AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

HANFORD TECHNICAL RECORD

(CLASSIFICATION)

GENERAL ELECTRIC

DECLASSIFIED

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-70772 C

SERIES AND COPY NO.

16

DATE

October 2, 1961

RESTRICTED DATA

THIS DOCUMENT CONTAINS DATA AS DEFINED IN EXECUTIVE ORDER NO. 11652, MAY ACT OF 1954. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED.

TITLE

PRODUCTION TEST IP-432-A-FP, EVALUATION OF THE CORROSION CHARACTERISTICS OF ELLIPTICAL BUMPER

OTHER OFFICIAL CLASSIFIED INFORMATION

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U. S. C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AUTHOR

M. A. Clinton

CIRCULATING COPY
RECEIVED 100D AREA

NOV 8 1961

RETURN TO

TECHNICAL INFORMATION FILES

THIS DOCUMENT MUST NOT BE LEFT UNATTENDED OR WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS TO IT. WHEN NOT IN USE IT MUST BE STORED IN AN APPROVED LOCKED CONTAINER WITHIN AN APPROVED GUARDED AREA. WHILE IT IS YOUR POSSESSION AND YOU HAVE OBTAINED A SIGNED RECEIPT FROM CLASSIFICATION FILES, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF PROJECT AND FROM ANY UNAUTHORIZED PERSON. ITS TRANSMITTAL TO, AND STORAGE AT YOUR PLACE OF RESIDENCE IS PROHIBITED. IT IS TO BE DUPLICATED. IF ADDITIONAL COPIES ARE REQUIRED, OBTAIN THEM FROM THE RECORDS SECTION. ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:

PAYROLL NO.

LOCATION

FILES ROUTE DATE

SIGNATURE AND DATE

D.W. Gristable

13661

1650

NOV 6 - 1961

J. H. Gristable

14098

1650

FEB 7 - 1962

J. H. Gristable

14175

1650

7-23-65

RECORD

COPY MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Indefinite Retention

Disposal Date

Authority

Authority

54-3000-340

DECLASSIFIED

(CLASSIFICATION)

DECLASSIFIED

HW-70772 C
Page 1

DISTRIBUTION

1. AEC-HOO: PM Midkiff	32. CG Hough/RD Shimer
2. AEC-HOO: RL Plum	33. JL Jaech
3. JD Agar	34. PC Jerman
4. TW Ambrose	35. LE Kusler/KB Sowa
5. ER Astley	36. LW Lang
6. RE Baars	37. CG Lewis
7. JT Baker	38. DS Lewis
8. RS Bell	39. GL Madsen
9. HE Berg	40. AR Maguire
10. AG Blasewitz	41. LH McEwen
11. RR Bloomstrand	42. RD Miller
12. HW Bown	43. WN Mobley
13. JH Brown	44. HC Money
14. JJ Cadwell	45. VH Nelson
15. MA Clinton	46. EJ Nesselson
16. DW Constable	47. R Nilson
17. RF Corlett	48. RE Olson
18. DL Cornell/JR Killen	49. EV Padgett
19. DL DeNeal	50. CA Priode
20. RL Dillon	51. T Prudich
21. EF Fairweather	52. WH Radtke
22. WF Ferguson	53. HW Reid
23. KE Fields	54. EA Smith
24. EJ Filip	55. HG Spencer
25. GC Fullmer/GF Owsley	56. CA Strand
26. SM Graves	57. JT Stringer
27. OH Greager	58. FW Van Wormer
28. CN Gross	59. EC Wood
29. LT Hagie/KW Norwood	60. JR Young
30. AK Hardin	61. 300 Files
31. WH Hodgson/WA Blanton	62. Record Copy

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of RML/ten
CG-PR-2 3-2-94
By J. E. Sawley 3-15-94
Verified By DK Hansen, 3-25-94

This document contains restricted information as defined in Executive Order 11652 of 1954. Its transmission in any form or by any means, in any manner to an unauthorized person is prohibited.

