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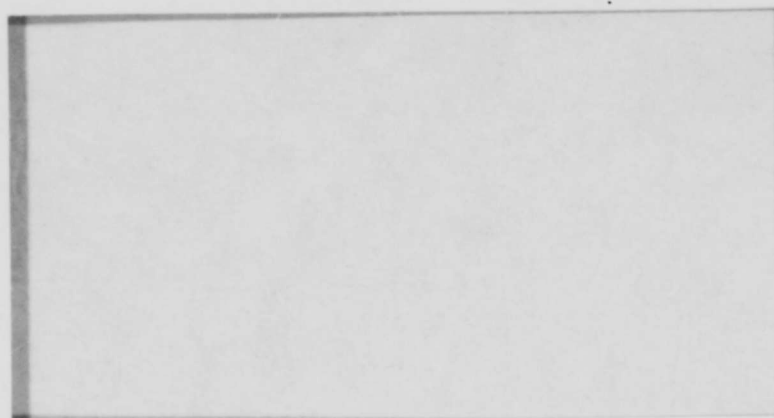
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EVALUATION OF GREAT LAKES STEEL CORPORATION

STEEL ALLOY NAXTRA 100

REPORT A240 SERIAL NO. 14

MCDONNELL

This report was prepared under Contract Number AF33(657)-11215 and BPSN: 63-6899-7381-738103. Additional information pertaining to any data contained herein may be obtained from the Directorate of Materials and Processes (ASRCEM-1), Aeronautical Systems Division, Air Force Systems Command, United States Air Force, Wright-Patterson Air Force Base, Ohio, or McDonnell Aircraft Corporation, St. Louis, Missouri

INDEX _____
CODE (FeL-4)(I-k)(VI-a,o) _____

DATE 29 June 1960

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ST. LOUIS, MISSOURI

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LABORATORY REPORT

SYSTEMS LABORATORY

FINAL REPORT

EVALUATION OF GREAT LAKES STEEL CORPORATION STEEL ALLOY NAXTRA 100

ABSTRACT

This test was conducted to determine if steel alloy NAXTRA 100 will conform to the technical requirements of MAC Material Specification MMS-202.

The testing consisted of determining the mechanical properties, welding and bending characteristics, and austenitic grain size of material furnished by Great Lakes Steel Corporation.

Although the first lot of material furnished exhibited low mechanical properties, the material submitted for retest met all the technical requirements of MMS-202.

PREPARED BY *R. H. [Signature]*
Test Engineer

APPROVED BY *H. [Signature]* 6/13
Senior Engineer, Materials
and Methods

APPROVED BY *[Signature]* 6/27
Chief, Systems Laboratory

APPROVED BY *[Signature]*
Laboratory Project Engineer

Distribution: M. Deutch (2), H. Siegel, W. Harris, H. S. Ram, Engineering Library

LABORATORY REPORT

1. OBJECT

To determine if NAXTRA 100 steel will conform to the technical requirements of MAC Material Specification MMS-202.

2. BACKGROUND

The two pieces of 24 inch x 24 inch x .250 inch NAXTRA 100 steel initially tested were determined to be of low strength and consequently Great Lakes Steel Corporation furnished two more plates for evaluation. This report presents data obtained from both sets of plates.

3. PROCEDURE**3.1 Tensile Tests**

Six tensile specimens (T052306, Type F2), three parallel to the rolling direction and three perpendicular to the rolling direction, were fabricated from each of the four plates furnished. The F_{tu} , F_{ty} , % elongation in 2.00 inches and stress vs strain curves were determined from each of the specimens.

3.2 Weld Tests

Two weldments, one from the first set of plates furnished and one from the second set of plates furnished, were fabricated by welding two 4 inch by 5 inch plates along the 5 inch length. After welding, four longitudinal tensile specimens (T-052306, Type F2) were fabricated from each of the weldments. The F_{tu} , F_{ty} and % elongation in 2.00 inches were determined from each of the specimens. All specimens were tested with the weld nugget in the "as welded" condition.

3.3 Grain Size Determination

Grain size was determined per Federal Test Method 311, Procedure A.

