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WRITTEN BY: R. Cygan SECTION: Sodium Reactors GROUP: Sodium Components UNIT: Coolant System Equipment APPROVED BY: (SUPERVISOR) W J Hallett OTHER	**ATOMICS INTERNATIONAL** *A Division of North American Aviation, Inc.* **TECHNICAL DATA RECORD** PROGRAM: Sodium Cooled Reactors PROJECT: Sodium System Components	TDR NO. 5951 GO 7519 LEDGER ACCT. 3621 SUB-ACCT. 4451 TWR 20188 DATE December 8, 1960 PAGE 1 OF 7

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SUBJECT:

Static Sodium Test of Westinghouse Flow Controller Bearing

CONTENTS:

I STATEMENT OF PROBLEM

To determine the action of a static sodium environment on a special high-temperature ball bearing while operating at the specified speed and loading.

II. SUMMARY OF RESULTS AND RECOMMENDATIONS

The test bearing supplied by the Atomic Equipment Division of Westinghouse was operated at specified conditions for 385 hours in static sodium at 1000°F. Operating conditions for the bearing were 85 rpm and 870 pounds axial load. Visual inspection of the test bearing showed a very marked increase in roughness of both the balls and the ball races. The initial surface roughness of both the balls and races was about 8 microinches RMS. The measured values after test were 200 to 300 microinches for the ball races and 60 microinches for the balls.

Details of the measurements are given in Table I and Figure I of this report. A photograph of the bearing parts after test is shown in Figure II. The inner race marked "T" mates with the outer race visible in the picture.

Further testing of this bearing has been discontinued and the unit has been returned to Westinghouse. On the basis of this test it does

not appear that this bearing will be satisfactory for the service intended.

III. DESCRIPTION OF EQUIPMENT AND METHOD USED

The test bearing assembly submitted is a cylinder approximately 2 inches in diameter and 1-3/8 inches long. A sketch of the unit is shown in Figure I. The materials of construction are as follows: outer race, Haynes Alloy No. 25; inner races, cast Stellite No. 19; balls, cast Stellite No. 3.

The test was carried out in the HNPF Freeze Seal Test Stand. The sodium chamber below the freeze seal location was cleared of all pipes and baffles to obtain a clear area for the test bearing. A holder was fabricated from austenitic stainless steel to position the bearing outer race rigidly both radially and axially. The maximum radial misalignment possible was 0.002 in. The inner races were attached to the test stand drive shaft with a lock nut that was tack welded to prevent loosening during test. During the tack welding operation, the bearing assembly was completely masked to prevent any accidental weld spatter getting to the bearing. The shaft extension added to the original shaft to accommodate the test unit was completely stress relieved after welding and before final machining to assure that no distortion would occur during the testing. This was checked before and after the test and found to be less than 0.002 in. TIR in both cases.

The stand was equipped with an induction-type level measuring unit so that the location of the sodium level relative to the bearing assembly could be determined to within one-eighth of an inch. The bearing holder was equipped with vent holes at the upper end of the assembly to assure that no gas pocket would prevent the sodium from filling all portions of the test bearing. The sodium level was checked daily to be certain that the level had not dropped due to a leaky valve. A satisfactory sodium level was maintained throughout the test.

The test stand has an overall height of approximately thirteen feet and a three-foot diameter. The shaft is approximately six

feet long and five inches in diameter. By adding a steel collar between the radial support bearings the weight of the shaft assembly was increased to 870 pounds to serve as the load for the test bearing. The shaft was free floating in the axial direction so that the loading was constant regardless of any thermal expansion in the test chamber.

The test stand was equipped with a 15 HP DC motor which was readily controlled down to the required 85 rpm speed. Speed was checked frequently by counting the revolutions against a stopwatch.

After assembly of all components, the bearing was checked by rotating the shaft by hand to assure completely free rotation. The shaft was equipped with a mechanical face seal to maintain an inert atmosphere (helium) in the gas space above the sodium surface. The test chamber was sealed and then evacuated and purged with helium three times in succession before any heat was applied. The procedure was repeated after the preheat temperature of 350°F was reached. After this purge sodium from the storage chamber at 250°F was added to the test chamber to a level that would assure full submersion of the test bearing at the 1000°F operating temperature. Sodium transfer was accomplished by using helium gas. By loading the clean chamber with sodium at 250°F the initial oxide content of the sodium was below 10 ppm. After reaching 1000°F, the sodium level was again checked, adjusted as required, and bearing rotation started. Test chamber temperature was automatically controlled $\pm$ 8°F throughout the 385-hour test period.

Upon completion of the test, the sodium was drained from the test chamber, the unit allowed to cool to room temperature and then disassembled. After removing the test bearing from its fixtures it was submerged in butyl alcohol to remove residual sodium. This was followed by a final soak in methyl alcohol to assure complete cleanliness. Dimensional checks and roughness measurements were then made on the clean unit at room temperature.

