Test Report T65-11-1

ROTOR CREEP TEST OF FUZE, MT, T366

by

W. E. CHANDLER

AMCMS 5530.12.58900

DA Project 1W542718P384

MARCH 1965

U.S. ARMY MUNITIONS COMMAND

UNITED STATES ARMY

FRANKFORD ARSENAL

RESEARCH & DEVELOPMENT DIRECTORATE

PHILADELPHIA, PA. 19137

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Philadelphia, Pa. 19137

March 1965

ABSTRACT

Tests were conducted to determine if the T366 fuze rotors(Fuze, MT, T366)could withstand storage temperatures under simulated loading conditions. Five 200-hour tests were conducted on these rotors which were subjected to loads of 8.25 lbs. and 16.5 lbs. at temperatures of -65° F, +70° F, +125° F and +165° F.

Overall results of the tests indicate that the rotors will withstand prolonged exposure to temperatures of -60° F and +165° F and still function satisfactorily.

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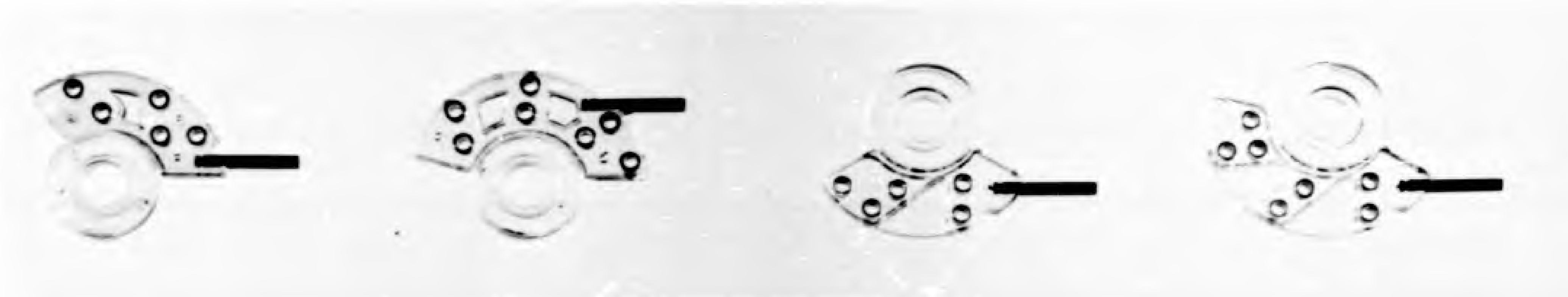
PROCEDURE

As required by FA Test Program Request (TPR) - FA-1610-566, (see Appendix A) four rotors (Figure 1) were tested under temperature conditions approximating those conditions present in actual storage and military applications. All four rotors are molded of a polycarbonate resin thermoplastic compound with a steel rotor pin and brass sleeves molded into the plastic. In the assembly of the T366 fuze, the rotor pin is subjected to a constant spring loading of 2.5 lbs. Excessive deflection of the rotor pin due to prolonged exposure to temperature extremes could result in a malfunction of the fuze. Therefore, the test program was designed to determine the amount of deflection (creep) of the rotor pin under given temperature conditions and also provide a basis for the prediction of T366 fuze shelf life relative to rotor function.

New rotors were used for each test conducted. Unlike the rotors used in the T366 fuze assembly, the rotors used in these tests have a longer unmachined rotor pin (see Figure 2). It was necessary to leave the pins long for these tests in order to have sufficient length to apply the simulated load and take deflection readings. It can readily be seen that a deflection reading taken at a specified point on this long rotor pin would be greater than a reading taken on the short pin used in the fuze assembly. Due to the many variables, such as the difference in the cross sectional areas of the different rotors tested, location of the rotor supports, location of the rotor pins relative to the rotor axis, etc., it was not possible to calculate a constant to determine the difference in the deflection readings (deflection differential) without an extensive study. Calculations were made of the bending moment of the long rotor pin (see Appendix B). The resulting deflections were considered insignificant. Three tests were also conducted to determine the magnitude of this deflection differential by actual measurement. Indicator readings were taken at the extreme end of the rotor pin and as close to the rotor as possible. The difference in these two readings is shown in Table I.

Table I. DEFLECTION DIFFERENTIAL TEST

Rotor Dwg. No.	Temperature	Load (lbs)	Deflection Differential (ins)
FD 21926	Ambient	16.5	.010
FD 21927	Ambient	16.5	.006
FD 21927	Ambient	8.25	.003



FD21881 FD21882 FD21926 FD21927

Figure 1. Test Rotors for Fuze, MT, T366

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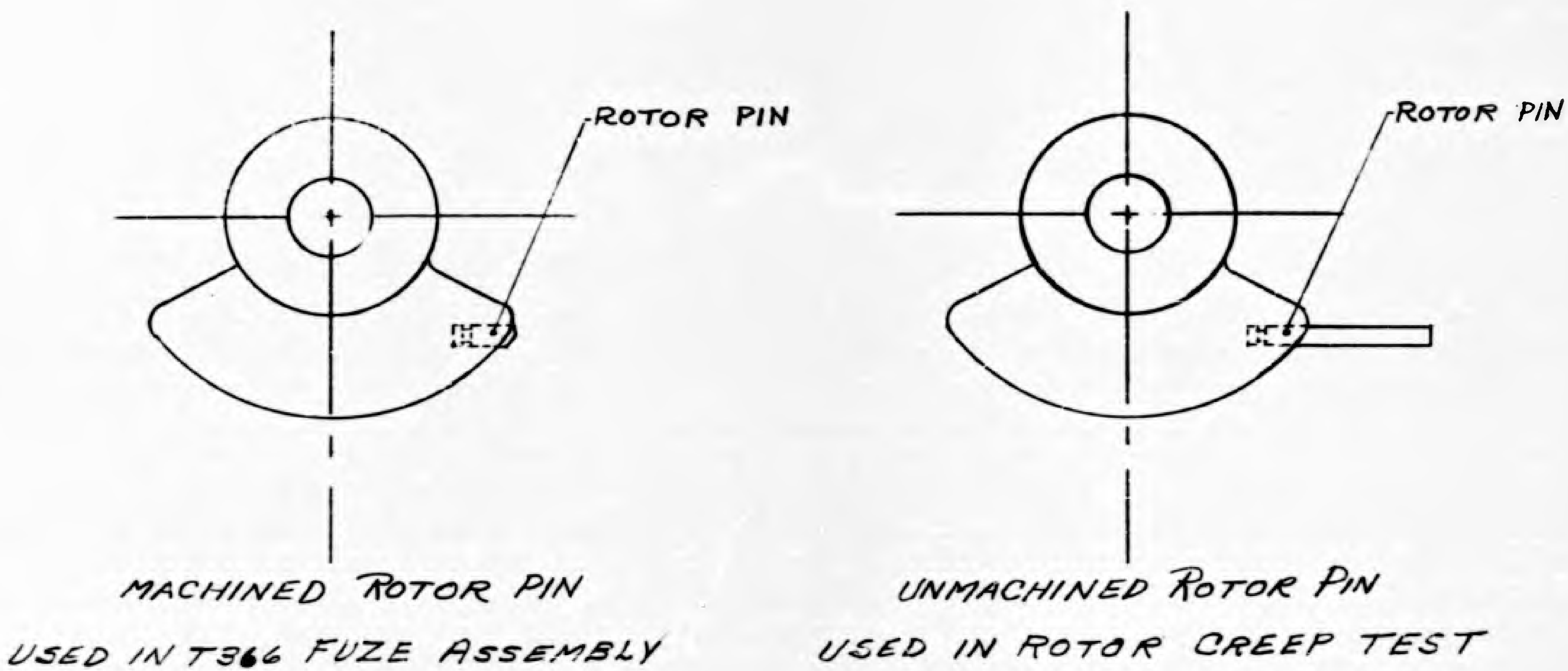


Figure 2. Rotor Pin Comparison

Comparing the deflection differential with the deflection obtained during actual test, under comparable temperature and load conditions, it was found that approximately one-half of the rotor pin deflection was actually deflection differential. It is therefore estimated that all the deflection readings given in this report are 50% greater than the pin will experience in the T366 fuze assembly.