3.4 Bend Tests

Two and one half inch wide specimens were bent thru an angle of 130° using the bend radii determined for T-1 steel. All bending was accomplished on a vertical press brake using a die radius of .5 inches for the bends perpendicular to the rolling direction and a die radius of .56 inches for bends, parallel to the rolling direction.

4. RESULTS

Results of mechanical properties tests are shown in Tables 1 and 2, pages 4 . Stress strain curves are presented in Figures 1, 2, and 3, pages 6 thru 8 .

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LABORATORY REPORT

4. RESULTS (Cont'd.)

Weld test data is presented in Tables 3 and 4, page 5 .

Grain size was predominately No. 6 which is finer than the No. 5 required by MMS-202.

Bend tests show that the NAXTRA 100 can be bent using the same radius determined for T-1 steel.

5. CONCLUSIONS

The intially furnished NAXTRA 100 steel exhibited low mechanical properties, but the material submitted for retest met all the technical requirements of MMS-202.

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Table 1
Mechanical Properties of Initially Furnished NAXTRA 100

Plate Number	Grain Direction	F _{ty} (Psi)	F _{tu} (Psi)	% Elong. in 2.00 in.
1	Longitudinal	94,000	109,000	19
1		93,000	108,500	19
1	↓	95,000	109,500	20
1	Transverse	94,000	109,500	18
1		95,500	109,500	20
1	↓	96,500	111,000	20
2	Longitudinal	94,000	107,500	20
2		96,500	109,500	20
2	↓	96,500	110,000	19
2	Transverse	93,500	109,000	18
2		96,500	109,500	19
2	↓	97,500	111,000	18
MMS-202 Min. Req.	Transverse	100,000	115,000	18

Table 2

Mechanical Properties of NAXTRA 100 Submitted For Retest

Plate Number	Grain Direction	F _{ty} (Psi)	F _{tu} (Psi)	% Elong. in 2.00 in.
1	Longitudinal	106,500	118,500	19
1		105,000	118,000	18
1	↓	106,000	118,500	19
1	Transverse	107,000	118,000	18
1		107,000	118,000	18
1	↓	103,500	118,000	18
2	Longitudinal	103,000	118,000	21
2		104,500	117,500	20
2	↓	104,500	118,000	20
2	Transverse	102,500	116,000	B.O.G.
2		102,000	117,000	B.O.G.
2	↓	103,000	Void	B.O.G.
MMS-202 Min. Req.	Transverse	100,000	115,000	18

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Table 3

Mechanical Properties of Welded NAXTRA 100
(Initially Furnished Material)

F _{ty} (psi)	F _{tu} (psi)	% Elong in 2.00 in.
84,000	108,000	15
79,000	106,500	14
86,500	109,000	16
89,000	107,000	13

Table 4

Mechanical Properties of Welded NAXTRA 100
(Material Submitted for Retest)

F _{ty} (psi)	F _{tu} (psi)	% Elong in 2.00 in.
90,500	118,500	16
91,000	119,000	16
93,000	119,000	16
90,000	118,500	16