This document consists of
7 pages No. 16 of
62 copies.

This document classified by
W. W. Ambrose

October 2, 1961

PRODUCTION TEST IP-432-A-FP, EVALUATION OF THE
CORROSION CHARACTERISTICS OF ELLIPTICAL BUMPER RAILS

OBJECTIVE

The objectives of this test are to evaluate the corrosion characteristics of elliptical bumper rails and to determine the feasibility of utilizing the rails on present OIII bumper elements.

DECLASSIFIED

DECLASSIFIED

HW-70772 C

Page 2

TEST SUMMARY

Twenty columns of OIIIN-B fuel elements, ten with bumper rails of the present design and ten with elliptical bumper rails, will be charged into D Reactor in pairs, i.e., a column of fuel elements with one rail design will be charged adjacent to a column containing the other bumper rail design. Performance of the elliptical bumper rail will be based on relative visual appearance and measured weight loss. The twenty columns of weighed and measured fuel elements required for this test may also be used to fulfill the fuel requirements for PT-IP-442-A. (1)

BASIS AND JUSTIFICATION

The present bumper rail design^(2,3), termed a solid bumper rail, has the disadvantage of increasing the annular hydraulic resistance. A comparison of the hydraulic characteristics of bumpered OIII-N fuel and non-bumpered OIII-N elements showed the bumpered fuel elements to have about 3% less tube flow at the same tube ΔP . Thus, development efforts were directed toward reducing this hydraulic disadvantage, and several new, more streamlined bumper rail designs evolved. Laboratory tests⁽⁴⁾ of one design, the "Elliptical Solid Bumper", have shown the elliptical bumper reduces individual tube flow losses to about 1%, (less than 0.5 gpm when compared to a non-bumpered element under old reactor conditions).

Also, the elliptical bumper design has several fabrication advantages:

- a. Improved bumper fuel yields are possible since 1/2 as many welds are required.
- b. Greater flexibility exists for positioning the bumper rail on the shorter enriched elements.
- c. Alignment of the bumper rails will be improved.

During the course of the projection fuel element development program, many rail designs have been developed and tested in reactor. Observations of the corrosion patterns on both the projection rails and fuel jackets have indicated increased corrosion may occur with conversion to the more streamlined rail designs. Consequently, the corrosion characteristics of each new rail design must be evaluated prior to acceptance for large scale use.

-
- (1) HW-71141, "Production Test IP-442-A, Half-Plant Reduction in Process Water pH, 105-D", E. J. Nesselson, 9/25/61.
 - (2) Drawing H-3-17003 Rev. 2, "Bumper Support for Ultrasonic Welding Model OIIN and OIIIN".
 - (3) HW-67414, "PITA-IP-140-I, D Reactor Full Pile Loading of Bumper Fuel Elements", J. L. Benson, 11/18/60.
 - (4) "Evaluation of Elliptical Bumper Design", P. A. Carlson to T. W. Ambrose, Letter, 5/18/61.
- [REDACTED]
- [REDACTED]

DECLASSIFIED

HW-70772 C

Page 3

TEST DETAILS

I. Reactor

D Reactor was selected to conduct this test for two reasons:

- A. The reactor is equipped to handle bumpered fuel elements.
- B. The fuel elements required for this test will also fulfill the fuel requirements of PT-IP-442-A.

II. Material

A. Fuel Elements

- 1. Twenty columns, 640 fuel elements, of normal production⁽⁵⁾ OIII-N fuel will be used in this test. All fuel elements will be from the same canning lot; half will have elliptical solid bumper rails⁽⁶⁾ attached and half will be fitted with bumper rails of the present design⁽⁷⁾. All rails will be attached by ultrasonic welding techniques. Finished fuel elements will have the following nominal dimensions:

<u>Dimension (Inches)</u>	<u>OIII-N</u>	<u>Present Bumper</u>	<u>Elliptical Rail</u>
Canned OD	1.445	----	----
Canned ID	0.310	----	----
Nested Length	8.865	----	----
Bumper Height		0.040	0.040
Bumper Length		1.875	1.000
Maximum Bumper Diameter		1.530	1.530
Distance Bumper from End of Fuel Element		1.500	2.000