Voltage readings, representing the deflections, were taken hourly during the working day while tests were in process. The tabulation of voltage readings was converted to inches of deflection. Curves of time versus deflection were plotted for each rotor pin (see Appendix C). Curves were not plotted for the deflection readings taken of the rotor itself because the amount of deflection was too insignificant to plot. Bar charts were made for each different design of rotor tested showing a comparison in the amount of deflection at each temperature and load (see Appendix D).

The rate of creep, given in these tests, is that rate at which the rotor pin deflected during each 24-hour period following the first 24 hours of test.

TEST EQUIPMENT

One of the prime requirements of these tests was the precise measurement of deflection at test temperature conditions. A survey was made of dial indicator manufacturers in an effort to locate a dial indicator that would function accurately at the temperature extremes of -60°F and +165°F. None of the commercially available dial indicators would meet these temperature requirements. A test setup was conceived employing a mechanical linkage system from the points of measurement on the rotors, located inside a temperature conditioning chamber, to dial indicators located outside of the chamber. Analysis of this proposed system proved that the accuracy of the indicator readings would be adversely affected by expansion and contraction of the linkages and the friction introduced at the pivot points. A search was therefore conducted for a means to measure the amount of deflection electronically. It was found that the functional characteristics, operational temperature range, and size of the linear variable differential transformer would meet the test requirements.

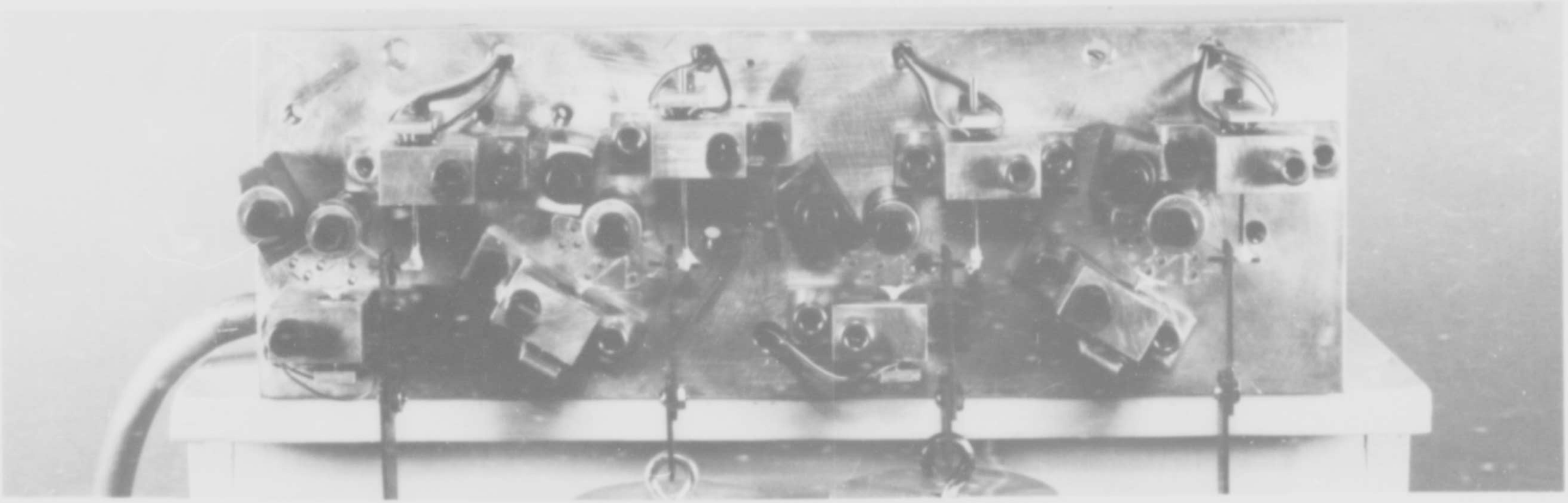
The linear variable differential transformer (LVDT) is an electromechanical transducer which produces an electrical voltage output proportional to the displacement of its movable core. It consists of three coils of wire equally spaced on a common cylinder with a magnetic core positioned axially within the coil assembly. The core provides a path for magnetic flux linking the coils. When the center or primary coil is energized with alternating current, voltages are induced in the two outer or secondary coils. If the secondary coils are connected in series opposition, the voltages in the secondary circuit are opposite in phase, thus the net output of the transformer is the difference of these voltages. At the null or central position the output voltage is zero.

When the core is moved from the null position, the voltage induced in the coil toward which the core is moved increases while the voltage induced in the opposite coil decreases. This produces the differential voltage output from the transformer which varies linearly with the change in the core position. Thus, a plot of voltage output versus core position produces a straight line through the null position within the range of the transformer.

All the transformers used in these tests were calibrated with a micrometer transformer calibration fixture. An input voltage of .34 volts at a frequency of 10,000 cps produced a transformer output voltage of two millivolts for each one thousandth of an inch displacement of the core. Calibration charts were plotted which illustrate the straight line linearity of the transformer output voltage and the linear motion of the core. Appendix E shows a typical chart of all eight LVDT's used in these tests.

In order to record the differential voltage output of the LVDT the following instrumentation was utilized: (see Figure 3 and Figure 4).

Voltage Regulator:	Used to eliminate frequency variations of the audio-oscillator due to fluctuations in the line voltage.
Voltmeter:	Used to provide a constant check on line voltage.
Audio Oscillator:	Used to produce an input voltage of .34 volts at a frequency of 10,000 cps to the primary coil of the LVDT.



