Abstract

BOEING

GPO PRICE $ _____

CFSTI PRICE(S) $ _____

Hard copy (HC) $3.00

Microfiche (MF) .65

ff 653 July 65

SPACE DIVISION LAUNCH SYSTEMS BRANCH

THE BOEING COMPANY
AERO-SPACE DIVISION
LAUNCH SYSTEMS BRANCH

DOCUMENT NO. T5-6556-10

VOLUME _____ OF _____

TITLE EVALUATION OF MACHINE SEWN JOINTS FOR THE FLEXIBLE HEAT SHIELD CURTAIN

MODEL NO. SATURN V/S-IC CONTRACT NO. NAS8-5608

ISSUE NO. M-12 ISSUED TO Scientific & Technical Information Facility

PREPARED BY	J. Dexter	12-6-66
SUPERVISED BY	E. Clark	12-20-66
APPROVED BY	T. Kornell	12/30/66
APPROVED BY		
APPROVED BY		
APPROVED BY		

REV. SYM. _____

S-406-10-3 REV 7/64

DISTRIBUTION

BOEING

E. L. Clark	5-7996	LS-92
J. N. Dexter	5-7996	LS-92
P. E. Oster	5-7354	LT-49

NASA

F. McDaniel	R-P&VE-VNR
F. Uptagrafft	R.P&VE-ME

Scientific and Technical Information Facility
Marshall Space Flight Center
Huntsville, Alabama (Attn: MS-1P)

Scientific and Technical Information Facility
P.O. Box 33
College Park, Maryland 20740

CHANGE RECORD

REV. SYM.	SECT.	PAGES REVISED	PAGES ADDED	PAGES DELETED	REV. SYM.	SECT.	PAGES REVISED	PAGES ADDED	PAGES DELETED

REVISIONS			
REV. SYM.	DESCRIPTION	DATE	APPROVED

ABSTRACT

Joints in the wire reinforced asbestos and silica cloth plies of the 60B20508 flexible flame curtain assembly are currently being made by hand sewing. This investigation covers results of attempts to machine sew these joints. Results indicate that acceptable joints can be machine sewn in the silica cloth ply. Machine sewing was unsuccessful for the asbestos ply.

KEY WORDS

Asbestos Sewing

Flexible Flame Curtain

Machine Sewing

Sewing

Silica Cloth Sewing

TABLE OF CONTENTS

1.0 OBJECT

The object of this investigation was to determine the feasibility of machine sewing the wire reinforced asbestos and silica cloth plies of the flexible heat shield curtain assembly.

2.0 BACKGROUND

The joints in the wire-reinforced asbestos and the silica cloth plies of the 60B20508 base heat shield curtain assembly are currently being sewn by hand. This test was conducted at the request of the Interstage and Heat Shield Group to determine the feasibility of machine sewing these joints. Should machine sewing prove to be feasible it could result in reducing manufacturing costs with a resulting cost savings to Boeing.

3.0 CONCLUSIONS

The results of this investigation indicate that it is feasible to machine sew the joints in the silica cloth using type 12 Astroquartz sewing thread which meet the 60B20508 drawing and the 60B32053 acceptance specification requirements. The results also show that it is not feasible to machine sew the joints in the wire reinforced asbestos ply using the metallic filament thread, since none of the joints made during this investigation met the requirements of 60B32053.

4.0 RECOMMENDATIONS

It is recommended that the joints in the silica cloth ply of the 60B20508 curtain assembly be machine sewn using type 12 Astroquartz sewing thread.

It should be borne in mind that silica cloth has poor abrasion resistance, therefore provisions must be made to insure against abrasion or scuffing damage to the silica cloth during machine sewing.

5.0 PROCEDURES AND RESULTS

5.1 The wire reinforced asbestos and silica cloth plies of the 60B20508 flexible heat shield curtain assembly are currently being made using hand sewing. While this does produce curtains of acceptable quality, it is relatively expensive. This program was performed at the request of the Interstage and Heat Shield Group to determine the feasibility of machine sewing the joints in these plies in order to effect a cost savings in the manufacture of the curtains. The request for this investigation specified that type 12 Astroquartz sewing thread (J. P. Stevens and CO.) be used for machine sewing the joints in the silica cloth and that types MF A1 12/300/7Z and MF-B1 25/270/2Z metallic filament threads (Groton Laboratories) be used to sew the joints in the wire reinforced asbestos.