- 2. Water mixer elements will not be used in this test.
- 3. Pre-irradiation measurement and marking - Each finished fuel element will be stamped with a series number (fuel identification number) which will identify it by column and position within the column. The individual piece position in a column will also be inked on the side of the element near the female end. The following measurements will be required:
 - a. OD - 3 locations on all pieces.
 - b. ID - 3 locations on all odd numbered pieces.
 - c. Warp-ellipticity on all pieces.
 - d. Weight on pieces 1 through 15.

(5) HW-47049, "Process Specifications, Fuel Element Manufacturing Processes", FPD.

(6) Drawing, H-3-17453, "Model OIII-N and OIII-E Elliptical Solid Bumper Support for Ultrasonic Welding".

(7) See Reference (2) Page 2.

DECLASSIFIED

HW-70772 C
Page 4

4. Column makeup - All fuel columns will be 32 pieces in length. Ten columns will be made up from material containing the new elliptical solid bumper rail and ten columns from material containing the currently used bumper rail design.
- B. Dummies and Seating - The downstream dummy pattern and seating method in use at the time of this test is charged shall be used.
- C. Probolog - Tubes selected for this test shall be probologged before and after irradiation of the test material. If test material is charged into newly installed process tubes, it will be necessary to probolog these tubes only after irradiation of the test material.
- D. Nozzles and Charge Machine - Tubes selected for this test must be equipped with approved nozzles modified to pass OIIN-B elements. All elements should be charged with the same prototype bumper charging machine.

III. Irradiation

- A. Charging - All columns will be serially numbered and will be charged in numerical order with piece number one downstream. Each column shall have the series number and lot number recorded opposite the tube number on the front face sequence sheets. Charging will be followed by a representative of Research and Engineering.

The twenty columns are to be charged in ten pairs; i.e., a column containing 32 fuel elements with one rail design to be charged adjacent to a column containing 32 elements with the other bumper rail design. The tubes selected for each pair should provide similar irradiation conditions, and while it is desirable to charge all tubes in one localized group, it is not essential. Tube locations will be selected from those available as a result of scheduled discharge and will be chosen by the assigned Process Engineer and Physicist with the concurrence of the test author. If the fuel elements for this test are used to satisfy the fuel requirements of PT-IP-442-A, the test details for PT-IP-442-A will be followed with the concurrence of the test authors.

Tube outlet water temperatures and flows will be recorded on data sheets which will be provided by the test author.

- B. Goal Exposure - The following discharge plan is suggested:

1. Two pair will be irradiated to 400 MWD/T.
2. Four pair will be irradiated to 800 MWD/T.
3. Four pair will be irradiated to 1000 MWD/T.

Goal exposure changes may be made by request from the test author with the concurrence of the Manager, D Processing Operation.

- C. Discharge - All columns of this test will require special pickup and shipment to the 105-C MEF for post-irradiation examination and measurement. During discharge operations particular care should be taken to report pertinent observations relative to post discharge handling.

All columns may be discharged before reaching goal discharge exposures after two failures have occurred provided all columns can be specially picked up.

DECLASSIFIED

HW-70772 C

Page 5

- D. Operating Conditions and Limits - Unless specifically excepted within this test, all operating limits and conditions currently in use for OIIIN-B fuel elements in D Reactor will apply toward this test material. (8)

IV. General

- A. Duration and Further Testing - Irradiation of this material will require about six months following charging. Further testing will require either a new supplement or a new test. This test authorization will terminate on November 1, 1962.

- B. Schedule - The fuel elements are being fabricated and will be ready for shipment to D Reactor in early October, 1961.

