027	-46	-50	66	70	0.050	016-1(N)	020-6	000-2
1028	-101	-150	20	0	0.013	016-1(N)	021-2	000-2
1029	-157	-250	5	0	0.000	016-1(N)	021-6	000-2
1030	121	250	103	100	0.070	018-3(N)	019-2	000-2
1031	204	400	107	100	0.077	018-3(N)	019-6	000-2
1032	38	100	95	100	0.064	018-3(N)	020-2	000-2
1033	-18	0	75	80	0.059	018-3(N)	020-6	000-2
1034	-73	-100	26	2	0.019	018-3(N)	021-2	000-2
1035	-129	-200	17	0	0.012	018-3(N)	021-6	000-2
1036	232	450	98	100	0.068	020-5(N)	019-2	000-2
1037	177	350	101	100	0.072	020-5(N)	019-6	000-2
1038	149	300	110	100	0.078	020-5(N)	020-2	000-2
1039	121	200	96	100	0.075	020-5(N)	020-6	000-2
1040	-59	-75	35	20	0.028	020-5(N)	021-2	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, WR orientation (continued)								
01C-1041	-59	-75	37	15	0.028	020-5(N)	021-6	000-2
1042	-73	-100	38	5	0.027	023-0(N)	019-2	000-2
1043	-87	-125	30	0	0.021	023-0(N)	019-6	000-2
1044	-87	-125	29	5	0.017	023-0(N)	020-2	000-2
1045	-101	-150	22	1	0.012	023-0(N)	020-6	000-2
1046	-46	-50	60	50	0.047	023-C(N)	021-2	000-2
1047	-18	0	82	100	0.064	023-0(N)	021-6	000-2
1/4t Layer, RW orientation								
01C-1048	260	500	123	100	0.077	015-1	015-6(N)	003-0
1049	204	400	134	100	0.077	015-5	015-6(N)	003-0
1050	177	350	123	100	0.077	016-1	015-6(N)	003-0
1051	149	300	133	100	0.082	016-5	015-6(N)	003-0
1052	121	250	130	100	0.079	017-1	015-6(N)	003-0
1053	93	200	125	100	0.076	017-5	015-6(N)	003-0
1054	66	150	125	100	0.075	018-1	015-6(N)	003-0
1055	38	100	80.5	65	0.061	018-5	015-6(N)	003-0
1056	10	50	56	10	0.043	019-1	015-6(N)	003-0
1057	-18	0	23	2	0.018	019-5	015-6(N)	003-0
1058	-46	-50	8	0	0.004	020-1	015-6(N)	003-0
1059	-73	-100	5	0	0.003	020-5	015-6(N)	003-0
1060	66	150	115	100	0.074	015-1	018-0(N)	003-0
1061	24	75	78	35	0.058	015-5	018-0(N)	003-0
1062	-4	25	50	10	0.038	016-1	018-0(N)	003-0
1063	-4	25	44	10	0.033	016-5	018-0(N)	003-0
1064	-18	0	34	2	0.024	017-1	018-0(N)	003-0
1065	-32	-25	13	0	0.011	017-5	018-0(N)	003-0
1066	-32	-25	14	0	0.009	018-1	018-0(N)	003-0
1067	260	500	125	100	0.083	018-5	018-0(N)	003-0
1068	52	125	92	70	0.068	019-1	018-0(N)	003-0
1069	38	100	85	100	0.063	019-5	018-0(N)	003-0
1070	24	75	71	20	0.052	020-1	018-0(N)	003-0
1071	10	50	42	10	0.033	020-5	018-0(N)	003-0
1/4t layer, WR orientation								
01C-1072	232	450	109	100	0.077	016-1(N)	019-2	003-0
1073	177	350	113	100	0.072	016-1(N)	019-6	003-0
1074	121	250	104	100	0.074	016-1(N)	020-2	003-0
1075	66	150	105	100	0.074	016-1(N)	020-6	003-0
1076	10	50	48.5	15	0.038	016-1(N)	021-2	003-0
1077	-46	-50	10	0	0.006	016-1(N)	021-6	003-0
1078	204	400	114	100	0.081	018-3(N)	019-2	003-0
1079	149	300	105	100	0.074	018-3(N)	019-6	003-0
1080	93	200	104	100	0.072	018-3(N)	020-2	003-0
1081	38	100	67	40	0.054	018-3(N)	020-6	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, WR orientation (continued)								
01C-1082	-18	0	20	1	0.018	018-3(N)	021-2	003-0
1083	-73	-100	4	0	0.003	018-3(N)	021-6	003-0
1084	288	550	102	100	0.070	020-5(N)	019-2	003-0
1085	260	500	109	100	0.070	020-5(N)	019-6	003-0
1086	52	125	95	65	0.067	020-5(N)	020-2	003-0
1087	24	75	62	35	0.047	020-5(N)	020-6	003-0
1088	-4	25	41	10	0.034	020-5(N)	021-2	003-0
1089	-4	25	36	1	0.029	020-5(N)	021-6	003-0
1090	-18	0	27	0	0.021	023-0(N)	019-2	003-0
1091	-32	-25	12	0	0.010	023-0(N)	019-6	003-0
1092	-32	-25	16	0	0.015	023-0(N)	020-2	003-0
1093	204	400	110	100	0.074	023-0(N)	020-6	003-0
1094	121	250	107	100	0.080	023-0(N)	021-2	003-0
1095	38	100	63	40	0.050	023-0(N)	021-6	003-0
1/2t layer, RW orientation								
01C-1096	260	500	110	100	0.079	015-1	015-6(N)	006-0
1097	204	400	115	100	0.043	015-5	015-6(N)	006-0
1098	177	350	119	100	0.079	016-1	015-6(N)	006-0
1099	149	300	112	100	0.079	016-5	015-6(N)	006-0
1100	121	250	117	100	0.082	017-1	015-6(N)	006-0
1101	93	200	103	100	0.076	017-5	015-6(N)	006-0
1102	66	150	95	100	0.070	018-1	015-6(N)	006-0
1103	38	100	64	45	0.051	018-5	015-6(N)	006-0
1104	10	50	50	20	0.039	019-1	015-6(N)	006-0
1105	-18	0	14	5	0.012	019-5	015-6(N)	006-0
1106	-46	-50	7.5	0	0.004	020-1	015-6(N)	006-0
1107	-73	-100	4	0	0.02	020-5	015-6(N)	006-0
1108	232	450	111	100	0.076	015-1	018-0(N)	006-0
1109	52	125	88	100	0.064	015-5	018-0(N)	006-0
1110	24	75	57	25	0.044	016-1	018-0(N)	006-0
1111	10	50	48	20	0.038	016-5	018-0(N)	006-0
1112	-4	25	31	10	0.025	017-1	018-0(N)	006-0
1113	-4	25	33	5	0.028	017-5	018-0(N)	006-0
1114	-18	0	16	5	0.015	018-1	018-0(N)	006-0
1115	288	550	106	100	0.074	018-5	018-0(N)	006-0
1116	93	200	110	100	0.079	019-1	018-0(N)	006-0
1117	46	115	80	60	0.058	019-5	018-0(N)	006-0
1118	38	100	70	40	0.054	020-1	018-0(N)	006-0
1119	24	75	55	30	0.050	020-5	018-0(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, WR orientation								
01C-1120	232	450	111	100	0.083	016-1(N)	019-2	006-0
1121	177	350	103	100	0.077	016-1(N)	019-6	006-0
1122	121	250	99	100	0.074	016-1(N)	020-2	006-0
1123	66	150	91	100	0.072	016-1(N)	020-6	006-0
1124	10	50	34	20	0.027	016-1(N)	021-2	006-0
1125	-46	-50	8	2	0.004	016-1(N)	021-6	006-0
1126	288	550	92	100	0.071	018-3(N)	019-2	006-0
1127	204	400	99	100	0.076	018-3(N)	019-6	006-0
1128	149	300	92	100	0.072	018-3(N)	020-2	006-0
1129	93	200	91	100	0.070	018-3(N)	020-6	006-0
1130	38	100	60	50	0.048	018-3(N)	021-2	006-0
1131	-18	0	18	1	0.016	018-3(N)	021-6	006-0
1132	288	550	90	100	0.073	020-5(N)	019-2	006-0
1133	260	500	94	100	0.073	020-5(N)	019-6	006-0
1134	232	450	93	100	0.072	020-5(N)	020-2	006-0
1135	52	125	69	65	0.055	020-5(N)	020-6	006-0
1136	24	75	45	25	0.038	020-5(N)	021-2	006-0
1137	10	50	29	20	0.026	020-5(N)	021-6	006-0
1138	-4	25	23	1	0.021	023-0(N)	019-2	006-0
1139	-4	25	30	2	0.024	023-0(N)	019-6	006-0
1140	-18	0	16	1	0.013	023-0(N)	020-2	006-0
1141	-32	-25	10	0	0.008	023-0(N)	020-6	006-0
1142	177	350	86	100	0.071	023-0(N)	021-2	006-0
1143	66	150	83	100	0.065	023-0(N)	021-6	006-0
3/4t layer, RW orientation								
01C-1144	260	500	123	100	0.073	015-1	015-6(N)	009-0
1145	204	400	127	100	0.081	015-5	015-6(N)	009-0
1146	177	350	123	100	0.078	016-1	015-6(N)	009-0
1147	149	300	136	100	0.084	016-5	015-6(N)	009-0
1148	121	250	123	100	0.080	017-1	015-6(N)	009-0
1149	93	200	130	100	0.082	017-5	015-6(N)	009-0
1150	66	150	120	90	0.078	018-1	015-6(N)	009-0
1151	38	100	83	35	0.062	018-5	015-6(N)	009-0
1152	10	50	57	20	0.042	019-1	015-6(N)	009-0
1153	-18	0	29	5	0.023	019-5	015-6(N)	009-0
1154	-46	-50	8	2	0.006	020-1	015-6(N)	009-0
1155	-73	-100	4	0	0.001	020-5	015-6(N)	009-0
1156	121	250	119	100	0.083	015-1	018-0(N)	009-0
1157	52	125	103	85	0.077	015-2	018-0(N)	009-0
1158	38	100	89	40	0.064	016-1	018-0(N)	009-0
1159	24	75	74	35	0.055	016-2	018-0(N)	009-0
1160	10	50	54	20	0.042	017-1	018-0(N)	009-0
1161	-4	25	34	10	0.029	017-5	018-0(N)	009-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
3/4t layer, RW orientation (continued)								
01C-1162	-4	25	41	10	0.034	013-1	018-0(N)	009-0
1163	-18	0	27	5	0.021	018-5	018-0(N)	009-0
1164	-32	-25	11	2	0.009	019-1	018-0(N)	009-0
1165	-32	-25	15	2	0.014	019-5	018-0(N)	009-0
1166	232	450	124	100	0.082	020-1	018-0(N)	009-0
1167	93	200	126	100	0.083	020-5	018-0(N)	009-0
3/4t layer, WR orientation								
01C-1168	288	550	98	100	0.073	016-1(N)	019-2	009-0
1169	232	450	102	100	0.071	016-1(N)	019-6	009-0
1170	177	350	103	100	0.069	016-1(N)	020-2	009-0
1171	121	250	102	100	0.076	016-1(N)	020-6	009-0
1172	66	150	95	90	0.072	016-1(N)	021-2	009-0
1173	38	100	71	40	0.053	016-1(N)	021-6	009-0
1174	24	75	52	30	0.041	018-3(N)	019-2	009-0
1175	10	50	46	20	0.035	018-3(N)	019-6	009-0
1176	-4	25	42	5	0.033	018-3(N)	020-2	009-0
1177	-18	0	20	1	0.017	018-3(N)	020-6	009-0
1178	-32	-25	12	0	0.008	018-3(N)	021-2	009-0
1179	-46	-50	10	0	0.003	018-3(N)	021-6	009-0
1180	-73	-100	4	0	0.000	020-5(N)	019-2	009-0
1181	260	500	97	100	0.072	020-5(N)	019-6	009-0
1182	204	400	103	100	0.070	020-5(N)	020-2	009-0
1183	149	300	103	100	0.078	020-5(N)	020-6	009-0
1184	93	200	100	100	0.073	020-5(N)	021-2	009-0
1185	52	125	87	75	0.065	020-5(N)	021-6	009-0
1186	38	100	60	35	0.048	023-0(N)	019-2	009-0
1187	24	75	61	25	0.047	023-0(N)	019-6	009-0
1188	10	50	37	20	0.029	023-0(N)	020-2	009-0
1189	-4	25	31	5	0.025	023-0(N)	020-6	009-0
1190	-18	0	17	0	0.015	023-0(N)	021-2	009-0
1191	-9	15	26	1	0.021	023-0(N)	021-6	009-0
1t layer, RW orientation								
01C-1192	232	450	128	100	0.080	015-1	015-6(N)	011-6
1193	177	350	123	100	0.081	015-5	015-6(N)	011-6
1194	149	300	125	100	0.076	016-1	015-6(N)	011-6
1195	121	250	131	100	0.080	016-5	015-6(N)	011-6
1196	93	200	123	100	0.077	017-1	015-6(N)	011-6
1197	66	150	122	100	0.082	017-5	015-6(N)	011-6
1198	38	100	129	100	0.081	018-1	015-6(N)	011-6
1199	10	50	115	100	0.080	018-5	015-6(N)	011-6

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1t layer, RW orientation (continued)								
01C-1200	-18	0	118	100	0.080	019-1	015-6(N)	011-6
1201	-46	-50	87	55	0.061	019-5	015-6(N)	011-6
1202	-73	-100	49	10	0.034	020-1	015-6(N)	011-6
1203	-101	-150	29	0	0.019	020-5	015-6(N)	011-6
1204	-129	-200	6	0	0.000	015-1	018-0(N)	011-6
1205	-157	-250	3	0	0.002	015-5	018-0(N)	011-6
1206	-32	-25	73	40	0.051	016-1	018-0(N)	011-6
1207	-59	-75	49	20	0.034	016-5	018-0(N)	011-6
1208	-59	-75	49	20	0.035	017-1	018-0(N)	011-6
1209	-73	-100	31	10	0.022	017-5	013-0(N)	011-6
1210	-87	-125	27	0	0.018	018-1	018-0(N)	011-6
1211	-87	-125	30	0	0.019	018-5	018-0(N)	011-6
1212	-101	-150	13	0	0.009	019-1	018-0(N)	011-6
1213	-115	-175	6	0	0.003	019-5	018-0(N)	011-6
1214	-115	-175	7	0	0.002	020-1	018-0(N)	011-6
1215	-18	0	90	55	0.062	020-5	018-0(N)	011-6
1t layer, WR orientation								
01C-1216	232	450	103	100	0.078	016-1(N)	019-2	011-6
1217	177	350	104	100	0.075	016-1(N)	019-6	011-6
1218	121	250	105	100	0.071	016-1(N)	020-2	011-6
1219	66	150	106	100	0.076	016-1(N)	020-6	011-6
1220	38	100	102	100	0.075	016-1(N)	021-2	011-6
1221	10	50	88	95	0.065	016-1(N)	021-6	011-6
1222	-18	0	77	85	0.060	018-3(N)	019-2	011-6
1223	-46	-50	45	35	0.035	018-3(N)	019-6	011-6
1224	-59	-75	38	5	0.028	018-3(N)	020-2	011-6
1225	-73	-100	27	0	0.021	018-3(N)	020-6	011-6
1226	-87	-125	16	0	0.011	018-3(N)	021-2	011-6
1227	-101	-150	15	0	0.007	018-3(N)	021-6	011-6
1228	-115	-175	13	0	0.006	020-5(N)	019-2	011-6
1229	-157	-250	3	0	0.001	020-5(N)	019-6	011-6
1230	-129	-200	9	0	0.003	020-5(N)	020-2	011-6
1231	204	400	93	100	0.070	020-5(N)	020-6	011-6
1232	149	300	96	100	0.072	020-5(N)	021-2	011-6
1233	93	200	95	100	0.068	020-5(N)	021-6	011-6
1234	-32	-25	60	80	0.051	023-0(N)	019-2	011-6
1235	-32	-25	75	80	0.056	023-0(N)	019-6	011-6
1236	-46	-50	54	40	0.040	023-0(N)	020-2	011-6
1237	-59	-75	43	30	0.035	023-0(N)	020-6	011-6
1238	-73	-100	34	10	0.027	023-0(N)	021-2	011-6
1239	-87	-125	27	0	0.019	023-0(N)	021-6	011-6

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Plate section 013								
Surface layer, RW orientation								
01E-1000	-157	-250	2.5	0	0.000	046-5	015-6(N)	000-3
1002	-129	-200	7	0	0.000	047-5	015-6(N)	000-3
1004	-101	-150	32	5	0.022	048-5	015-6(N)	000-3
1006	-73	-100	46	25	0.035	049-5	015-6(N)	000-3
1008	-46	-50	89	85	0.043	050-5	015-6(N)	000-3
1010	-18	0	105	100	0.072	051-5	015-6(N)	000-3
1012	10	50	106	100	0.075	052-5	015-6(N)	000-3
1014	38	100	117	100	0.080	053-5	015-6(N)	000-3
1016	93	200	112	100	0.081	054-5	015-6(N)	000-3
1018	149	300	125	100	0.080	055-5	015-6(N)	000-3
1020	-62	-80	61	40	0.045	056-5	015-6(N)	000-3
1022	-90	-130	38	15	0.027	057-5	015-6(N)	000-3
1024	-118	-180	20	1	0.013	058-5	015-6(N)	000-3
1026	204	400	105	100	0.071	046-5	018-4(N)	000-3
1028	121	250	120	100	0.077	047-5	018-4(N)	000-3
1030	66	150	112	100	0.077	048-5	018-4(N)	000-3
1032	-1	30	118	100	0.082	049-5	018-4(N)	000-3
1034	-29	-20	102	100	0.074	050-5	018-4(N)	000-3
1036	-51	-60	85	80	0.062	051-5	018-4(N)	000-3
1038	-68	-90	56	35	0.044	052-5	018-4(N)	000-3
1040	-79	-110	48	25	0.034	053-5	018-4(N)	000-3
1042	-84	-120	37	20	0.026	054-5	018-4(N)	000-3
1044	-96	-140	38	10	0.028	055-5	018-4(N)	000-3
1046	-107	-160	22	5	0.013	056-5	018-4(N)	000-3
1048	-123	-190	15	1	0.007	057-5	018-4(N)	000-3
1050	-140	-220	9	0	0.003	058-5	018-4(N)	000-3
1051	177	350	112	100	0.078	059-1	018-4(N)	000-3
1/4t layer, RW orientation								
01E-1052	-73	-100	4	0	0.003	046-5	015-6(N)	000-3
1054	-46	-50	10	0	0.008	047-5	015-6(N)	000-3
1056	-18	0	40	15	0.031	048-5	015-6(N)	000-3
1058	10	50	55	30	0.045	049-5	015-6(N)	000-3
1060	38	100	101	70	0.074	050-5	015-6(N)	000-3
1062	66	150	125	100	0.089	051-5	015-6(N)	000-3
1064	93	200	123	100	0.085	052-5	015-6(N)	000-3
1066	149	300	125	100	0.081	053-5	015-6(N)	000-3
1068	204	400	116	100	0.084	054-5	015-6(N)	000-3
1070	27	80	88	65	0.064	055-5	015-6(N)	000-3
1072	-7	20	42	30	0.033	056-5	015-6(N)	000-3
1074	-34	-30	13	0	0.011	057-5	015-6(N)	000-3
1076	232	450	120	100	0.084	058-5	015-6(N)	000-3
1078	177	350	124	100	0.080	046-5	018-4(N)	000-3
1080	121	250	123	100	0.078	047-5	018-4(N)	000-3

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01E-1082	49	120	111	90	0.080	048-5	018-4(N)	003-0
1084	21	70	73	45	0.055	049-5	018-4(N)	003-0
1086	-1	30	43	30	0.036	050-5	018-4(N)	003-0
1088	-12	10	45	20	0.037	051-5	018-4(N)	003-0
1090	-23	-10	14	10	0.012	052-5	018-4(N)	003-0
1092	-29	-20	13	5	0.011	053-5	018-4(N)	003-0
1094	-40	-40	13	0	0.011	054-5	018-4(N)	003-0
1096	-57	-70	7	0	0.005	055-5	018-4(N)	003-0
1098	-18	0	45	10	0.037	056-5	018-4(N)	003-0
1100	4	40	57	30	0.045	057-5	018-4(N)	003-0
1102	-29	-20	28	0	0.023	058-5	018-4(N)	003-0
Plate section 01K								
Surface layer, RW orientation								
01K-7668	-62	-80	77	80	0.061	093-4	117-6(N)	000-3
7669	-84	-120	43	25	0.030	092-7	117-6(N)	000-3
7670	-40	-40	82	85	0.065	092-2	117-6(N)	000-3
7671	-73	-100	50	40	0.040	091-5	117-6(N)	000-3
7672	-101	-150	25	5	0.019	082-3	122-6(N)	000-3
7673	-118	-180	25	0	0.017	083-0	122-6(N)	000-3
7674	-68	-90	47	28	0.038	083-5	122-6(N)	000-3
7675	-157	-250	3	0	0.007	084-2	122-6(N)	000-3
7676	38	100	109	100	0.080	084-7	122-6(N)	000-3
7677	-51	-60	70	40	0.055	085-4	122-6(N)	000-3
7678	4	40	112	100	0.081	086-1	122-6(N)	000-3
7679	-7	20	105	100	0.074	086-6	122-6(N)	000-3
7680	-18	0	112	100	0.073	096-1	121-4(N)	000-3
7681	-29	-20	101	100	0.065	095-4	121-4(N)	000-3
7682	-96	-140	32	5	0.023	094-7	121-4(N)	000-3
7683	-129	-200	12	0	0.010	094-2	121-4(N)	000-3
7684	-79	-110	50	15	0.036	093-5	121-4(N)	000-3
7685	-90	-130	40	10	0.031	093-0	121-4(N)	000-3
7686	-107	-160	31	1	0.024	092-3	121-4(N)	000-3
7687	-118	-180	21	0	0.013	091-6	121-4(N)	000-3
7756 ^a	-73	-100	33	20	0.023	098-1	110-3(N)	000-2
7781 ^a	-73	-100	53	20	0.035	113-6	110-3(N)	000-2
7782	93	200	117	100	0.083	114-3	110-3(N)	000-2
7783	93	200	113	100	0.078	115-0	110-3(N)	000-2
7787 ^a	-73	-100	42	30	0.028	117-4	110-3(N)	000-2
7788 ^a	-73	-100	48	30	0.035	118-1	110-3(N)	000-2
7789 ^a	-73	-100	43	30	0.034	118-6	110-3(N)	000-2
7790 ^a	-73	-100	46	30	0.034	119-3	110-3(N)	000-2
7791 ^a	-73	-100	56	35	0.041	120-0	110-3(N)	000-2
7792 ^a	-73	-100	44	30	0.033	098-1	108-0(N)	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, RW orientation (continued)								
01K-7817 ^a	-40	-40	98	90	0.070	113-6	108-0(N)	000-2
7823 ^a	-40	-40	86	80	0.062	117-4	108-0(N)	000-2
7824 ^a	-40	-40	94	90	0.068	118-1	108-0(N)	000-2
7825 ^a	-40	-40	93	90	0.067	118-6	108-0(N)	000-2
7826 ^a	-40	-40	100	95	0.067	119-3	108-0(N)	000-2
7827 ^a	-40	-40	91	90	0.066	120-0	108-0(N)	000-2
7828 ^a	-73	-100	22	20	0.016	098-1	105-5(N)	000-2
7853 ^a	-107	-160	28	5	0.020	113-6	105-5(N)	000-2
7859 ^a	-107	-160	26	5	0.017	117-4	105-5(N)	000-2
7860 ^a	-107	-160	26	5	0.017	118-1	105-5(N)	000-2
7861 ^a	-107	-160	26	5	0.022	118-6	105-5(N)	000-2
7862 ^a	-107	-160	28	5	0.020	119-3	105-5(N)	000-2
7863 ^a	-107	-160	30	5	0.021	120-0	105-5(N)	000-2
Surface layer, WR orientation								
01K-7644	-62	-80	33	20	0.031	083-4(N)	105-4	000-3
7645	-84	-120	25	5	0.021	083-4(N)	106-2	000-3
7646	-40	-40	58	45	0.049	086-1(N)	105-4	000-3
7647	-18	0	80	100	0.070	086-1(N)	106-2	000-3
7648	4	40	85	100	0.066	095-0(N)	108-6	000-3
7649	-96	-140	23	5	0.018	095-0(N)	108-0	000-3
7650	-157	-250	5	0	0.002	092-3(N)	108-6	000-3
7651	66	150	86	100	0.068	092-3(N)	108-0	000-3
7652	-51	-60	47	30	0.042	083-4(N)	116-6	000-3
7653	27	80	80	100	0.054	083-4(N)	117-4	000-3
7654	-29	-20	55	40	0.044	086-1(N)	116-6	000-3
7655	-73	-100	24	10	0.021	086-1(N)	117-4	000-3
7656	-107	-160	19	0	0.015	095-0(N)	120-0	000-3
7657	-118	-180	16	0	0.004	095-0(N)	119-3	000-3
7658	-129	-200	15	0	0.009	092-3(N)	120-0	000-3
7659	-140	-220	7	0	0.009	092-3(N)	119-3	000-3
7660	-57	-70	30	20	0.025	083-4(N)	120-4	000-3
7661	-68	-90	31	15	0.026	083-4(N)	121-1	000-3
7662	-79	-110	28	10	0.024	086-1(N)	120-4	000-3
7663	-90	-130	25	5	0.018	086-1(N)	121-1	000-3
7664	-101	-150	24	1	0.018	095-0(N)	123-6	000-3
7665	-73	-100	37	10	0.029	095-0(N)	123-1	000-3
7666	-62	-80	45	30	0.037	092-3(N)	123-6	000-3
7667	53	200	90	100	0.069	092-3(N)	123-1	000-3