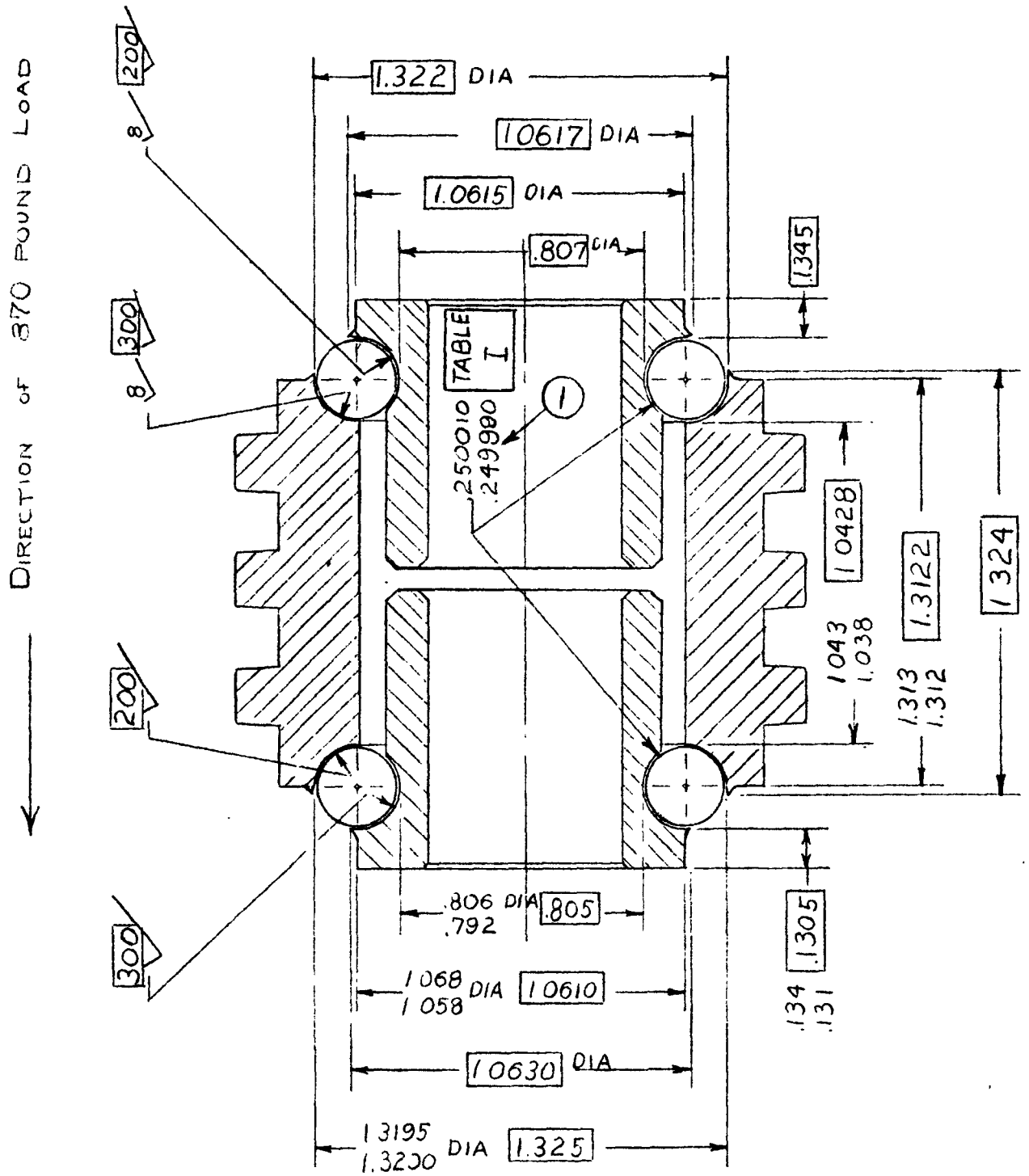
IV. REFERENCES

Westinghouse Drawings as follows:

1. 366C336 Sodium Flow Controller Roller Assembly
2. 366C335 Sodium Flow Controller Roller Outer Race
3. 258B220 Sodium Flow Controller Inner Race
4. 160A413 Sodium Flow Controller Ball for Roller Nut

PREPARED BY:	**ATOMICS INTERNATIONAL** A DIVISION OF NORTH AMERICAN AVIATION, INC.	PAGE NO. 5 OF 7
CHECKED BY:		REPORT NO. 5951
DATE: 9/30/60	SODIUM FLOW CONTROLLER	MODEL NO.

