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WANL-TME - 1530
October, 1966

Westinghouse Astronuclear Laboratory

FINAL TEST SPECIFICATION

STRUCTURAL MATERIALS TEST

37/W405

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Astronuclear
Laboratory

WANL-TME - 1530

October, 1966

FINAL TEST SPECIFICATION
STRUCTURAL MATERIALS TEST

37/W405

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Radiation Test Operation Planning

INFORMATION CATEGORY

Unclassified

Authorized Classifier Date 10/14/66

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RADIATION EFFECTS TESTING

System:	REN
Component:	Materials
Test:	37/ 405
Date:	Nov. 1966
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MANL-TLE-1530

FINAL TEST SPECIFICATION
STRUCTURAL MATERIALS TEST

I. EXPERIMENT IDENTIFICATION

A. TEST PLAN REFERENCE	37/405
B. SPONSOR	MANL
C. TEST FACILITY	GL/F' (GTR-19)
D. TEST DATE	November, 1966

II. PURPOSE OF EXPERIMENT

The purpose of this experiment is to obtain mechanical properties data for structural materials exposed to a radiation environment. These data are required for NERVA reactor design activities.

III. DRAWINGS

MANL'S DRAWING NUMBERS

DESCRIPTION

650A577	Round Tensile Specimen Be-IP
650A578	Round Notched Tensile Specimen Be-IP
650A582	Flexure Specimen Be-IP
650A584	Compression Specimen Be-IC
650A587	Biaxial Brittle Fracture Specimen
650A579	Plain and Notched Sheet Tensile Specimens
650A581, Rev. A	Plain and Notched Round Tensile Specimens
650A583, Rev. A	Brazed Tensile Shear Specimen

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RADIATION EFFECTS TESTING

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IV. EQUIPMENT LIST

A. TO BE PROVIDED BY WANL.

<u>1. Test Specimens</u>	<u>Irradiation</u>	<u>Control</u>	<u>Total</u>
Beryllium	144	78	222
Ti-5Al-2.5Sn	108	60	168
Inconel 718	75	55	130
Inconel X750	65	50	115
Aluminum 2219	122	66	188
Lockalloy	30	18	48

2. Tensile Testing Cryostat

3. Flexure Testing Fixture Compatible with GD Instron Machine

4. Fixture for Measuring Elongation

5. Grips and Pull Rods

6. Compression Test Apparatus Compatible with GD Instron Machine

7. Accessory to Hardness Tester for Cryogenic Hardness Testing

B. TO BE PROVIDED BY TESTING AGENCY (GENERAL DYNAMICS/FORT WORTH)

1. Test Racks and Dewar for Holding Specimens During Irradiation

2. Instron Floor Model, Minimum Capacity 10,000 Pounds

3. Storage Dewar for Maintaining LN₂ Temperature

4. Instrumentation for Recording all Data

5. Transfer Devices to Transfer Specimens Under LN₂

6. Annealing Furnace (2000°R)

7. Furnace for High Temperature Testing Compatible with Instron Machine (2000°R)

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V. TEST ENVIRONMENT

	<u>Condition 1</u>	<u>Condition 2</u>
A. TEMPERATURE		
1. IRRADIATION TEMPERATURE	LN ₂ (-320°F)	Ambient
B. PRESSURE	Ambient	Ambient
C. HUMIDITY	Not Applicable	Not Applicable
D. VIBRATION	Not Applicable	Not Applicable
E. 1. UNPERTURBED FAST NEUTRON FLUX (E > 1.0 Mev)	Maximum Possible 1.3 x 10 ¹² nv	
2. UNPERTURBED THERMAL NEUTRON FLUX		3.5 x 10 ¹³ nv
F. UNPERTURBED INTEGRATED DOSE		
1. Fast Neutron (E > 1.0 Mev)	Maximum Possible 2 x 10 ¹⁸ nvt	
2. Thermal Neutron (Maximum Possible)		Minimum of 5 x 10 ¹⁹ nvt
G. FLUID ENVIRONMENT (During Irradiation)	LN ₂	N ₂
H. DURATION	400 Hours	400 Hours

VI. ANALYTICAL

- A. PREDICTED PERTURBED FLUXES
1. Not Significant
- B. ACTIVATION LEVELS
1. Not Applicable

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Component: Materials

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VII. FACILITY REQUIREMENTS

- A. ELECTRICAL 110 Volts - 60 Cycles
- B. PNEUMATIC Not Applicable
- C. HYDRAULIC Not Applicable
- D. SPECIAL FLUIDS LN₂ for Irradiation - LN₂ for Testing

VIII. DOSIMETRY - (To be supplied by GD)

Thermal and fast neutron dosimetry at the front and rear of each experiment.