1

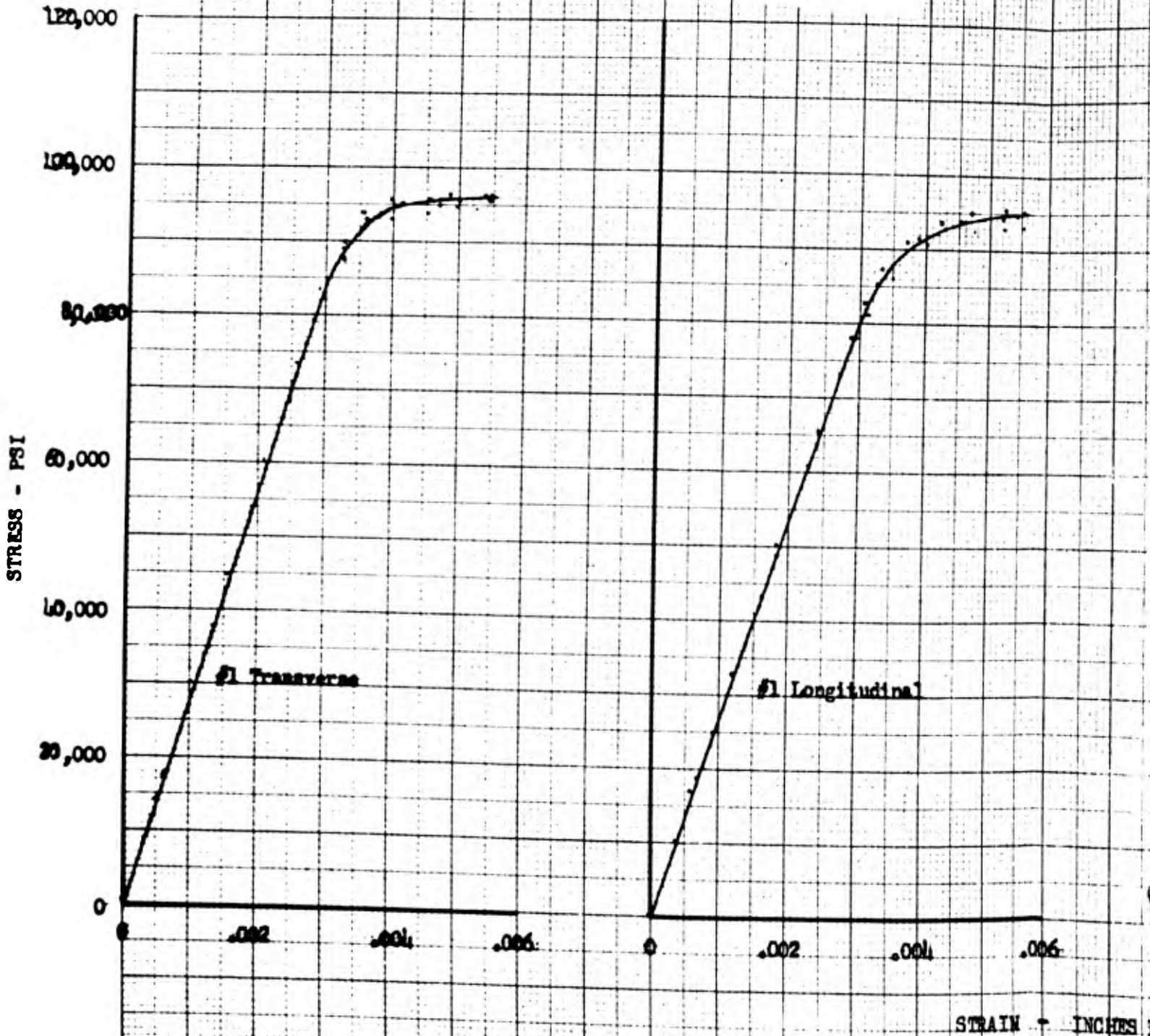