Exploded View of Rotor Test Fixture

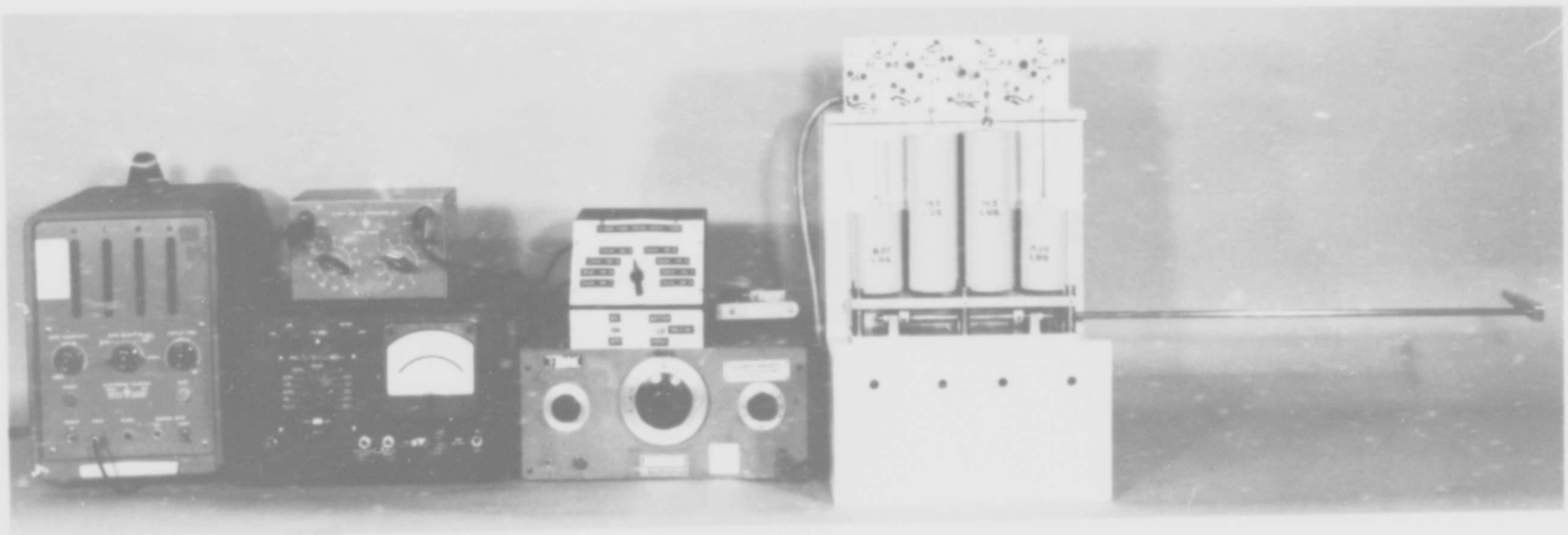


Figure 3. Rotor Creep Test Apparatus for Fuze, MT, T366

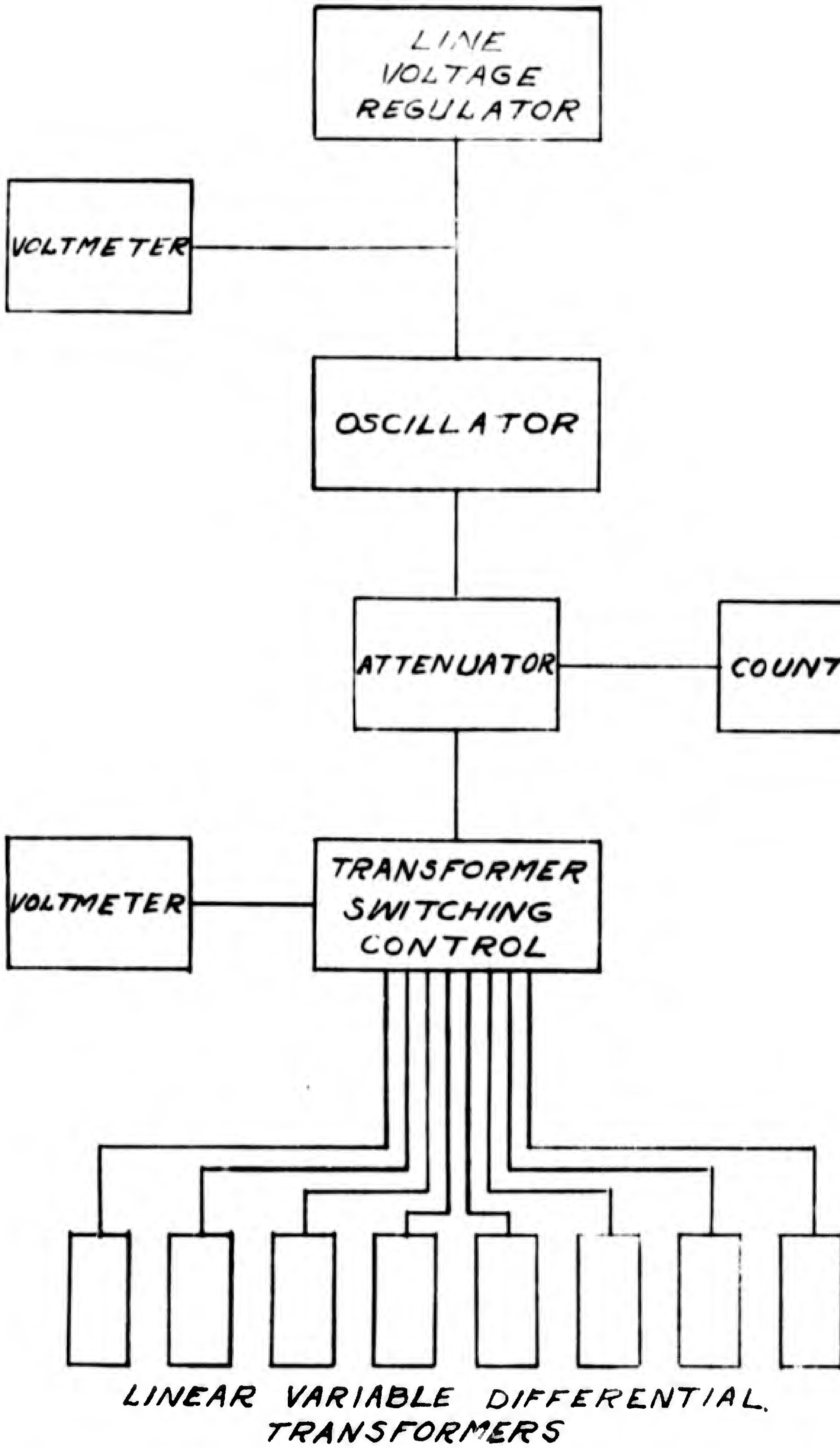


Figure 4. Block Diagram of Instrumentation

Counter:	Used to provide a constant check of the frequency output of the audio oscillator.
Attenuator:	Used to decrease the audio oscillator output voltage in order to operate it in a more accurate voltage range.
LVDT Switching Control:	Used to obtain the input and output voltage of each of the eight LVDT's.

TEST FIXTURE

The test fixture (see Figure 5) was designed to support the four different types of rotors and the LVDT's in accordance with the test setup and dimensional locations suggested in the test program request. Changes in the original test program necessitated modifications to the test fixtures. LVDT core rods were cemented directly to the rotors and rotor arms with dental cement. Eight terminal blocks were mounted on the back of the fixture to facilitate electrical connections from each LVDT to the switching control panel.

The necessity of having the test fixture inside a conditioning chamber required a means of applying the load to each of the rotors simultaneously from outside the chamber. A platform was designed that would support the weights in a raised position and when lowered would transfer the weights to the rotor arms simultaneously at the start of each test. This was accomplished by affixing two eccentrics qualified with each other on a common shaft which extended through the access port of the chamber. The shaft was mounted on a base plate and the eccentrics supported a movable top plate. Six guide pins fastened to the base plate and extending through the movable top plate insured parallelism of the top plate. When the handle of the eccentric shaft was vertical, the top plate was in a raised position. As the handle was rotated 90° in a clockwise direction, the point of contact between the top plate and the eccentrics moved to the position of minimum eccentricity, thus lowering the top plate. A wood test stand supported the test fixture and the weight platform while maintaining correct alignment with the chamber access port.