IX. DATA REQUIREMENTS

- A. TEMPERATURE RECORDINGS
- B. REACTOR OPERATION LOG
- C. LOAD DEFLECTION CURVES
- D. ELONGATION - BENCH CHECK
- E. REDUCTION OF AREA MEASUREMENTS AND PHOTOGRAPHS
- F. DOSIMETRY
- G. DEFLECTION MEASUREMENTS FOR FLEXURE SPECIMENS (FROM INSTRON)
- H. COMPRESSION DATA
- I. "ADHESION" MEASUREMENTS

X. TEST DESCRIPTION

A total of 492 specimens will be irradiated in a LN₂ environment. In addition 52 specimens will be irradiated in a water environment at the location of the

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maximum thermal flux. A description of the post-irradiation test conditions is itemized in Tables 1 through 6. Specific specimen numbers for each test point are shown in parentheses.

A. RECEIVING INSPECTION PROCEDURE

Upon receipt of specimens from WANL, all specimens will be visually inspected by GD/FW for possible damage due to handling and the results of this inspection recorded.

B. PRE-IRRADIATION CHECKOUT

Pre-irradiation checks will include (1) the measurement and recording of pre-test dimensions on all specimens by WANL and (2) identification of all specimens to be used in either the control or irradiation tests by WANL. The identification symbols assigned to each specimen, which are scribed on each end and listed in the attached tables, together with a description of the material will be entered in a permanent log book, along with the recorded location of specimens and dosimetry as installed on racks in the test fixture by GL/FW. A GL/FW sketch of the dewar loading with specimen numbers in place has been prepared by WANL and forwarded to GL/FW.

Detailed procedures including operating check lists shall be prepared by General Dynamics and approved by WANL.

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C. REACTOR INSTALLATION PROCEDURES

Upon initiation of LN₂ flow, all events affecting temperature of test specimens will be recorded.

D. IRRADIATION TEST PROCEDURE

The reactor shall be operated for 400 hours at 10 megawatts. There are no special requirements relating to reactor startup or shutdown procedures, except that the specimens irradiated under Condition 1 must remain under LN₂ from the start of irradiation through the post-irradiation testing unless otherwise specified.

E. POST-IRRADIATION

The control specimens will be exposed to the same temperature environment including thermal cycling as the irradiated specimens. The Condition 1 test specimens shall be maintained at LN₂ temperature throughout the complete program through post-irradiation testing, except those specifically warmed up, and not allowed to warm up above the test temperature. Procedures similar to those employed in GTR 16 will be required for the transfer of test specimens from the test dewar to the cryostat used in conjunction with the tests. GD/FW will concur with WANL on the use of load ranges for specific tests and materials. Annealing times and conditions to be specified later.

1. Tensile Tests - Upon completion of tensile tests, the specimens

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will be fitted together and bench elongation data will be obtained with WANL fixture. Area of reduction measurements using the photographic technique and/or micrometers will also be made. Detailed alignment checks on the tensile system used for beryllium will be made similar to that for GTR-18, Test No. 37/403. This procedure may involve the use of strain gages on some control specimens. Specific plan will be forwarded to GD/FW later.

2. Compression Tests - Compression tests will be performed on the compression sub-press supplied by WANL as specified. Load-deflection curves will be used to determine the 0.2% offset compressive yield load.
3. Flexure Tests - The flexure specimens will be loaded with a 4-point loading device supplied by WANL. The fracture load and deflection will be determined from the Instron load-deflection curves.
4. Hardness Tests - Three (3) hardness tests will be performed on each flexure specimen at the same test conditions as the corresponding flexure test. Rockwell B and/or C scales will be used. Care must be taken to keep those flexure specimens broken under H_2 in Li_2O continuously until after hardness is measured under H_2 .

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5. Biaxial Brittle Fracture Tests - The biaxial brittle fracture specimens will be tested in tension per Table 1. Specific test conditions will depend on the results of similar tests on ^{WOL}irradiated specimens at WANL and initial tests on this program. Details will be specified by the cognizant WANL representative.