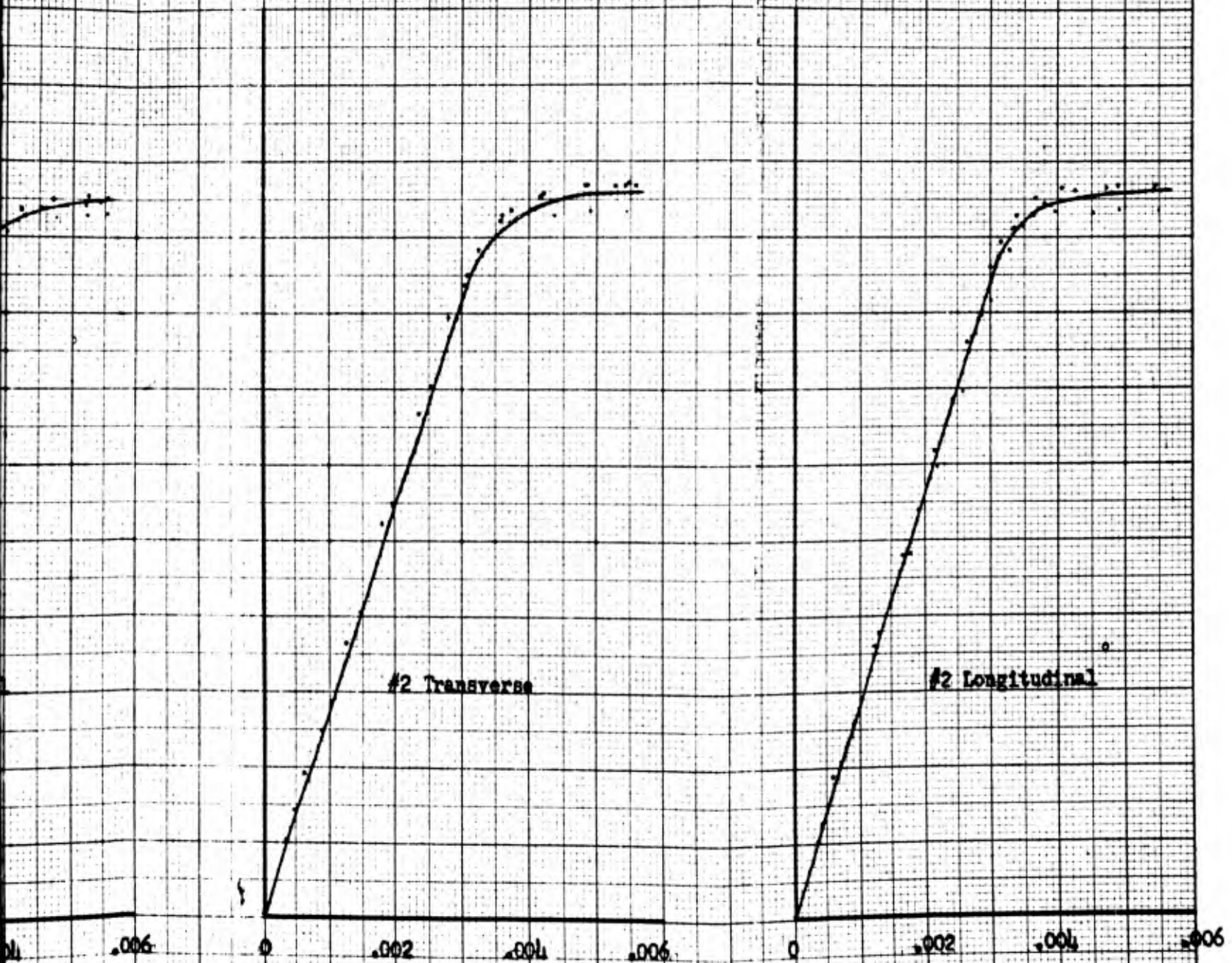