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/8t layer, RW orientation								
01K-9208 ^b	-40	-40	12	5	0.009	060-5	106-0(N)	001-6
9209 ^b	-40	-40	23	5	0.017	061-1	106-0(N)	001-6
9210 ^b	-7	20	53	42	0.041	061-5	106-0(N)	001-6
9211 ^b	-7	20	54	33	0.043	062-1	106-0(N)	001-6
9212 ^b	21	70	75.5	61	0.058	062-5	106-0(N)	001-6
9213 ^b	21	70	76	60	0.061	063-1	106-0(N)	001-6
9214 ^b	177	350	119	100	0.080	063-5	106-0(N)	001-6
9215 ^b	177	350	120	100	0.082	064-1	106-0(N)	001-6
9216 ^b	-40	-40	40	5	0.032	064-5	106-0(N)	001-6
9217 ^b	-40	-40	26.5	5	0.017	065-1	106-0(N)	001-6
9218 ^b	-40	-40	19	5	0.014	065-5	106-0(N)	001-6
9219 ^b	-40	-40	13	5	0.013	066-1	106-0(N)	001-6
9220 ^b	-40	-40	29	5	0.024	066-5	106-0(N)	001-6
9221 ^b	-40	-40	39	5	0.031	067-1	106-0(N)	001-6
9222 ^b	-40	-40	11	1	0.010	067-5	106-0(N)	001-6
9223 ^b	-40	-40	22	5	0.016	068-1	106-0(N)	001-6
9224 ^b	-40	-40	33	5	0.025	068-5	106-0(N)	001-6
9225 ^b	-40	-40	19	5	0.013	069-1	106-0(N)	001-6
9226	-84	-120	6	0	0.008	069-5	106-0(N)	001-6
9227	-84	-120	5	0	0.008	070-1	106-0(N)	001-6
9228	-62	-80	10	0	0.012	070-5	106-0(N)	001-6
9229	-62	-80	7	0	0.008	071-1	106-0(N)	001-6
9230	-51	-60	11	0	0.011	071-5	106-0(N)	001-6
9231	-51	-60	6	0	0.007	072-1	106-0(N)	001-6
9232 ^b	-51	-60	21	0	0.019	072-5	106-0(N)	001-6
9233 ^b	-40	-40	29	5	0.024	060-5	108-2(N)	001-6
9234 ^b	-40	-40	12	1	0.011	061-1	108-2(N)	001-6
9235 ^b	-7	20	61	37	0.048	061-5	108-2(N)	001-6
9236 ^b	-7	20	58	32	0.046	062-1	108-2(N)	001-6
9237 ^b	21	70	86	80	0.064	062-5	108-2(N)	001-6
9238 ^b	21	70	70	70	0.054	063-1	108-2(N)	001-6
9239 ^b	177	350	120	100	0.080	063-5	108-2(N)	001-6
9240 ^b	177	350	122	100	0.080	064-1	108-2(N)	001-6
9241	-29	-20	34	10	0.027	064-5	108-2(N)	001-6
9242	-29	-20	35	10	0.031	065-1	108-2(N)	001-6
9243	-18	0	38	15	0.031	065-5	108-2(N)	001-6
9244	-18	0	44	15	0.035	066-1	108-2(N)	001-6
9245	4	40	54	40	0.048	066-5	108-2(N)	001-6
9246	4	40	65	35	0.056	067-1	108-2(N)	001-6
9247	16	60	70	55	0.054	067-5	108-2(N)	001-6
9248	16	60	68	75	0.058	068-1	108-2(N)	001-6
9249	27	80	92	70	0.070	068-5	108-2(N)	001-6
9250	27	80	86	80	0.070	069-1	108-2(N)	001-6

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/8t layer, RW orientation (continued)								
01K-9251	38	100	102	85	0.072	069-5	108-2(N)	001-6
9252	38	100	94	95	0.071	070-1	108-2(N)	001-6
9253	49	120	116	100	0.080	070-5	108-2(N)	001-6
9254	49	120	122	100	0.085	071-1	108-2(N)	001-6
9255	60	140	120	100	0.084	071-5	108-2(N)	001-6
9256	60	140	122	100	0.086	072-1	108-2(N)	001-6
9257	71	160	118	100	0.087	072-5	108-2(N)	001-6
9258 ^b	-40	-40	22.5	0	0.016	060-5	110-5(N)	001-6
9259 ^b	-40	-40	12	0	0.012	061-1	110-5(N)	001-6
9260 ^b	-7	20	64	38	0.051	061-5	110-5(N)	001-6
9261 ^b	-7	20	50	31	0.039	062-1	110-5(N)	001-6
9262 ^b	21	70	87	68	0.065	062-5	110-5(N)	001-6
9263 ^b	21	70	78	66	0.059	063-1	110-5(N)	001-6
9264 ^b	177	350	118	100	0.080	063-5	110-5(N)	001-6
9265 ^b	177	350	122	100	0.083	064-1	110-5(N)	001-6
9266	71	160	123	100	0.088	064-5	110-5(N)	001-6
9267	82	180	117	100	0.086	065-1	110-5(N)	001-6
9268	82	180	116	100	0.086	065-5	110-5(N)	001-6
9269	93	200	118	100	0.087	066-1	110-5(N)	001-6
9270	93	200	116	100	0.085	066-5	110-5(N)	001-6
9271	116	240	115	100	0.085	067-1	110-5(N)	001-6
9272	116	240	120	100	0.084	067-5	110-5(N)	001-6
9273	138	280	122	100	0.084	068-1	110-5(N)	001-6
9274	138	280	125	100	0.084	068-5	110-5(N)	001-6
9275	160	320	123	100	0.086	069-1	110-5(N)	001-6
9276	204	400	120	100	0.090	069-5	110-5(N)	001-6
9277	227	440	123	100	0.081	070-1	110-5(N)	001-6
9278	249	480	125	100	0.087	070-5	110-5(N)	001-6
9279	271	520	122	100	0.080	071-1	110-5(N)	001-6
9280	293	560	117	100	0.076	071-5	110-5(N)	001-6
9281	316	600	117	100	0.079	072-1	110-5(N)	001-6
9283 ^b	-40	-40	29	0	0.024	060-5	112-7(N)	001-6
9284 ^b	-40	-40	40	0	0.032	061-1	112-7(N)	001-6
9285 ^b	-7	20	60	31	0.046	061-5	112-7(N)	001-6
9286 ^b	-7	20	50	38	0.039	062-1	112-7(N)	001-6
9287 ^b	21	70	76	63	0.057	062-5	112-7(N)	001-6
9288 ^b	21	70	80	60	0.063	063-1	112-7(N)	001-6
9289 ^b	177	350	120	100	0.083	063-5	112-7(N)	001-6
9290 ^b	177	350	120	100	0.083	064-1	112-7(N)	001-6
9291	71	160	120	100	0.084	064-5	112-7(N)	001-6
9292	71	160	122	100	0.082	065-1	112-7(N)	001-6
9293	27	80	100	80	0.071	065-5	112-7(N)	001-6
9294	-29	-20	40	15	0.030	066-1	112-7(N)	001-6
9295	-84	-120	6	9	0.002	066-5	112-7(N)	001-6

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/8t layer, RW orientation (continued)								
01K-9295	-84	-120	6	0	0.002	066-5	112-7(N)	001-6
9297	-30	-22	30	10	0.024	067-5	112-7(N)	001-6
9298	4	39	40.5	45	0.031	068-1	112-7(N)	001-6
9299	95	203	119.25	0	0.085	068-5	112-7(N)	001-6
9308 ^b	-40	-40	29	10	0.023	060-5	115-1(N)	001-6
9309 ^b	-40	-40	34	10	0.028	061-1	115-1(N)	001-6
9310 ^b	-7	20	57.5	38	0.043	061-5	115-1(N)	001-6
9311 ^b	-7	20	46.5	35	0.037	062-1	115-1(N)	001-6
9312 ^b	21	70	77	57	0.061	062-5	115-1(N)	001-6
9313 ^b	21	70	80	75	0.057	063-1	115-1(N)	001-6
9314 ^b	177	350	121	100	0.084	063-5	115-1(N)	001-6
9315 ^b	177	350	118.5	100	0.082	064-1	115-1(N)	001-6
9316 ^b	-40	-40	10	0	0.008	064-5	115-1(N)	001-6
9317 ^b	-40	-40	10.5	0	0.008	065-1	115-1(N)	001-6
9318 ^b	-40	-40	32	0	0.024	065-5	115-1(N)	001-6
9319 ^b	-40	-40	25	0	0.021	066-1	115-1(N)	001-6
9320 ^b	-40	-40	16	0	0.012	066-5	115-1(N)	001-6
9321 ^b	-40	-40	14.5	5	0.010	067-1	115-1(N)	001-6
9322 ^b	-40	-40	15.5	5	0.010	067-5	115-1(N)	001-6
9323 ^b	-40	-40	20.5	5	0.015	068-1	115-1(N)	001-6
9324 ^b	-40	-40	28.5	5	0.018	068-5	115-1(N)	001-6
9325 ^b	-40	-40	23	5	0.016	069-1	115-1(N)	001-6
1/4t layer, RW orientation								
01K-7000 ^a	-40	-40	10	0		096-7	127-0(N)	003-0
7001 ^a	-18	0	45	21		096-7	124-5(N)	003-0
7002 ^a	4	40	55	25	0.042	096-7	122-3(N)	003-0
7003 ^a	-23	-10	24	19	0.005	096-7	120-1(N)	003-0
7004 ^a	-4	25	52	30	0.011	096-7	112-7(N)	003-0
7005 ^a	-12	10	44	20	0.033	096-7	110-5(N)	003-0
7006 ^a	-18	0	47	17	0.009	096-7	108-3(N)	003-0
7007 ^a	-29	-20	34	5	0.007	096-7	106-0(N)	003-0
7074	-40	-40	13	0	0.010	102-4	122-3(N)	003-0
7075	-18	0	24	23	0.019	102-4	120-1(N)	003-0
7076	-1	30	50	30	0.039	102-4	112-7(N)	003-0
7077	16	60	63	45	0.051	102-4	110-5(N)	003-0
7078	38	100	86	65	0.060	102-4	108-3(N)	003-0
7079	60	140	112	100	0.085	102-4	106-0(N)	003-0
7126	27	80	75	45	0.054	106-2	108-3(N)	003-0
7127	26	79	71	45	0.060	106-2	106-0(N)	003-0
7128	-62	-80	5	0	0.002	106-7	127-0(N)	003-0
7129	93	200	120	100	0.084	106-7	124-5(N)	003-0
7130	149	300	118	100	0.080	106-7	122-3(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01K-7131	204	400	120	100	0.083	106-7	120-1(N)	003-0
7132	-51	-60	10	0	0.005	106-7	112-7(N)	003-0
7133	49	120	87	73	0.069	106-7	110-5(N)	003-0
7134	93	200	115	100	0.083	106-7	108-3(N)	003-0
7135	26	79	77	58	0.059	106-7	106-0(N)	003-0
7136	38	100	92	60	0.064	107-4	127-0(N)	003-0
7137	93	200	123	100	0.079	107-4	124-5(N)	003-0
7138	260	500	115	100	0.074	107-4	122-3(N)	003-0
7139	49	120	113	82	0.078	107-4	120-1(N)	003-0
7140	-73	-100	5	0	0.002	107-4	112-7(N)	003-0
7141	-29	-20	14	0	0.013	107-4	110-5(N)	003-0
7142	54	130	111	85	0.076	107-4	108-3(N)	003-0
7143	54	130	99	71	0.073	107-4	106-0(N)	003-0
7144 ^a	-40	-40	10			108-1	127-0(N)	003-0
7145 ^a	-18	0	34	15	0.028	108-1	124-5(N)	003-0
7146 ^a	4	40	55			108-1	122-3(N)	003-0
7147 ^a	-23	-10	32	0	0.028	108-1	120-1(N)	003-0
7148 ^a	-7	20	45	15	0.032	108-1	112-7(N)	003-0
7149 ^a	-12	10	42	5	0.031	108-1	110-5(N)	003-0
7150 ^a	-29	-20	9	5	0.011	108-1	108-3(N)	003-0
7151 ^a	-18	0	15	19	0.016	108-1	106-0(N)	003-0
7216 ^a	-40	-40	20	1	0.027	113-6	127-0(N)	003-0
7217 ^a	-18	0	37	10	0.031	113-6	124-5(N)	003-0
7218 ^a	4	40	57	25	0.047	113-6	122-3(N)	003-0
7219 ^a	-29	-20	18	5	0.019	113-6	120-1(N)	003-0
7220 ^a	-7	20	48	15	0.039	113-6	112-7(N)	003-0
7221 ^a	-23	-10	33	10	0.029	113-6	110-5(N)	003-0
7222 ^a	-12	10	53	25	0.041	113-6	108-3(N)	003-0
7223 ^a	-34	-30	17	5	0.013	113-6	106-0(N)	003-0
7256 ^a	-40	-40	23	5	0.021	116-7	127-0(N)	003-0
7257 ^a	-18	0	53	20	0.043	116-7	124-5(N)	003-0
7258 ^a	4	40	68	30	0.056	116-7	122-3(N)	003-0
7259 ^a	-29	-20	31	10	0.025	116-7	120-1(N)	003-0
7260 ^a	-7	20	43	25	0.034	116-7	112-7(N)	003-0
7261 ^a	-34	-30	17	10	0.018	116-7	110-5(N)	003-0
7262 ^a	-23	-10	30	10	0.024	116-7	108-3(N)	003-0
7263 ^a	-12	10	48	25	0.040	116-7	106-0(N)	003-0
7280 ^a	-40	-40	37	5	0.028	118-6	127-0(N)	003-0
7281 ^a	-18	0	52	20	0.041	118-6	124-7(N)	003-0
7282 ^a	4	40	71	35	0.056	118-6	122-3(N)	003-0
7283 ^a	-29	-20	35	5	0.029	118-6	120-1(N)	003-0
7284 ^a	-7	20	60	25	0.048	118-6	112-7(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01K-7285 ^a	-34	-30	36	10	0.033	118-6	110-5(N)	003-0
7286 ^a	-46	-50	14	5	0.014	118-6	108-3(N)	003-0
7287 ^a	-40	-40	13	10	0.013	118-6	106-0(N)	003-0
7288 ^a	-40	-40	31	10	0.025	119-3	127-0(N)	003-0
7289 ^a	-18	0	67	20	0.052	119-3	124-5(N)	003-0
7290 ^a	4	40	81	45	0.057	119-3	122-3(N)	003-0
7291 ^a	-29	-20	57	15	0.043	119-3	120-1(N)	003-0
7292 ^a	-51	-60	14	10	0.014	119-3	112-7(N)	003-0
7293 ^a	-34	-30	54	20	0.043	119-3	110-5(N)	003-0
7294 ^a	-46	-50	12	10	0.012	119-3	108-3(N)	003-0
7295 ^a	-40	-40	31	10	0.024	119-3	106-0(N)	003-0
7296 ^a	-73	-100	8	5	0.009	120-0	127-0(N)	003-0
7297 ^a	-40	-40	49	15	0.039	120-0	124-5(N)	003-0
7298 ^a	-18	0	57	30	0.045	120-0	122-3(N)	003-0
7299 ^a	-51	-60	16	20	0.018	120-0	120-1(N)	003-0
7300 ^a	-46	-50	47	25	0.035	120-0	112-7(N)	003-0
7301 ^a	-34	-30	61	35	0.043	120-0	110-5(N)	003-0
7302 ^a	-57	-70	31	10	0.025	120-0	108-3(N)	003-0
7303 ^a	-46	-50	47	20	0.035	120-0	106-0(N)	003-0
7698	-18	0	28	0	0.022	083-5	111-4(N)	003-0
7699	-40	-40	9	0	0.008	084-2	111-4(N)	003-0
7700	4	40	38	33	0.035	084-7	111-4(N)	003-0
7701	21	70	63	47	0.053	085-4	111-4(N)	003-0
7702	-7	20	45	28	0.039	086-1	111-4(N)	003-0
7703	38	100	90	66	0.068	086-6	111-4(N)	003-0
7704	60	140	98	80	0.075	095-7	111-4(N)	003-0
7705	-157	-250	3	0	0.004	095-2	111-4(N)	003-0
7706	121	250	118	100	0.049	094-5	111-4(N)	003-0
7707	-29	-20	20	0	0.020	094-0	111-4(N)	003-0
7708	16	60	60	44	0.051	093-3	111-4(N)	003-0
7709	-12	10	25	25	0.024	092-6	111-4(N)	003-0
7710	-29	-20	10	0	0.010	092-1	111-4(N)	003-0
7711	-1	30	50	37	0.040	091-4	111-4(N)	003-0
1/4t layer, WR orientation								
01K-7688	-7	20	40	10	0.035	095-0(N)	105-4	003-0
7689	-29	-20	15	1	0.014	092-3(N)	105-4	003-0
7690	16	60	46	25	0.042	083-4(N)	109-2	003-0
7691	-40	-40	10	1	0.010	083-4(N)	109-7	003-0
7692	-18	0	21	5	0.020	086-1(N)	109-2	003-0
7693	-12	10	20	5	0.020	086-1(N)	109-7	003-0
7694	27	80	50	30	0.046	095-0(N)	109-2	003-0
7695	4	40	35	15	0.031	095-0(N)	109-7	003-0
7696	71	160	93	100	0.076	092-3(N)	109-2	003-0
7697	-7	20	45	10	0.038	092-3(N)	109-7	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, WR orientation (continued)								
01K-5103	38	100	55	40	0.047	070-5(N)	105-3	003-0
5109	49	120	70	70	0.055	061-6(N)	115-7	003-0
5116	60	140	80	85	0.066	073-2(N)	116-7	003-0
5117	93	200	93	100	0.074	061-6(N)	120-5	003-0
5129	149	300	98	100	0.077	070-5(N)	126-5	003-0
5130	204	400	95	100	0.075	070-5(N)	127-3	003-0
1/4t layer, TW orientation								
01K-7608	-62	-80	4	0	0.005	053-4	114-5	003-0(N)
7609	-40	-40	11	1	0.009	053-4	115-2	003-0(N)
7610	-18	0	17	5	0.014	053-4	115-7	003-0(N)
7611	4	40	30	10	0.024	053-4	116-4	003-0(N)
7620	27	80	47	30	0.037	054-2	114-5	003-0(N)
7621	49	120	63	40	0.052	054-2	115-2	003-0(N)
7622	71	160	76	100	0.059	054-2	115-7	003-0(N)
7623	93	200	66	100	0.056	054-2	116-4	003-0(N)
7632	138	280	87	100	0.068	055-0	114-5	003-0(N)
7633	182	360	80	100	0.062	055-0	115-2	003-0(N)
7634	116	240	82	100	0.061	055-0	115-7	003-0(N)
7635	216	420	88	100	0.072	055-0	116-4	003-0(N)
1/3t layer, RT orientation								
01K-5219	-18	0	37.5	5	0.029	103-7	112-6(N)	004-0
5220	-46	-50	9	1	0.009	104-3	112-6(N)	004-0
5221	38	100	86	60	0.065	104-7	112-6(N)	004-0
5222	66	150	120	100	0.089	105-3	112-6(N)	004-0
5223	10	50	71	30	0.056	105-7	112-6(N)	004-0
5224	-73	-100	4.5	0	0.004	106-3	112-6(N)	004-0
5225	93	200	118	100	0.081	106-7	112-6(N)	004-0
5226	149	300	121	100	0.083	107-3	112-6(N)	004-0
5227	-4	25	45	10	0.037	107-7	112-6(N)	004-0
5228	-32	-25	30	1	0.025	108-3	112-6(N)	004-0
3/8t layer, RW orientation								
01K-7736	-18	0	9	10	0.010	093-3	115-2(N)	004-4
7737	-40	-40	10	0	0.008	092-6	115-2(N)	004-4
7738	4	40	36	20	0.031	092-1	115-2(N)	004-4
7739	-7	20	27	10	0.023	091-4	115-2(N)	004-4
7740	16	60	58	30	0.048	082-3	119-0(N)	004-4
7741	38	100	68	50	0.052	083-0	119-0(N)	004-4
7742	93	200	120	100	0.086	083-5	119-0(N)	004-4
7743	-73	-100	1	0	0.004	084-2	119-0(N)	004-4