XI. HAZARDS

A. PERSONNEL

No foreseeable hazard other than handling irradiated material for testing at high temperature.

B. FACILITY

No foreseeable hazards other than those connected with usual reactor operation.

XII. DATA REDUCTION

Data to be included in the report shall include ultimate and 0.2% offset yield tensile strength, 0.2% offset compressive yield strength, hardness, elongation, total plastic elongation obtained with bench measurement, flexure strength, and reduction of area photography as specified. Original or legible reproduced copies of all load-deflection curves and raw data tabulations are to be made available to WANL as soon after testing as possible.

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XIII. DISPOSITION OF SPECIMENS AND HARDWARE

LANL-TL-1530

Disposition of irradiated test specimens and/or equipment will be handled in accordance with current AEC regulations. The test specimens will be returned to LANL if specified. Obtain approval from LANL prior to disposition of any material or equipment.

XIV. SHIPPING AND RECEIVING INSTRUCTIONS

Specimens to be shipped to Mr. J. W. Allen at General Dynamics, Fort Worth, Texas.

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Component: Materials

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TABLE I: Beryllium

LN₂ (140°R Irradiation)Tensile Tests*

Test Temp. (°R)	Anneal Temp.	Control		Irradiated	
		Unnotched	Notched	Unnotched	Notched
140	-	4(68,69,111,112)	4(1,2,34,35)	4(78,79,121,122)	4(11,12,44,45)
140	240			4(80,81,123,124)	4(13,14,46,47)
140	340			12** (82-87,125-130)	4(15,16,48,49)
140	440			4(88,89,131,132)	4(17,18,50,51)
140	540			12** (90-95,133-138)	4(19,20,52,53)
240	-	4(70,71,113,114)	4(3,4,36,37)	4(96,97,139,140)	4(21,22,54,55)
340	-	4(72,73,115,116)	4(5,6,38,39)	4(98,99,141,142)	4(23,24,56,57)
440	-	4(74,75,117,118)	4(7,8,40,41)	4(100,101,143,144)	4(25,26,58,59)
540	-	4(76,77,119,120)	4(9,10,42,43)	4(102,103,145,146)	4(27,28,60,61)
Averages	-	3(104,105,147)	3(29,30,62)	7(106-108,148-151)	4(31,32,33,63)

* Crosshead Speed - 0.005 in./min.

** 4 Specimens for each of 3 different annealing times; 2 specimens from each of 2 groups of numbers for each time. Annealing times to be specified later on basis of CTR-18, Test No. 37/W403 results.

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TABLE I (Cont'd)

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Flexure Tests***

<u>Test</u> <u>Temp., °R</u>	<u>Anneal</u> <u>Temp., °R</u>	<u>Control</u>	<u>Irradiated</u>
140	-	6(1-3, 21-23)	6(11-13, 31-33)
140	540		6(14-16, 34-36)
540	-	6(4-6, 24-26)	6(17-19, 37-39)
Spares		8(7-10, 27-30)	2(20, 40)

*** Hardness measurements on each specimen at respective test temperatures.
Crosshead Speed for flexure tests - 0.005 in./min.

Compression Tests****

<u>Test</u> <u>Temp., °R</u>	<u>Anneal</u> <u>Temp., °R</u>	<u>Control</u>	<u>Irradiated</u>
140	-	4(1, 2, 16, 18)	4(6, 7, 22, 23)
140	540		4(8, 9, 24, 25)
540	-	4(3, 4, 19, 20)	4(10, 11, 26, 27)
Spares		2(5, 21)	3(12, 13, 28)

**** Crosshead Speed - 0.005 in./min.

Biaxial Brittle Fracture Tests*****

<u>Test</u> <u>Temp., °R</u>	<u>Anneal</u> <u>Temp., °R</u>	<u>Control</u>	<u>Irradiated</u>
140°R	-	2(IL20, IT20)	4(IL21, IT21, IT22, IT23)

These specimens to remain under W_2 ----- 6(IL23, IT23, IL24,
until results determined for first six IT24, IL25, IT25)
specimens. Specific test conditions
to be specified at that time.