Figure 1
Stream Curves For Initially Furnished
NAXTRA 100 Steel

2



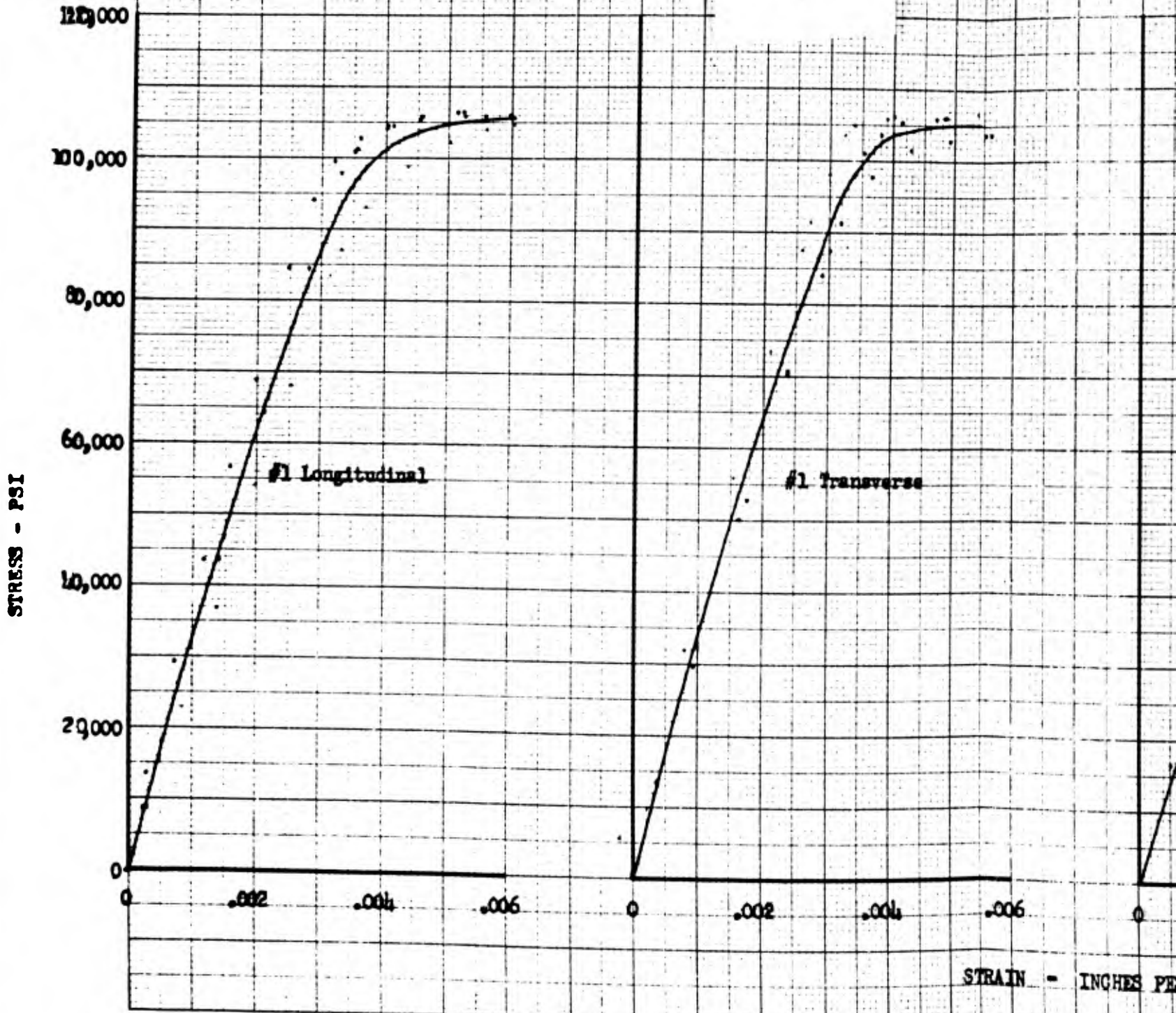
STRAIN - INCHES PER INCH

Prepared By Pat Ford
Checked By R. Brooks

Figure 2

Stress vs. Strain Curves For NAXTRA 1

1

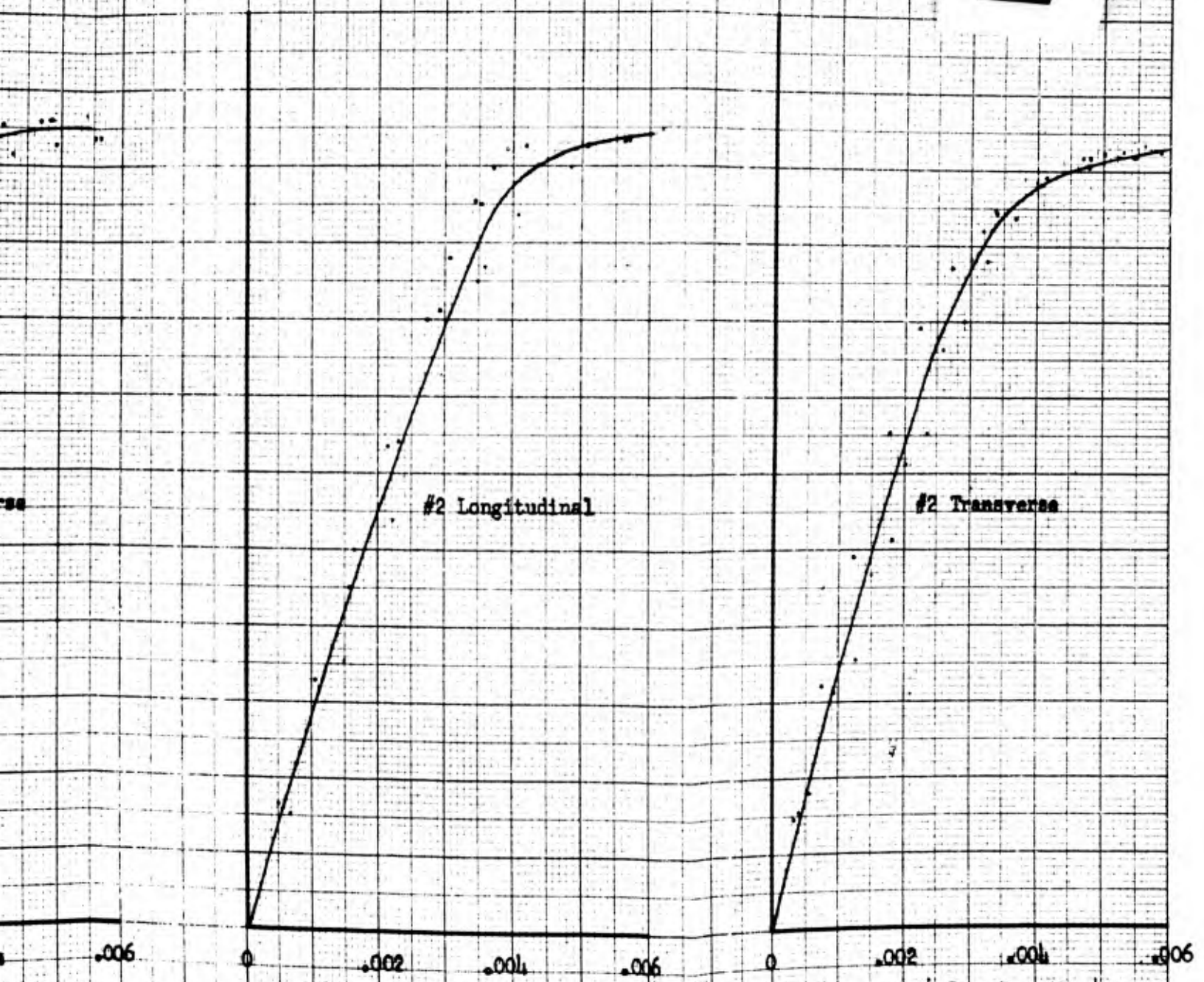


STRAIN - INCHES PER INCH

Figure 2

Curves For NAXTRA 100 Submitted For Retest

2



STRAIN - INCHES PER INCH

Prepared By Pat Ford
Checked By R. Brooks

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Figure 3

Stress vs Strain Curves For Weld

STRESS - PSI

120,000

100,000

80,000

60,000

40,000

20,000

Material Submitted For Retest

1

.002

.004

.006

.008

.010

STRAIN - INCHES PER INCH

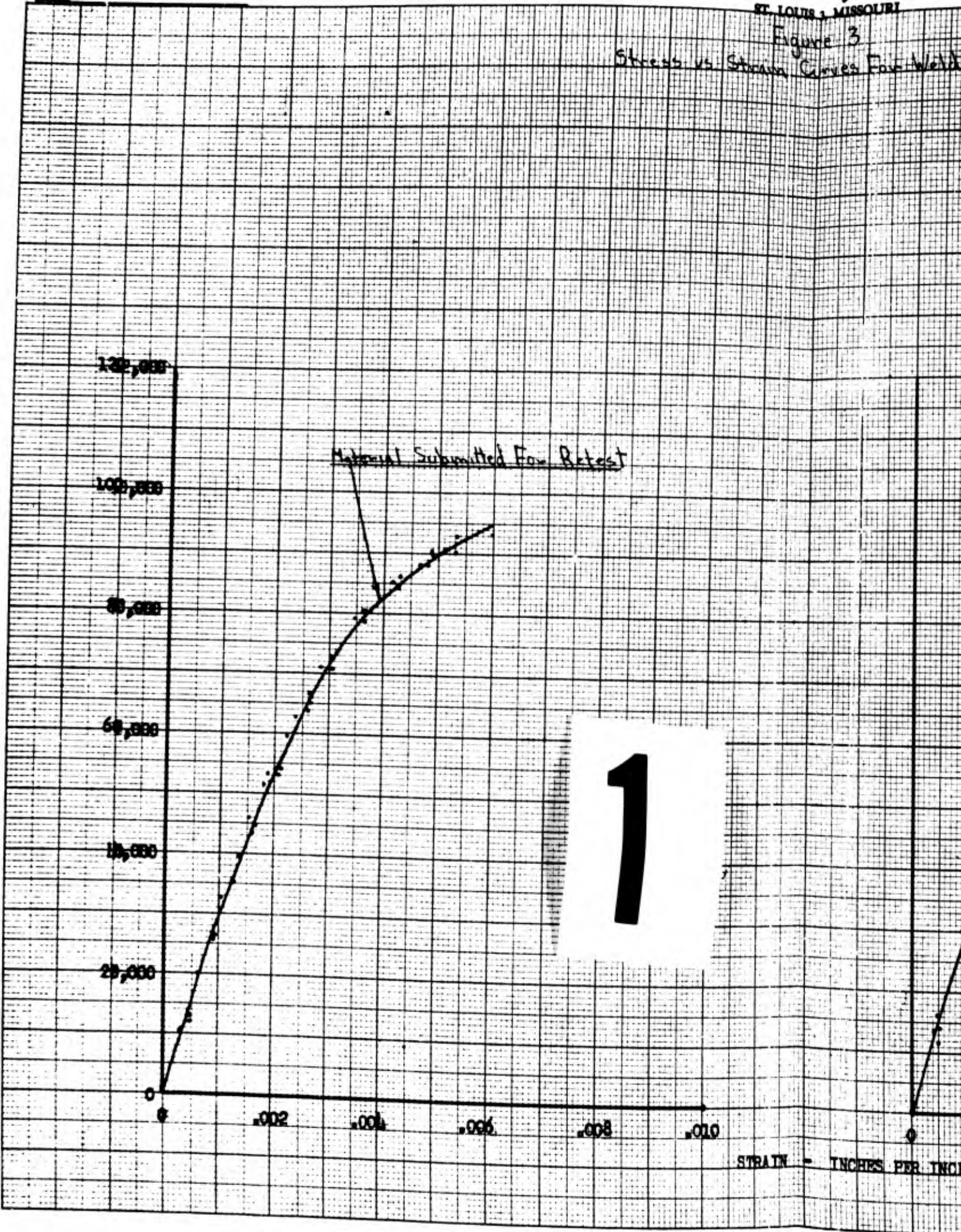


Figure 3