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
3/8t layer, RW orientation (continued)								
01K-7744	149	300	105	100	0.079	084-7	119-0(N)	004-4
7745	66	150	108	100	0.081	085-4	119-0(N)	004-4
7746	10	50	48	25	0.038	086-1	119-0(N)	004-4
7747	-1	30	30	20	0.026	086-6	119-0(N)	004-4
7748	-12	10	30	10	0.038	095-7	117-6(N)	004-4
7749	-18	0	27	5	0.021	095-2	117-6(N)	004-4
7750	-23	-10	12	0	0.014	094-5	117-6(N)	004-4
7751	-29	-20	11	0	0.011	094-0	117-6(N)	004-4
7752	-34	-30	10	0	0.011	093-3	117-6(N)	004-4
7753	-7	20	35	10	0.030	092-6	117-6(N)	004-4
7754	-1	30	41	10	0.036	092-1	117-6(N)	004-4
7755	4	40	37	15	0.031	091-4	117-6(N)	004-4
3/8t layer, WR orientation								
01K-7712	-7	20	37	10	0.032	083-4(N)	105-4	004-4
7713	-29	-20	20	1	0.016	083-4(N)	106-1	004-4
7714	16	60	38	20	0.032	086-1(N)	105-4	004-4
7715	-40	-40	8	0	0.008	086-1(N)	106-1	004-4
7716	-18	0	29	5	0.025	095-0(N)	108-6	004-4
7717	66	150	75	100	0.065	095-0(N)	108-1	004-4
7718	-73	-100	3	0	0.002	092-3(N)	108-6	004-4
7719	149	300	90	100	0.069	092-3(N)	108-1	004-4
7720	49	120	56	80	0.050	083-4(N)	113-0	004-4
7721	38	100	52	60	0.050	083-4(N)	113-5	004-4
7722	27	80	50	40	0.044	086-1(N)	113-0	004-4
7723	4	40	27	15	0.027	086-1(N)	113-5	004-4
7724	-1	30	33	10	0.027	095-0(N)	113-0	004-4
7725	-12	10	31	5	0.025	095-0(N)	113-5	004-4
7726	-23	-10	16	0	0.015	092-3(N)	113-0	004-4
7727	-34	-30	7	0	0.007	092-3(N)	113-5	004-4
7728	21	70	32	20	0.031	083-4(N)	116-6	004-4
7729	93	200	87	100	0.071	083-4(N)	117-3	004-4
7730	32	90	53	50	0.047	086-1(N)	116-7	004-4
7731	21	70	41	40	0.038	086-1(N)	117-3	004-4
7732	10	50	34	15	0.046	095-0(N)	120-0	004-4
7733	4	40	36	10	0.031	095-0(N)	119-3	004-4
7734	-7	20	25	10	0.030	092-3(N)	120-0	004-4
7735	-18	0	14	5	0.025	092-3(N)	119-3	004-4
1/2t layer, RW orientation								
01K-7304 ^a	-40	-40	9	0	0.008	096-7	127-0(N)	006-0
7305 ^a	-18	0	31	20	0.027	096-7	124-5(N)	006-0
7306 ^a	4	40	50	36	0.041	096-7	122-3(N)	006-0
7307 ^a	38	100	87	72	0.065	096-7	120-1(N)	006-0
7308 ^a	-23	-10	11	19	0.009	096-7	112-7(N)	006-0
7309 ^a	-12	10	23	21	0.022	096-7	110-5(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW orientation (continued)								
01K-7310 ^a	-29	-20	12	16	0.011	096-7	108-3(N)	006-0
7311 ^a	-7	20	19	30	0.017	096-7	106-0(N)	006-0
7394	27	80	65	60	0.052	103-6	122-3(N)	006-0
7395	-7	20	37	30	0.036	103-6	120-1(N)	006-0
7396	71	160	104	100	0.073	103-6	112-7(N)	006-0
7397	49	120	87	82	0.071	103-6	110-5(N)	006-0
7398	10	50	44	37	0.033	103-6	108-3(N)	006-0
7399	-23	-10	20	27	0.013	103-6	106-0(N)	006-0
7400	-73	-100	3	0	0.002	104-3	127-0(N)	006-0
7401	-129	-200	2	0	0.001	104-3	124-5(N)	006-0
7402	121	250	110	100	0.083	104-3	122-3(N)	006-0
7303	204	400	109	100	0.086	104-3	120-1(N)	006-0
7404	93	200	107	100	0.072	104-3	112-7(N)	006-0
7405	138	280	104	100	0.070	104-3	110-5(N)	006-0
7406	160	320	105	100	0.058	104-3	108-3(N)	006-0
7407	182	360	114	100	0.080	104-3	106-0(N)	006-0
7408	227	440	112	100	0.082	105-0	127-0(N)	006-0
7409	249	480	120	100	0.084	105-0	124-5(N)	006-0
7410	271	520	120	100	0.081	105-0	122-3(N)	006-0
7411	293	560	113	100	0.080	105-0	120-1(N)	006-0
7412	316	600	117	100	0.076	105-0	112-7(N)	006-0
7448 ^a	-40	-40	12	0	0.012	108-1	127-0(N)	006-0
7449 ^a	-18	0	15	10	0.017	108-1	124-5(N)	006-0
7450 ^a	4	40	51	30	0.044	108-1	122-3(N)	006-0
7451 ^a	-7	20	24	20	0.023	108-1	120-1(N)	006-0
7452 ^a	-23	-10	18	10	0.015	108-1	112-7(N)	006-0
7453 ^a	-12	10	31	15	0.029	108-1	110-5(N)	006-0
7454 ^a	-1	30	42	30	0.032	108-1	108-3(N)	006-0
7455 ^a	-29	-20	16	10	0.013	108-1	106-0(N)	006-0
7520 ^a	-40	-40	12	0	0.013	113-6	127-0(N)	006-0
7521 ^a	-18	0	35	10	0.031	113-6	124-5(N)	006-0
7522 ^a	4	40	55	30	0.045	113-6	122-3(N)	006-0
7523 ^a	-29	-20	13	1	0.014	113-6	120-1(N)	006-0
7524 ^a	-7	20	41	20	0.035	113-6	112-7(N)	006-0
7525 ^a	-23	-10	37	10	0.032	113-6	110-5(N)	006-0
7526 ^a	-12	10	37	15	0.031	113-6	108-3(N)	006-0
7527 ^a	-34	-30	11	5	0.008	113-6	106-0(N)	006-0
7560 ^a	-40	-40	11	0	0.009	116-7	127-0(N)	006-0
7561 ^a	-18	0	33	10	0.030	116-7	124-5(N)	006-0
7562 ^a	4	40	45	25	0.037	116-7	122-3(N)	006-0
7563 ^a	-29	-20	28	5	0.023	116-7	120-1(N)	006-0
7564 ^a	-7	20	50	20	0.040	116-7	112-7(N)	006-0
7565 ^a	-34	-30	16	5	0.016	116-7	110-5(N)	006-0
7566 ^a	-23	-10	43	10	0.035	116-7	108-3(N)	006-0
7567 ^a	-29	-20	37	5	0.029	116-7	106-0(N)	006-0
7584 ^a	-40	-40	21	0	0.017	118-6	127-0(N)	006-0
7585 ^a	-18	0	26	10	0.023	118-6	124-5(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW orientation (continued)								
01K-7586 ^a	4	40	53	25	0.045	118-6	122-3(N)	006-0
7587 ^a	-29	-20	29	5	0.027	118-6	120-1(N)	006-0
7588 ^a	-7	20	44	15	0.036	118-6	112-7(N)	006-0
7589 ^a	-23	-10	37	5	0.030	118-6	110-5(N)	006-0
7590 ^a	-34	-30	15	5	0.011	118-6	108-3(N)	006-0
7591 ^a	-40	-40	9	0	0.010	118-6	106-0(N)	006-0
7592 ^a	-40	-40	21	0	0.019	119-3	127-0(N)	006-0
7593 ^a	-18	0	43	10	0.039	119-3	124-5(N)	006-0
7594 ^a	4	40	72	25	0.056	119-3	122-3(N)	006-0
7595 ^a	-7	20	52	20	0.043	119-3	120-1(N)	006-0
7596 ^a	-29	-20	32	5	0.025	119-3	112-7(N)	006-0
7597 ^a	-23	-10	36	5	0.030	119-3	110-5(N)	006-0
7598 ^a	-34	-30	20	1	0.016	119-3	108-3(N)	006-0
7599 ^a	-46	-50	12	0	0.009	119-3	106-0(N)	006-0
7600 ^a	-73	-100	6	0	0.004	120-0	127-0(N)	006-0
7601 ^a	-40	-40	41	1	0.034	120-0	124-5(N)	006-0
7602 ^a	-18	0	60	10	0.048	120-0	122-3(N)	006-0
7603 ^a	-51	-60	12	0	0.012	120-0	120-1(N)	006-0
7604 ^a	-46	-50	12	0	0.010	120-0	112-7(N)	006-0
7605 ^a	-34	-30	30	5	0.025	120-0	110-5(N)	006-0
7606 ^a	4	40	83	35	0.061	120-0	108-3(N)	006-0
7607 ^a	-29	-20	46	5	0.036	120-0	106-0(N)	006-0
1/2t layer, WR orientation								
01K-5133	-62	-80	3	0	0.002	061-6(N)	116-7	006-0
5134	-51	-60	5	0	0.004	061-6(N)	117-5	006-0
5135	-40	-40	5	0	0.006	064-3(N)	116-7	006-0
5136	-29	-20	7	1	0.007	064-3(N)	117-5	006-0
5137	-18	0	12	5	0.012	070-5(N)	119-1	006-0
5138	-7	20	20	10	0.021	070-5(N)	119-7	006-0
5139	4	40	24	20	0.023	073-2(N)	119-1	006-0
5140	16	60	31	30	0.031	073-2(N)	119-7	006-0
5141	27	80	54	30	0.045	061-6(N)	120-5	006-0
5142	38	100	60	45	0.048	061-6(N)	121-3	006-0
5143	49	120	62	60	0.052	064-3(N)	120-5	006-0
5144	60	140	74	100	0.054	064-3(N)	121-3	006-0
5145	71	160	75	100	0.078	070-5(N)	122-7	006-0
5146	82	180	72	100	0.059	070-5(N)	123-5	006-0
5147	93	200	76	100	0.062	073-2(N)	122-7	006-0
5148	138	280	76	100	0.070	073-2(N)	123-5	006-0
5149	182	360	94	100	0.080	061-6(N)	124-3	006-0
5150	160	320	70	100	0.061	061-6(N)	125-1	006-0
5151	227	440	90	100	0.075	064-3(N)	124-3	006-0
5152	21	70	46	35	0.040	064-3(N)	125-1	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, WR orientation (continued)								
01K-5153	160	320	70	100	0.061	070-5(N)	126-5	006-0
5154	138	280	91	100	0.065	070-5(N)	127-3	006-0
5155	-12	10	10.5	10	0.009	073-2(N)	126-5	006-0
5156	116	240	84	100	0.065	073-2(N)	127-3	006-0
1/2t layer, TW orientation								
01K-7612	-62	-80	2	0	0.002	053-4	114-5	006-0(N)
7613	-40	-40	4	5	0.003	053-4	115-2	006-0(N)
7614	-18	0	7	10	0.007	053-4	115-7	006-0(N)
7615	4	40	11	20	0.012	053-4	116-4	006-0(N)
7624	27	80	27	100	0.028	054-2	114-5	006-0(N)
7625	49	120	37	100	0.035	054-2	115-2	006-0(N)
7626	71	160	50	100	0.053	054-2	115-7	006-0(N)
7627	93	200	64	100	0.059	054-2	116-4	006-0(N)
7636	138	280	20	100	0.022	055-0	114-5	006-0(N)
7637	182	360	51	100	0.052	055-0	115-2	006-0(N)
7638	160	320	47	100	0.050	055-0	115-7	006-0(N)
7639	160	320	55	100	0.053	055-0	116-4	006-0(N)
5/8t layer, RW orientation								
01K-5157	-62	-80	3	0	0.002	060-5	107-5(N)	007-4
5158	-51	-60	5	0	0.004	061-2	107-5(N)	007-4
5159	-40	-40	10	1	0.009	061-7	107-5(N)	007-4
5160	-29	-20	9	5	0.008	062-4	107-5(N)	007-4
5161	-18	0	20	5	0.014	063-1	107-5(N)	007-4
5162	-7	20	32	10	0.024	063-6	107-5(N)	007-4
5163	4	40	45	15	0.010	064-3	107-5(N)	007-4
5164	16	60	48	20	0.037	065-0	107-5(N)	007-4
5169	27	80	68	35	0.048	069-6	106-3(N)	007-4
5170	38	100	75	50	0.055	070-3	106-3(N)	007-4
5171	49	120	94	65	0.060	071-1	106-3(N)	007-4
5172	71	160	94	99	0.069	071-5	106-3(N)	007-4
5173	93	200	124	100	0.077	072-2	106-3(N)	007-4
5174	138	280	120	100	0.077	072-7	106-3(N)	007-4
5175	182	360	115	100	0.073	073-4	106-3(N)	007-4
5176	82	180	117	100	0.075	074-1	106-3(N)	007-4
5/8t layer, WR orientation								
01K-5165	-62	-80	3	0	0.004	061-6(N)	105-3	007-4
5166	-51	-60	4	0	0.006	061-6(N)	106-0	007-4
5167	-40	-40	7	0	0.008	064-3(N)	105-3	007-4
5168	-29	-20	12	1	0.012	064-3(N)	106-0	007-4
5177	-18	0	19	5	0.018	070-5(N)	107-6	007-4
5178	-7	20	25	10	0.021	070-5(N)	108-3	007-4
5179	4	40	28	15	0.026	073-2(N)	107-6	007-4

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
5/8t Layer, WR orientation (continued)								
01K-5180	16	60	42	20	0.031	073-2(N)	108-3	007-4
5189	27	80	45	25	0.043	061-6(N)	109-1	007-4
5190	38	100	65	30	0.050	061-6(N)	109-6	007-4
5191	49	120	68	50	0.061	064-3(N)	109-1	007-4
5192	71	160	87	100	0.066	064-3(N)	109-6	007-4
5201	93	200	93	100	0.076	070-5(N)	111-4	007-4
5202	149	300	89	100	0.070	070-5(N)	112-1	007-4
5203	204	400	94	100	0.070	073-2(N)	111-4	007-4
5204	60	140	83	80	0.065	073-2(N)	112-1	007-4
3/4t Layer, TW orientation								
01K-7616	-62	-80	3	0	0.004	053-4	114-5(N)	009-0
7617	-40	-40	7	1	0.007	053-4	115-2(N)	009-0
7618	-18	0	19	5	0.018	053-4	115-7(N)	009-0
7619	4	40	35	20	0.030	053-4	116-4(N)	009-0
7628	27	80	40	35	0.025	054-2	114-5(N)	009-0
7629	49	120	56	55	0.029	054-2	115-2(N)	009-0
7630	71	160	77	100	0.061	054-2	115-7(N)	009-0
7631	93	200	82	100	0.065	054-2	116-4(N)	009-0
7640	138	280	80	100	0.066	055-0	114-5(N)	009-0
7641	182	360	79	100	0.066	055-0	115-2(N)	009-0
7642	-7	20	23	10	0.020	055-0	115-7(N)	009-0
7643	29	-20	13	5	0.010	055-0	116-4(N)	009-0
7/8t Layer, RW orientation								
01K-5017	-84	-120	4	0	0.008	082-3	107-6(N)	010-0
5018	-62	-80	5	0	0.004	083-0	107-6(N)	010-0
5019	-40	-40	7	0	0.004	083-5	107-6(N)	010-0
5020	-18	0	25	5	0.020	084-2	107-6(N)	010-0
5021	4	40	47	20	0.038	084-7	107-6(N)	010-0
5022	27	80	79	40	0.050	085-4	107-6(N)	010-0
5023	49	120	95	70	0.068	086-1	107-6(N)	010-0
5024	71	160	114	100	0.079	086-6	107-6(N)	010-0
5029	149	300	118	100	0.083	091-4	106-4(N)	010-0
5030	204	400	119	100	0.078	092-1	106-4(N)	010-0
5031	121	250	117	100	0.075	092-6	106-4(N)	010-0
5032	16	60	59	25	0.044	093-3	106-4(N)	010-0
5033	-7	20	47	10	0.033	094-0	106-4(N)	010-0
5034	-12	10	42	5	0.033	094-5	106-4(N)	010-0
5035	-12	10	34	5	0.025	095-2	106-4(N)	010-0
5036	-7	20	41	10	0.031	095-7	106-4(N)	010-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
7/8t layer, WR orientation								
01K-5025	93	200	92	100	0.076	083-4(N)	105-4	010-0
5026	71	160	90	100	0.069	083-4(N)	106-1	010-0
5027	49	120	80	80	0.068	086-1(N)	105-4	010-0
5028	27	80	68	50	0.054	086-1(N)	106-1	010-0
5037	4	40	28	25	0.031	092-3(N)	107-7	010-0
5038	-18	0	27	5	0.022	092-3(N)	108-4	010-0
5039	-40	-40	7	1	0.007	095-5(N)	107-7	010-0
5040	-62	-80	5	0	0.004	095-5(N)	108-4	010-0
5041	-29	-20	12	5	0.011	083-4(N)	116-2	010-0
5042	-7	20	21	10	0.019	083-4(N)	115-5	010-0
5043	16	60	48	30	0.041	086-1(N)	116-2	010-0
5044	138	280	106	100	0.080	086-1(N)	115-5	010-0
5045	227	440	103	100	0.072	092-3(N)	113-7	010-0
5046	116	240	100	100	0.070	092-3(N)	113-2	010-0
5047	182	360	103	100	0.080	095-0(N)	113-7	010-0
5048	-18	0	29	5	0.024	095-0(N)	113-2	010-0
1t layer, RW orientation								
01K-5049	-157	-250	5	0	0.003	082-3	106-4(N)	011-5
5050	-129	-200	18	0	0.011	083-0	106-4(N)	011-5
5051	-118	-180	16	0	0.007	083-5	106-4(N)	011-5
5052	-107	-160	29	1	0.019	084-2	106-4(N)	011-5
5053	-96	-140	24	5	0.016	084-7	106-4(N)	011-5
5054	-84	-120	34	10	0.023	085-4	106-4(N)	011-5
5055	-73	-100	40	15	0.025	086-1	106-4(N)	011-5
5056	-51	-60	81	80	0.058	086-6	106-4(N)	011-5
5061	-29	-20	98	100	0.069	091-4	107-6(N)	011-5
5062	-7	20	103	100	0.068	092-1	107-6(N)	011-5
5063	16	60	109	100	0.071	092-6	107-6(N)	011-5
5064	60	140	110	100	0.079	093-3	107-6(N)	011-5
5065	49	120	110	100	0.073	094-0	107-6(N)	011-5
5067	121	250	111	100	0.076	095-2	107-6(N)	011-5
5068	-62	-80	59	50	0.041	095-7	107-6(N)	011-5
1t layer, WR orientation								
01K-5057	-157	-250	0	0	0.003	083-4(N)	108-6	011-5
5058	-129	-200	12	0	0.007	083-4(N)	108-1	011-5
5059	-118	-180	17	0	0.011	086-1(N)	108-6	011-5
5060	-107	-160	20	1	0.012	086-1(N)	108-1	011-5
5069	-84	-120	32	10	0.024	092-3(N)	106-3	011-5
5070	-73	-100	37	20	0.026	092-3(N)	105-6	011-5
5071	-51	-60	54	30	0.046	095-0(N)	106-3	011-5

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1t layer, WR orientation (continued)								
01K-5072	-29	-20	79	100	0.061	095-0(N)	105-6	011-5
5073	-7	20	85	100	0.068	083-4(N)	113-0	011-5
5074	16	60	87	100	0.069	083-4(N)	113-5	011-5
5075	60	140	93	100	0.074	086-1(N)	113-0	011-5
5076	-96	-140	14	5	0.013	086-1(N)	113-5	011-5
5077	121	250	96	100	0.069	092-3(N)	115-3	011-5
5078	177	350	92	100	0.065	092-3(N)	116-0	011-5
5079	4	40	87	100	0.068	095-0(N)	115-3	011-5
5080	-96	-140	22	1	0.015	095-0(N)	116-0	011-5
Plate section 01MU								
Surface (0t) layer, RW orientation								
01MU-9036	-18	0	107	100	0.069	043-6	244-6(N)	000-3
9037	-40	-40	80	80	0.056	044-2	244-6(N)	000-3
9038	-62	-80	48	30	0.034	044-6	244-6(N)	000-3
9039	-84	-120	36	5	0.023	045-2	244-6(N)	000-3
9040	-107	-160	33	0	0.021	045-6	244-6(N)	000-3
9041	-129	-200	9	0	0.001	046-2	244-6(N)	000-3
9042	-151	-240	3	0	0.000	046-6	244-6(N)	000-3
9043	27	80	125	100	0.078	047-2	244-6(N)	000-3
9044	71	160	118	100	0.075	047-6	244-6(N)	000-3
9045	-118	-180	5	0	0.000	048-2	244-6(N)	000-3
9046	-96	-140	2	0	0.000	048-6	244-6(N)	000-3
9047	-73	-100	25	10	0.016	049-2	244-6(N)	000-3
9048	-51	-60	45		0.032	049-6	244-6(N)	000-3
9049	4	40	115	100	0.073	050-2	244-6(N)	000-3
9050	116	240	128	100	0.075	050-6	244-6(N)	000-3
9051	182	360	125	100	0.079	051-2	244-6(N)	000-3
9052	-84	-120	42	10	0.030	051-6	244-6(N)	000-3
9053	-107	-160	22	0	0.012	052-2	244-6(N)	000-3
9054	-62	-80	66	50	0.046	052-6	244-6(N)	000-3
9055	-73	-100	45	10	0.032	053-2	244-6(N)	000-3
5433	-129	-200	5	0	0.001	043-6	219-2(N)	000-3
5434	-107	-160	3	0	0.001	044-2	219-2(N)	000-3
5435	-84	-120	12	5	0.007	044-6	219-2(N)	000-3
5436	-62	-80	32		0.021	045-2	219-2(N)	000-3
5437	-40	-40	63		0.044	045-6	219-2(N)	000-3
5438	-18	0	96	90	0.061	046-2	219-2(N)	000-3
5439	4	40	123	100	0.073	046-6	219-2(N)	000-3
5440	27	80	122	100	0.092	047-2	219-2(N)	000-3
5441	71	160	119	100	0.081	047-6	219-2(N)	000-3
5442	116	240	125	100	0.083	048-2	219-2(N)	000-3
5443	182	360	121	100	0.078	048-6	219-2(N)	000-3
5444	-151	-240	3	0	0.004	049-2	219-2(N)	000-3
5445	-118	-180	3	0	0.004	043-6	221-7(N)	000-3