***** Crosshead Speed - 0.005 in./min.

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L₂ (140°C) IrradiationTensile Tests*

Test Temp. °C	Anneal Test °C	Bar Material				Sheet Material							
		Control		Irradiated		Control				Irradiated			
		U	N	U	N	U	N	UW	NW	U	N	UW	NW
140	-	(151)	(152)	(541)	(542)	(9-1)	(10-1)	(11-1)	(12-1)	(9-10)	(10-10)	(11-10)	(12-10)
		3(162)	3(161)	3(552)	3(551)	3(9-2)	3(10-2)	3(11-2)	3(12-2)	3(9-11)	3(10-11)	3(11-11)	3(12-11)
		(172)	(171)	(561)	(562)	(9-3)	(10-3)	(11-3)	(12-3)	(9-12)	(10-12)	(11-12)	(12-12)
140	340			(572)	(571)								
				3(581)	3(582)								
				(592)	(591)								
140	540			(601)	(602)					(9-13)	(10-13)	(11-13)	(12-13)
				3(611)	3(612)					3(9-14)	3(10-14)	3(11-14)	3(12-14)
				(622)	(621)					(9-15)	(10-15)	(11-15)	(12-15)
140	1000			(631)	(632)					(9-16)	(10-16)		
				3(642)	3(641)					3(9-17)	3(10-17)		
				(651)	(652)					(9-18)	(10-18)		
140	1500			(662)	(661)					(9-19)	(10-19)		
				3(671)	3(672)					3(9-20)	3(10-20)		
				(682)	(681)					(9-21)	(10-21)		
340	-	(252)	(251)	(701)	(702)								
		3(261)	3(262)	3(712)	3(711)								
		(271)	(272)	(721)	(722)								
540	-	(362)	(361)	(732)	(731)	(9-4)	(10-4)	(11-4)	(12-4)	(9-22)	(10-22)	(11-16)	(12-16)
		3(372)	3(371)	3(741)	3(742)	3(9-5)	3(10-5)	3(11-5)	3(12-5)	3(9-23)	3(10-23)	3(11-17)	3(12-17)
		(501)	(502)	(752)	(751)	(9-6)	(10-6)	(11-6)	(12-6)	(9-24)	(10-24)	(11-18)	(12-18)
Spares		(512)	(511)	(761)	(762)	(9-7)	(10-7)	(11-7)	(12-7)	(9-25)	(10-25)	(11-19)	(12-19)
		3(521)	3(522)	3(772)	3(771)	3(9-8)	3(10-8)	3(11-8)	3(12-8)	3(9-26)	3(10-26)	3(11-20)	3(12-20)
		(532)	(531)	(791)	(792)	(9-9)	(10-9)	(11-9)	(12-9)	(9-27)	(10-27)	(11-21)	(12-21)

* U Unnotched; N Notched; UW Unnotched, Welded; NW Notched, Welded.
Crosshead Speed - 0.1 in./min.

TABLE 3: Inconel 718
LN₂ (140°R) Irradiation

Tensile Tests*

Test Temp., °R	Anneal Temp., °R	Control**					Irradiated				
		U	N	UW	NW	UB	U	N	UW	NW	UB
140	-	(1-1)	(2-1)	(3-1)	(4-1)	(1)	(1-7)	(2-9)	(3-8)	(4-7)	(9)
		3(1-2)	3(2-2)	3(3-2)	3(4-2)	3(2)	3(1-8)	3(2-10)	3(3-9)	3(4-8)	3(10)
		(1-3)	(2-3)	(3-3)	(4-3)	(3)	(1-9)	(2-11)	(3-10)	(4-9)	(11)
140	540						(1-10)	(2-12)	(3-11)		(12)
							3(1-11)	3(2-13)	3(3-12)	0	3(13)
							(1-12)	(2-14)	(3-13)		(14)
540	-	(1-4)	(2-4)	(3-4)	(4-4)	(4)	(1-13)	(2-15)	(3-14)	(4-10)	(15)
		3(1-5)	3(2-5)	3(3-5)	3(4-5)	3(5)	3(1-14)	3(2-16)	3(3-15)	3(4-11)	3(16)
		(1-6)	(2-6)	(3-6)	(4-6)	(6)	(1-15)	(2-17)	(3-16)	(4-12)	(17)
Spares		0	2(2-7) (2-8)	0	0	2(7) (8)	2(1-38) (1-39)	2(2-18) (2-19)	1(3-17)	0	2(18) (19)

* LN₂ Irradiation - Crosshead Speed - 0.1 in./min.