5.2 The conclusions which can be made from the results of this investigation are as follows:

1. Machine sewing the joints in the wire reinforced asbestos with the metallic filament threads is unacceptable because those joints made per 60B20508 using the MF-A1-12/300/7Z thread did not meet the strength requirements of 60B32053. Also, it was impossible to machine sew with the MF-B1-25/270/2Z thread because its diameter was too large to permit it to be fed through the sewing machine.

2. Machine sewing the silica cloth with type 12 astroquartz sewing thread will produce joints which meet the 60B20508 drawing requirements and the strength requirements of the 60B32053 acceptance specification.

5.3

5.3.1 Samples of wire reinforced asbestos cloth were cut so that joints could be made in which the warp threads were parallel for some of the joints and at 45° for the remainder to see if fabric thread orientation would have any effect during machine sewing of the joints. The first attempts at machine sewing these joints with the metallic filament threads were unsuccessful because the diameter of the MF-B1-25/270/2Z thread was too large and because of excessive breakage of the MF-A1-12/300/7Z thread. The thread breakage problem was solved by modifying the Pfaff sewing machine by replacing its 725 rpm 0.4 horsepower motor with a 500 rpm 0.5 horse power motor. All attempts at modifying the sewing machine to feed the large diameter filament thread were unsucessful.

The sewn joints made with the MF-A1-12/300/7Z thread on the parallel warp material were tested for breaking strength at room temperature and after being subjected to the temperature cycle shown in Figure I or Figure II. The joints were made with both free ends of the thread knotted and with the free ends unknotted. The breaking strength results are shown in Table I.

While the 60B32053 acceptance specification requires room temperature breaking strength only for the asbestos joints, the elevated temperature tests were run to determine what effect the elevated temperatures would have upon the integrity of the metallic filaments. Visual examination of the joints after the elevated temperature cycles indicated near total deterioration of the filaments as evidenced by a charred appearance and by crumbling when the joints were flexed.

5.3.1 (Continued)

The room temperature breaking strengths of the metallic filament threads were determined and are shown in Table II. The 0.010 inch diameter Inconel wire which is currently being used for hand sewing the asbestos joints was tested and is included in Table I for comparison purposes.

5.3.2 Machine sewn joints were made in the high silica cloth using the type 12 astroquartz thread. The joints were made using the stitching specified in 60B20508 and tested for room temperature. breaking strength per 60B32053. An average breaking strength of 23 lb/in of width was obtained for the three samples tested. Since the individual values (20 lb/in, 24 lb/in, and 25 lb/in) as well as the average, were above the minimum of 18 lb/in required by 60B32053, machines sewing appears to be feasible for making the joints in the high silica cloth. The silica cloth joints were not tested at elevated temperature because the type 12 thread and the thread presently being used for hand sewing these joints are made of essentially the same material and the hand sewn joints have had no difficulty in surviving the thermal environment expected for the curtain assembly.

TABLE I

MACHINE SEWN WIRE REINFORCED ASBESTOS JOINTS

MF-A1-12/300/7Z THREAD

Minimum Acceptable Breaking Strength per 60B32053-
250 lb/inch of width

1. Both ends of thread knotted

Temperature	Breaking Strength lbs/inch of width
Room Temperature	194
After Figure I cycle	70
After Figure II cycle	90