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface (0t) layer, RW orientation (continued)								
OIMU-5446	-96	-140	7	0	0.008	044-2	221-7(N)	000-3
5447	-73	-100	13	10	0.014	044-6	221-7(N)	000-3
5448	-51	-60	45		0.036	045-2	221-7(N)	000-3
5449	-29	-20	71		0.052	045-6	221-7(N)	000-3
5450	-40	-40	60		0.043	046-2	221-7(N)	000-3
5451	-51	-60	68		0.050	046-6	221-7(N)	000-3
5452	-62	-80	58	35	0.043	047-2	221-7(N)	000-3
5453	-68	-90	47	30	0.037	047-6	221-7(N)	000-3
5454	-62	-80	47	25	0.035	048-2	221-7(N)	000-3
5455	-73	-100	39	10	0.034	048-6	221-7(N)	000-3
5456	71	160	125	100	0.075	049-2	221-7(N)	000-3
Surface (0t) layer, WR orientation								
OIMU-9154	-18	0	80	95	0.061	066-7(N)	235-2	000-3
9155	-40	-40	55	35	0.045	066-7(N)	235-6	000-3
9156	-62	-80	34	5	0.026	066-7(N)	236-2	000-3
9157	-84	-120	10	2	0.008	066-7(N)	236-6	000-3
9158	-107	-160	3	0	0.007	066-7(N)	237-2	000-3
9159	-129	-200	5	0	0.001	066-7(N)	237-6	000-3
9160	-151	-240	3	0	0.001	066-7(N)	238-2	000-3
9161	27	80	92	100	0.070	066-7(N)	238-6	000-3
9162	116	240	103	100	0.075	066-7(N)	239-2	000-3
9163	71	160	92	100	0.068	066-7(N)	239-6	000-3
9164	-73	-100	30	2	0.021	066-7(N)	240-2	000-3
9165	204	400	94	100	0.071	066-7(N)	240-6	000-3
9166	-29	-20	51	35	0.043	066-7(N)	241-2	000-3
9167	-51	-60	41	10	0.031	066-7(N)	241-6	000-3
9168	-68	-90	32	5	0.025	066-7(N)	242-2	000-3
9169	-79	-110	25	0	0.019	066-7(N)	242-6	000-3
9170	-29	-20	60	75	0.051	066-7(N)	243-2	000-3
9171	149	300	92	100	0.068	066-7(N)	243-6	000-3
1/4t layer, RW orientation								
OIMU-9056	-62	-80	5	0	0.001	043-6	244-6(N)	003-0
9057	-40	-40	8	0	0.001	044-2	244-6(N)	003-0
9058	4	40	44	10	0.035	044-6	244-6(N)	003-0
9059	-18	0	22	5	0.015	045-2	244-6(N)	003-0
9060	27	80	94	30	0.062	045-6	244-6(N)	003-0
9061	49	120	104	80	0.073	046-2	244-6(N)	003-0
9062	71	160	135	100	0.078	046-6	244-6(N)	003-0
9063	93	200	135	100	0.076	047-2	244-6(N)	003-0
9064	138	280	139	100	0.079	047-6	244-6(N)	003-0
9065	182	360	135	100	0.079	048-2	244-6(N)	003-0
9066	-29	-20	10	0	0.007	048-6	244-6(N)	003-0
9067	-7	20	38	5	0.029	049-2	244-6(N)	003-0
9068	16	60	79	20	0.057	049-6	244-6(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01MU-9069	38	100	90	40	0.057	050-2	244-6(N)	003-0
9070	60	140	123	90	0.076	050-6	244-6(N)	003-0
9071	16	60	73	25	0.055	051-2	244-6(N)	003-0
9072	-84	-120	3	0	0.000	051-6	244-6(N)	003-0
9073	-29	-20	12	0	0.010	052-2	244-6(N)	003-0
9074	260	500	147	100	0.072	052-6	244-6(N)	003-0
9075	204	400	144	100	0.075	053-2	244-6(N)	003-0
5457	-62	-80	2	0	0.000	043-6	219-2(N)	003-0
5458	-40	-40	9	0	0.009	044-2	219-2(N)	003-0
5459	-18	0	20	0	0.018	044-6	219-2(N)	003-0
5460	4	40	41	10	0.033	045-2	219-2(N)	003-0
5461	27	80	51	25	0.042	045-6	219-2(N)	003-0
5462	49	120	88	55	0.067	046-2	219-2(N)	003-0
5463	71	160	118	100	0.081	046-6	219-2(N)	003-0
5464	93	200	124	100	0.076	047-2	219-2(N)	003-0
5465	138	280	127	100	0.087	047-6	219-2(N)	003-0
5466	182	360	121	100	0.075	048-2	219-2(N)	003-0
5467	-29	-20	10	0	0.010	048-6	219-2(N)	003-0
5468	-7	20	31	5	0.028	049-2	219-2(N)	003-0
5469	16	60	62	20	0.048	043-6	221-7(N)	003-0
5470	38	100	84	50	0.063	044-2	221-7(N)	003-0
5471	60	140	104	100	0.075	044-6	221-7(N)	003-0
5472	204	400	125	100	0.082	045-2	221-7(N)	003-0
5473	32	90	68	35	0.051	045-6	221-7(N)	003-0
5474	-7	20	25	5	0.020	046-2	221-7(N)	003-0
5475	-18	0	30	5	0.025	046-6	221-7(N)	003-0
5476	-29	-20	14	0	0.013	047-2	221-7(N)	003-0
5477	-84	-120	2	0	0.004	047-6	221-7(N)	003-0
5478	-107	-160	1	0	0.005	048-2	221-7(N)	003-0
5479	4	40	41	10	0.035	048-6	221-7(N)	003-0
5480	16	60	55	20	0.047	049-2	221-7(N)	003-0
1/4t layer, WR orientation								
01MU-9172	-62	-80	2	0	0.000	066-7(N)	235-2	003-0
9173	-40	-40	7	0	0.006	066-7(N)	235-6	003-0
9174	-18	0	17	0	0.016	066-7(N)	236-2	003-0
9175	4	40	40	10	0.031	066-7(N)	236-6	003-0
9176	27	80	61	30	0.047	066-7(N)	237-2	003-0
9177	49	120	83	70	0.063	066-7(N)	237-6	003-0
9178	71	160	112	99	0.078	066-7(N)	238-2	003-0
9179	93	200	101	100	0.069	066-7(N)	238-6	003-0
9180	138	280	113	100	0.083	066-7(N)	239-2	003-0
9181	182	360	98	100	0.071	066-7(N)	239-6	003-0
9182	-29	-20	10	0	0.009	066-7(N)	240-2	003-0
9183	-7	20	32	5	0.026	066-7(N)	240-6	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, WR orientation (continued)								
OIMU-9184	160	320	108	100	0.077	066-7(N)	241-2	003-0
9185	116	240	112	100	0.077	066-7(N)	241-6	003-0
9186	204	400	97	100	0.073	066-7(N)	242-2	003-0
9187	82	180	102	100	0.076	066-7(N)	242-6	003-0
9188	-12	10	18	2	0.016	066-7(N)	243-2	003-0
9189	16	60	54	15	0.047	066-7(N)	243-6	003-0
1/4t layer, TR orientation								
OIMU-9136	-62	-80	3	0	0.001	065-0	235-2	003-0(N)
9137	-40	-40	9	0	0.007	065-0	235-6	003-0(N)
9138	-18	0	20	0	0.016	065-0	236-2	003-0(N)
9139	4	40	21	5	0.017	065-0	236-6	003-0(N)
9140	27	80	42	10	0.038	065-0	237-2	003-0(N)
9141	49	120	55	40	0.049	065-0	237-6	003-0(N)
9142	71	160	70	100	0.063	065-0	238-2	003-0(N)
9143	93	200	83	100	0.066	065-0	238-6	003-0(N)
9144	138	280	85	100	0.068	065-0	239-2	003-0(N)
9145	182	360	77	100	0.069	065-0	239-6	003-0(N)
9146	-29	-20	15	0	0.011	065-0	240-2	003-0(N)
9147	-7	20	21	2	0.014	065-0	240-6	003-0(N)
9148	16	60	33	5	0.031	065-0	241-2	003-0(N)
9149	116	240	79	100	0.063	065-0	241-6	003-0(N)
9150	160	320	77	100	0.065	065-0	242-2	003-0(N)
9151	232	450	73	100	0.064	065-0	242-6	003-0(N)
9152	4	40	26	2	0.025	065-0	243-2	003-0(N)
9153	-18	0	15	0	0.014	065-0	243-6	003-0(N)
1/2t layer, RW orientation								
OIMU-9076	-62	-80	4	0	0.000	043-6	244-6(N)	006-0
9077	-40	-40	7	0	0.004	044-2	244-6(N)	006-0
9078	-18	0	13	0	0.010	044-6	244-6(N)	006-0
9079	4	40	57	5	0.049	045-2	244-6(N)	006-0
9080	27	80	85	50	0.062	045-6	244-6(N)	006-0
9081	49	120	123	100	0.077	046-2	244-6(N)	006-0
9082	71	160	117	100	0.076	046-6	244-6(N)	006-0
9083	93	200	131	100	0.072	047-2	244-6(N)	006-0
9084	138	280	127	100	0.079	047-6	244-6(N)	006-0
9085	182	360	129	100	0.077	048-2	244-6(N)	006-0
9086	-29	-20	10	0	0.008	048-6	244-6(N)	006-0
9087	-18	0	14	0	0.012	049-2	244-6(N)	006-0
9088	-7	20	22	0	0.017	049-6	244-6(N)	006-0
9089	16	60	63	10	0.050	050-2	244-6(N)	006-0
9090	38	100	106	70	0.070	050-6	244-6(N)	006-0
9091	-1	30	33	0	0.028	051-2	244-6(N)	006-0
9092	-7	20	41	0	0.034	051-6	244-6(N)	006-0
9093	-12	10	38	0	0.033	052-2	244-6(N)	006-0
9095	4	40	38	5	0.034	053-2	244-6(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, WR orientation								
01MU-9190	-62	-80	2	0	0.000	066-7(N)	235-2	006-0
9191	-40	-40	5	0	0.003	066-7(N)	235-6	006-0
9192	-18	0	13	0	0.011	066-7(N)	236-2	006-0
9193	4	40	29	5	0.023	066-7(N)	236-6	006-0
9194	27	80	44	30	0.040	066-7(N)	237-2	006-0
9195	49	120	78	70	0.061	066-7(N)	237-6	006-0
9196	71	160	82	100	0.060	066-7(N)	238-2	006-0
9197	93	200	97	100	0.076	066-7(N)	238-6	006-0
9198	138	280	95	100	0.070	066-7(N)	239-2	006-0
9199	182	360	94	100	0.075	066-7(N)	239-6	006-0
9200	-7	20	24	?	0.022	066-7(N)	240-2	006-0
9201	38	100	70	50	0.055	066-7(N)	240-6	006-0
9202	116	240	106	100	0.067	066-7(N)	241-2	006-0
9203	160	320	104	100	0.072	066-7(N)	241-6	006-0
9204	32	90	70	35	0.052	066-7(N)	242-2	006-0
9205	16	60	33	25	0.033	066-7(N)	242-6	006-0
9206	-12	10	18	0	0.017	066-7(N)	243-2	006-0
9207	32	90	54	40	0.048	066-7(N)	243-6	006-0
Plate section 01SH								
1/4t layer, RW orientation								
01SH-5481	-62	-80	3	0	0.000	066-2	170-5(N)	003-0
5482	-40	-40	6	0	0.004	066-6	170-5(N)	003-0
5483	-29	-20	19	0	0.014	067-2	170-5(N)	003-0
5484	-18	0	27	10	0.023	067-6	170-5(N)	003-0
5485	-7	20	32	10	0.025	068-2	170-5(N)	003-0
5486	4	40	40	20	0.032	068-6	170-5(N)	003-0
5487	16	60	65	30	0.051	069-2	170-5(N)	003-0
5488	38	100	81	55	0.061	069-6	170-5(N)	003-0
5489	60	140	104	75	0.070	070-2	170-5(N)	003-0
5490	82	180	121	100	0.081	070-6	170-5(N)	003-0
5491	104	220	126	100	0.084	071-2	170-5(N)	003-0
5492	149	300	125	100	0.079	071-6	170-5(N)	003-0
5493	204	400	120	100	0.082	066-2	173-2(N)	003-0
5494	260	500	124	100	0.079	066-6	173-2(N)	003-0
5495	-51	-60	5	0	0.002	067-2	173-2(N)	003-0
5496	-40	-40	9	0	0.006	067-6	173-2(N)	003-0
5497	-23	-10	11	5	0.009	068-2	173-2(N)	003-0
5498	-12	10	31	10	0.024	068-6	173-2(N)	003-0
5499	-1	30	42	20	0.041	069-2	173-2(N)	003-0
5500	10	50	57	25	0.053	069-6	173-2(N)	003-0
5501	27	80	75	40	0.057	070-2	173-2(N)	003-0
5503	-18	0	22	5	0.017	071-2	173-2(N)	003-0
5504	-23	-10	24	1	0.017	071-6	173-2(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1t layer, RW orientation								
01SH-5505	-129	-200	5	0	0.002	066-2	170-5(N)	011-5
5506	-107	-160	11	0	0.009	066-6	170-5(N)	011-5
5507	-96	-140	23	1	0.017	067-2	170-5(N)	011-5
5508	-84	-120	35	1	0.028	067-6	170-5(N)	011-5
5509	-73	-100	47	5	0.038	068-2	170-5(N)	011-5
5510	-62	-80	41	15	0.032	068-6	170-5(N)	011-5
5511	-40	-40	63	25	0.046	069-2	170-5(N)	011-5
5512	-18	0	86	60	0.066	069-6	170-5(N)	011-5
5513	4	40	122	100	0.080	070-2	170-5(N)	011-5
5514	38	100	125	100	0.080	070-6	170-5(N)	011-5
5515	93	200	128	100	0.082	071-2	170-5(N)	011-5
5516	149	300	123	100	0.082	071-6	170-5(N)	011-5
5517	204	400	118	100	0.082	066-2	173-2(N)	011-5
5518	260	500	134			066-6	173-2(N)	011-5
5519	-118	-180	7	0	0.007	067-2	173-2(N)	011-5
5521	-57	-70	43	15	0.021	068-2	173-2(N)	011-5
5522	-62	-80	47	10	0.036	068-6	173-2(N)	011-5
5523	-68	-90	43	10	0.034	069-2	173-2(N)	011-5
5524	-73	-100	36	5	0.029	069-6	173-2(N)	011-5
5525	-79	-110	33	5	0.024	070-2	173-2(N)	011-5
5526	-84	-120	31	1	0.020	070-6	173-2(N)	011-5
5528	-7	20	93	70	0.071	071-6	173-2(N)	011-5
Plate section 02AH								
Surface layer, RW orientation								
02AH-1000	-157	-250	13	0	0.009	012-1	013-7(N)	000-2
1001	-129	-200	22	0	0.015	012-5	013-7(N)	000-2
1002	-101	-150	30	0	0.022	013-1	013-7(N)	000-2
1003	-73	-100	56.5	30	0.039	013-5	013-7(N)	000-2
1004	-46	-50	87	90	0.057	014-1	013-7(N)	000-2
1005	-18	0	108	100	0.073	014-5	013-7(N)	000-2
1006	10	50	107	100	0.076	015-1	013-7(N)	000-2
1007	38	100	112	100	0.075	015-5	013-7(N)	000-2
1008	66	150	118	100	0.083	016-1	013-7(N)	000-2
1009	93	200	113	100	0.075	016-5	013-7(N)	000-2
1010	121	250	113	100	0.079	017-1	013-7(N)	000-2
1011	-112	-170	26	0	0.022	017-5	013-7(N)	000-2
1012	-84	-120	43	10	0.029	012-1	016-1(N)	000-2
1013	-57	-70	80	80	0.059	012-5	016-1(N)	000-2
1014	-34	-30	98	99	0.072	013-1	016-1(N)	000-2
1015	177	350	117	100	0.077	013-5	016-1(N)	000-2
1016	232	450	116	100	0.071	014-1	016-1(N)	000-2
1017	288	550	113	100	0.082	014-5	016-1(N)	000-2
1018	288	550	117	100	0.084	015-1	016-1(N)	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface Layer, RW orientation (continued)								
02AH-1019	-140	-220	21	0	0.013	015-5	016-1(N)	000-2
1020	-90	-130	40	10	0.029	016-1	016-1(N)	000-2
1021	-68	-90	59	40	0.044	016-5	016-1(N)	000-2
1022	149	300	123	100	0.082	017-1	016-1(N)	000-2
1023	-62	-80	59	35	0.042	017-5	016-1(N)	000-2
Surface Layer, WR orientation								
02AH-1024	-157	-250	7	0	0.003	013-1(N)	017-3	000-2
1025	-129	-200	18.5	0	0.010	013-1(N)	017-7	000-2
1026	-101	-150	20	2	0.011	013-1(N)	018-3	000-2
1027	-73	-100	37	30	0.026	013-1(N)	018-7	000-2
1028	-46	-50	65	80	0.049	013-1(N)	019-3	000-2
1029	-18	0	83	100	0.061	013-1(N)	019-7	000-2
1030	10	50	88	100	0.065	015-3(N)	017-3	000-2
1031	38	100	96	100	0.074	015-3(N)	017-7	000-2
1032	66	150	100	100	0.075	015-3(N)	018-3	000-2
1033	93	200	97	100	0.068	015-3(N)	018-7	000-2
1034	121	250	99.5	100	0.074	015-3(N)	019-3	000-2
1035	149	300	93	100	0.072	015-3(N)	019-7	000-2
1036	-112	-170	17	0	0.011	017-5(N)	017-3	000-2
1037	-84	-120	28	0	0.020	017-5(N)	017-7	000-2
1038	-57	-70	47	40	0.036	017-5(N)	018-3	000-2
1039	-34	-30	82	100	0.057	017-5(N)	018-7	000-2
1040	177	350	85	100	0.070	017-5(N)	019-3	000-2
1041	232	450	91	100	0.071	017-5(N)	019-7	000-2
1042	288	550	94	100	0.070	019-7(N)	017-3	000-2
1043	288	550	94	100	0.073	019-7(N)	017-7	000-2
1044	-140	-220	15	0	0.008	019-7(N)	018-3	000-2
1045	-7	20	84	100	0.065	019-7(N)	018-7	000-2
1046	21	70	81	100	0.063	019-7(N)	019-3	000-2
1047	10	50	86	100	0.063	019-7(N)	019-7	000-2
1/4t Layer, RW orientation								
02AH-1048	-73	-100	4	0	0.005	012-1	013-7(N)	003-0
1049	-46	-50	13	0	0.010	012-5	013-7(N)	003-0
1050	-18	0	35	0	0.030	013-1	013-7(N)	003-0
1051	10	50	67	20	0.051	013-5	013-7(N)	003-0
1052	38	100	82	40	0.062	014-1	013-7(N)	003-0
1053	66	150	105	100	0.079	014-5	013-7(N)	003-0
1054	93	200	115	100	0.086	015-1	013-7(N)	003-0
1055	121	250	122	100	0.090	015-5	013-7(N)	003-0
1056	149	300	115	100	0.081	016-1	013-7(N)	003-0
1057	177	350	128	100	0.091	016-5	013-7(N)	003-0
1058	204	400	113	100	0.084	017-1	013-7(N)	003-0
1059	-34	-30	14	0	0.013	017-5	013-7(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
02AH-1060	-7	20	40	5	0.034	012-1	016-1(N)	003-0
1061	21	70	65	35	0.054	012-5	016-1(N)	003-0
1062	49	120	90	45	0.073	013-1	016-1(N)	003-0
1063	232	450	111	100	0.086	013-5	016-1(N)	003-0
1064	288	550	108	100	0.080	014-1	016-1(N)	003-0
1065	288	550	112	100	0.085	014-5	016-1(N)	003-0
1066	-23	-10	29	0	0.025	015-1	016-1(N)	003-0
1067	4	40	45	15	0.038	015-5	016-1(N)	003-0
1068	27	80	67	30	0.054	016-1	016-1(N)	003-0
1069	-62	-80	6	0	0.004	016-5	016-1(N)	003-0
1070	-29	-20	21	0	0.019	017-1	016-1(N)	003-0
1071	160	320	117	100	0.089	017-5	016-1(N)	003-0
1/4t layer, WR orientation								
02AH-1072	-73	-100	4	0	0.004	013-1(N)	017-3	003-0
1073	-46	-50	8	0	0.006	013-1(N)	017-7	003-0
1074	-18	0	19	0	0.016	013-1(N)	018-3	003-0
1075	10	50	50	10	0.042	013-1(N)	018-7	003-0
1076	38	100	67	30	0.057	013-1(N)	019-3	003-0
1077	66	150	97	99	0.076	013-1(N)	019-7	003-0
1078	93	200	105	100	0.079	015-3(N)	017-3	003-0
1079	121	250	98	100	0.081	015-3(N)	017-7	003-0
1080	149	300	104	100	0.084	015-3(N)	018-3	003-0
1081	177	350	106	100	0.083	015-3(N)	018-7	003-0
1082	204	400	102	100	0.080	015-3(N)	019-3	003-0
1083	-34	-30	11	100	0.011	015-3(N)	019-7	003-0
1084	-7	20	37	0	0.032	017-5(N)	017-3	003-0
1085	21	70	47	15	0.041	017-5(N)	017-7	003-0
1086	49	120	77	40	0.062	017-5(N)	018-3	003-0
1087	232	450	101	100	0.077	017-5(N)	018-7	003-0
1088	288	550	94	100	0.074	017-5(N)	019-3	003-0
1089	288	550	98	100	0.078	017-5(N)	019-7	003-0
1090	-12	10	32	0	0.028	019-7(N)	017-3	003-0
1091	4	40	47	5	0.039	019-7(N)	017-7	003-0
1092	27	80	55	20	0.048	019-7(N)	018-3	003-0
1093	54	130	77	80	0.064	019-7(N)	018-7	003-0
1094	93	200	95	100	0.080	019-7(N)	019-3	003-0
1095	121	250	96	100	0.081	019-7(N)	019-7	003-0
Plate section 02B								
0.40 to 0.52t layer, WR orientation								
02B-1000	204	400	71	100	0.063	043-1(N)	061-7	005-6
1001	204	400	72	100	0.058	043-1(N)	061-1	005-6
1003	204	400	79	100	0.066	043-1(N)	059-7	005-6
1004	149	300	81	100	0.069	043-1(N)	061-7	006-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
0.40 to 0.52t Layer, WR orientation (continued)								
02B-1005	149	300	86	100	0.072	043-1(N)	061-1	006-2
1007	149	300	76	100	0.066	043-1(N)	059-7	006-2
1008	93	200	74	100	0.069	040-5(N)	061-7	004-6
1009	93	200	77	100	0.060	040-5(N)	061-1	004-6
1011	93	200	60	100	0.053	040-5(N)	059-7	004-6
1012	16	60	20	30	0.018	040-5(N)	061-7	005-2
1013	16	60	28	25	0.024	040-5(N)	061-1	005-2
1015	16	60	35	25	0.028	040-5(N)	059-7	005-2
1016	-1	30	24	20	0.024	048-1(N)	061-7	004-6
1017	-1	30	23	20	0.019	048-1(N)	061-1	004-6
1019	-1	30	17	20	0.017	048-1(N)	059-7	004-6
1020	121	250	83	100	0.072	048-1(N)	061-7	005-2
1021	121	250	81	100	0.067	048-1(N)	061-1	005-2
1023	121	250	83	100	0.066	048-1(N)	059-7	005-2
Plate section 02C								
0.44 to 0.56t Layer, WR orientation								
02C-1000	149	300	92	100	0.070	118-7(N)	082-5	005-2
1001	149	300	92	100	0.074	118-7(N)	081-7	005-2
1003	149	300	85	100	0.069	118-7(N)	080-5	005-2
1004	93	200	95	100	0.072	118-7(N)	082-5	005-6
1005	93	200	91	100	0.066	118-7(N)	081-7	005-6
1007	93	200	90	100	0.067	118-7(N)	080-5	005-6
1008	16	60	27	20	0.025	118-7(N)	082-5	006-2
1009	16	60	28.5	20	0.023	118-7(N)	081-7	006-2
1011	16	60	37	20	0.037	118-7(N)	080-5	006-2
1012	49	120	58	60	0.057	118-7(N)	082-5	006-6
1013	49	120	59	55	0.053	118-7(N)	081-7	006-6
1015	49	120	62	65	0.054	118-7(N)	080-5	006-6
Plate section 02F								
Surface layer, RW orientation								
02F-5608	-157	-250	9	0	0.004	012-1	138-7(N)	000-2
5609	-129	-200	25	0	0.023	012-5	138-7(N)	000-2
5610	-101	-150	35	2	0.025	013-1	138-7(N)	000-2
5611	-73	-100	50	10	0.036	013-5	138-7(N)	000-2
5612	-46	-50	90	100	0.065	014-1	138-7(N)	000-2
5613	-18	0	106	100	0.073	014-5	138-7(N)	000-2
5614	10	50	109	100	0.075	015-1	138-7(N)	000-2
5615	38	100	113	100	0.078	015-5	138-7(N)	000-2
5616	66	150	113	100	0.082	016-1	138-7(N)	000-2
5617	93	200	121	100	0.083	016-5	138-7(N)	000-2
5618	121	250	110	100	0.080	017-1	138-7(N)	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface Layer, RW orientation (continued)								
02F-5619	-140	-220	25	0	0.016	017-5	138-7(N)	000-2
5620	-112	-170	27	0	0.018	012-1	141-1(N)	000-2
5621	-84	-120	45	10	0.033	012-5	141-1(N)	000-2
5622	-57	-70	80	80	0.056	013-1	141-1(N)	000-2
5623	-34	-30	104	100	0.071	013-5	141-1(N)	000-2
5624	-7	20	110	100	0.076	014-1	141-1(N)	000-2
5625	177	350	121	100	0.083	014-5	141-1(N)	000-2
5626	232	450	117	100	0.083	015-1	141-1(N)	000-2
5627	288	550	123	100	0.077	015-5	141-1(N)	000-2
5628	288	550	111	100	0.080	016-1	141-1(N)	000-2
5629	-62	-80	73	60	0.054	016-5	141-1(N)	000-2
5630	-68	-90	50	40	0.038	017-1	141-1(N)	000-2
5631	-146	-230	14	0	0.008	017-5	141-1(N)	000-2
Surface Layer, WR orientation								
02F-5632	-157	-250	10	0	0.007	013-1(N)	142-3	000-2
5633	-129	-200	21	0	0.014	013-1(N)	142-7	000-2
5634	-101	-150	21	0	0.013	013-1(N)	143-3	000-2
5635	-73	-100	33	5	0.024	013-1(N)	143-7	000-2
5636	-46	-50	70	90	0.056	013-1(N)	144-3	000-2
5637	-18	0	89	100	0.067	013-1(N)	144-7	000-2
5638	10	50	85	100	0.067	015-3(N)	142-3	000-2
5639	38	100	100	100	0.074	015-3(N)	142-7	000-2
5640	66	150	99	100	0.075	015-3(N)	143-3	000-2
5641	93	200	95	100	0.077	015-3(N)	143-7	000-2
5642	121	250	90	100	0.072	015-3(N)	144-3	000-2
5643	-140	-220	22	0	0.014	015-3(N)	144-7	000-2
5644	-112	-170	21	0	0.015	017-5(N)	142-3	000-2
5645	-84	-120	40	0	0.027	017-5(N)	142-7	000-2
5646	-57	-70	52	20	0.036	017-5(N)	143-3	000-2
5647	-34	-30	91	100	0.067	017-5(N)	143-7	000-2
5648	-7	20	84	100	0.066	017-5(N)	144-3	000-2
5649	177	350	100	100	0.074	017-5(N)	144-7	000-2
5650	232	450	90	100	0.073	020-0(N)	142-3	000-2
5651	288	550	91	100	0.073	020-0(N)	142-7	000-2
5652	288	550	100	100	0.076	020-0(N)	143-3	000-2
5653	-96	-140	27	0	0.018	020-0(N)	143-7	000-2
5654	-134	-210	9	0	0.004	020-0(N)	144-3	000-2
5655	-68	-90	22	10	0.019	020-0(N)	144-7	000-2
1/4t Layer, RW orientation								
02F-5656	-73	-100	5	0	0.005	012-1	138-7(N)	003-0
5657	-46	-50	13	0	0.011	012-5	138-7(N)	003-0
5658	-18	0	29	5	0.023	013-1	138-7(N)	003-0
5659	10	50	60	20	0.049	013-5	138-7(N)	003-0
5660	38	100	90	80	0.071	014-1	138-7(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
02F-5661	66	150	123	100	0.073	014-5	138-7(N)	003-0
5662	93	200	118	100	0.087	015-1	138-7(N)	003-0
5663	121	250	119.5	100	0.085	015-5	138-7(N)	003-0
5664	149	300	115	100	0.085	016-1	138-7(N)	003-0
5665	177	350	122	100	0.082	016-5	138-7(N)	003-0
5666	204	400	118.5	100	0.081	017-1	138-7(N)	003-0
5667	-57	-70	9	0	0.003	017-5	138-7(N)	003-0
5668	-34	-30	16	2	0.014	012-1	141-1(N)	003-0
5669	-7	20	35	10	0.033	012-5	141-1(N)	003-0
5670	21	70	72	40	0.053	013-1	141-1(N)	003-0
5671	49	120	100	85	0.077	013-5	141-1(N)	003-0
5672	232	450	121	100	0.072	014-1	141-1(N)	003-0
5673	288	550	106	100	0.078	014-5	141-1(N)	003-0
5674	288	550	107	100	0.082	015-1	141-1(N)	003-0
5675	260	500	114	100	0.079	015-5	141-1(N)	003-0
5676	-1	30	49	15	0.040	016-1	141-1(N)	003-0
5677	-23	-10	32	5	0.029	016-5	141-1(N)	003-0
5678	66	150	110	100	0.082	017-1	141-1(N)	003-0
5679	-29	-20	28	2	0.023	017-5	141-1(N)	003-0
1/4t layer, WR orientation								
02F-5680	-73	-100	7	0	0.005	013-1(N)	142-3	003-0
5681	-46	-50	8	0	0.006	013-1(N)	142-7	003-0
5682	-18	0	29	5	0.024	013-1(N)	143-3	003-0
5683	10	50	44	10	0.036	013-1(N)	143-7	003-0
5684	38	100	60	35	0.055	013-1(N)	144-3	003-0
5685	66	150	94	100	0.077	013-1(N)	144-7	003-0
5686	93	200	93	100	0.078	015-3(N)	142-3	003-0
5687	121	250	95	100	0.074	015-3(N)	142-7	003-0
5688	149	300	98	100	0.079	015-3(N)	143-3	003-0
5689	177	350	99	100	0.080	015-3(N)	143-7	003-0
5690	204	400	103	100	0.079	015-3(N)	144-3	003-0
5691	-57	-70	7	0	0.005	015-3(N)	144-7	003-0
5692	-34	-30	32	0	0.026	017-5(N)	142-3	003-0
5693	-7	20	35	5	0.030	017-5(N)	142-7	003-0
5694	21	70	59	30	0.047	017-5(N)	143-3	003-0
5695	49	120	73	100	0.065	017-5(N)	143-7	003-0
5696	232	450	95	100	0.079	017-5(N)	144-3	003-0
5697	288	550	95	100	0.079	017-5(N)	144-7	003-0
5698	288	550	95	100	0.073	020-0(N)	142-3	003-0
5699	-29	-20	20	100	0.018	020-0(N)	142-7	003-0
5700	-40	-40	7	0	0.006	020-0(N)	143-3	003-0
5701	27	80	51	10	0.044	020-0(N)	143-7	003-0
5702	54	130	77	100	0.064	020-0(N)	144-3	003-0
5703	-34	-30	12	70	0.012	020-0(N)	144-7	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Plate section 02FB								
Surface Layer, RW orientation								
02FB-7864	93	200	105	100	0.076	047-3	146-2(N)	000-3
7865	-18	0	98	100	0.071	047-7	146-2(N)	000-3
7866	-29	-20	92	100	0.063	048-3	146-2(N)	000-3
7867	-40	-40	92	100	0.069	048-7	146-2(N)	000-3
7868	-51	-60	65	75	0.050	049-3	146-2(N)	000-3
7869	-62	-80	54	45	0.041	049-7	146-2(N)	000-3
7870	-73	-100	44	35	0.034	050-3	146-2(N)	000-3
7871	-84	-120	30	10	0.019	050-7	146-2(N)	000-3
7872	-96	-140	24	5	0.016	051-3	146-2(N)	000-3
7873	-107	-160	20	0	0.016	051-7	146-2(N)	000-3
7874	27	80	101	100	0.069	052-3	146-2(N)	000-3
7875	49	120	105	100	0.072	052-7	146-2(N)	000-3
7876	71	160	105	100	0.073	053-3	146-2(N)	000-3
7877	4	40	103	100	0.070	053-7	146-2(N)	000-3
7878	-84	-120	37	15	0.026	054-3	146-2(N)	000-3
7879	-84	-120	30	15	0.021	054-7	146-2(N)	000-3
7880	-118	-180	19	0	0.012	055-3	146-2(N)	000-3
7881	-129	-200	11.5	0	0.008	055-7	146-2(N)	000-3
7882	-84	-120	38	15	0.027	056-3	146-2(N)	000-3
7883	-96	-140	26	10	0.018	056-7	146-2(N)	000-3
Surface layer, WR orientation								
02FB-7982	27	80	85	100	0.063	070-4(N)	136-6	000-3
7983	49	120	82.5	100	0.064	070-4(N)	137-2	000-3
7984	71	160	85	100	0.063	070-4(N)	137-6	000-3
7985	93	200	89	100	0.066	070-4(N)	138-2	000-3
7986	4	40	80	100	0.057	070-4(N)	138-6	000-3
7987	-18	0	75	100	0.060	070-4(N)	139-2	000-3
7988	-29	-20	76	100	0.057	070-4(N)	139-6	000-3
7989	-40	-40	60	80	0.049	070-4(N)	140-2	000-3
7990	-51	-60	59	70	0.050	070-4(N)	140-6	000-3
7991	-62	-80	45	35	0.032	070-4(N)	141-2	000-3
7992	-73	-100	31	30	0.023	070-4(N)	141-6	000-3
7993	-84	-120	28	20	0.019	070-4(N)	142-2	000-3
7994	-96	-140	20.5	10	0.013	070-4(N)	142-6	000-3
7995	-107	-160	14.5	5	0.010	070-4(N)	143-2	000-3
7996	-73	-100	27	25	0.020	070-4(N)	143-6	000-3
7997	-73	-100	31	30	0.023	070-4(N)	144-2	000-3
7998	-84	-120	25	20	0.018	070-4(N)	144-6	000-3
7999	-84	-120	28	15	0.020	070-4(N)	145-2	000-3