** U = Unnotched; N = Notched; UW = Unnotched, Welded; NW = Notched, Welded; UB = Unnotched, Brazed

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TABLE 3: (Cont'd)

Water (Ambient) Irradiation

Tensile Tests***

Test Temp., °F	Anneal Temp., °F	Control		Irradiated	
		U	UW	U	UW
540	-	(1-16)	(3-18)	(1-25)	(3-27)
		3(1-17)	3(3-19)	3(1-26)	3(3-28)
		(1-18)	(3-20)	(1-27)	(3-29)
1500	-	(1-19)	(3-21)	(1-28)	(3-30)
		3(1-20)	3(3-22)	3(1-29)	3(3-31)
		(1-21)	(3-23)	(1-30)	(3-32)
2000	-	(1-22)	(3-24)	(1-31)	(3-33)
		3(1-23)	3(3-25)	3(1-32)	3(3-34)
		(1-24)	(3-26)	(1-33)	(3-35)
540	2000	2(1-37)	1(3-7)	3(1-34)	3(3-36)
		(1-40)		(1-35)	(3-37)
				(1-36)	(3-38)
Spares		0	0	1(1-41)	1(3-39)

*** Water Irradiation - Crosshead Speed: 0.002 in./min. throughout

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TABLE 4: Inconel K750

Li₂ (140°C) IrradiationTensile Tests*

Test Temp., °C	Anneal Temp., °C	Control**				Irradiated			
		U	N	UW	NW	U	N	UW	NW
140	-	(5-1)	(6-1)	(7-1)	(8-1)	(5-9)	(6-9)	(7-9)	(8-10)
		3(5-2)	3(6-2)	3(7-2)	3(8-3)	3(5-11)	3(6-10)	3(7-10)	3(8-11)
		(5-3)	(6-3)	(7-3)	(8-4)	(5-12)	(6-11)	(7-11)	(8-12)
140	540					(5-13)	(6-12)	(7-12)	
						3(5-14)	3(6-13)	3(7-13)	0
						(5-16)	(6-14)	(7-14)	
540	-	(5-4)	(6-4)	(7-4)	(8-5)	(5-18)	(6-15)	(7-15)	(8-13)
		3(5-5)	3(6-5)	3(7-5)	3(8-8)	3(5-19)	3(6-16)	3(7-16)	3(8-14)
		(5-6)	(6-6)	(7-6)	(8-9)	(5-20)	(6-17)	(7-17)	(8-15)
Spares		0	2(6-7)	0	0	2(5-21)	2(6-18)	2(7-18)	0
			(6-8)			(5-22)	(6-19)	(7-19)	

* Li₂ Irradiation - Crosshead Speed - 0.1 in./min.

** U = Unnotched; N = Notched; UW = Unnotched, Welded; NW = Notched, Welded

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TABLE 4: (Cont'd)

Water (Ambient) Irradiation

Tensile Tests***

Test Temp., °F	Anneal Temp., °F	Control		Irradiated	
		U	UW	U	UW
540	-	(5-23)	(7-20)	(5-34)	(7-30)
		3(5-24)	3(7-21)	3(5-35)	3(7-31)
		(5-25)	(7-22)	(5-37)	(7-32)
1500	-	(5-26)	(7-23)	(5-38)	(7-33)
		3(5-27)	3(7-24)	3(5-39)	3(7-34)
		(5-29)	(7-25)	(5-40)	(7-35)
2000	-	(5-30)	(7-26)	(5-41)	(7-36)
		3(5-31)	3(7-27)	3(5-42)	3(7-37)
		(5-32)	(7-28)	(5-43)	(7-38)
540	2000	(5-7)	(7-7)	(5-44)	(7-39)
		3(5-8)	3(7-8)	3(5-45)	3(7-40)
		(5-33)	(7-29)	(5-46)	(7-41)
Spares		0	0	1(5-47)	1(7-42)