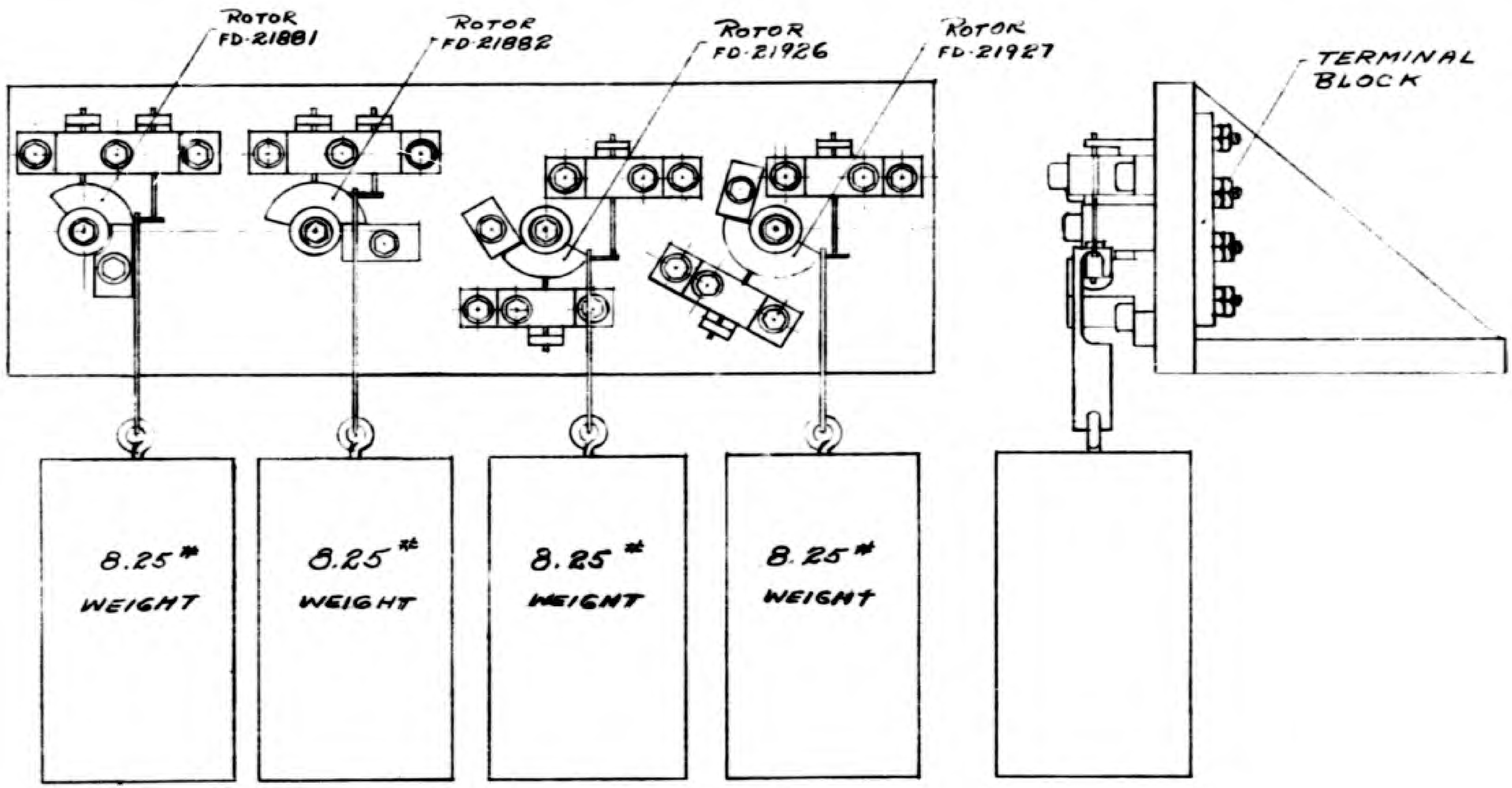


Figure 5. Assembly Sketch of Creep Test Fixture

TEST PROGRAM

It was agreed that the test program as outlined in Appendix A would be changed and the test conducted under the following conditions and in the following order.

Test I - Four rotors, FD-21881, FD-21882, FD-21926 and FD-21927, each subjected to a load of 8.25 lbs. for a period of 200 consecutive hours at a temperature of +70° F.

Test II - Four rotors, FD-21881, FD-21882, FD-21926 and FD-21927, each subjected to a load of 8.25 lbs. for a period of 200 consecutive hours at a temperature of +165° F.

Test III - Four rotors, FD-21881, FD-21882, FD-21926 and FD-21927, each subjected to a load of 8.25 lbs. for a period of 200 consecutive hours at a temperature of -60° F.

Test IV - Four rotors, FD-21881, FD-21882, FD-21926 and FD-21927, each subjected to a load of 8.25 lbs. for a period of 200 consecutive hours at a temperature of +125° F.

Note: This test to be cancelled if the amount of creep obtained in Test II is not excessive.

Test V - Two rotors, FD-21926 and FD-21927, subjected to a load of 8.25 lbs. and two rotors, FD-21926 and FD-21927, subjected to a load of 16.5 lbs for a period of 200 consecutive hours at a temperature of +165° F.

Text VI - Two rotors, FD-21926 and FD-21927, subjected to a load of 8.25 lbs. and two rotors, FD-21926 and FD-21927, subjected to a load of 16.5 lbs. for a period of 200 consecutive hours at a temperature of +125° F.

RESULTS

TEST I

Rotors FD 21881, FD 21882, FD 21926 and FD 21927 were mounted on the test fixture and temperature conditioned at +70° F for approximately two hours prior to start of the test (see Table II).

TEST II

Rotors FD 21881, FD 21882, FD 21926 and FD 21927 were mounted on the test fixture and temperature conditioned at +165° F for a period of 24 hours prior to start of the test (see Table III).

During the period between 75 and 96 hours of testing, which was after the normal working day, the thermostatic control of the temperature conditioning chamber malfunctioned. Temperatures in excess of 200° F were attained. A sharp increase in the amount of deflection occurred during this period. This abnormal increase in deflection is included in the final deflection readings tabulated in table III. The average rates of creep shown in table III are those obtained between 96 and 200 hours of testing at +165° F.

Remarks

A dotted line was plotted on each of the curves for this test to represent the curve that would have, in all probability, been generated if the chamber had not overheated.

Upon examination of the rotors at the completion of this test, it was discovered that cracks in the plastic had developed in rotors FD 21926 and FD 21927. The areas of the rotors where the cracks developed were photographed at approximately 15 magnifications (see Figures 6 and 7). The cracks were attributed to one or a combination of the following conditions:

1. The temperatures during the period of chamber malfunction may have reached a point close to the plasticity temperature of the polycarbonate resin plastic.

2. The rate of decrease in temperature, back to +165° F, immediately following the chamber malfunction was too rapid; thus strain cracks developed.

Table II. RESULTS OF TEST I

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 200 Hrs. (ins)
FD 21881	8.25	.0034	.0035	.00006	.004
FD 21882	8.25	.0008	.0015	.00003	.0018
FD 21926	8.25	.0054	.0057	.00008	.0065
FD 21927	8.25	.0047	.005	.00006	.0057

Table III. TEST RESULTS OF TEST II

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 200 Hrs. (ins)
FD 21881	8.25	.0038	.0053	.0001	.0072
FD 21882	8.25	.0022	.0024	.00005	.0027
FD 21926	8.25	.0090	.0168	.00017	.0275
FD 21927	8.25	.0077	.0130	.00015	.0212