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation								
02FB-7884	149	300	109	100	0.080	047-3	146-2	003-0
7885	38	100	82	66	0.061	047-7	146-2	003-0
7886	27	80	55	57	0.044	048-3	146-2	003-0
7887	16	60	55	43	0.041	048-7	146-2	003-0
7888	4	40	41	36	0.033	049-3	146-2	003-0
7889	-7	20	31	25	0.024	049-7	146-2	003-0
7890	-18	0	14	21	0.011	050-3	146-2	003-0
7891	-29	-20	12	0	0.012	050-7	146-2	003-0
7892	-40	-40	10	0	0.008	051-3	146-2	003-0
7893	-51	-60	4	0	0.001	051-7	146-2	003-0
7894	60	140	106	87	0.070	052-3	146-2	003-0
7895	82	180	120	100	0.079	052-7	146-2	003-0
7896	104	220	113	100	0.082	053-3	146-2	003-0
7897	127	260	113	100	0.076	053-7	146-2	003-0
7898	-7	20	31.5	25	0.025	054-3	146-2	003-0
7899	-7	20	35	26	0.028	054-7	146-2	003-0
7900	-18	0	23	18	0.020	055-3	146-2	003-0
7901	-7	20	28.5	22	0.023	055-7	146-2	003-0
7902	27	80	58	50	0.045	056-3	146-2	003-0
7903	49	120	92	74	0.072	056-7	146-2	003-0
1/4t layer, WR orientation								
02FB-9000	27	80	51	30	0.040	070-4(N)	136-6	003-0
9001	38	100	58	35	0.047	070-4(N)	137-2	003-0
9002	60	140	87	85	0.066	070-4(N)	137-6	003-0
9003	104	220	95	100	0.073	070-4(N)	138-2	003-0
9004	149	300	97	100	0.069	070-4(N)	138-6	003-0
9005	16	60	40	15	0.029	070-4(N)	139-2	003-0
9006	4	40	33	10	0.026	070-4(N)	139-6	003-0
9007	-7	20	19	5	0.014	070-4(N)	140-2	003-0
9008	-18	0	25	5	0.019	070-4(N)	140-6	003-0
9009	-29	-20	8	2	0.006	070-4(N)	141-2	003-0
9010	-40	-40	10	0	0.007	070-4(N)	141-6	003-0
9011	-51	-60	6	0	0.004	070-4(N)	142-2	003-0
9012	-29	-20	13	2	0.011	070-4(N)	142-6	003-0
9013	-7	20	28	5	0.024	070-4(N)	143-2	003-0
9014	82	180	95	100	0.073	070-4(N)	143-6	003-0
9015	-18	0	28.5	5	0.026	070-4(N)	144-2	003-0
9016	4	40	36	10	0.030	070-4(N)	144-6	003-0
9017	-18	0	24	2	0.017	070-4(N)	145-2	003-0
1/4t layer, TR orientation								
02FB-7964	27	80	46	40	0.016	068-5	136-6	003-0(N)
7965	38	100	46.5	50	0.043	068-5	137-2	003-0(N)
7966	60	140	71	70	0.059	068-5	137-6	003-0(N)