*** Water Irradiation - Crosshead Speed: 0.002 in./min. throughout

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TABLE 5: Aluminum 2219

LN₂ (140°R) IrradiationTensile Tests*

Test Temp. °R	Anneal Temp. °R	<u>Forging</u>				<u>Sheet</u>							
		Control		Irradiated		Control				Irradiated			
		U	N	U	N	U	N	UW	NW	U	N	UW	NW
140	-	(0)	(00)	(17)	(27)	(13-1)	(14-1)	(15-1)	(16-1)	(13-9)	(14-9)	(15-9)	(16-9)
		3(1) (2)	3(01) (02)	3(18) (19)	3(28) (29)	3(13-2) (13-3)	3(14-2) (14-3)	3(15-2) (15-3)	3(16-2) (16-3)	3(13-10) (13-11)	3(14-10) (14-11)	3(15-10) (15-11)	3(16-10) (16-11)
140	240			(30)	(40)								
				3(31) (32)	3(41) (42)								
140	340			9** (33-39) (45,50)	3(43) (44) (46)								
				(51)	(47)								
140	440			3(52) (53)	3(48) (49)								
140	540			9** (54-59) (70-72)	3(60) (61) (62)					(13-12)	(14-12)	(15-12)	(16-12)
										3(13-13) (13-14)	3(14-13) (14-14)	3(15-13) (15-14)	3(16-13) (16-14)

* Crosshead Speed - 0.1 in./min.

U = Unnotched; N = Notched; UW = Unnotched, Welded; NW = Notched, Welded

** 3 specimens at each of 3 different annealing times; annealing times to be specified later on basis of GTR-18, Test No. 37/403 results.

TABLE 5: (Cont'd)

Test Temp. °F	Anneal Temp. °F	Forging				Sheet							
		Control		Irradiated		Control				Irradiated			
		U	N	U	N	U	N	UW	NW	U	N	UW	N
240	-	(3)	(03)	(73)	(63)								
		3(4)	3(04)	3(74)	3(64)								
		(5)	(05)	(75)	(65)								
		(6)	(06)	(76)	(66)								
		3(7)	3(07)	3(77)	3(67)								
340	-	(8)	(08)	(78)	(68)								
440	-	(9)	(09)	(79)	(69)								
		3(10)	3(20)	3(90)	3(80)								
		(11)	(21)	(91)	(81)								
540	-	(12)	(22)	(92)	(82)	(13-4)	(14-4)	(15-4)	(16-4)	(13-15)	(14-15)	(15-15)	(16-15)
		3(13)	3(23)	3(93)	3(83)	3(13-5)	3(14-5)	3(15-5)	3(16-5)	3(13-16)	3(14-16)	3(15-16)	3(16-16)
		(14)	(24)	(94)	(84)	(13-6)	(14-6)	(15-6)	(16-6)	(13-17)	(14-17)	(15-17)	(16-17)
Spares		2(15)	2(25)	5(95-99)	3(85)	2(13-7)	2(14-7)	2(15-7)	2(16-7)	3(13-18)	3(14-18)	3(15-18)	3(16-18)
		(16)	(26)		(86)	(13-8)	(14-8)	(15-8)	(16-8)	(13-19)	(14-19)	(15-19)	(16-19)
					(87)					(13-20)	(14-20)	(15-20)	(16-20)

* Crosshead Speed - 0.1 in./min.

U = Unnotched; N = Notched; UW = Unnotched, Welded; NW = Notched, Welded

** 3 specimens at each of 3 different annealing times; annealing times to be specified later on basis of GTR-18, Test No. 37/403 results.

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RADIATION EFFECTS TESTING

System: 12.7

Component: materials

Test: 37/405

Date: ev. 1966

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WL-111-1530

TABLE 6: Lockalloy
LN₂ (140°K) Irradiation

Tensile Tests*

Test Temp., °K	Anneal Temp., °K	Control		Irradiated	
		Unnotched	Notched	Unnotched	Notched
140	-	(L-1)	(L-10)	(L-19)	(L-34)
		3(L-2)	3(L-11)	3(L-20)	3(I-35)
		(L-3)	(L-12)	(L-21)	(I-36)
140	340			(I-22)	(I-37)
				3(I-23)	3(I-38)
				(L-24)	(I-39)
140	540			(I-25)	(I-40)
				3(I-26)	3(I-41)
				(L-27)	(L-42)
340	-	(L-4)	(L-13)	(L-28)	(I-43)
		3(L-5)	3(L-14)	3(I-29)	3(I-44)
		(L-6)	(L-15)	(L-30)	(I-45)
540	-	(I-7)	(I-16)	(I-31)	(I-46)
		3(I-8)	3(I-17)	3(I-32)	3(I-47)
		(I-9)	(I-18)	(I-33)	(I-48)

* Crosshead Speed - 0.005 in./min.

