MASTER

ATOMICS INTERNATIONAL
A Division of North American Aviation, Inc.

JUN 28 1961

NAA-SR-MEMO-5775

This document contains 9 pages

This is copy _____ of _____ series _____

Do not remove
this sheet

UNCLASSIFIED

Security Classification

*NAA-SR-MEMOs are working papers and may be expanded,
modified, or withdrawn at any time,
and are intended for internal use only.*

This report may not be published without the approval of the Patent Branch, AEC.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission to the extent that such employee or contractor prepares, handles or distributes, or provides access to, any information pursuant to his employment or contract with the Commission.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

0288

ATOMICS INTERNATIONAL A Division of North American Aviation, Inc.		NAA-SR- TDR NO. 5775	APPROVALS <i>R.E. Durand</i>
TECHNICAL DATA RECORD		PAGE 1 OF 9	<i>L.S. Blay</i>
AUTHOR E. R. Meigs G. C. Gower		DEPT. & GROUP NO. 794 42 794 42	DATE 11/25/60
		GO NO. 7529	
TITLE Design, fabrication and installation of SRE fuel element guide assembly 7519-44741		S/A NO. 4474 20866 TWR 20867	RECOMMENDED FOR OUTSIDE DISTRIBUTION ☐ YES ☐ NO
PROGRAM SRE	SUBACCOUNT TITLE SRE Operational Development		SIGNATURE
DISTRIBUTION USE AN ASTERISK (*) TO INDICATE THOSE WHO ARE TO RECEIVE COMPLETE COPIES W. S. DeBear * R. W. Dickinson * R. E. Durand * L. E. Glasgow * L. L. Johnson E. N. Pearson P. L. Soske L. E. Vorderbruggen H. Vislay R. D. Burch J. O. Greenleaf	STATEMENT OF PROBLEM I. To design, fabricate, test and provide facilities for testing and installing guides on the SRE fuel element assemblies. This TDR explains the approach taken to solve the above problem. Its main purpose, however, is to record the reasons for selecting the particular dimensions and shapes incorporated into the newly designed SRE fuel element guide assembly shown on drawing 9693-44741. XXXXXXXXXX II. Summary of Results and Recommendations <u>Summary of Results</u> Since this guide was to replace one that had previously proved unsatisfactory, its design was altered to eliminate objectionable features of the previous guides and incorporate additional features that mock-up testing proved to be of value for providing a safe and reliable guide. Some of the major alterations were as follows: overall length increased from 5-7/8 in. to 7-1/8 in., the hexagon sleeve was lengthened from 3/4 in. to 1-5/8 in., i.d. of the hole in the hexagon sleeve was reduced from 0.391 in. to 0.386 in., 1/8 in. dia. bar was replaced with 3/16 in. and the bar bend angle at the tip was increased from 30° to 45°, the plate edge was rounded at its periphery, and the bending radius of the bars at the sleeve end was increased from 1/4 in. to 1/2 in. The reasons for making these and other changes are presented in this TDR under Design Criteria. A preliminary design was selected and after extensive testing in the mock-up under all possible adverse conditions a final design was established for the guide. Each of the guides was given a visual inspection, functionally tested in the ETB mockup assembly and given an inspection tag and number. All guides were fabricated and inspected on jigs to insure uniform configuration and proper alignment. Pictures showing the final guide design in various elevations in the mock-up assembly and a sketch (figure 3) of the mock-up assembly are included in the Appendices. <u>Recommendations</u> It is recommended that, when possible, all future core elements be given an operational test in a mock-up before they are placed in the fuel handling machine, reactor core, wash cell		

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5775
DATE 11/25/60
PAGE 2 OF 9

or storage cell and all edges should be rounded at points where one surface may possibly slide against another.

III. Discussion, Method used, Design Criteria

Discussion

The guide had to be designed with the proper configuration and sufficient strength to insure smooth unimpeded travel of the fuel element from the fuel handling machines into the moderator coolant tube and subsequent fuel handling operations that are necessary for removing the fuel element assemblies from the moderator coolant tube to wash cells or to fuel storage cells. The guide design also was to be such that it would function properly when the center line of the hole in the top shield plug was as much as $1\frac{1}{4}$ in. out of alignment with the center line of the moderator coolant tube. Since these guides were required for immediate use, it was also necessary to consider fabrication and material procurement problems. The design selected was from materials that were available for immediate delivery and the configuration was such that the fabrication would not be difficult or time consuming.

These guides were to be used to replace guides 7519-40156 which had proved to be unsatisfactory. Therefore, it was necessary to provide facilities for replacing the old guides with the new ones. The old guides and the fuel element assemblies had been in sodium in the reactor core. Therefore it was necessary to construct a pressure tight glovebox to maintain an inert atmosphere for making these changes. This glovebox was constructed to be used with either the fuel handling machine or the long gas lock. A picture of the glovebox is included in the appendices. See reference 5 for additional information.