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, TR orientation (continued)								
02FB-7967	104	220	78	100	0.066	068-5	138-2	003-0(N)
7968	149	300	83	100	0.066	068-5	138-6	003-0(N)
7969	16	60	37.5	25	0.031	068-5	139-2	003-0(N)
7970	4	40	25	20	0.022	068-5	139-6	003-0(N)
7971	-7	20	23	10	0.019	068-5	140-2	003-0(N)
7972	-18	0	22	7.5	0.019	068-5	140-6	003-0(N)
7973	-29	-20	11.5	5	0.008	068-5	141-2	003-0(N)
7974	-40	-40	5.5	1	0.005	068-5	141-6	003-0(N)
7975	-51	-60	5	1	0.004	068-5	142-2	003-0(N)
7976	-7	20	22	10	0.019	068-5	142-6	003-0(N)
7977	4	40	26.5	15	0.024	068-5	143-2	003-0(N)
7978	49	120	63	50	0.053	068-5	143-6	003-0(N)
7979	16	60	30	30	0.026	068-5	144-2	003-0(N)
7980	-18	0	10	5	0.007	068-5	144-6	003-0(N)
7981	82	180	73	90	0.064	068-5	145-2	003-0(N)
3/8t layer, RW orientation								
02FB-9622	-40	-40	6	0	0.005	051-7	142-4(N)	004-1
9623	-18	0	19	0	0.017	052-3	142-4(N)	004-1
9624	4	40	30	27	0.025	052-7	142-4(N)	004-1
9625	27	80	47	40	0.040	053-3	142-4(N)	004-1
9626	49	120	75	68	0.055	053-7	142-4(N)	004-1
9627	71	160	104	100	0.083	054-3	142-4(N)	004-1
9628	93	200	112	100	0.080	054-7	142-4(N)	004-1
9629	138	280	114	100	0.087	055-3	142-4(N)	004-1
1/2t layer, RW orientation								
02FB-7904	149	300	116	100	0.080	047-3	146-2(N)	006-0
7905	38	100	60	60	0.049	047-7	146-2(N)	006-0
7906	27	80	65	50	0.049	048-3	146-2(N)	006-0
7907	16	60	45	35	0.039	048-7	146-2(N)	006-0
7908	4	40	50	25	0.040	049-3	146-2(N)	006-0
7909	-7	20	33	15	0.028	049-7	146-2(N)	006-0
7910	-18	0	18	1	0.018	050-3	146-2(N)	006-0
7911	-29	-20	14	1	0.012	050-7	146-2(N)	006-0
7912	-40	-40	4	1	0.004	051-3	146-2(N)	006-0
7913	-51	-60	6	1	0.004	051-7	146-2(N)	006-0
7914	38	100	75	60	0.058	052-3	146-2(N)	006-0
7915	60	140	100	85	0.077	052-7	146-2(N)	006-0
7916	82	180	122	100	0.081	053-3	146-2(N)	006-0
7917	104	220	113	100	0.079	053-7	146-2(N)	006-0
7918	127	260	124	100	0.078	054-3	146-2(N)	006-0
7919	-7	20	12.5	20	0.012	054-7	146-2(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW orientation (continued)								
02FB-7920	-7	20	28.5	20	0.024	055-3	146-2(N)	006-0
7921	-1	30	27	25	0.023	055-7	146-2(N)	006-0
7922	-1	30	30	25	0.027	056-3	146-2(N)	006-0
7923	-7	20	12.5	25	0.011	056-7	146-2(N)	006-0
1/2t layer, WR orientation								
02FB-9018	27	80	35	30	0.029	070-4(N)	136-6	006-0
9019	38	100	60	40	0.049	070-4(N)	137-2	006-0
9020	60	140	60	80	0.050	070-4(N)	137-6	006-0
9021	104	220	94	100	0.070	070-4(N)	138-2	006-0
9022	149	300	100	100	0.071	070-4(N)	138-6	006-0
9023	16	60	27.5	25	0.026	070-4(N)	139-2	006-0
9024	4	40	23	20	0.022	070-4(N)	139-6	006-0
9025	-7	20	17	10	0.016	070-4(N)	140-2	006-0
9026	-18	0	8	5	0.008	070-4(N)	140-6	006-0
9027	-29	-20	7	0	0.004	070-4(N)	141-2	006-0
9028	-40	-40	6	0	0.002	070-4(N)	141-6	006-0
9029	-51	-60	6.5	0	0.003	070-4(N)	142-2	006-0
9030	38	100	75	50	0.061	070-4(N)	142-6	006-0
9031	82	180	75.5	100	0.065	070-4(N)	143-2	006-0
9032	27	80	61	40	0.048	070-4(N)	143-6	006-0
9033	4	40	24	25	0.025	070-4(N)	144-2	006-0
9034	27	260	70	100	0.064	070-4(N)	144-6	006-0
9035	16	60	38	35	0.035	070-4(N)	145-2	006-0
Plate section 02HC								
Surface layer, RW orientation								
02HC-1000	-157	-250		0	0.002	068-5	237-7(N)	000-2
1001	-129	-200	20	0	0.013	069-1	237-7(N)	000-2
1002	-101	-150	37	10	0.027	069-5	237-7(N)	000-2
1003	-73	-100	45	30	0.034	070-1	237-7(N)	000-2
1004	-46	-50	83	80	0.063	070-5	237-7(N)	000-2
1005	-18	0	100	100	0.075	071-1	237-7(N)	000-2
1006	10	50	105	100	0.080	071-5	237-7(N)	000-2
1007	38	100	116	100	0.082	072-1	237-7(N)	000-2
1008	66	150	115	100	0.085	072-5	237-7(N)	000-2
1009	93	200	113	100	0.081	073-1	237-7(N)	000-2
1010	121	250	117	100	0.081	073-5	237-7(N)	000-2
1011	-115	-175	28	5	0.019	074-1	237-7(N)	000-2
1012	-87	-125	35	20	0.028	068-5	240-1(N)	000-2
1013	-59	-75	60	40	0.047	069-1	240-1(N)	000-2
1014	-32	-25	104	100	0.076	069-5	240-1(N)	000-2
1015	-4	25	110.5	100	0.082	070-1	240-1(N)	000-2
1016	177	350	128	100	0.094	070-5	240-1(N)	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, RW orientation (continued)								
02HC-1017	232	450	119	100	0.088	071-1	240-1(N)	000-2
1018	288	550	120	100	0.083	071-5	240-1(N)	000-2
1019	288	550	125	100	0.079	072-1	240-1(N)	000-2
1020	-140	-220	13	0	0.006	072-5	240-1(N)	000-2
1021	-51	-60	72	80	0.060	073-1	240-1(N)	000-2
1022	-68	-90	50	40	0.035	073-5	240-1(N)	000-2
1023	-96	-140	20	15	0.019	074-1	240-1(N)	000-2
Surface layer, WR orientation								
02HC-1024	-157	-250	4	0	0.002	069-5(N)	241-3	000-2
1025	-129	-200	9.5	0	0.005	069-5(N)	241-7	000-2
1026	-101	-150	23	0	0.014	069-5(N)	242-3	000-2
1027	-73	-100	36	30	0.029	069-5(N)	242-7	000-2
1028	-46	-50	56	75	0.048	069-5(N)	243-3	000-2
1029	-18	0	81	100	0.070	069-5(N)	243-7	000-2
1030	10	50	82	100	0.066	071-7(N)	241-3	000-2
1031	38	100	83	100	0.068	071-7(N)	241-7	000-2
1032	66	150	81	100	0.072	071-7(N)	242-3	000-2
1033	93	200	85	100	0.073	071-7(N)	242-7	000-2
1034	121	250	89	100	0.072	071-7(N)	243-3	000-2
1035	-112	-170	17	0	0.012	071-7(N)	243-7	000-2
1036	-84	-120	28	0	0.021	074-1(N)	241-3	000-2
1037	-57	-70	39		0.031	074-1(N)	241-7	000-2
1038	-34	-30	71	90	0.059	074-1(N)	242-3	000-2
1039	-7	20	78	100	0.063	074-1(N)	242-7	000-2
1040	177	350	94	100	0.074	074-1(N)	243-3	000-2
1041	232	450	87	100	0.075	074-1(N)	243-7	000-2
1042	288	550	88	100	0.074	076-4(N)	241-3	000-2
1043	288	550	89	100	0.075	076-4(N)	241-7	000-2
1044	-140	-220	9	0	0.004	076-4(N)	242-3	000-2
02HC-1045	-51	-60	56	70	0.052	076-4(N)	242-7	000-2
1046	-40	-40	64	90	0.055	076-4(N)	243-3	000-2
1047	66	150	85	100	0.074	076-4(N)	243-7	000-2
1/4t Layer, RW orientation								
02HC-1048	-73	-100	4	0	0.002	068-5	237-7(N)	003-0
1049	-46	-50	9.5	0	0.007	069-1	237-7(N)	003-0
1050	-18	0	34	10	0.029	069-5	237-7(N)	003-0
1051	10	50	41	35	0.037	070-1	237-7(N)	003-0
1052	38	100	94.5	80	0.069	070-5	237-7(N)	003-0
1053	66	150	111	100	0.086	071-1	237-7(N)	003-0
1054	93	200	127	100	0.087	071-5	237-7(N)	003-0
1055	121	250	121	100	0.089	072-1	237-7(N)	003-0
1056	149	300	122	100	0.080	072-5	237-7(N)	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
02HC-1057	177	350	126.5	100	0.091	073-1	237-7(N)	003-0
1058	204	400	115	100	0.084	073-5	237-7(N)	003-0
1059	-32	-25	20	0	0.016	074-1	237-7(N)	003-0
1060	-4	25	52	20	0.041	068-5	240-1(N)	003-0
1061	24	75	80	50	0.063	069-1	240-1(N)	003-0
1062	52	125	108	100	0.080	069-5	240-1(N)	003-0
1063	288	550	120	100	0.080	070-1	240-1(N)	003-0
1064	10	50	55	30	0.047	070-5	240-1(N)	003-0
1065	288	550	134	100	0.084	071-1	240-1(N)	003-0
1066	246	475	130	100	0.082	071-5	240-1(N)	003-0
1067	4	40	59	30	0.047	072-1	240-1(N)	003-0
1068	-68	-90	4	0	0.003	072-5	240-1(N)	003-0
1069	-12	10	41	10	0.035	073-1	240-1(N)	003-0
1070	16	60	71	30	0.058	073-5	240-1(N)	003-0
1071	-23	-10	35	5	0.029	074-1	240-1(N)	003-0
1/4t layer, WR orientation								
02HC-1072	-73	-100	4	0	0.001	069-5(N)	241-3	003-0
1073	-46	-50	6	0	0.004	069-5(N)	241-7	003-0
1074	-18	0	21	5	0.018	069-5(N)	242-3	003-0
1075	10	50	52	20	0.041	069-5(N)	242-7	003-0
1076	38	100	80	40	0.064	069-5(N)	243-3	003-0
1077	66	150	101	100	0.074	069-5(N)	243-7	003-0
1078	93	200	97.5	100	0.078	071-7(N)	241-3	003-0
1079	121	250	80	100	0.072	071-7(N)	241-7	003-0
1080	149	300	92	100	0.075	071-7(N)	242-3	003-0
1081	177	350	104	100	0.084	071-7(N)	242-7	003-0
1082	204	400	90	100	0.077	071-7(N)	243-3	003-0
1083	-34	-30	15	0	0.012	071-7(N)	243-7	003-0
1084	-7	20	25	10	0.023	074-1(N)	241-3	003-0
1085	21	70	63	20	0.053	074-1(N)	241-7	003-0
1086	49	120	93	60	0.074	074-1(N)	242-3	003-0
1087	232	450	109	100	0.085	074-1(N)	242-7	003-0
1088	288	550	99	100	0.083	074-1(N)	243-3	003-0
1089	288	550	100	100	0.081	074-1(N)	243-7	003-0
1090	-1	30	35	10	0.033	076-4(N)	241-3	003-0
1091	4	40	41	15	0.035	076-4(N)	241-7	003-0
1092	121	250	104	100	0.078	076-4(N)	242-3	003-0
1093	82	180	109	100	0.083	076-4(N)	242-7	003-0
1094	27	80	65	35	0.082	076-4(N)	243-3	003-0
1095	149	300	106	100	0.080	076-4(N)	243-7	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW orientation								
02HC-1096	-73	-100	4	0	0.004	068-5	237-7(N)	006-0
1097	-46	-50	15	0	0.014	069-1	237-7(N)	006-0
1098	-18	0	25.5	10	0.025	069-5	237-7(N)	006-0
1099	10	50	54	30	0.047	070-1	237-7(N)	006-0
1100	38	100	86	70	0.065	070-5	237-7(N)	006-0
1101	66	150	123	100	0.084	071-1	237-7(N)	006-0
1102	93	200	121	100	0.083	071-5	237-7(N)	006-0
1103	121	250	121	100	0.083	072-1	237-7(N)	006-0
1104	149	300	121	100	0.084	072-5	237-7(N)	006-0
1105	177	350	115	100	0.097	073-1	237-7(N)	006-0
1106	204	400	131	100	0.085	073-5	237-7(N)	006-0
1107	-57	-70	5.5	0	0.005	074-1	237-7(N)	006-0
1108	-34	-30	11	5	0.012	068-5	240-1(N)	006-0
1109	-7	20	35	15	0.031	069-1	240-1(N)	006-0
1110	21	70	60	35	0.052	069-5	240-1(N)	006-0
1111	49	120	102	90	0.078	070-1	240-1(N)	006-0
1112	232	450	115	100	0.084	070-5	240-1(N)	006-0
1113	288	550	101	100	0.086	071-1	240-1(N)	006-0
1114	288	550	56	100	0.060	071-5	240-1(N)	006-0
1115	-23	-10	32	5	0.035	072-1	240-1(N)	006-0
1116	4	40	62	20	0.055	072-5	240-1(N)	006-0
1117	32	90	103	70	0.080	073-1	240-1(N)	006-0
1118	288	550	129	100	0.082	073-5	240-1(N)	006-0
1119	27	80	95	65	0.073	074-1	240-1(N)	006-0
1/2t layer, WR orientation								
02HC-1120	-73	-100	4	0	0.002	069-5(N)	241-3	006-0
1121	-46	-50	9	0	0.008	069-5(N)	241-7	006-0
1122	-18	0	32	5	0.028	069-5(N)	242-3	006-0
1123	10	50	54	30	0.046	069-5(N)	242-7	006-0
1124	38	100	64	70	0.054	069-5(N)	243-3	006-0
1125	66	150	108	95	0.078	069-5(N)	243-7	006-0
1126	93	200	80	100	0.076	071-7(N)	241-3	006-0
1127	121	250	101	100	0.081	071-7(N)	241-7	006-0
1128	149	300	105	100	0.075	071-7(N)	242-3	006-0
1129	177	350	101	100	0.075	071-7(N)	242-7	006-0
1130	204	400	107	100	0.076	071-7(N)	243-3	006-0
1131	-57	-70	6	0	0.004	071-7(N)	243-7	006-0
1132	-34	-30	10	5	0.010	074-1(N)	241-3	006-0
1133	-7	20	42	10	0.034	074-1(N)	241-7	006-0
1134	21	70	51	50	0.044	074-1(N)	242-3	006-0
1135	49	120	81	80	0.068	074-1(N)	242-7	006-0
1136	77	170	105	100	0.081	074-1(N)	243-3	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, WR orientation (continued)								
02HC-1137	104	220	117	100	0.077	074-1(N)	243-7	006-0
1138	232	450	92	100	0.077	076-4(N)	241-3	006-0
1139	288	550	97	100	0.069	076-4(N)	241-7	006-0
1140	288	550	105	100	0.079	076-4(N)	242-3	006-0
1141	-29	-20	25	5	0.022	076-4(N)	242-7	006-0
1142	93	200	122	100	0.087	076-4(N)	243-3	006-0
1143	99	210	103	100	0.076	076-4(N)	243-7	006-0
3/4t layer, RW orientation								
02HC-1144	-73	-100	4	0	0.004	068-5	237-7(N)	009-0
1145	-46	-50	7.5	0	0.006	069-1	237-7(N)	009-0
1146	-18	0	26	5	0.024	069-5	237-7(N)	009-0
1147	10	50	61	20	0.049	070-1	237-7(N)	009-0
1148	38	100	85	40	0.064	070-5	237-7(N)	009-0
1149	66	150	123	100	0.084	071-1	237-7(N)	009-0
1150	93	200	125	100	0.088	071-5	237-7(N)	009-0
1151	121	250	131	100	0.090	072-1	237-7(N)	009-0
1152	149	300	129	100	0.086	072-5	237-7(N)	009-0
1153	177	350	135	100	0.099	073-1	237-7(N)	009-0
1154	204	400	125	100	0.084	073-5	237-7(N)	009-0
1155	-57	-70	5	0	0.004	074-1	237-7(N)	009-0
1156	-34	-30	11	0	0.010	068-5	240-1(N)	009-0
1157	-7	20	43	10	0.036	069-1	240-1(N)	009-0
1158	21	70	74	30	0.058	069-5	240-1(N)	009-0
1159	49	120	93	70	0.073	070-1	240-1(N)	009-0
1160	232	450	130	100	0.091	070-5	240-1(N)	009-0
1161	288	550	116	100	0.086	071-1	240-1(N)	009-0
1162	288	550	122	100	0.080	071-5	240-1(N)	009-0
1163	-23	-10	47	7.5	0.040	072-1	240-1(N)	009-0
1164	-12	10	42	10	0.035	072-5	240-1(N)	009-0
1165	4	40	62	20	0.051	073-1	240-1(N)	009-0
1166	54	130	100	70	0.079	073-5	240-1(N)	009-0
1167	-29	-20	24	5	0.021	074-1	240-1(N)	009-0
3/4t layer, WR orientation								
02HC-1168	-73	-100	5	0	0.002	069-5(N)	241-3	009-0
1169	-46	-50	7	0	0.004	069-5(N)	241-7	009-0
1170	-18	0	17.5	5	0.015	069-5(N)	242-3	009-0
1171	10	50	46	20	0.038	069-5(N)	242-7	009-0
1172	38	100	80	70	0.062	069-5(N)	243-3	009-0
1173	66	150	102	100	0.080	069-5(N)	243-7	009-0
1174	93	200	109	100	0.075	071-7(N)	241-3	009-0
1175	121	250	102	100	0.076	071-7(N)	241-7	009-0
1176	149	300	105	100	0.084	071-7(N)	242-3	009-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
3/4t Layer, WR orientation (continued)								
02HC-1177	177	350	88	100	0.071	071-7(N)	242-7	009-0
1178	204	400	102	100	0.080	071-7(N)	243-3	009-0
1179	-57	-70	5	0	0.004	071-7(N)	243-7	009-0
1180	-34	-30	15	0	0.014	074-1(N)	241-3	009-0
1181	-7	20	31	15	0.022	074-1(N)	241-7	009-0
1182	21	70	52	25	0.043	074-1(N)	242-3	009-0
1183	49	120	92	80	0.071	074-1(N)	242-7	009-0
1184	232	450	108	100	0.078	074-1(N)	243-3	009-0
1185	288	550	109	100	0.076	074-1(N)	243-7	009-0
1186	288	550	104	100	0.085	076-4(N)	241-3	009-0
1187	-1	30	47	15	0.040	076-4(N)	241-7	009-0
1188	27	80	63	30	0.051	076-4(N)	242-3	009-0
1189	-12	10	34	5	0.027	076-4(N)	242-7	009-0
1190	177	350	104	100	0.079	076-4(N)	243-3	009-0
1191	-1	30	37	15	0.032	076-4(N)	243-7	009-0
1t Layer, RW orientation								
02HC-1192	-157	-250	7	0	0.001	068-5	237-7(N)	011-6
1193	-129	-200	14	0	0.007	069-1	237-7(N)	011-6
1194	-101	-150	26	0	0.017	069-5	237-7(N)	011-6
1195	-73	-100	48	20	0.036	070-1	237-7(N)	011-6
1196	-46	-50	71	75	0.052	070-5	237-7(N)	011-6
1197	-18	0	107	100	0.076	071-1	237-7(N)	011-6
1198	10	50	119	100	0.074	071-5	237-7(N)	011-6
1199	38	100	118	100	0.080	072-1	237-7(N)	011-6
1200	66	150	121	100	0.074	072-5	237-7(N)	011-6
1201	93	200	116	100	0.083	073-1	237-7(N)	011-6
1202	121	250	133	100	0.080	073-5	237-7(N)	011-6
1203	-140	-220	8	0	0.003	074-1	237-7(N)	011-6
1204	-112	-170	23	0	0.016	068-5	240-1(N)	011-6
1205	-84	-120	33	2	0.024	069-1	240-1(N)	011-6
1206	-57	-70	73	80	0.057	069-5	240-1(N)	011-6
1207	-34	-30	83	90	0.060	070-1	240-1(N)	011-6
1208	-7	20	113	100	0.078	070-5	240-1(N)	011-6
1209	21	70	110	100	0.076	071-1	240-1(N)	011-6
1210	177	350	127	100	0.077	071-5	240-1(N)	011-6
1211	232	450	120	100	0.073	072-1	240-1(N)	011-6
1212	288	550	117.5	100	0.077	072-5	240-1(N)	011-6
1213	288	550	117.5	100	0.077	073-1	240-1(N)	011-6
1214	-29	-20	117	100	0.081	073-5	240-1(N)	011-6
1215	-62	-80	56	30	0.042	074-1	240-1(N)	011-6

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1t layer, WR orientation								
02HC-1216	-157	-250	5	0	0.002	069-5(N)	241-3	011-6
1217	-129	-200	17	0	0.011	069-5(N)	241-7	011-6
1218	-101	-150	27	0	0.017	069-5(N)	242-3	011-6
1219	-73	-100	33	2	0.020	069-5(N)	242-7	011-6
1220	-46	-50	50	30	0.040	069-5(N)	243-3	011-6
1221	-18	0	82	100	0.062	069-5(N)	243-7	011-6
1222	10	50	83	100	0.063	071-7(N)	241-3	011-6
1223	38	100	97	100	0.072	071-7(N)	241-7	011-6
1224	66	150	94	100	0.067	071-7(N)	242-3	011-6
1225	93	200	97	100	0.067	071-7(N)	242-7	011-6
1226	121	250	94	100	0.073	071-7(N)	243-3	011-6
1227	-140	-220	10	0	0.004	071-7(N)	243-7	011-6
1228	-112	-170	10	0	0.004	074-1(N)	241-3	011-6
1229	-84	-120	26	0	0.018	074-1(N)	241-7	011-6
1230	-57	-70	46	20	0.034	074-1(N)	242-3	011-6
1231	-34	-30	65	70	0.049	074-1(N)	242-7	011-6
1232	-7	20	93	100	0.065	074-1(N)	243-3	011-6
1233	21	70	93	100	0.068	074-1(N)	243-7	011-6
1234	177	350	100	100	0.074	076-4(N)	241-3	011-6
1235	232	450	93	100	0.074	076-4(N)	241-7	011-6
1236	288	550	97	100	0.075	076-4(N)	242-3	011-6
1237	288	550	94	100	0.069	076-4(N)	242-7	011-6
1238	-62	-80	42	15	0.027	076-4(N)	243-3	011-6
1239	-107	-160	18	0	0.016	076-4(N)	244-7	011-6
Plate section 03CA								
Surface layer, RW orientation								
03CA-1048	-157	-250	8	0	0.003	055-3	019-5(N)	000-2
1049	-129	-200	17	0	0.014	055-7	019-5(N)	000-2
1050	-101	-150	28	10	0.018	056-3	019-5(N)	000-2
1051	-73.3	-100	47	25	0.036	056-7	019-5(N)	000-2
1052	-45.6	-50	85	90	0.064	057-3	019-5(N)	000-2
1053	-17.8	0	105	100	0.076	057-7	019-5(N)	000-2
1054	37.8	100	111	100	0.080	058-3	019-5(N)	000-2
1055	93.3	200	110	100	0.079	058-7	019-5(N)	000-2
1056	177	350	119	100	0.078	059-3	019-5(N)	000-2
1057	288	550	108	100	0.078	059-7	019-5(N)	000-2
1058	-87.2	-125	45	40	0.033	060-3	019-5(N)	000-2
1059	-59.4	-75	62	60	0.046	060-7	019-5(N)	000-2
Surface layer, WR orientation								
03CA-1060	-157	-250	7.5	0	0.002	056-3(N)	020-7	000-2
1061	-129	-200	18	5	0.010	056-3(N)	021-3	000-2
1062	-45.6	-50	62	90	0.053	056-3(N)	021-7	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, WR orientation (continued)								
03CA-1063	-73.3	-100	38	35	0.031	056-3(N)	022-3	000-2
1064	-45.6	-50	64	90	0.051	056-3(N)	022-7	000-2
1065	-17.8	0	74	100	0.057	056-3(N)	023-3	000-2
1066	37.8	100	83	100	0.064	058-5(N)	020-7	000-2
1067	93.3	200	79	100	0.070	058-5(N)	021-3	000-2
1068	177	350	79	100	0.066	058-5(N)	021-7	000-2
1069	288	550	84	100	0.072	058-5(N)	022-3	000-2
1070	-59.4	-75	51.5	65	0.043	058-5(N)	022-7	000-2
1071	-87.2	-125	29	10	0.022	058-5(N)	023-3	000-2
1/4t layer, RW orientation								
03CA-1072	-73.3	-100	4	0	0.003	055-3	019-5(N)	003-0
1073	-45.6	-50	7	5	0.007	055-7	019-5(N)	003-0
1074	-17.8	0	15	10	0.014	056-3	019-5(N)	003-0
1075	10.0	50	53	30	0.044	056-7	019-5(N)	003-0
1076	37.8	100	82	50	0.065	057-3	019-5(N)	003-0
1077	65.6	150	110	100	0.085	057-7	019-5(N)	003-0
1078	93.3	200	110	100	0.079	058-3	019-5(N)	003-0
1079	121	250	117	100	0.075	058-7	019-5(N)	003-0
1080	177	350	117	100	0.086	059-3	019-5(N)	003-0
1081	288	550	109	100	0.075	059-7	019-5(N)	003-0
1082	-3.9	25	48	20	0.037	060-3	019-5(N)	003-0
1083	-12.2	10	20	10	0.018	060-7	019-5(N)	003-0
1/4t layer, WR orientation								
03CA-1084	-73.3	-100	5	0	0.004	056-3(N)	020-7	003-0
1085	-45.6	-50	7	0	0.005	056-3(N)	021-3	003-0
1086	-17.8	0	23	10	0.020	056-3(N)	021-7	003-0
1087	10.0	50	40	25	0.033	056-3(N)	022-3	003-0
1088	37.8	100	57	40	0.048	056-3(N)	022-7	003-0
1089	65.6	150	85	90	0.070	056-3(N)	023-3	003-0
1090	93.3	200	95	100	0.079	058-5(N)	020-7	003-0
1091	121	250	98	100	0.078	058-5(N)	021-3	003-0
1092	177	350	98	100	0.077	058-5(N)	021-7	003-0
1093	288	550	95	100	0.074	058-5(N)	022-3	003-0
1094	-3.9	25	27	20	0.025	058-5(N)	022-7	003-0
1095	23.5	75	48	30	0.041	058-5(N)	023-3	003-0
Plate section 03CB								
Surface layer, RW orientation								
03CB-1000	-157	-250	6	0	0.003	097-7	020-5(N)	000-2
1001	-129	-200	23	0	0.013	098-3	020-5(N)	000-2
1002	-101	-150	36	5	0.027	098-7	020-5(N)	000-2
1003	-73.3	-100	50.5	10	0.038	099-3	020-5(N)	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, RW orientation (continued)								
03CB-1004	-45.6	-50	90	85	0.065	099-7	020-5(N)	000-2
1005	-17.8	0	106	100	0.072	100-3	020-5(N)	000-2
1006	37.8	100	116	100	0.077	100-7	020-5(N)	000-2
1007	93.3	200	113	100	0.079	101-3	020-5(N)	000-2
1008	177	350	118	100	0.078	101-7	020-5(N)	000-2
1009	288	550	111	100	0.077	102-3	020-5(N)	000-2
1010	-59.4	-75	68	40	0.050	102-7	020-5(N)	000-2
1011	-87.2	-125	48	20	0.037	103-3	020-5(N)	000-2
Surface Layer, WR Orientation								
03CB-1012	-157	-250	7	0	0.002	098-7(N)	021-7	000-2
1013	-129	-200	16	5	0.011	098-7(N)	022-3	000-2
1014	-101	-150	25	5	0.018	098-7(N)	022-7	000-2
1015	-73.3	-100	45	30	0.034	098-7(N)	023-3	000-2
1016	-45.6	-50	61	85	0.055	098-7(N)	023-7	000-2
1017	-17.8	0	84	100	0.070	098-7(N)	024-3	000-2
1018	37.8	100	87	100	0.071	101-1(N)	021-7	000-2
1019	93.3	200	93	100	0.075	101-1(N)	022-3	000-2
1020	177	350	93	100	0.069	101-1(N)	022-7	000-2
1021	288	550	91	100	0.071	101-1(N)	023-3	000-2
1022	-87.2	-125	32	15	0.023	101-1(N)	023-7	000-2
1023	-59.4	-75	50	30	0.040	101-1(N)	024-3	000-2
1/4t layer, RW orientation								
03CB-1024	-73.3	-100	3.5	0	0.004	097-7	020-5(N)	003-0
1025	-45.6	-50	6	0	0.004	098-3	020-5(N)	003-0
1026	-17.8	0	18	5	0.013	098-7	020-5(N)	003-0
1027	10.0	50	55	20	0.045	099-3	020-5(N)	003-0
1028	37.8	100	79	60	0.060	099-7	020-5(N)	003-0
1029	65.6	150	105	100	0.078	100-3	020-5(N)	003-0
1030	93.3	200	114	100	0.084	100-7	020-5(N)	003-0
1031	121	250	123	100	0.086	101-3	020-5(N)	003-0
1032	177	350	118	100	0.087	101-7	020-5(N)	003-0
1033	288	550	110.5	100	0.077	102-3	020-5(N)	003-0
1034	-3.9	25	39	15	0.030	102-7	020-5(N)	003-0
1035	23.9	75	55	30	0.046	103-3	020-5(N)	003-0
1/4t layer, WR orientation								
03CB-1036	-73.3	-100	3	0	0.003	098-7(N)	021-7	003-0
1037	-45.6	-50	8	0	0.008	098-7(N)	022-3	003-0
1038	-17.8	0	16	10	0.015	098-7(N)	022-7	003-0
1039	10.0	50	40	20	0.032	098-7(N)	023-3	003-0
1040	37.8	100	62	40	0.050	098-7(N)	023-7	003-0
1041	65.6	150	87	100	0.067	098-7(N)	024-3	003-0

Table B.i. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, WR orientation (continued)								
03CB-1042	93.3	200	98.5	100	0.078	101-1(N)	021-7	003-0
1043	121	250	94	100	0.072	101-1(N)	022-3	003-0
1044	177	350	95	100	0.072	101-1(N)	022-7	003-0
1045	288	550	95	100	0.068	101-1(N)	023-3	003-0
1046	-3.9	25	33	20	0.026	101-1(N)	023-7	003-0
1047	23.9	75	51	30	0.047	101-1(N)	024-1	003-0
Plate section 03E								
Surface layer, RW orientation								
03E-1000	22.2	72	105	100	0.074	047-2	130-0(N)	000-3
1001	4.4	40	102	100	0.072	047-6	130-0(N)	000-3
1002	-17.8	0	99	100	0.073	048-2	130-0(N)	000-3
1003	-40	-40	87	90	0.066	048-6	130-0(N)	000-3
1004	-62.2	-80	50	30	0.036	049-2	130-0(N)	000-3
1005	-84.4	-120	34	10	0.024	049-6	130-0(N)	000-3
1006	-107	-160	21	0	0.018	050-2	130-0(N)	000-3
1007	-129	-200	4	0	0.000	050-6	130-0(N)	000-3
1008	93.3	200	114	100	0.085	051-2	130-0(N)	000-3
1009	204	400	118	100	0.086	051-6	130-0(N)	000-3
1010	-95.6	-140	28	10	0.018	052-2	130-0(N)	000-3
1011	-106	-160	23	5	0.015	052-6	130-0(N)	000-3
1012	-95.6	-140	29	10	0.020	053-2	130-0(N)	000-3
1013	-84.4	-120	35	10	0.029	053-6	130-0(N)	000-3
1014	-73.3	-100	42	20	0.031	054-2	130-0(N)	000-3
1015	48.9	120	105	100	0.076	054-6	130-0(N)	000-3
1016	93.3	200	111	100	0.079	055-2	130-0(N)	000-3
1017	204	400	119	100	0.081	055-6	130-0(N)	000-3
1018	-84.4	-120	31	10	0.026	056-2	130-0(N)	000-3
1019	-95.6	-140	22	10	0.016	056-6	130-0(N)	000-3
Surface layer, WR orientation								
03E-1118	22.2	72	84	100	0.071	070-3(N)	120-4	000-3
1119	4.4	40	79	100	0.061	070-3(N)	121-0	000-3
1120	-17.8	0	67	100	0.056	070-3(N)	121-4	000-3
1121	-40	-40	49	70	0.041	070-3(N)	122-0	000-3
1122	-62.2	-80	37	35	0.031	070-3(N)	122-4	000-3
1123	-84.4	-120	18	20	0.017	070-3(N)	123-0	000-3
1124	-107	-160	10	5	0.009	070-3(N)	123-4	000-3
1125	-129	-200	7	0	0.000	070-3(N)	124-0	000-3
1126	93.3	200	87	100	0.062	070-3(N)	124-4	000-3
1127	204	400	86	100	0.069	070-3(N)	125-0	000-3
1128	-73.3	-100	25	20	0.021	070-3(N)	125-4	000-3
1129	-73.3	-100	30	20	0.024	070-3(N)	126-0	000-3
1130	-62.2	-80	35	30	0.027	070-3(N)	126-4	000-3