C. Post-Irradiation Examination

1. All fuel elements will be weaseled and visually inspected for surface conditions, particularly bumper and hot spots.
 2. All fuel elements will be measured for diameter (OD at three places and ID at three places on odd numbered pieces), warp, ellipticity, and bumping. Elements having unusual measurements or corrosion patterns shall be set aside for further examination.
 3. Pre-weighed elements will be weighed to determine weight loss. (downstream 15 pieces).
 4. Photographs will be made of pieces showing unusual surface conditions (bumping, severe hot-spots, etc).
 5. If deemed advisable, selected elements will be sent to Radiometallurgy Laboratory for more complete examination.
- D. Costs - All incremental costs associated with the performance of this test may be charged to XXXX-5R24-XXX.73. Outage time requirements are listed below for scheduling purposes:

<u>Job</u>	<u>Processing Time</u>	<u>Elevator Time</u>
Charge tubes	1/4 mh/tube	1/6 hr/tube
Probolog (includes flushing)	1 mh/10 tubes	1 hr/10 tubes
Special pickup	1/2 mh/tube	

- E. Hazards - Hazards peculiar to this test are primarily associated with the design and presence of the bumper rails on the fuel surface. It is conceivable that the bumpered fuel element could stick more severely than a non-bumpered element. It appears that no extreme risk is involved in this test with regards to safety.

(8) HW-67414, "PITA-IP-14-I, D Reactor Full Pile Loading of Bumper Fuel Elements", J. L. Benson, 11/18/60.

DECLASSIFIED

RESPONSIBILITIES

Fuels Preparation Department

Responsibilities assigned to the Fuels Preparation Department are authorized by HW-70772-B which in brief, authorizes fabrication of the test material and assigns responsibilities within Fuels Preparation Department necessary to carrying out this production test.

Irradiation Processing Department

Research and Engineering Section

Process and Reactor Development Sub-Section - shall be responsible for coordination of the test, analysis of operating data, reporting of in-reactor performance, and for provision of bases for operating limits.

Process Technology Sub-Section - shall be responsible for providing assistance to both the Processing Operation and the Process and Reactor Development Sub-Section in pre-shutdown scheduling, in charging the test materials, in selection of test channel locations, for forwarding operating data to the author, and for specification of operating limits.

Operational Physics Sub-Section - shall be responsible for providing assistance in selecting test channel locations, and for reactivity adjustments as required by this test.

Component Testing Unit - shall be responsible for post-irradiation fuel element examination and measurements.

Manufacturing Section

D-DR Reactor Operation

D Processing Operation - shall be responsible for scheduling, for operational safety and production continuity of the reactor, and for charging the test material.

D-DR Maintenance Operation - shall be responsible for all maintenance work required to perform this test.

M. A. Clinton

M. A. Clinton, Engineer
Reactor Fuels Unit
Research and Engineering Section
IRRADIATION PROCESSING DEPARTMENT

MAC:gb

APPROVALS

DECLASSIFIED

J. H. Brown, Manager
Process and Reactor Development Subsection
IRRADIATION PROCESSING DEPARTMENT

J. T. Baker, Manager
D Processing Operation
IRRADIATION PROCESSING DEPARTMENT

R. W. Reid, Manager
Process Technology Subsection
IRRADIATION PROCESSING DEPARTMENT

A. R. Maguire, Manager
D-DR Reactor Operation
IRRADIATION PROCESSING DEPARTMENT

G. C. Fullmer, Manager
Operational Physics Subsection
IRRADIATION PROCESSING DEPARTMENT

C. A. Priode, Manager
Production Operation
IRRADIATION PROCESSING DEPARTMENT

C. G. Lewis, Manager
Testing Subsection
IRRADIATION PROCESSING DEPARTMENT

E. R. Astley, Manager
Applied Reactor Engineering
IRRADIATION PROCESSING DEPARTMENT

O. H. Greager, Manager
Research and Engineering Section
IRRADIATION PROCESSING DEPARTMENT

O. C. Schroeder, Manager
Manufacturing Section
IRRADIATION PROCESSING DEPARTMENT

II

DATE

FILMED

8/23/94

END