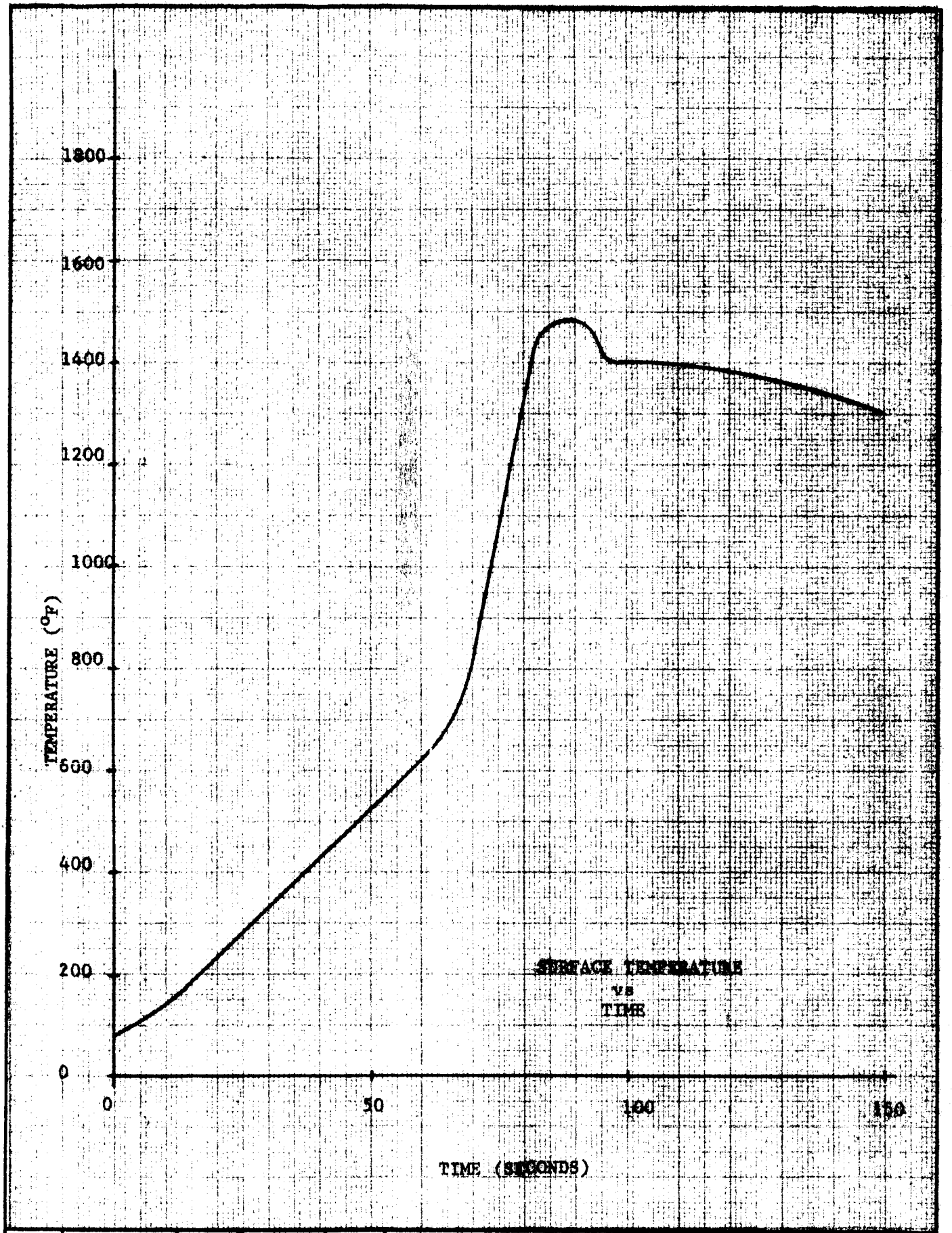
2. Both ends of thread unknotted

Temperature	Breaking Strength lbs/inch of width
Room Temperature	115
After Figure I cycle	105
After Figure II cycle	86