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface layer, WR orientation (continued)								
03E-1131	-84.4	-120	20	20	0.017	070-3(N)	127-0	000-3
1132	93.3	200	92	100	0.075	070-3(N)	127-4	000-3
1133	204	400	89	100	0.066	079-3(N)	128-0	000-3
1134	-62.2	-80	34	25	0.027	070-3(N)	128-4	000-3
1135	-73.3	-100	23	25	0.019	070-3(N)	129-0	000-3
1/4t layer, RW orientation								
03E-1020	22.2	72	53	30	0.045	047-2	130-0(N)	003-0
1021	4.4	40	46	25	0.037	047-6	130-0(N)	003-0
1022	-17.8	0	17	5	0.019	048-2	130-0(N)	003-0
1023	-40	-40	7	0	0.006	048-6	130-0(N)	003-0
1024	48.9	120	76	50	0.061	049-2	130-0(N)	003-0
1025	71.1	160	113	100	0.083	049-6	130-0(N)	003-0
1026	93.3	200	121	100	0.086	050-2	130-0(N)	003-0
1027	149	300	123	100	0.085	050-6	130-0(N)	003-0
1028	204	400	117	100	0.079	051-2	130-0(N)	003-0
1029	-6.7	20	30	5	0.027	051-6	130-0(N)	003-0
1030	-17.8	0	16	10	0.017	052-2	130-0(N)	003-0
1031	-6.7	20	18	15	0.017	052-6	130-0(N)	003-0
1032	4.4	40	44	20	0.037	053-2	130-0(N)	003-0
1033	15.6	60	57	30	0.049	053-6	130-0(N)	003-0
1034	93.3	200	120	100	0.084	054-2	130-0(N)	003-0
1035	149	300	124	100	0.083	054-6	130-0(N)	003-0
1036	204	400	120	100	0.080	055-2	130-0(N)	003-0
1037	-17.8	0	18	5	0.019	055-6	130-0(N)	003-0
1038	-6.7	20	17	5	0.020	056-2	130-0(N)	003-0
1039	4.4	40	37	10	0.031	056-6	130-0(N)	003-0
1/4t layer, WR orientation								
03E-1136	22.8	73	38	30	0.038	070-3(N)	120-4	003-0
1137	4.4	40	34	25	0.030	070-3(N)	121-0	003-0
1138	-17.8	0	21	10	0.018	070-3(N)	121-4	003-0
1139	-40	-40	6	5	0.005	070-3(N)	122-0	003-0
1140	48.9	120	68	70	0.055	070-3(N)	122-4	003-0
1141	71.1	160	85	90	0.069	070-3(N)	123-0	003-0
1142	93.3	200	95	100	0.077	070-3(N)	123-4	003-0
1143	149	300	91	100	0.072	070-3(N)	124-0	003-0
1144	204	400	94	100	0.075	070-3(N)	124-4	003-0
1145	-6.7	20	21	20	0.023	070-3(N)	125-0	003-0
1146	4.4	40	36	20	0.033	070-3(N)	125-4	003-0
1147	-6.7	20	24	10	0.023	070-3(N)	126-0	003-0
1148	149	300	90	100	0.068	070-3(N)	126-4	003-0
1149	15.6	60	34	25	0.032	070-3(N)	127-0	003-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, WR orientation (continued)								
03E-1150	4.4	40	29	30	0.025	070-3(N)	127-4	003-0
1151	204	400	94	100	0.070	070-3(N)	128-0	003-0
1152	-6.7	20	14	20	0.012	070-3(N)	128-4	003-0
1153	15.6	60	43	35	0.023	070-3(N)	129-0	003-0
1/4t layer, TR orientation								
03E-1100	22.2	72	31	30	0.034	068-4	120-4	003-0(N)
1101	4.4	40	27	30	0.022	068-4	121-0	003-0(N)
1102	-17.8	0	15	10	0.016	068-4	121-4	003-0(N)
1103	-40	-40	5	0	0.005	068-4	122-0	003-0(N)
1104	48.9	120	54	70	0.050	068-4	122-4	003-0(N)
1105	71.1	160	75	95	0.060	068-4	123-0	003-0(N)
1106	93.3	200	75	100	0.066	068-4	123-4	003-0(N)
1107	149	300	83	100	0.069	068-4	124-0	003-0(N)
1108	204	400	78	100	0.070	068-4	124-4	003-0(N)
1109	15.6	60	43	30	0.040	068-4	125-0	003-0(N)
1110	-6.7	20	12	15	0.012	068-4	125-4	003-0(N)
1111	4.4	40	20	30	0.023	068-4	126-0	003-0(N)
1112	15.6	60	32	25	0.030	068-4	126-4	003-0(N)
1113	93.3	200	70	100	0.060	068-4	127-0	003-0(N)
1114	149	300	77	100	0.071	068-4	127-4	003-0(N)
1115	204	400	82	100	0.064	068-4	128-0	003-0(N)
1116	4.4	40	21	25	0.018	068-4	128-4	003-0(N)
1117	15.6	60	28	25	0.032	068-4	129-0	003-0(N)
1/2t layer, RW orientation								
03E-1040	22.2	72	45	40	0.038	047-2	130-0(N)	006-0
1041	4.4	40	49	40	0.041	047-6	130-0(N)	006-0
1042	-17.8	0	12	5	0.013	048-2	130-0(N)	006-0
1043	-40	-40	8	0	0.012	048-6	130-0(N)	006-0
1044	48.9	120	103	80	0.076	049-2	130-0(N)	006-0
1045	71.1	160	123	100	0.080	049-6	130-0(N)	006-0
1046	93.3	200	117	100	0.079	050-2	130-0(N)	006-0
1047	149	300	115	100	0.081	050-6	130-0(N)	006-0
1048	204	400	121	100	0.084	051-2	130-0(N)	006-0
1049	-6.7	20	21	20	0.023	051-6	130-0(N)	006-0
1050	4.4	40	36	35	0.036	052-2	130-0(N)	006-0
1051	-6.7	20	31	25	0.025	052-6	130-0(N)	006-0
1052	4.4	40	14	30	0.016	053-2	130-0(N)	006-0
1053	15.6	60	50	40	0.040	053-6	130-0(N)	006-0
1054	93.3	200	125	100	0.084	054-2	130-0(N)	006-0
1055	149	300	125	100	0.081	054-6	130-0(N)	006-0
1056	204	400	128	100	0.083	055-2	130-0(N)	006-0
1057	-6.7	20	34	20	0.030	055-6	130-0(N)	006-0
1058	4.4	40	26	15	0.024	056-2	130-0(N)	006-0
1059	-17.8	0	13	5	0.013	056-6	130-0(N)	006-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, WR orientation								
03E-1154	22.8	73	53	25	0.046	070-3(N)	120-4	006-0
1155	4.4	40	20	25	0.023	070-3(N)	121-0	006-0
1156	-17.8	0	8	10	0.008	070-3(N)	121-4	006-0
1157	-40	-40	5	0	0.005	070-3(N)	112-0	006-0
1158	48.9	120	73	65	0.066	070-3(N)	122-4	006-0
1159	71.1	160	85	99	0.065	070-3(N)	123-0	006-0
1160	93.3	200	88	100	0.078	070-3(N)	123-4	006-0
1161	149	300	74	100	0.067	070-3(N)	124-0	006-0
1162	204	400	88	100	0.075	070-3(N)	124-4	006-0
1163	15.6	60	21	30	0.022	070-3(N)	125-0	006-0
1164	149	300	91	100	0.072	070-3(N)	125-4	006-0
1165	15.6	60	39	35	0.035	070-3(N)	126-0	006-0
1166	22.2	72	48	40	0.044	070-3(N)	126-4	006-0
1167	149	300	96	100	0.078	070-3(N)	127-0	006-0
1168	204	400	85	100	0.069	070-3(N)	127-4	006-0
1169	-6.7	20	14	10	0.016	070-3(N)	128-0	006-0
1170	4.4	40	35	20	0.031	070-3(N)	128-4	006-0
1171	15.6	60	35	30	0.029	070-3(N)	129-0	006-0
3/4t layer, RW orientation								
03E-1325	22.8	73	50	30		047-2	130-0(N)	009-0
1326	4.4	40	42	30	0.035	047-6	130-0(N)	009-0
1327	-17.8	0	16	5	0.018	048-2	130-0(N)	009-0
1328	-40	-40	7	0		048-6	130-0(N)	009-0
1329	48.9	120	87	75		049-2	130-0(N)	009-0
1330	71.1	160	119	100	0.087	049-6	130-0(N)	009-0
1331	93.3	200	116	100	0.085	050-2	130-0(N)	009-0
1332	149	300	120	100	0.085	050-6	130-0(N)	009-0
1333	204	400	117	100	0.088	051-2	130-0(N)	009-0
1334	-6.7	20	35	20	0.032	051-6	130-0(N)	009-0
1335	-17.8	0	23	10	0.020	052-2	130-0(N)	009-0
1336	-6.7	20	21	10	0.020	052-6	130-0(N)	009-0
1337	4.4	40	29	20	0.025	053-2	130-0(N)	009-0
1338	93.3	200	119	100	0.089	053-6	130-0(N)	009-0
1339	149	300	123	100	0.080	054-2	130-0(N)	009-0
1340	204	400	119	100	0.082	054-6	130-0(N)	009-0
1341	-17.8	0	15	5	0.013	055-2	130-0(N)	009-0
1342	-6.7	20	35	10	0.029	055-6	130-0(N)	009-0
1343	4.4	40	40	10	0.035	056-2	130-0(N)	009-0
1344	-6.7	20	34	10	0.027	056-6	130-0(N)	009-0
3/4t layer, WR orientation								
03E-1365	22.8	73	53	35	0.042	070-3(N)	120-4	009-0
1366	4.4	40	42	25	0.030	070-3(N)	121-0	009-0
1367	-17.8	0	14	10	0.011	070-3(N)	121-4	009-0
1368	-40	-40	9	10	0.003	070-3(N)	122-0	009-0

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
3/4t layer, WR orientation (continued)								
03E-1369	48.9	120	68	70	0.054	070-3(N)	122-4	009-0
1370	71.1	160	83	90	0.064	070-3(N)	123-0	009-0
1371	93.3	200	87	100	0.069	070-3(N)	123-4	009-0
1372	149	300	97	100	0.070	070-3(N)	124-0	009-0
1373	204	400	91	100	0.072	070-3(N)	124-4	009-0
1374	-6.7	20	30	20	0.025	070-3(N)	125-0	009-0
1375	-17.8	0	12	15	0.008	070-3(N)	125-4	009-0
1376	-6.7	20	20	15	0.016	070-3(N)	126-0	009-0
1377	4.4	40	40	30	0.035	070-3(N)	126-4	009-0
1378	149	300	99	100	0.068	070-3(N)	127-0	009-0
1379	204	400	100	100	0.070	070-3(N)	127-4	009-0
1380	93.3	200	94	100	0.074	070-3(N)	128-0	009-0
1381	-6.7	20	27	20	0.021	070-3(N)	128-4	009-0
1382	4.4	40	28	20	0.020	070-3(N)	129-0	009-0
1t layer, RW orientation								
03E-1345	22.8	73	108	100	0.068	047-2	130-0(N)	011-5
1346	4.4	40	103	100	0.065	047-6	130-0(N)	011-5
1347	-17.8	0	94	93	0.060	048-2	130-0(N)	011-5
1348	-40	-40	60	70	0.039	048-6	130-0(N)	011-5
1349	-62.2	-80	50	40	0.031	049-2	130-0(N)	011-5
1350	-84.4	-120	30	10	0.020	049-6	130-0(N)	011-5
1351	-107	-160	7	5	0.003	050-2	130-0(N)	011-5
1352	-129	-200	7	10	0.004	050-6	130-0(N)	011-5
1353	93.3	200	116	100	0.074	051-2	130-0(N)	011-5
1354	204	400	122	100	0.071	051-6	130-0(N)	011-5
1355	-73.3	-100	46	30	0.030	052-2	130-0(N)	011-5
1356	-95.6	-140	20	5	0.011	052-6	130-0(N)	011-5
1357	-65.6	-140	22	10	0.012	053-2	130-0(N)	011-5
1358	-84.4	-120	17	20	0.009	053-6	130-0(N)	011-5
1359	-73.3	-100	38	20	0.022	054-2	130-0(N)	011-5
1360	48.9	120	115	100	0.075	054-6	130-0(N)	011-5
1361	93.3	200	111	100	0.071	055-2	130-0(N)	011-5
1362	204	400	117	100	0.076	055-6	130-0(N)	011-5
1363	-73.3	-100	34	20	0.018	056-2	130-0(N)	011-5
1364	-84.4	-120	32	20	0.022	056-6	130-0(N)	011-5
1t layer, WR orientation								
03E-1383	22.8	73	79	100	0.057	070-3(N)	120-4	011-5
1384	4.4	40	79	100	0.060	070-3(N)	121-0	011-5
1385	-17.8	0	75	95	0.059	070-3(N)	121-4	011-5
1386	-40	-40	58	80	0.044	070-3(N)	122-0	011-5
1387	-62.2	-80	36	40	0.029	070-3(N)	122-4	011-5
1388	-84.4	-120	24	30	0.015	070-3(N)	123-0	011-5

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
It layer, WR orientation (continued)								
03E-1389	-107	-160	19	5	0.013	070-3(N)	123-4	011-5
1390	-129	-200	15	0	0.010	070-3(N)	124-0	011-5
1391	93.3	200	80	100	0.064	070-3(N)	124-4	011-5
1392	204	400	84	100	0.070	070-3(N)	125-0	011-5
1393	-73.3	-100	31	40	0.019	070-3(N)	125-4	011-5
1394	-84.4	-120	29	30	0.018	070-3(N)	126-0	011-5
1395	-73.3	-100	33	35	0.021	070-3(N)	126-4	011-5
1396	-62.2	-80	34	40	0.023	070-3(N)	127-0	011-5
1397	93.3	200	77	100	0.064	070-3(N)	127-4	011-5
1398	204	400	85	100	0.066	070-3(N)	128-0	011-5
1399	-129	-200	9	0	0.003	070-3(N)	128-4	011-5
1400	-73.3	-100	30	20	0.025	070-3(N)	129-0	011-5
Plate section 03GA								
Surface layer, RW orientation								
03GA-1000	-157	-250	3	0	0.001	047-7	219-7(N)	000-2
1001	-129	-200	6	0	0.003	048-3	219-7(N)	000-2
1002	-101	-150	28	10	0.022	048-7	219-7(N)	000-2
1003	-73	-100	48	20	0.034	049-3	219-7(N)	000-2
1004	-46	-50	70	50	0.054	049-7	219-7(N)	000-2
1005	-18	0	105	100	0.075	050-3	219-7(N)	000-2
1006	38	100	113	100	0.081	050-7	219-7(N)	000-2
1007	93	200	122	100	0.082	051-3	219-7(N)	000-2
1008	177	350	118.5	100	0.080	051-7	219-7(N)	000-2
1009	260	500	115	100	0.072	052-3	219-7(N)	000-2
1010	-87	-125	37	15	0.038	052-7	219-7(N)	000-2
1011	-59	-75	55	30	0.045	053-3	219-7(N)	000-2
Surface layer, WR orientation								
03GA-1012	-157	-250	4.5	0	0.002	048-7(N)	221-1	000-2
1013	-129	-200	7	0	0.004	048-7(N)	221-5	000-2
1014	-101	-150	20	0	0.017	048-7(N)	222-1	000-2
1015	-73	-100	32	20	0.026	048-7(N)	222-5	000-2
1016	-46	-50	50	70	0.044	048-7(N)	223-1	000-2
1017	-18	0	74.5	85	0.060	048-7(N)	223-5	000-2
1018	38	100	89	100	0.068	051-1(N)	221-1	000-2
1019	93	200	88	100	0.073	051-1(N)	221-5	000-2
1020	177	350	89.5	100	0.072	051-1(N)	222-1	000-2
1021	260	500	85	100	0.069	051-1(N)	222-5	000-2
1022	-87	-125	21	10	0.014	051-1(N)	223-1	000-2
1023	-59	-175	17	5	0.010	051-1(N)	223-5	000-2

Table B.1. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation								
03GA-1024	-73	-100	4	0	0.002	047-7	219-7(N)	003-0
1025	-46	-50	7	0	0.005	048-3	219-7(N)	003-0
1026	-18	0	13	10	0.009	048-7	219-7(N)	003-0
1027	10	50	63	25	0.051	049-3	219-7(N)	003-0
1028	38	100	85	40	0.062	049-7	219-7(N)	003-0
1029	66	150	104	90	0.075	050-3	219-7(N)	003-0
1030	93	200	124	100	0.087	050-7	219-7(N)	003-0
1031	149	300	121	100	0.078	051-3	219-7(N)	003-0
1032	204	400	122	100	0.074	051-7	219-7(N)	003-0
1033	288	550	119	100	0.085	052-3	219-7(N)	003-0
1034	-4	25	36	20	0.032	052-7	219-7(N)	003-0
1035	4	40	23	25	0.020	053-3	219-7(N)	003-0
1/4t layer, WR orientation								
03GA-1036	-73	-100	3	0	0.001	048-7(N)	221-1	003-0
1037	-46	-50	5	0	0.002	048-7(N)	221-5	003-0
1038	-18	0	16	10	0.014	048-7(N)	222-1	003-0
1039	10	50	40	30	0.036	048-7(N)	222-5	003-0
1040	38	100	65	40	0.055	048-7(N)	223-1	003-0
1041	93	200	104	100	0.078	048-7(N)	223-5	003-0
1042	149	300	96	100	0.077	051-1(N)	221-1	003-0
1043	204	400	96	100	0.084	051-1(N)	221-5	003-0
1044	288	550	96	100	0.076	051-1(N)	222-1	003-0
1045	66	150	99	100	0.075	051-1(N)	222-5	003-0
1046	-4	25	33	15	0.029	051-1(N)	223-1	003-0
1047	24	75	44	35	0.040	051-1(N)	223-5	003-0

^aSpecimens used to determine edge effects.^bSpecimens used to determine data scatter.

Table B.2. Charpy V-notch impact properties of 305-mm-thick
(12-in.) HSST plate 01 to determine edge effects

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Plate section 01K								
Surface (0t) layer, RW orientation								
01K-9333	-18	0	113	100	0.066	000-4	106-2(N)	000-3
9334	-18	0	111	100	0.067	001-0	106-2(N)	000-3
9335	-18	0	103	100	0.061	001-4	106-2(N)	000-3
9336	-18	0	109	100	0.069	002-0	106-2(N)	000-3
9337	-18	0	120	100	0.083	002-4	106-2(N)	000-3
9338	-18	0	112	100	0.068	003-0	106-2(N)	000-3
9339	-18	0	104	100	0.067	003-4	106-2(N)	000-3
9340	-18	0	107	100	0.065	004-0	106-2(N)	000-3
9341	-18	0	102	100	0.064	004-4	106-2(N)	000-3
9342	-18	0	109	100	0.065	005-0	106-2(N)	000-3
9343	-62	-80	77	70	0.048	000-4	108-4(N)	000-3
9344	-62	-80	61	70	0.045	001-0	108-4(N)	000-3
9345	-62	-80	59	60	0.039	001-4	108-4(N)	000-3
9346	-62	-80	64	40	0.050	002-0	108-4(N)	000-3
9347	-62	-80	58	40	0.036	002-4	108-4(N)	000-3
9348	-62	-80	52	30	0.037	003-0	108-4(N)	000-3
9349	-62	-80	60	30	0.035	003-4	108-4(N)	000-3
9350	-62	-80	77	80	0.051	004-0	108-4(N)	000-3
9351	-62	-80	72	80	0.050	004-4	108-4(N)	000-3
9352	-62	-80	54	70	0.043	005-0	108-4(N)	000-3
9353	-107	-160	28	10	0.017	000-4	110-7(N)	000-3
9354	-107	-160	28	10	0.018	001-0	110-7(N)	000-3
9355	-107	-160	32	10	0.022	001-4	110-7(N)	000-3
9356	-107	-160	27	10	0.016	002-0	110-7(N)	000-3
9359	-107	-160	31	10	0.022	003-4	110-7(N)	000-3
9360	-107	-160	31	10	0.019	004-0	110-7(N)	000-3
9361	-107	-160	30	10	0.019	004-4	110-7(N)	000-3
9362	-107	-160	27	10	0.020	005-0	110-7(N)	000-3
9363	71	160	117	100	0.072	000-4	113-1(N)	000-3
9364	71	160	120	100	0.073	001-0	113-1(N)	000-3
9365	71	160	115	100	0.076	001-4	113-1(N)	000-3
9366	71	160	117	100	0.080	002-0	113-1(N)	000-3
9367	71	160	125	100	0.073	002-4	113-1(N)	000-3
9368	71	160	115	100	0.075	003-0	113-1(N)	000-3
9369	71	160	113	100	0.075	003-4	113-1(N)	000-3
9370	71	160	119	100	0.075	004-0	113-1(N)	000-3
9371	71	160	121	100	0.073	004-4	113-1(N)	000-3
9372	71	160	122	100	0.076	005-0	113-1(N)	000-3
9373	-157	-250	6	0	0.000	000-4	120-0(N)	000-3
9374	-157	-250	3	0	0.000	001-0	120-0(N)	000-3
9375	-157	-250	4	0	0.001	001-4	120-0(N)	000-3