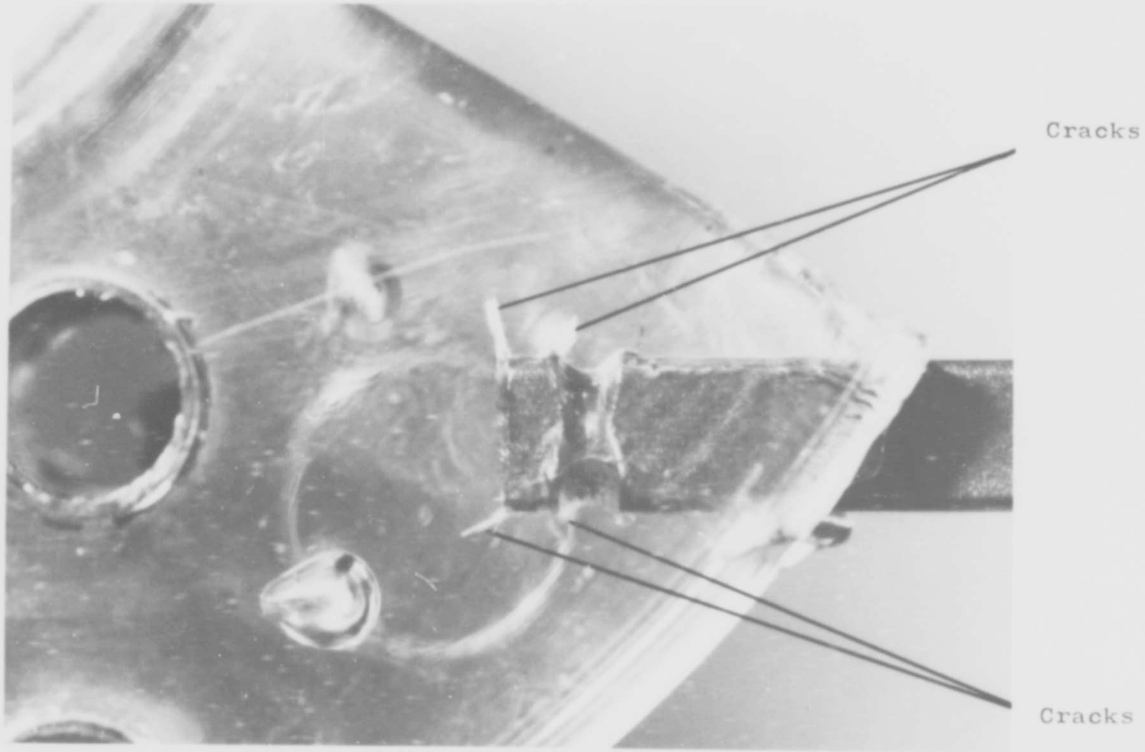


Figure 6. Cracks in Rotor FD 21926

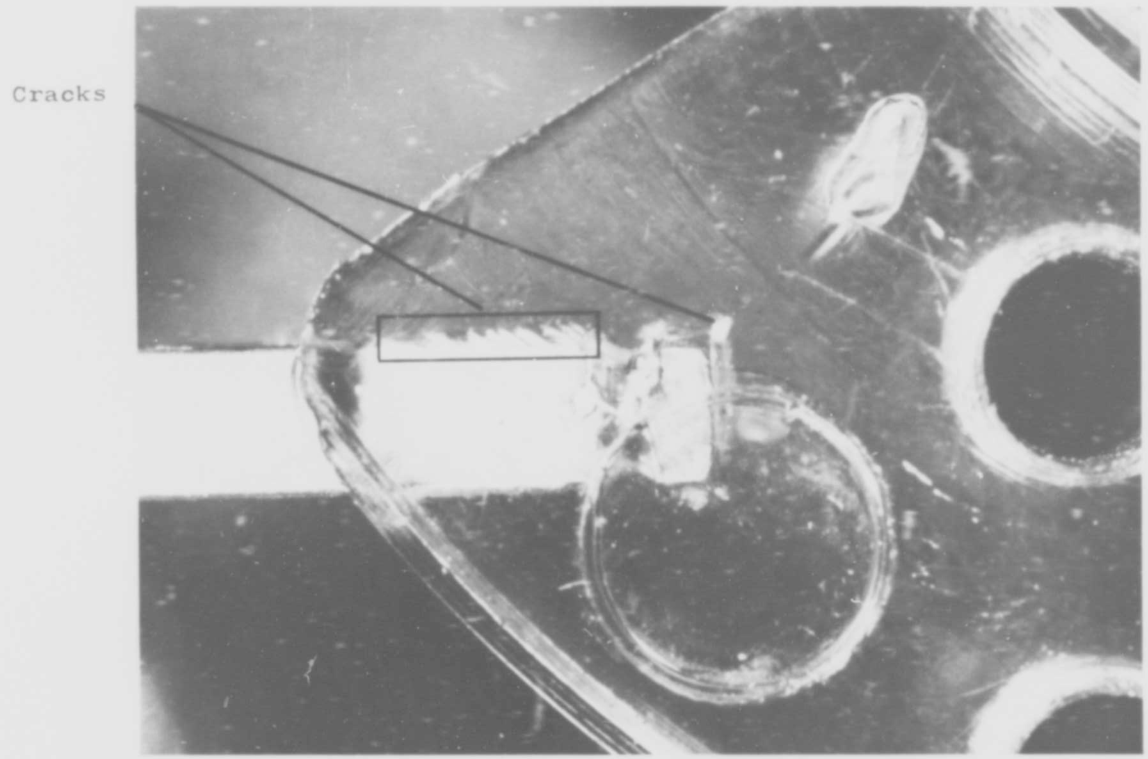


Figure 7. Cracks in Rotor FD 21927

3. The comparatively sharp corners on the rotor pins caused stress points and subsequent cracks.

TEST III

Rotors FD 21881, FD 21882, FD 21926 and FD 21927 were mounted on the test fixture and temperature conditioned at -60° F for a period of 16-1/2 hours prior to start of the test (see Table IV).

After 146 hours of test the circulating fan stopped functioning. The chamber was shut down and the test fixture was removed from the chamber. Upon completion of repairs to the chamber the test was continued for an additional 60 hours (see Table V).

Remarks

Some amount of permanent set was evident at the start of the 60 additional hours of test which affected both the rate of creep and the final deflection. Time versus deflection curves were plotted for both the 146 hours and 60 additional hours of test and were included on the same chart.

Each of the rotors was examined at the end of the test. No cracks developed in any of the rotors around the area of the rotor pin. However, strain cracks developed in the plastic in a radial pattern surrounding the brass sleeves on rotors FD 21926 and FD 21927.

TEST IV

Test IV was cancelled. Upon consideration of the results of Test II and the results of Test VI which partially duplicates this test, it was decided that no appreciable information would be gained by conducting this test.

TEST V

Two rotors, FD 21926 and two rotors, FD 21927 were mounted on the test fixture and temperature conditioned at +165° F for a period of 18 hours prior to start of the test (see Table VI).

Table IV. RESULTS OF TEST III (146 Hours)

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 146 Hrs. (ins)
FD 21881	8.25	.0029	.0029	-	.0029
FD 21882	8.25	.0015	.0016	-	.0016
FD 21926	8.25	.0049	.0058	.00012	.0063
FD 21927	8.25	.0093	.0094	.00001	.0095

Table V. RESULTS OF TEST III (60 Hours)

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 60 Hrs. (ins)
FD 21881	8.25	.0022	.0023	.00004	.0024
FD 21882	8.25	.0009	.0010	.00004	.0011
FD 21926	8.25	.0031	.0033	.00004	.0034
FD 21927	8.25	.0045	.0041	.00004	.0042

Table VI. RESULTS OF TEST V

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 200 Hrs. (ins)
FD 21926	8.25	.0132	.0193	.0004	.0226
FD 21927	8.25	.0126	.0147	.0004	.0177
FD 21926	16.5	.0347	.0411	.0011	.0500
FD 21927	16.5	.0477	.0588	.0008	.0645

Table VII. RESULTS OF TEST VI

Rotor Dwg. No.	Load (lbs.)	Deflection After 5 Min. (ins)	Deflection After 24 Hrs. (ins)	Rate of Creep Per 24 Hrs. (ins)	Final Deflection After 200 Hrs. (ins)
FD 21926	8.25	.0104	.0118	.00018	.0131
FD 21927	8.25	.0070	.0079	.00011	.0087
FD 21926	16.5	.0190	.0239	.00051	.0275
FD 21927	16.5	.0152	.0185	.00035	.0210

Remarks:

Each of the rotors was examined at the end of the test. No cracks developed in the area of the rotor pin. Strain cracks developed in a radial pattern surrounding the brass sleeves on all four rotors tested. The cracks were more severe on the rotors subjected to the 16.5 lbs. load. In addition to these cracks, minute strain cracks were evident throughout the plastic in each of the rotors. Again, they were more severe on the rotors subjected to the 16.5 lb load.

TEST VI

Two rotors, FD 21926 and two rotors, FD 21927 were mounted on the test fixture and temperature conditioned at +125° F for a period of 67 hours prior to start of the test (see Table VII).

Remarks:

Each of the rotors was examined at the end of the test. No cracks developed in the area of the rotor pin. Strain cracks developed in the plastic in a radial pattern surrounding the brass sleeves and surface strain cracks appeared in the areas of stress concentrations. However, none of the cracks in these rotors were as severe as those developed in Test V.

CONCLUSIONS

The tests conducted indicate that any one of the four rotors tested will withstand prolonged exposure to temperature extremes of -60° F to +165° F and still function satisfactorily. Overall results show that the following factors or conditions have the most significant effects on the proper operation of the T366 fuze rotors after storage at varying temperature conditions.

1. High temperatures (+165° F) most drastically affects the stability of the polycarbonate resin plastic in the rotors.

2. Low temperatures (-60° F) seem to increase the stability of the plastic.

3. Sharp corners on the steel rotor pins are conducive to local cracking of the plastic.

The ability of the four different designs of rotors tested to resist deflection, creep, and cracking are listed below in the order of their effectiveness:

a. FD 21882

b. FD 21881

c. FD 21927

d. FD 21926

RECOMMENDATIONS

It is recommended that the following additional tests be conducted to obtain additional information that may contribute to T366 fuze reliability:

1. A long term creep and durability test of approximately 9000 hours duration at elevated temperatures. This test would determine how aging will affect the stability of the plastic.

2. A -60° F to 165° F temperature shock test. This test would determine the rotors' ability to withstand severe thermal changes.

3. A high temperature destruction test using selected loads and increasing the temperature until rotor failure. These tests would determine safe maximum storage temperatures.

APPENDIX A

Frankford Arsenal
Research & Development Group
Artillery Ammunition Components Division
Mechanical Time Fuze Branch-1610
Philadelphia, Pennsylvania 19137

Test Program Request
JFBaker/eh/21230
30 September 1963

TPR-FA-1610-566

1. Material for Test:

   Supplied by RAD Eng. Electro Mech. Time Fuze Br. 1610:-

   a. Four Large Rotors for "B" switch, Dwg. FD 21927.

   b. Four Small Rotors for "B" switch, Dwg. FD 21926.

   c. Four Large Rotors for "A" switch, Dwg. FD 21882.

   d. Four Small Rotors for "A" switch, Dwg. FD 21881.

2. Project:

   Fuze, MT, T366, DEP 370.

3. Classification:

   Unclassified

4. Expenditure Order:

   43621-05

5. Previous Tests:

   None

6. Precautions in Handling and Testing:

   Normal care to prevent damage to the items to be tested.

7. Object of Tests:

To test the ability of these rotors to withstand the storage temperatures while under the influence of the spring loads.