Stress vs. Strain Curves For Welded 5NAXTRA 100 Steel

Initially Furnished Material

2

STRAIN - INCHES PER INCH

Prepared By Pat Ford
Checked By R. Brunkes

TITLE OF TEST EVALUATION OF GREAT LAKES STEEL CORPORATION STEEL
ALLOY NAXTRA 100

LABORATORY OR DEPT. RESPONSIBLE FOR TEST <u>Department 655 <i>TK</i> 1-6-60</u>	MODEL <u>Misc.</u>
TEST PARTS LIST TO BE ISSUED BY LABORATORY <input type="checkbox"/>	APL.
TEST PARTS LIST NOT REQUIRED <input checked="" type="checkbox"/>	

WORK REQUESTED (GIVE PURPOSE OF TEST, WORK AND DATA REQUIRED, INCLUDING SERVICE HISTORY AND BACKGROUND INFORMATION.)

1.0 OBJECT:

1.1 To determine if NAXTRA 100 steel will conform to the technical requirements of MAC Material Specification MMS-202.

2.0 TEST ARTICLES:

(2) Plates - .250" x 24" x 24" NAXTRA 100 Steel

3.0 PROCEDURE:

3.1 Test samples shall be subjected to the following tests as noted in MMS-202, Paragraphs 5.3, 5.4, 5.5 and 5.7.*

4.0 DATA REQUIRED

4.1 Report all weldability, mechanical properties, grain size and bend test results noted in Paragraph 3.1. Include all stress vs. strain curves,

REV 'A' ADD'L M-H'S TO MACHINE NEW SPECIMENS. ORIG. MATL SUPPLIED BY VENDOR - IMPROPER HEAT TREAT. W. Beckler 5/18/60
* TESTING TO BE AS FOLLOWS: (MMS-202)
FOR C. F. ... BY AVO

- PARA 5.3 FIVE WELDED TENSILE SPEC.
- 5.4 12 TENSILE SPECIMENS
- 5.5 2 GRAIN SIZE DETERMINATIONS PER FED. TEST METHOD 311 PROCEDURE A
- 5.7 COMPARE BEND TEST DATA WITH THAT OBTAINED FOR T-1 STEEL.