Table B.2. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
Surface (0t) layer, RW orientation (continued)								
01K-9376	-157	-250	4	0	0.000	002-0	120-0(N)	000-3
9377	-157	-250	2	0	0.000	002-4	120-0(N)	000-3
9378	-157	-250	2	0	0.001	003-0	120-0(N)	000-3
9379	-157	-250	4	0	0.000	003-4	120-0(N)	000-3
9380	-157	-250	3	0	0.000	004-0	120-0(N)	000-3
9381	-157	-250	6	0	0.001	004-4	120-0(N)	000-3
9382	-157	-250	3	0	0.000	005-0	120-0(N)	000-3
9383	-129	-200	18	0	0.009	000-4	122-2(N)	000-3
9384	-129	-200	11	0	0.006	001-0	122-2(N)	000-3
9385	-129	-200	9	0	0.002	001-4	122-2(N)	000-3
9386	-129	-200	8	0	0.002	002-0	122-2(N)	000-3
9387	-129	-200	13	0	0.004	002-4	122-2(N)	000-3
9388	-129	-200	13	0	0.010	003-0	122-2(N)	000-3
9389	-129	-200	6	0	0.003	003-4	122-2(N)	000-3
9390	-129	-200	13	0	0.005	004-0	122-2(N)	000-3
9391	-129	-200	15	0	0.008	004-4	122-2(N)	000-3
9392	-129	-200	17	0	0.012	005-0	122-2(N)	000-3
9293	27	80	115	100	0.078	000-4	124-5(N)	000-3
9394	27	80	114	100	0.073	001-0	124-5(N)	000-3
9395	27	80	113	100	0.074	001-4	124-5(N)	000-3
9396	27	80	117	100	0.079	002-0	124-5(N)	000-3
9397	27	80	112	100	0.074	002-4	124-5(N)	000-3
9398	27	80	117	100	0.077	003-0	124-5(N)	000-3
9399	27	80	112	100	0.075	003-4	124-5(N)	000-3
9400	27	80	112	100	0.080	004-0	124-5(N)	000-3
9401	27	80	118	100	0.085	004-4	124-5(N)	000-3
9402	27	80	112	100	0.076	005-0	124-5(N)	000-3
9403	-84	-120	50	20	0.039	000-4	126-7(N)	000-3
9404	-84	-120	45	20	0.034	001-0	126-7(N)	000-3
9405	-84	-120	43	20	0.035	001-4	126-7(N)	000-3
9406	-84	-120	43	20	0.033	002-0	126-7(N)	000-3
9407	-84	-120	47	20	0.036	002-4	126-7(N)	000-3
9408	-84	-120	44	20	0.035	003-0	126-7(N)	000-3
9409	-84	-120	40	20	0.030	003-4	126-7(N)	000-3
9410	-84	-120	34	20	0.026	004-0	126-7(N)	000-3
9411	-84	-120	55	20	0.043	004-4	126-7(N)	000-3
9412	-84	-120	50	20	0.039	005-0	126-7(N)	000-3
1/4t layer, RW orientation								
01K-9413	-18	0	54	20	0.042	000-4	106-2(N)	000-3
9414	-18	0	46	20	0.036	001-0	106-2(N)	000-3
9415	-18	0	65	20	0.054	001-4	106-2(N)	000-3
9416	-18	0	42	10	0.036	002-0	106-2(N)	000-3
9417	-18	0	53	10	0.044	002-4	106-2(N)	000-3

Table B.2. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01K-9418	-13	0	41	10	0.038	003-0	106-2(N)	003-0
9419	-13	0	20	5	0.021	003-4	106-2(N)	003-0
9420	-13	0	47	10	0.040	004-0	106-2(N)	003-0
9421	-13	0	49	10	0.041	004-4	106-2(N)	003-0
9422	-13	0	39	10	0.033	005-0	106-2(N)	003-0
9423	-62	-80	10	0	0.013	000-4	108-4(N)	003-0
9424	-62	-80	10	0	0.011	001-0	108-4(N)	003-0
9425	-62	-80	8	0	0.008	001-4	108-4(N)	003-0
9426	-62	-80	7	0	0.008	002-0	108-4(N)	003-0
9427	-62	-80	6	0	0.007	002-4	108-4(N)	003-0
9429	-62	-80	6	0	0.004	003-4	108-4(N)	003-0
9430	-62	-80	5	0	0.003	004-0	108-4(N)	003-0
9431	-62	-80	6	0	0.006	004-4	108-4(N)	003-0
9432	-62	-80	6	0	0.004	005-0	108-4(N)	003-0
9433	-40	-40	39	2	0.028	000-4	110-7(N)	003-0
9434	-40	-40	37	2	0.026	001-0	110-7(N)	003-0
9435	-40	-40	13	0	0.014	001-4	110-7(N)	003-0
9436	-40	-40	16	0	0.014	002-0	110-7(N)	003-0
9437	-40	-40	15	0	0.011	002-4	110-7(N)	003-0
9438	-40	-40	14	0	0.021	003-0	110-7(N)	003-0
9439	-40	-40	20	0	0.015	003-4	110-7(N)	003-0
9440	-40	-40	12	0	0.008	004-0	110-7(N)	003-0
9441	-40	-40	6	0	0.005	004-4	110-7(N)	003-0
9442	-40	-40	11	0	0.009	005-0	110-7(N)	003-0
9443	27	80	107	90	0.059	000-4	113-1(N)	003-0
9444	27	80	98	35	0.068	001-0	113-1(N)	003-0
9445	27	80	93	35	0.065	001-4	113-1(N)	003-0
9446	27	80	92	70	0.064	002-0	113-1(N)	003-0
9447	27	80	112	80	0.071	002-4	113-1(N)	003-0
9448	27	80	78	40	0.058	003-0	113-1(N)	003-0
9449	27	80	94	60	0.059	003-4	113-1(N)	003-0
9450	27	80	76	30	0.058	004-0	113-1(N)	003-0
9451	27	80	80	30	0.056	004-4	113-1(N)	003-0
9452	27	80	79	30	0.057	005-0	113-1(N)	003-0
9453	-29	-20	35	2	0.026	000-4	120-0(N)	003-0
9454	-29	-20	44	2	0.033	001-0	120-0(N)	003-0
9455	-29	-20	30	0	0.027	001-4	120-0(N)	003-0
9456	-29	-20	35	0	0.026	002-0	120-0(N)	003-0
9457	-29	-20	27	0	0.019	002-4	120-0(N)	003-0
9458	-29	-20	18	0	0.013	003-0	120-0(N)	003-0
9459	-29	-20	20	0	0.017	003-4	120-0(N)	003-0
9460	-29	-20	14	5	0.012	004-0	120-0(N)	003-0

Table B.2. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/4t layer, RW orientation (continued)								
01K-9461	-29	-20	15	0	0.011	004-4	120-0(N)	003-0
9462	-29	-20	13	0	0.010	005-0	120-0(N)	003-0
9463	27	80	85	70	0.056	000-4	122-2(N)	003-0
9464	27	80	102	90	0.070	001-0	122-2(N)	003-0
9465	27	80	97	90	0.063	001-4	122-2(N)	003-0
9466	27	80	91	40	0.063	002-0	122-2(N)	003-0
9467	27	80	81	35	0.057	002-4	122-2(N)	003-0
9469	27	80	89	60	0.062	003-4	122-2(N)	003-0
9470	27	80	85	45	0.062	004-0	122-2(N)	003-0
9471	27	80	89	45	0.062	004-4	122-2(N)	003-0
9472	27	80	86	40	0.065	005-0	122-2(N)	003-0
9473	160	320	123	100	0.078	000-4	124-5(N)	003-0
9474	160	320	127	100	0.078	001-0	124-5(N)	003-0
9475	160	320	135	100	0.072	001-4	124-5(N)	003-0
9476	160	320	122	100	0.084	002-0	124-5(N)	003-0
9477	160	320	127	100	0.078	002-4	124-5(N)	003-0
9478	160	320	126	100	0.074	003-0	124-5(N)	003-0
9479	160	320	121	100	0.081	003-4	124-5(N)	003-0
9480	160	320	120	100	0.076	004-0	124-5(N)	003-0
9481	160	320	123	100	0.074	004-4	124-5(N)	003-0
9482	160	320	122	100	0.086	005-0	124-5(N)	003-0
9483	71	160	122	100	0.074	000-4	126-7(N)	003-0
9484	71	160	123	100	0.077	001-0	126-7(N)	003-0
9485	71	160	121	100	0.075	001-4	126-7(N)	003-0
9486	71	160	119	100	0.076	002-0	126-7(N)	003-0
9487	71	160	113	100	0.079	002-4	126-7(N)	003-0
9488	71	160	115	100	0.077	003-0	126-7(N)	003-0
9489	71	160	121	100	0.079	003-4	126-7(N)	003-0
9490	71	160	122	100	0.076	004-0	126-7(N)	003-0
9491	71	160	116	100	0.077	004-4	126-7(N)	003-0
9492	71	160	117	100	0.074	005-0	126-7(N)	003-0
1/2t Layer, RW orientation								
01K-9393	-18	0	43	5	0.033	000-4	106-2(N)	006-0
9494	-18	0	39	5	0.028	001-0	106-2(N)	006-0
9495	-18	0	37	5	0.030	001-4	106-2(N)	006-0
9496	-18	0	33	5	0.027	002-0	106-2(N)	006-0
9497	-18	0	32	5	0.024	002-4	106-2(N)	006-0
9498	-18	0	35	5	0.027	003-0	106-2(N)	006-0
9499	-18	0	33	5	0.025	003-4	106-2(N)	006-0
9500	-18	0	22	5	0.019	004-0	106-2(N)	006-0
9501	-18	0	24	5	0.016	004-4	106-2(N)	006-0
9502	-18	0	18	5	0.015	005-0	106-2(N)	006-0

Table B.2. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibrous)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW orientation (continued)								
01K-9503	-62	-80	5	5	0.001	000-4	108-4(N)	006-0
9504	-62	-80	6	0	0.003	001-0	108-4(N)	006-0
9505	-62	-80	6	0	0.003	001-4	108-4(N)	006-0
9506	-62	-80	5	0	0.003	002-0	108-4(N)	006-0
9507	-62	-80	5	0	0.002	002-4	108-4(N)	006-0
9508	-62	-80	6	0	0.005	003-0	108-4(N)	006-0
9509	-62	-80	6	0	0.003	003-4	108-4(N)	006-0
9510	-62	-80	5	0	0.003	004-0	108-4(N)	006-0
9511	-62	-80	5	0	0.002	004-4	108-4(N)	006-0
9512	-62	-80	5	0	0.003	005-0	108-4(N)	006-0
9513	-40	-40	22	0	0.016	000-4	110-7(N)	006-0
9514	-40	-40	7	0	0.003	001-0	110-7(N)	006-0
9515	-40	-40	10	0	0.005	001-4	110-7(N)	006-0
9516	-40	-40	10	0	0.005	002-0	110-7(N)	006-0
9517	-40	-40	12	0	0.009	002-4	110-7(N)	006-0
9518	-40	-40	11	0	0.007	003-0	110-7(N)	006-0
9519	-40	-40	9	0	0.006	003-4	110-7(N)	006-0
9520	-40	-40	8	0	0.005	004-0	110-7(N)	006-0
9521	-40	-40	10	0	0.009	004-4	110-7(N)	006-0
9522	-40	-40	8	0	0.004	005-0	110-7(N)	006-0
9523	27	80	91	40	0.053	000-4	113-1(N)	006-0
9524	27	80	87	40	0.057	001-0	113-1(N)	006-0
9525	27	80	83	40	0.056	001-4	113-1(N)	006-0
9526	27	80	73	40	0.055	002-0	113-1(N)	006-0
9527	27	80	71	40	0.053	002-4	113-1(N)	006-0
9528	27	80	84	40	0.058	003-0	113-1(N)	006-0
9529	27	80	74	40	0.049	003-4	113-1(N)	006-0
9530	27	80	73	40	0.055	004-0	113-1(N)	006-0
9531	27	80	88	40	0.061	004-4	113-1(N)	006-0
9532	27	80	80	40	0.054	005-0	113-1(N)	006-0
9533	71	160	122	100	0.074	000-4	120-0(N)	006-0
9534	71	160	115	100	0.072	001-0	120-0(N)	006-0
9535	71	160	124	100	0.080	001-4	120-0(N)	006-0
9536	71	160	121	100	0.079	002-0	120-0(N)	006-0
9537	71	160	122	100	0.078	002-4	120-0(N)	006-0
9538	71	160	114	100	0.079	003-0	120-0(N)	006-0
9539	71	160	123	100	0.073	003-4	120-0(N)	006-0
9540	71	160	125	100	0.076	004-0	120-0(N)	006-0
9541	71	160	110	100	0.080	004-4	120-0(N)	006-0
9542	71	160	124	100	0.077	005-0	120-0(N)	006-0
9543	4	40	68	25	0.048	000-4	122-2(N)	006-0
9544	4	40	67	25	0.050	001-0	122-2(N)	006-0
9545	4	40	49	25	0.036	001-4	122-2(N)	006-0

Table B.2. (continued)

Specimen	Temperature		Energy (ft-lb)	Fracture appearance (% fibr)	Lateral expansion (in.)	Specimen location and orientation		
	(°C)	(°F)				X	Y	Z
1/2t layer, RW or					n (continued)			
01K-9546	4	40	66	25	0.049	002-0	122-2(N)	006-0
9547	4	40	51	25	0.038	002-4	122-2(N)	006-0
9548	4	40	57	25	0.043	003-0	122-2(N)	006-0
9549	4	40	57	25	0.042	003-4	122-2(N)	006-0
9550	4	40	51	25	0.038	004-0	122-2(N)	006-0
9551	4	40	45	25	0.033	004-4	122-2(N)	006-0
9552	4	40	58	25	0.050	005-0	122-2(N)	006-0
9553	160	320	124	100	0.083	000-4	124-5(N)	006-0
9554	160	320	118	100	0.080	001-0	124-5(N)	006-0
9555	160	320	122	100	0.081	001-4	124-5(N)	006-0
9556	160	320	120	100	0.084	002-0	124-5(N)	006-0
9557	160	320	122	100	0.082	002-4	124-5(N)	006-0
9558	160	320	118	100	0.087	003-0	124-5(N)	006-0
9559	160	320	121	100	0.077	003-4	124-5(N)	006-0
9560	160	320	122	100	0.085	004-0	124-5(N)	006-0
9561	160	320	125	100	0.087	004-4	124-5(N)	006-0
9562	160	320	133	100	0.091	005-0	124-5(N)	006-0
9563	49	120	116	100	0.076	000-4	126-7(N)	006-0
9564	49	120	115	100	0.082	001-0	126-7(N)	006-0
9565	49	120	108	100	0.074	001-4	126-7(N)	006-0
9566	49	120	105	100	0.079	002-0	126-7(N)	006-0
9567	49	120	108	100	0.079	002-4	126-7(N)	006-0
9568	49	120	108	100	0.076	003-0	126-7(N)	006-0
9569	49	120	110	100	0.079	003-4	126-7(N)	006-0
9570	49	120	101	100	0.079	004-0	126-7(N)	006-0
9571	49	120	107	100	0.079	004-4	126-7(N)	006-0
9572	49	120	103	100	0.082	005-0	126-7(N)	006-0

Appendix C

INSTRUMENTED CHARPY V-NOTCH DATA

Editor's note:

The table in this appendix was prepared before ORNL's adoption of the SI system of units, and it is reproduced as is to avoid further delay of this report. To convert foot-pounds to joules, multiply by 1.3558; to convert pounds to newtons multiply by 4.448. Celsius temperatures can be obtained by $^{\circ}\text{C} = (^{\circ}\text{F} - 32)/1.8$.

Table C.1. Instrumented Charpy impact properties of 305-mm-thick
(12-in.) ASTM A 533 grade B class 1 steel plates

Specimen ^a	Test temperature (°F)	Load (lb)				Energy (ft-lb)		
		General yield	Fast fracture initiation	Fracture arrest	Maximum	To fast fracture	To maximum load	Total
Plate section 01K								
1/4t layer, RW orientation								
01K-7128	-80		2600	0		2.3		3
7132	-60		2700	0		7.1	3.9	10
7074	-40	3570	3750	300		9.6		13
7075	0	3150	3820	550		16.3		24
7076	30	3070	4250	1120		42.7		50
7077	60	3070	4190	1120	4250	54.7	41.8	63
7135	79	3000	3700	2180	4100	68.3	45.8	77
7078	100	2920	3970	1800	4300	66.2	46.0	86
7133	120	2300	2850		4000	60.0	41.2	87
7079	140	2600			3970		42.7	112
7130	300	2320			3550		37.9	118
7131	400	2250			3500		36.4	120
7138	500	2460			3320		39.7	115
7137	200	2500			3810		39.7	123
7136	100	2800	3560	1950	4000	69.7	45.3	92
7139	120	2900	2860	1840	4000	87.0	46.3	113
7140	-100		2500	0		1.1	3.7	5
7141	-20	3360	3500	200		9.6		14
7143	130	2900	3060	1900	3900	71.7	39.6	99
1/3t layer, RT orientation								
01K-5224	-100		2960	0				4.5
5220	-50		3400	0				9
5228	-25	3310	4080	260				30
5227	25	3110	4100	520				45
5223	50	3110	3710	920	4050			71
5221	100	2900	3600	1850	3960			86
5222	150	2700			3880			120
5225	200	2560			3720			118
5226	300	2400			3500			121
5/8t layer, RW orientation								
01K-5157	-80		2170	0				3
5158	-60		2570	0				5
5159	-40		3160	0				10
5160	-20		3080	100				9
5161	0	3100	3500	180				20
5162	20	2970	3750	120				32
5164	60	2770	3750	620				48
5169	80	2830	3750	1320	3870			68
5170	100	2730	3420	1580	3780			75

Table C.1. (continued)

Specimen ^a	Test temperature (°F)	Load (lb)				Energy (ft-lb)		
		General yield	Fast fracture initiation	Fracture arrest	Maximum	To fast fracture	To maximum load	Total
5/8t layer, RW orientation (continued)								
01K-5171	120	2700	3230	1930	3880			94
5172	160	2570			3720			94
5176	180	2500			3680			117
5174	280	2370			3480			120
5175	360	2250			3300			115
Plate section 02FB								
1/4t layer, RW orientation								
02FB-7893	-60		2620	0				4
7892	-40		3250	0				10
7891	-20		3060	0				12
7890	0	3140	3560	0				14
7900	0	3140	3770	270				23
7889	20	2990	3770	660	3830			31
7898	20	3140	3770	270				31.5
7899	20	3060	4070	730				35
7888	40	2920	3830	800	3900			41
7887	60	2990	3900	1170				55
7886	80	2990	3900	1930	3900			55
7885	100	2990	3450	2340				82
7903	120	2920	3370	2620	4000			92
7894	140	2770	2340	1930	3900			106
7896	220	2680	2070	2060	3770			113
7897	260	2550			3680			113
7884	300	2330			3520			109
3/8t layer, RW orientation								
02FB-9622	-40							6
9623	0	3240	3300	170				19
9624	40	3040	3700	270				30
9625	80	2780	3830	440				47
9626	120	2840	3900	1130	3960			75
9627	160	2640	3500	2120	3770			104
9628	200	2580			3770			112
9629	280	2450			3530			114

^aFor specimen coordinates see Appendix B, Table B1.

Appendix D

DROP WEIGHT DATA

Table D.1. Drop-weight results from ASTM A 533 grade B
class 1 steel plate

Depth	Temperature		Specimen type and orientation ^a					
			P1		P2			P3
	(°C)	(°F)	RW	WR	RW	WR	TR	RW WR
<i>Plate section 01E</i>								
0t	-73	-100						4N
	-84	-120						2B
1/4t	-18	0						1N
	-29	-20						3N
	-40	-40						2B
<i>Plate section 01K</i>								
0t	-29	-20			1N			1N
	-34	-30						2N
	-40	-40	1N	1N	3N			1N
	-46	-50			1B, 2N			1N
	-51	-60		3N	1B, 1N	3N		1N
	-57	-70		4N	1B	1B, 1N		
	-62	-80	2N	1B, 4N		1B, 1N		1N 1N
	-68	-90	1B, 2N	1B, 1N		1B		2N
	-73	-100	1B			1B		1B 1N
	-79	-110						1B, 1N
	-84	-120						2B
1/8t	-7	20			4N			1N
	-12	10			1B, 3N			4N
	-18	0			1B			1B, 3N
	-29	-20			1B			1B
1/4t	4	40		1N				
	-1	30		7N				
	-7	20	2N	4B, 3N			3N	
	-12	10			1B, 3N	3N	2B	2N
	-18	0	1B		3B	1B, 3N	1B	4N 2B, 1N
	-23	-10			1B, 1N	1B		3B 1B
	-29	-20	1B, 1N	1B	1B			1B, 1N
	-34	-30	1B					1B
	-40	-40	1B					
3/8t	4	40	1N					
	-1	30	3N	7N				1N
	-7	20	1B, 2N	4B, 3N		4N		1B, 2N
	-12	10		1B, 1N	4N	1B, 2N		1B, 3N 1B, 1N
	-18	0			3B, 2N	1B		1B 2N
	-23	-10			1B	1B		1B 1B, 1N

Table D.1. (continued)

Depth	Temperature		Specimen type and orientation ^a						
	(°C)	(°F)	P1		P2			P3	
			RW	WR	RW	WR	TR	RW	WR
Plate section 01K (continued)									
1/2t	4	40	1N						
	-1	30	3N						
	-7	20	1B, 2N	1N	3N	1N		3N	
	-12	10		5N	2B, 2N	1B, 2N		1B, 3N	2N
	-18	0		3B, 1N	1N	1B		1B	1B, 2N
	-23	-10			1B	1B		1B	1B
	-29	-20			1B			1B	
5/8t	4	40	2N						
	-1	30	1B, 2N	4N					
	-7	20	1B	1B, 3N				2N	
	-12	10		1B	2N			1B, 1N	
	-18	0		1N	2B				
3/4t	4	40		4N					
	-1	30	2N	1B, 5N					
	-7	20	1B, 1N	2B, 4N	2N				
	-12	10	1B		1B, 1N			1N	
	-18	0	1B						
	-23	-10						1N	
	-29	-20	1B					1B	
7/8t	-34	-30						1B	
	-12	10			1N				
	-18	0			1N			1N	
	-23	-10			1N			2N	
	-29	-20			1N			1B	
	-40	-40			1N				
	-51	-60			1N				
	-62	-80			1B, 1N				
	-68	-90			1B				
	-73	-100			1B				
1t	-51	-60		1N	1N				
	-57	-70		5N					
	-62	-80	3N	3B, 2N	1N				
	-68	-90	1B	2B	1N			1N	
	-73	-100	1B	1B	1B			2N	
	-84	-120						1B	

Table D.1. (continued)

Depth	Temperature		Specimen type and orientation ^a					
			P1		P2			P3
	(°C)	(°F)	RW	WR	RW	WR	TR	RW WR
<i>Plate section 01MU</i>								
0t	-18	0						1N
	-73	-100						1B, 2N
	-79	-110						1B
	-84	-120						2B
1/4t	-18	0						1B, 3N
	-29	-20						3B, 1N
1/2t	-18	0						3N
	-29	-20						3B, 1N
	-40	-40						1B
<i>Plate section 02FB</i>								
0t	-62	-80						1N
	-68	-90						2N
	-73	-100						1B, 2N
	-76	-105						2B
1/4t	-12	10						1N
	-18	0						1B, 2N
	-23	-10						2B
1/2t	-12	10						7N
	-18	0						3B, 6N
	-23	-10						1B
	-34	-30						1B
3/4t	-7	20						1N
	-12	10						2N
	-18	0						1N
	-23	-10						1B, 2N
	-29	-20						1B, 2N
	-34	-30						1B
	-40	-40						1B

Table D.1. (continued)

Depth	Temperature		Specimen type and orientation ^a						
			P1		P2			P3	
	(°C)	(°F)	RW	WR	RW	WR	TR	RW	WR
	<i>Plate section 03E</i>								
0t	-62	-80							1N
	-68	-90							1N
	-73	-100							3N
	-77	-107							3B
1/4t	-7	20							4N
	-12	10							1B, 2N
	-18	0							1B, 1N
	-23	-10							2B, 1N
1/2t	-34	-30							1B
	-4	40							1N
	-7	20							3N
	-12	10							1B, 1N
3/4t	-18	0							2B
	-4	40							1N
	-7	20							3N
	-12	10							1B, 1N
1t	-18	0							2B
	-62	-80							2N
	-68	-90							1N
	-73	-100							3N
	-77	-107							2B

^aAn "N" indicates no break; a "B" indicates break; 1/2 break is regarded as a break.

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