.000— PER REF. DRAWING
.000— AFTER 385 HR. AT 85 RPM IN 1000°F SODIUM



① BALL DIA. VARIATION IN ANY INDIVIDUAL BEARING MUST NOT EXCEED .000020

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TABLE I

DIMENSIONS OF BALLS FOR ROLLER NUT AFTER 385 HR AT 85 RPM IN 1000°F SODIUM

UPPER PART		LOWER PART	
Ball No.	Size	Ball No.	Size
1	0.2507 0.2502	1	0.2504 0.2500
2	0.2509 0.2504	2	0.2505 0.2500
3	0.2508 0.2500	3	0.2503 0.2500
4	0.2509 0.2504	4	0.2504 0.2500
5	0.2510 0.2505	5	0.2503 0.2500
6	0.2510 0.2505	6	0.2503 0.2500
7	0.2509 0.2504	7	0.2504 0.2500
8	0.2509 0.2504	8	0.2503 0.2500
9	0.2510 0.2504	9	0.2504 0.2499
10	0.2509 0.2505	10	0.2504 0.2500
11	0.2510 0.2505	11	0.2503 0.2500
12	0.2509 0.2504	12	0.2503 0.2500
13	0.2509 0.2501	13	0.2504 0.2500

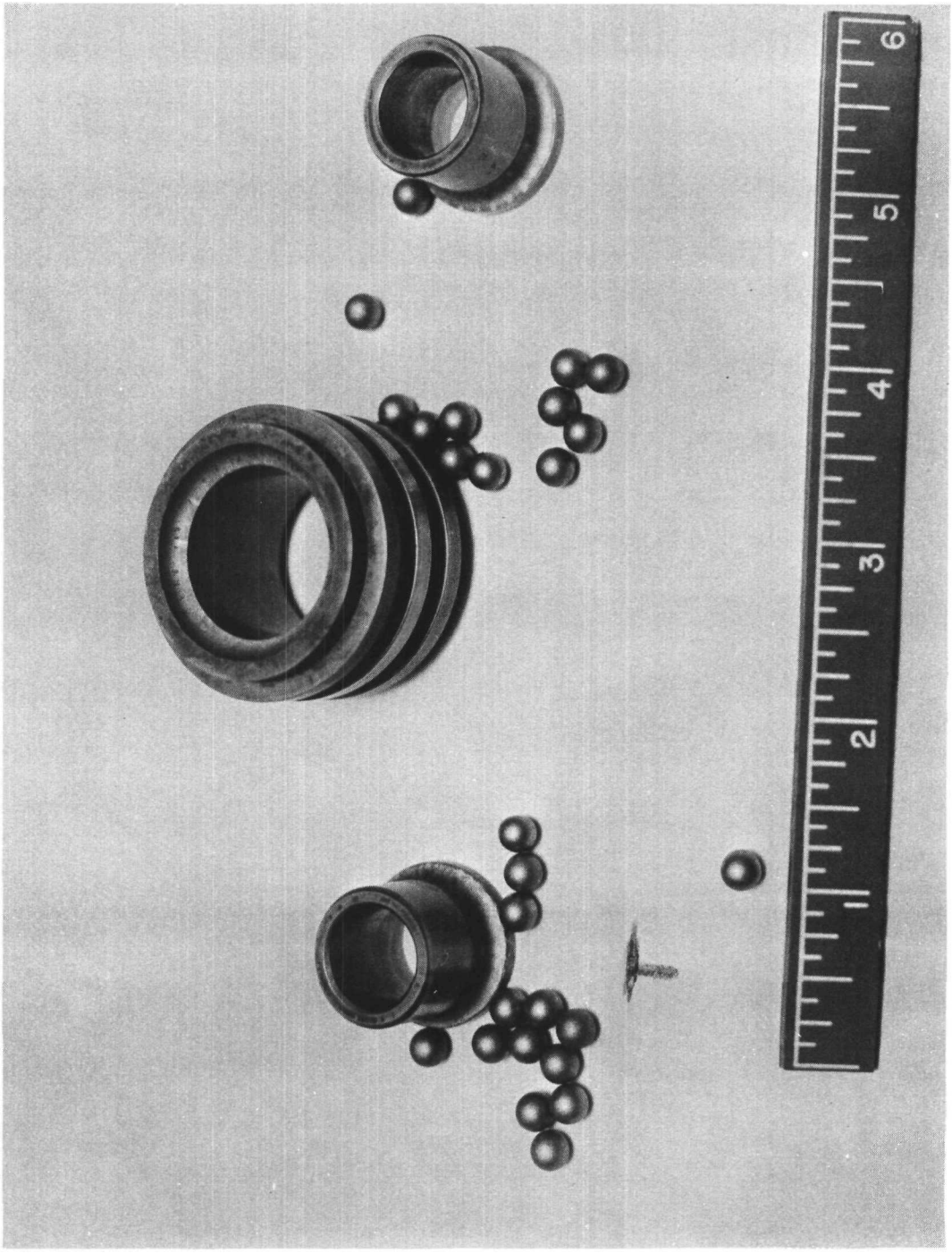

Figure II