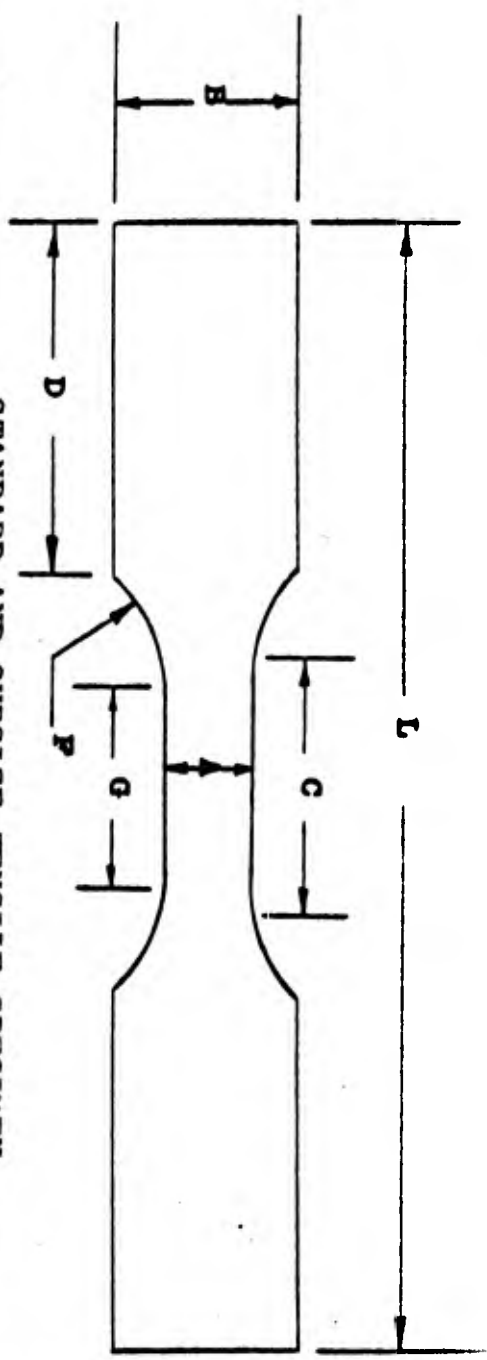
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SPECIFICATIONS & DRAWINGS:

NOTE 1: Contact W. Harris Department 684 prior to weldability (Para 5.3, MMS 202) Tests.

NOTE 2: Material has been delivered to H. Tourkakis Dept. 655

TK

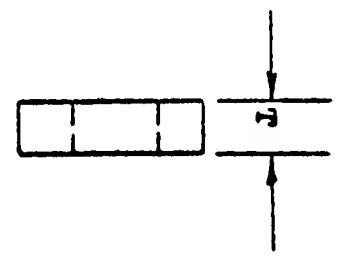


STANDARD AND SUBSIZE TENSILE SPECIMEN

DIMENSIONS	F1	F2 WAS	F2 NOW	F3
A - WIDTH AT CENTER	1.50 \pm .125 -.260	.50 \pm .01	.500 \pm .010	.500
B - WIDTH AT GRIPS, APPROX.	2.00	.75	.75	.75
C - LENGTH OF REDUCED SECTION	9.00 (Min.)	2.25 (Min.)	2.50 (Min.)	1.25
D - GRIP LENGTH	3.0 (Approx.)	2.375 (Min.)	2.375 (Min.)	
F - FILLET RADIUS, MIN.	1.00	.50	3.00	.50
G - GAGE LENGTH	8.00 \pm .01	2.000 \pm .005	2.000 \pm .005	1.00
L - TOTAL LENGTH, MIN.	15.0	8.0	10.0	
T - THICKNESS	.375 to 2.00	.500 Max.	.500 Max.	25 or less

NOTES:

1. Reduced section must be parallel within .002
2. To be determined by length of available stock.
3. The reduced section shall be parallel to within .002.
4. Under no circumstances shall the diameter of the ends of the reduced section be less than the diameter of the center.



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