Method Used

A preliminary study was conducted to predict the possible hang-up points in the fuel element transfer cycles that would require guiding to insure unimpeded movement of the fuel element. A mock-up of the necessary reactor core components was installed at the ETB. This mock-up was such that the center line of the opening in the moderator coolant tube could be moved a maximum of $1\frac{1}{4}$ inches from the center line of the hole in the top shield. Since this movement could produce misalignment in excess of any that could be reasonably expected to occur in the reactor core, a guide that functioned properly under the worst misalignment conditions in the mock-up was considered satisfactory. A preliminary design was fabricated and thoroughly tested in the mock-up. This test indicated that a few changes to this preliminary design would provide a satisfactory guide.

Design Criteria

The points indicated in the following paragraphs by capital letters are shown and identified on figures 1 and 2 in the appendices.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5775
DATE 11/25/60
PAGE 3 OF 9

The entire guide was constructed from Type 304 stainless steel except the $3/4$ in. diameter hexagon sleeve. Type 304 SS $3/4$ in. hexagon bar is not a stock item. The material used here had to be available for immediate delivery so a substitution of $3/4$ in. hexagon bar of 303 SS was accepted since it was a stock item. Type 303 SS has better machining properties, but is somewhat harder to weld and a little less resistant to corrosion than Type 304. These differences did not prohibit this substitution in order to meet completion schedules. If both grades are available, type 304 should be used for future guides.

The framework of the guide was constructed of $3/16$ in. diam. bar. Past experience proved that smaller diameter bar would bend and deform instead of guiding properly. Angle C was selected to be 45° to insure that point A would be inside the projected coolant tube opening in the Moderator Can Top Casting when the wire guides were in contact with the guide ring at point E. This was done to keep point A from striking the edge of the moderator can casting at surface B. To further ensure that point A would not strike the surface at point B, the dimension D was made $1-7/8$ in. This dimension was selected to place the rounded surface at F in contact with E before point A reached the elevation of B. Dimension K was selected to be a maximum of $2-5/16$ in. in order to keep the distance X a minimum. The periphery of the $3/8$ in. plate was rounded to its maximum radius of $3/16$ in. These features gave an interference free surface for movement of the plate when meeting sharp edges encountered in reactor core, fuel handling machine, storage cells, wash cells, etc.

Diameter I was made 0.386 in. which was as small as was practical for maintaining a free sliding fit for changing guides and still be tight enough to prevent excessive movement of point A from the vertical center line of the fuel element assembly. For this same reason as stated above dimension H was established at $1-5/8$ in. which extended it to the end of the fuel hanger rod. Dimension J was made $5-1/4$ in. This length was determined by the distance between the second guide ring and the bottom guide ring which was $4-3/4$ in. If J were less than the vertical distance between these two rings, it would be possible for the fuel assembly to move horizontally allowing the guide to pass between these two rings and establish a hang-up condition. The bend radius at G was made $5/16$ in. This was sufficiently large to insure that there would be no hang-up on any of the withdrawal movements and still not large enough to expose the bottom of the fuel rods to hang-up during insertion. The dimension L which is measured from center line of sleeve to the tangent point of curve was made 1.25 in. The reduction in size at this end produced a slight taper which improved guiding during withdrawal. Further reduction in L would have exposed the fuel rod ends to hang-up.

The diameter M of the hole in the sleeve was made $1/4$ in. to facilitate placing the cotter pin in the hanger rod. The top edge of the hole in the sleeve was aligned with the top edge of the hole in the hanger rod to prevent vertical movement of the guide on the hanger rod after the cotter pin has been inserted. The hole was drilled across the corners of the sleeve so that the guide bars would not interfere with cotter pin insertion.

681 004

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5775
DATE 11/25/60
PAGE 4 OF 9

IV. REFERENCES AND APPENDICES

REFERENCES

1. TWR No. 20366, R. E. Durand to E. R. Meise dated Sept. 23, 1960.
2. Drawing 7519-44741-Fuel Element Guide Assembly.
3. N-25-R No. 04557, Sept. 27, 1960.
4. Drawing 7519-40156, 5-rod Fuel Element Guide-Lower.
5. H. Vislay's notebook #B037001, page B 037013.

681 005

ATOMICS INTERNATIONAL
A Division of North American Aviation, Inc.

NO. 5775
DATE 11/25/60
PAGE 5 OF 9

1

2

3

4

681 006

This view of glove box shows gloves mounted in openings in the front panel which was fabricated from plexiglas.

View of glove box showing the purge connections.

Glove Box

681 007

PREPARED BY: <i>Meise</i>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. <i>SFE Fuel Element</i> <i>Guide Assembly</i>	PAGE NO. <i>7</i> OF <i>9</i>
CHECKED BY:		REPORT NO. <i>TDR-5715</i>
DATE: <i>10-28-60</i>		MODEL NO.

FIGURE 1

A-A

681 008

PREPARED BY: <i>Meise</i>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC.	PAGE NO. <i>8</i> of <i>9</i>
CHECKED BY:	<i>SRE Fuel Element</i>	REPORT NO. <i>TDR-5775</i>
DATE: <i>10-28-60</i>	<i>Guide Assembly</i>	MODEL NO.

FIGURE 2

681 009

PREPARED BY: GOWER

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.

PAGE NO. 9 of 9

CHECKED BY:

REPORT NO. TDR-5775

DATE: 11-1-60

SRE FUEL CHANNEL MOCK-UP

MODEL NO.

681 010