Astronuclear
Laboratory

WANL-TME-1824

Revision 1

August, 1968

FINAL TEST SPECIFICATION

SPOT WELDED TITANIUM BANDS TEST

15/W003

REVISION 1

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INFORMATION CATEGORY

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RADIATION EFFECTS TESTING

System: NERVA

Component: Spot Welded
Ti Bands

Test: 15/W003

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FINAL TEST SPECIFICATION
SPOT WELDED TITANIUM BANDS TEST
REVISION 1

I. EXPERIMENT IDENTIFICATION

A. EXPERIMENT DESIGN REFERENCE	15/W003, WANL-TME-1819
B. SPONSOR	WANL
C. TEST FACILITY	GD/FW (GTR-20)
D. TEST DATE	August, 1968

II. PURPOSE OF EXPERIMENT

The objective of this radiation effects experiment is simply to demonstrate that the welded region is still stronger than the unwelded region, when bands are tensile tested with the welded region on a cylindrical surface with the same radius as R-1 control drum pulleys. In unirradiated tests the unwelded region has always failed when the welded region is on the cylindrical surface with the lap joint (or 3/4" edge of band) toward the saddle as shown in Figure 1. The ultimate load (lbs) will be determined.

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III. PHOTOGRAPHS

WANL'S PHOTOGRAPH NUMBERS

DESCRIPTION

68211-1	Specimen Test Set-Up at LN ₂ Temperature
68211-3*	Broken Band Specimens - LN ₂ Temperature
68211-4	Broken Band Specimens - Room Temperature
68115-2	Specimen Test Fixture - View 1
68115-3	Specimen Test Fixture - View 2
68115	Specimen Test Fixture with Broken Specimen

IV. EQUIPMENT LIST

A. TO BE PROVIDED BY WANL

<u>1. Test Specimens</u>	<u>Irradiation</u>	<u>Control</u>	<u>Total</u>
Bands	4	4	8

Load Testing Fixture shown in Figure 1.

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

1. Test Racks and Dewar for Holding Specimens During Irradiation
2. Storage Dewar for Maintaining LN₂ Temperature
3. Instrumentation for Recording all Data
4. Transfer Devices fo Transfer Specimens under LN₂
5. Tinius-Olsen tensile testing machine (or equivalent)
6. Micrometer
7. Cryostat for Load Testing

*Specimen 8, fixture failed at indicated load.

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RADIATION EFFECTS DATA BOOK

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V. TEST ENVIRONMENT

A. TEMPERATURE

1. IRRADIATION TEMPERATURE LN_2 (-320°F)

B. PRESSURE Ambient

C. HUMIDITY Not Applicable

D. VIBRATION Not Applicable

E. 1. UNPERTURBED FAST NEUTRON FLUX 2.3×10^{12} nv
($E > 1.0$ MeV)

2. UNPERTURBED THERMAL NEUTRON FLUX As determined by experiment conditions.

F. UNPERTURBED INTEGRATED DOSE

1. Fast Neutron ($E > 1.0$ MeV) 5×10^{18} nvt

2. Thermal Neutron As determined by experiment conditions.

G. FLUID ENVIRONMENT (During Irradiation) LN_2

H. DURATION 600 Hours

VI. ANALYTICAL

A. PREDICTED PERTURBED FLUXES

1. Not Significant

B. ACTIVATION LEVELS

1. Not Applicable

VII. FACILITY REQUIREMENTS

A. ELECTRICAL 110 Volts - 60 Cycles

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B. PNEUMATIC	Not Applicable
C. HYDRAULIC	Not Applicable
D. SPECIAL FLUIDS	LN ₂ for Irradiation - LN ₂ 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

Provide overall and closeup photographs of the test fixture setup at room and LN₂ temperatures.

A. TENSILE TEST - ROOM TEMPERATURE

The thickness and width of each specimen is required. Record the ultimate load at which each band fails and the location and description and/or photograph of each failure. Provide a copy of each X-Y plot indicating load versus time, also comments if erratic motion is noted.

B. TENSILE TEST - LN₂ TEMPERATURE

Same requirements as IX.A.

C. ACCURACY REQUIREMENTS

The ultimate loads shall be recorded to within ± 10 lbs.

Thermocouple readings of the test fixture shall be recorded to within $\pm 10^\circ\text{R}$ during load testing.

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X. TEST DESCRIPTION

A total of 4 specimens will be irradiated in a LN_2 environment.

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 (band thickness using a micrometer) 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, inked on each end, 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 GD/FW.

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

C. REACTOR INSTALLATION PROCEDURES

Upon initiation of LN_2 flow, all events affecting temperature of test specimens will be recorded.

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D. IRRADIATION TEST PROCEDURE

There are no special requirements relating to reactor startup or shutdown procedures, except that the specimens irradiated 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 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 ranged for specific tests and materials.

F. TENSILE TEST - ROOM TEMPERATURE

Determine the yield and ultimate load required to cause failure of the spotwelded band specimen at room temperature.

- a. Ultrasonically clean the specimen. Measure and record the specimen thickness and width. (To be done prior to irradiation.)

* Two control specimens will be tested at room temperature.

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b. Burnish the curved surface of the saddle (Item 103 of Drawing No. WT701748 Figure 1) with Molybdenite powder (MoS_2) (M 8565-3). The powder shall be applied by hand burnishing the surface with a clean lint-free cloth until a uniform dense coating has been applied.

c. Place the specimen in the test fixture. NOTE: The lapped joint of the specimen shall be placed against the saddle surface.

d. Load the specimen until 100 pounds is indicated.

e. Use an X-Y plotter to indicate the load versus time.

Proceed from the 100 pound load to failure at a constant low speed. Note any observed erratic motion during the test.

f. Repeat Steps "F.a" through "F.e" for three additional specimens.

G. TENSILE TEST - LIQUID NITROGEN TEMPERATURE

Determine the yield and ultimate load required to cause failure of the spotwelded band specimen at liquid nitrogen temperature.

a. Repeat Step "F.a." (To be done prior to irradiation.)

b. Repeat Step "F.b."

c. Repeat Step "F.c."

d. Repeat Step "F.d."

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e. Immerse the specimen in LN₂ and let soak approximately 15 minutes.

If the load deviates by more than 10% from the preload then
readjust to 100 pounds.

f. Repeat Step "F.e."

g. Repeat Steps "F.a" through "F.f" for three additional specimens.

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

The ultimate load required to break the specimen, and temperature
of the specimen and/or half cylinder block shall be recorded.

Photographs shall be taken of the broken specimens.

XIII. DISPOSITION OF SPECIMENS AND HARDWARE

Disposition of irradiated test specimens and/or equipment will be
handled in accordance with current AEC regulations. The test

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PROGRAM

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specimens will be returned to WANL if specified. Obtain approval from WANL 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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2 TAG IDENT AS FOLLOWS: WT701743-101 PER P234517-1.
 1 - UNLESS OTHERWISE SPECIFIED:
 REMOVE BURRS & BREAK ALL SHARP EDGES
 .005 TO .015 RADIUS OR CHAMFER.

FIGURE 1 Load Testing Fixture

Figure 2. Specimen Test Set-Up at LN₂ Temperature

Figure 3. Broken Band Specimens - LN₂ Temperature

Figure 4. Broken Band Specimens - Room Temperature