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[illegible]

CODE 3

A-20

2-ALL DIAMETERS A .005 TIR

1-UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
 $.XXX \pm .005$ CODE 3

WANL TME 1530

REVISIONS														
SYM	DESCRIPTION	DATE	APPROVED											
<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> $.250 \pm .001$ </div> <div style="text-align: center;"> $2.750 \pm .005$ </div> <div style="text-align: center;"> $.500 \pm .002$ </div> </div>														

CODE 3

REV STATUS	REV													
OF SHEETS	SHEET													

UNLESS OTHERWISE SPECIFIED INTERPRET DWG PER MIL-D-1000		CONTRACT NO. NP-1		Westinghouse Astronuclear Laboratory Pittsburgh, Pennsylvania	
		DFTM. CADLE		DATE OF DWG. 4-28-66	
		CHECKER W.P. Kuchler		DESIGN <i>[Signature]</i>	

TOLERANCES			<div style="font-size: 2em; font-weight: bold;">FLEXURE</div> <div style="font-size: 1.5em; font-weight: bold;">SPECIMEN Be-IF</div>		
DEC	ANGLES	32/			
±	±	AA			

INFORMATION CATEGORY <i>UNCLASSIFIED</i>			DWG SIZE A	CODE IDENT NO. 14683	DWG. NO. 650A582
AUTHORISED CLASSIFIER DATE			SCALE 1/1	REV	SHEET 1 OF 1

WANL TME 1530

REVISIONS	
SYM	DESCRIPTION
DATE	APPROVED

REV STATUS	REV															
OF SHEETS	SHEET															

UNLESS OTHERWISE SPECIFIED INTERPRET DWG PER MIL-D-1000		CONTRACT NO. NP-1				Westinghouse Astronuclear Laboratory Pittsburgh, Pennsylvania	
		DFTM. J.R. KOZMA	DATE OF DWG. 6-25-66	CODE 3			
TOLERANCES		CHECKER W.P. Kochler		DESIGN W.P. Kochler		<div style="font-size: 1.2em;">COMPRESSION SPECIMEN</div> <div style="font-size: 1.2em;">Be-1C</div>	
DEC ± —	ANGLES ± —						
INFORMATION CATEGORY <i>Unclassified</i> 6/25/66		DS 751512CE		DWG SIZE A	CODE IDENT NO. 14683	DWG. NO. 650A584	
AUTHORIZED CLASSIFIER				SCALE NTS		REV	SHEET 1 OF 1

WANL TME 1530

REV STATUS	REV																		
OF SHEETS	SHEET																		
UNLESS OTHERWISE SPECIFIED INTERPRET DWG PER MIL-D-1000		CONTRACT NO. NP-1				Westinghouse Astronuclear Laboratory Pittsburgh, Pennsylvania													
TOLERANCES		DFTM. L. MAINS		DATE OF DWG. 8-4-66		BIAXIAL BRITTLE FRACTURE SPECIMEN													
DEC ANGLES 63/		CHECKER W.P. Kuchler		DESIGN R. Kuchler															
± 0° 30'		5-10-66		J.E. Puffer															
INFORMATION CATEGORY		DWG SIZE		CODE IDENT NO.		DWG. NO.													
Unclassified		A		14683		650A587													
AUTHORIZED CLASSIFIER DATE		SCALE 2/1		REV		SHEET 1 OF 1													

A-25

WANL TME 1530

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	1.750 GAGE LGTH WAS NOT ON D 751512 CF	7/26/66 8-3/66 8-3-66	M.P. Kuchler R. Plachar M.P. Kuchler

CENTER DR. BOTH ENDS .125 MAX DEPTH

3-BLEND ALL RADII, DO NOT UNDERCUT.

2-ALL DIAMETERS A.005 TIR

1-UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
.XX = ±.01 AND .XXX = ±.001

CODE 3

REV STATUS	REV	A															
OF SHEETS	SHEET	1															

UNLESS OTHERWISE SPECIFIED INTERPRET DWG PER MIL-D-1000		CONTRACT NO. NP-1		Westinghouse Astronuclear Laboratory Pittsburgh, Pennsylvania	
		DFTM. CADLE	DATE OF DWG. 4-27-66		
		CHECKER M.P. Kuchler	DESIGN M.P. Kuchler		
		PLAIN AND NOTCHED ROUND TENSILE SPECIMENS			
		DWG SIZE A	CODE IDENT NO. 14683	DWG. NO. 650A581	REV A
		SCALE 1/1	REV	SHEET 1	OF 1

INFORMATION CATEGORY
UNCLASSIFIED
AUTHORIZED CLASSIFIER DATE

[illegible]

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