8. Test Program:

a. The rotors will be set up in the environmental chamber as shown in appendix A in groups of four rotors. Each group shall consist of one rotor of each type as noted in appendix A except small rotor FD 21881 and large rotor FD 21882 of which there will be two in each group. One large and one small rotor shall have the 8 1/4 lbs loading while the second pair shall have the 16 1/2 lb loading.

b. Exposure temperatures shall be as follows:

Group A+165° F
Group B+125° F
Group C+70° F
Group D-60° F

c. Exposure times at the respective temperatures shall be up to and including 200 hours or until failure occurs.

d. Deflection readings shall be taken at the following times:

1) Two minutes after start of test.

2) Two hours after start.

3) Twenty hours after start and at one hundred and two hundred hours after start of test.

4) All deflection readings shall be recorded as per temperature, total time lapse, and total deflection.

e. It is suggested that these tests be accomplished in alphabetical order and in as short a time as possible.

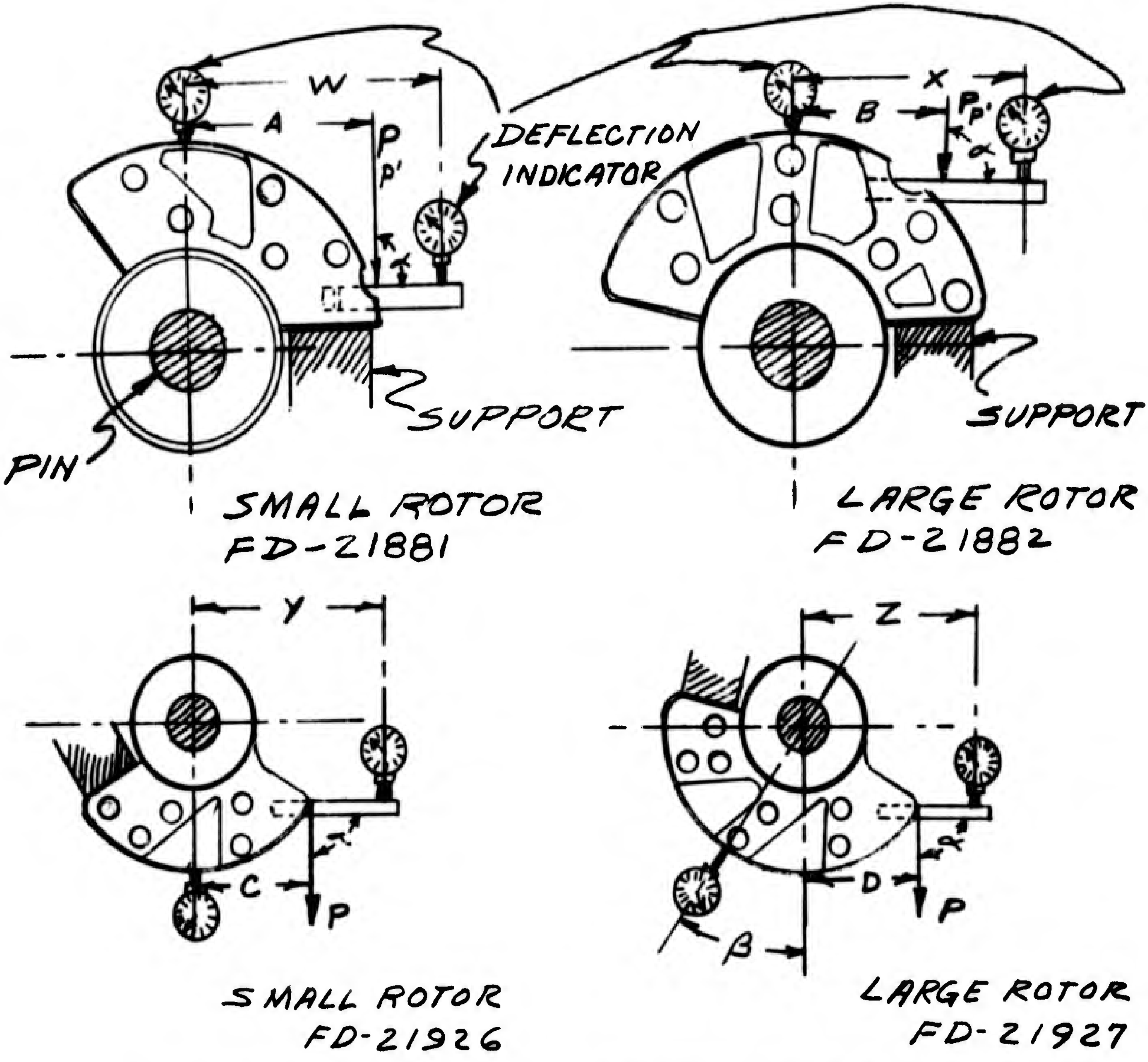
PREPARED BY: /s/JOHN F. BAKER

REVIEWED BY: /s/D. R. LENTON

APPROVED BY: /s/B. D. NABRESKI

APPENDIX A

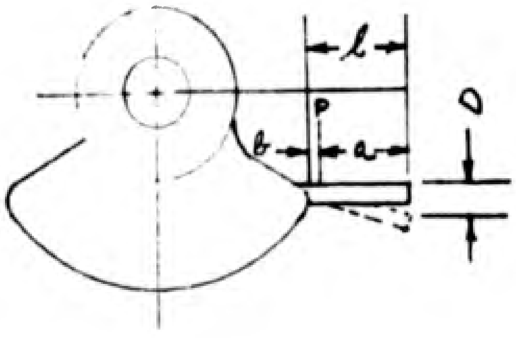
TEST SETUP (SUGGESTED)



A	.688	W	.938	α	90°
B	.531	X	.781	β	30°
C	.562	Y	.875	P	8.25#
D	.562	Z	.750	P'	16.50#
PIN DIA.	.249-.000				

APPENDIX B

BENDING MOMENT CALCULATIONS OF ROTOR PIN

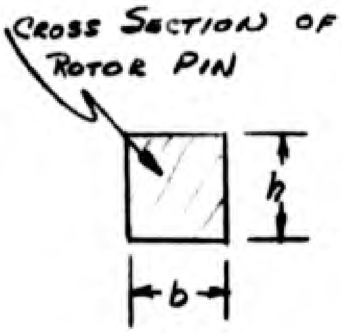


D = DEFLECTION (INCHES)

P = LOAD (LBS)

E = MODULUS OF ELASTICITY

I = MOMENT OF INERTIA



$h = .062$

$b = .062$

$$I = \frac{1}{12}\, b\, h^3$$

$$I = \frac{1}{12}\, .062 \times (.062)^3$$

$$I = \frac{1}{12}\, (.062)^4$$

$$I = .000001$$

<u>ROTOR - FD 21881 AND FD 21882</u>

$P = 16.5 \text{ lbs.}$ $\quad b = .031''$ $\quad l = .250$

$$D = \frac{P b^2}{6EI}(3l - b)$$

$$D = \frac{16.5(.031)^2}{6EI}(.75 - .031)$$

$$D = \frac{16.5 \times .001 \times .719}{6 \times 30{,}000{,}000 \times .000001}$$

$$D = \frac{.0165 \times .719}{180}$$

$$D = .00006$$

ROTOR - FD21881 AND FD21882

$P = 8.25$ lbs. $b = .031$ $l = .250$

$$D = \frac{Pb^2}{6EI}(3l - b)$$

$$D = \frac{8.25\,(.031)^2}{6EI}(.75 - .031)$$

$$D = \frac{8.25 \times .001 \times .719}{6 \times 30{,}000{,}000 \times .000001}$$

