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12

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WANL-TME-557

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A 5 MECHANICAL TEST OF
CORE SUPPORT BLOCK
(WR 41:41:03-5W)
PRELIMINARY REPORT
(Title Unclassified)

fep

SPECIAL REREVIEW FINAL DETERMINATION	Reviewer	Class.	Date
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TABLE OF CONTENTS

	<u>Page</u>
Abstract	1
Introduction	2
Purpose	3
Discussion	4
Test Results and Conclusions	5
Recommendations	6
Schematic of Test Set-Up (Figure 1)	7
Bar Chart (Figure 2)	8
Components of Support Block Assembly (Figure 3)	9
Typical Failure Pattern - Support Block Assembly (Figure 4)	10

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ABSTRACT

Seven coated and seven uncoated regular configuration interlocking support block assemblies were statically tested to destruction under ambient conditions.

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INTRODUCTION

The NRX-A1 core contains seven different configurations of support blocks. These variations in shapes combined with non-symmetrical loads from pressure and thermal gradients make an accurate theoretical analysis extremely difficult. A developmental test program was initiated to assist the designer in determining the parameters necessary to design the present NRX-A support block assembly. The present program (A 5) as outlined in WANL-TNR-095 is a structural integrity test of the present design and is much more comprehensive than the initial tests. It will entail mechanical testing of all the configurations of support block assemblies statically and dynamically under ambient and thermal environments.

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PURPOSE

The purpose of the A 5 program is to demonstrate the structural integrity of the different configurations of support blocks and associated pyrolytic parts under ambient and thermal conditions. The testing described in this report was conducted to evaluate the effect of niobium coating on the static strength of the regular interlocking support block at room temperature.

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DISCUSSION

Testing is divided into two separate phases, ambient and thermal, and each of these is further sub-divided into static and dynamic loadings. This preliminary report will concern itself only with the preliminary ambient static tests.

In addition to calculating the standard deviation for a normal statistical probability curve, the "t" significance test as outlined in the C. R. C. Standard Mathematical Tables, 11th edition by C. D. Hodgman, was used to determine if the results from the coated blocks had any real significance in relation to the results obtained from the uncoated blocks.

Seven each of the coated and uncoated regular interlocking support block assemblies made from NRX-A1 production quality materials were statically loaded in compression to destruction at ambient conditions. The loads were applied by a Wiedemann-Baldwin machine through a load jack into the support block assembly as shown on Figure 1. The loading rate was constant at approximately 1200 to 1500 pounds per minute. A highly sensitive microphone was attached to the specimen to detect initial failure. Loading was stopped and the block assembly removed for inspection in selected tests when significant audible sounds were picked up by the microphone. A bar chart (Figure 2) shows the ultimate failure loads and the load values where the first cracking noise was detected. Photographs showing a support block assembly prior to testing and a typical failed specimen are attached.

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TEST RESULTS AND CONCLUSIONS

The arithmetical mean failure load for the niobium coated blocks is 4010 lbs with a minimum of 3725 lbs and a maximum of 4480 lbs. The uncoated block strengths are approximately 5% greater with a mean failure load of 4170 lbs, a minimum of 3850 lbs and a maximum of 4650 lbs. The calculated standard deviations are 230 lbs and 260 lbs for the coated and uncoated blocks respectively.

The "t" significance analysis shows that the "t" value (defined as the difference in mean values of the coated and uncoated results divided by the standard deviation) is approximately .32 and the probability, "P", of having a deviation numerically greater than .32 was determined from a table from the C.R.C. Handbook. Although the comparative results indicate a slight decrease in strength due to the coating process, the calculated value of "P" (approximately .75) is defined in the "t" test as having no apparent significance.

Using the amplifying system and interim inspections before complete failure, it was determined that the support block seat is the area where initial failure occurs in the assembly. This confirms the validity of the design changes initiated from the developmental tests conducted. The increase in the pyrolytic cup bearing surface and an addition of a pyrolytic bearing washer has conclusively proven that the pyrolytic parts which were the weakest in the block assembly have been strengthened beyond that of the block itself.

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RECOMMENDATIONS

The results of the "t" significance analysis of the coated and uncoated block assemblies indicate that there is no apparent significant difference in the ambient static strength due to the coating process. Therefore, it is recommended that the scheduled ambient static testing of the remaining configurations of coated block assemblies be cancelled.

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FIGURE 1

MAXIMUM LOAD EXPERIENCED OF REGULAR, INTERLOCKING SUPPORT BLOCKS

▨ Indicates Cracking Sounds as Received Through Microphone

FIGURE 2

FIGURE 3
COMPONENTS OF TEST SUPPORT BLOCK ASSEMBLY

FIGURE 4

TYPICAL STATIC FAILURE OF SUPPORT BLOCK ASSEMBLY
UNDER AMBIENT CONDITIONS