TABLE II

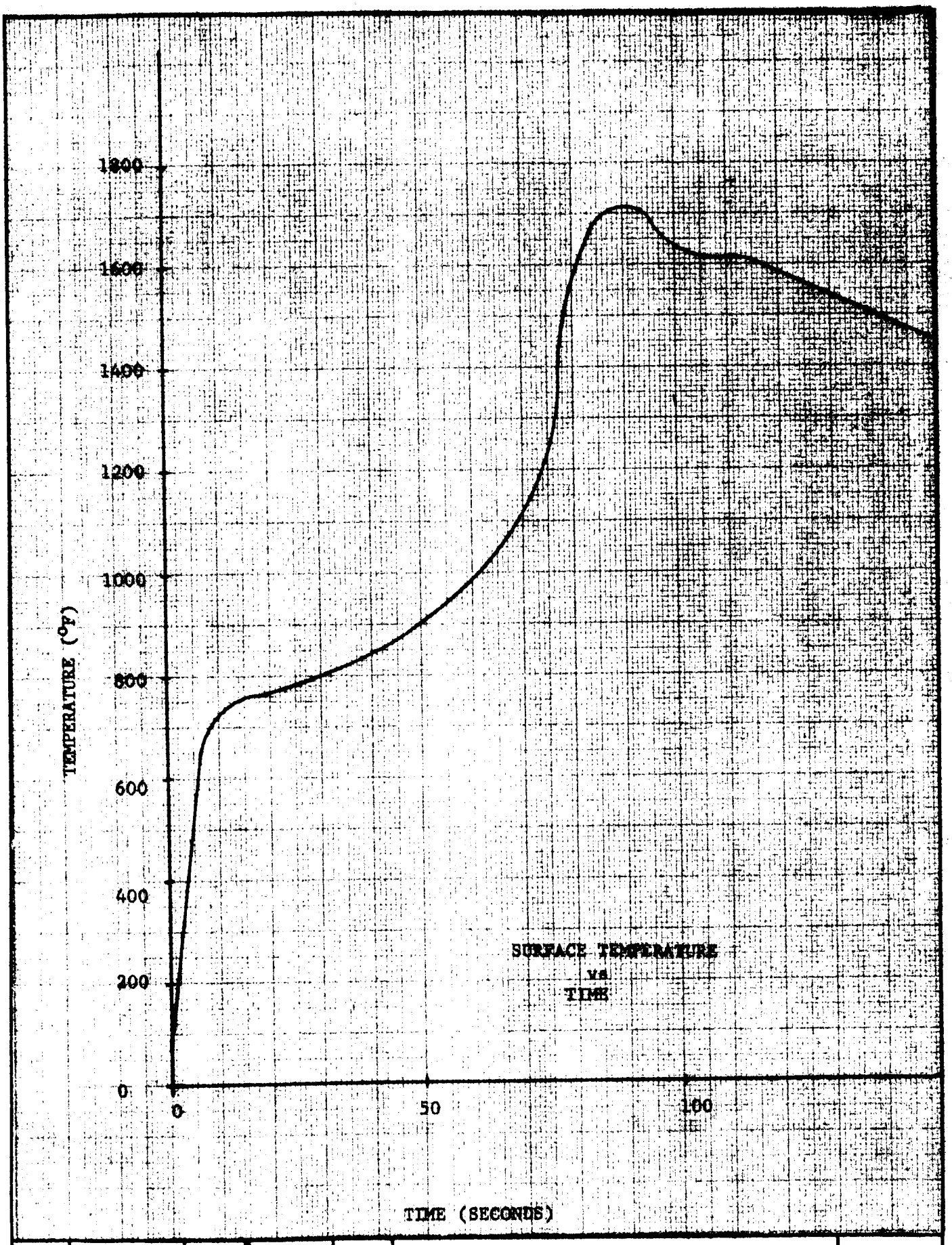
SEWING THREAD ROOM TEMPERATURE BREAKING STRENGTH

Material	Breaking Strength (lbs)
MF-A1 12/300/7Z Metallic Filament Thread	1.44 1.67
MF-B1 25/270/2Z Metallic Filament Thread	4.75 5.00
0.010 inch Inconel wire	3.86 4.18



CALC			REVISED	DATE	FIGURE I	T5-6556-10
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 6

US 4013 8000



			REVISED	DATE		
CALC						
CHECK					FIGURE II	
APR						T5-6556-10
APR					THE BOEING COMPANY	PAGE 7

US 4918 8000