$$D = \frac{.0082 \times .719}{180}$$

$$D = .00003$$

ROTOR - FD21926

$P = 16.5$ lbs. $b = .031$ $l = .313$

$$D = \frac{Pb^2}{6EI}(3l - b)$$

$$D = \frac{16.5\,(.031)^2}{6EI}(.939 - .031)$$

$$D = \frac{16.5 \times .001 \times .908}{180}$$

$$D = \frac{.0165 \times .908}{180}$$

$$D = .00008$$

ROTOR - FD 21926

$P = 8.25$ lbs. $\quad b = .031 \quad l = .313$

$$D = \frac{Pb^2}{6EI}(3l - b)$$

$$D = \frac{8.25(.031)^2}{6EI}(.939 - .031)$$

$$D = \frac{8.25 \times .001 \times .908}{180}$$

$$D = \frac{.0082 \times .908}{180}$$

$$D = .00004$$

ROTOR - FD 21927

$P = 16.5 \quad b = .031 \quad l = .188$

$$D = \frac{Pb^2}{6EI}(3l - b)$$

$$D = \frac{16.5(.031)^2}{6EI}(.564 - .031)$$

$$D = \frac{16.5 \times .001 \times .533}{180}$$

$$D = \frac{.0165 \times .533}{180}$$

$$D = .00004$$

ROTOR - FD 21927

$P = 8.25$ $b = .031$ $l = .188$

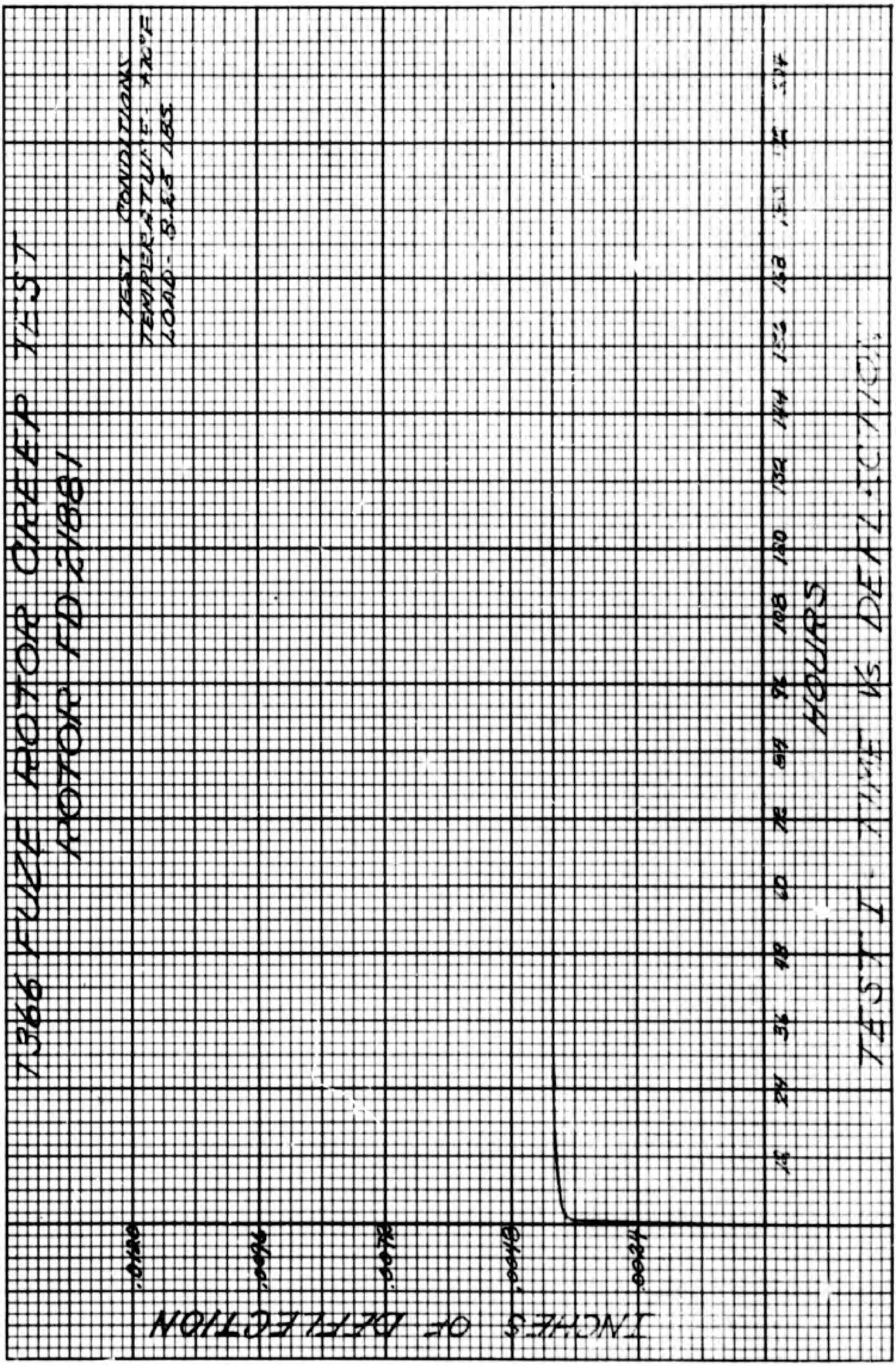
$$D = \frac{Pb^2}{6EI}(3l - b)$$

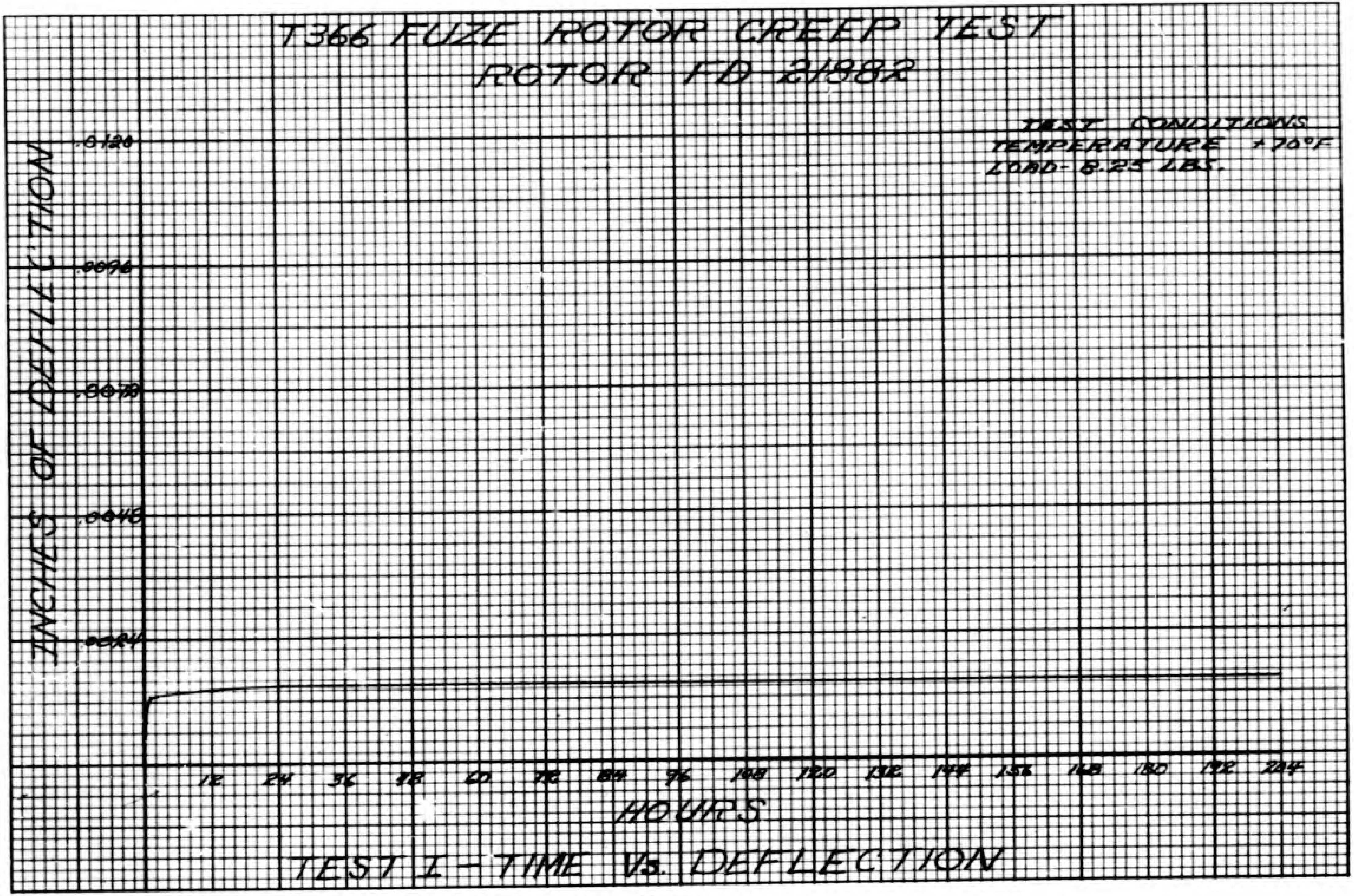
$$D = \frac{8.25\,(.031)^2}{6EI}(.564 - .031)$$

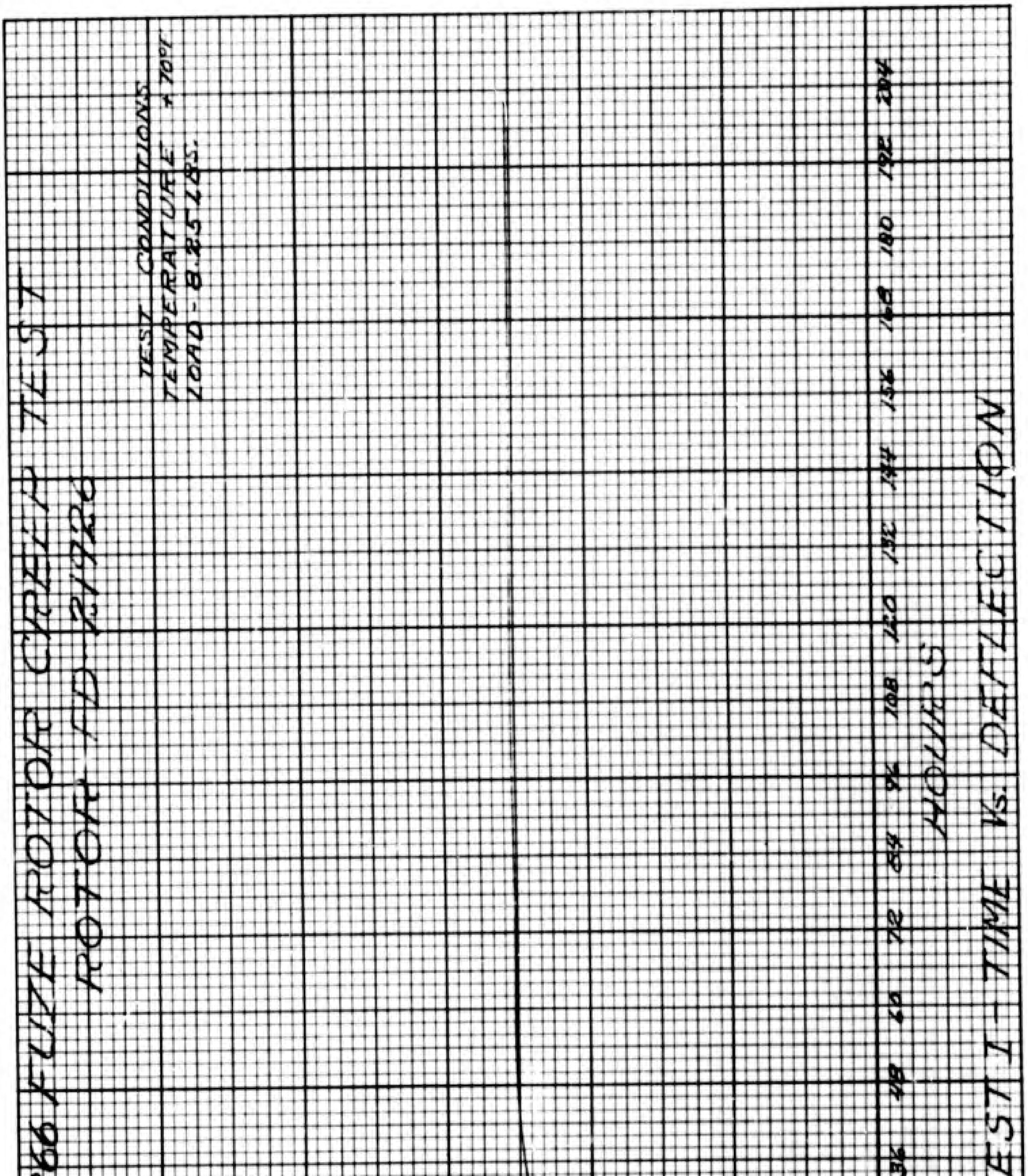
$$D = \frac{8.25 \times .001 \times .533}{180}$$

$$D = \frac{.0082 \times .533}{180}$$

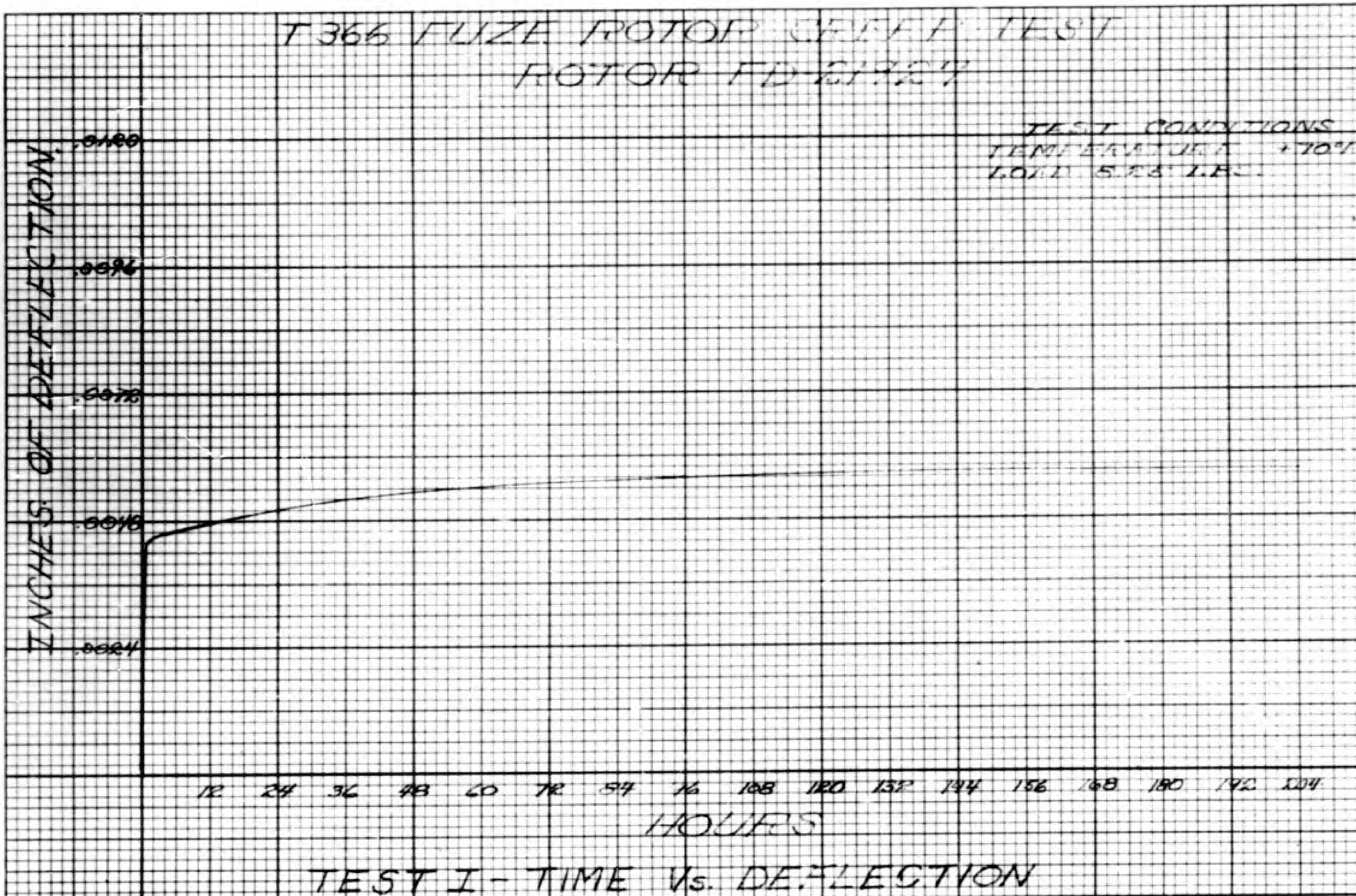
$$D = .00002$$

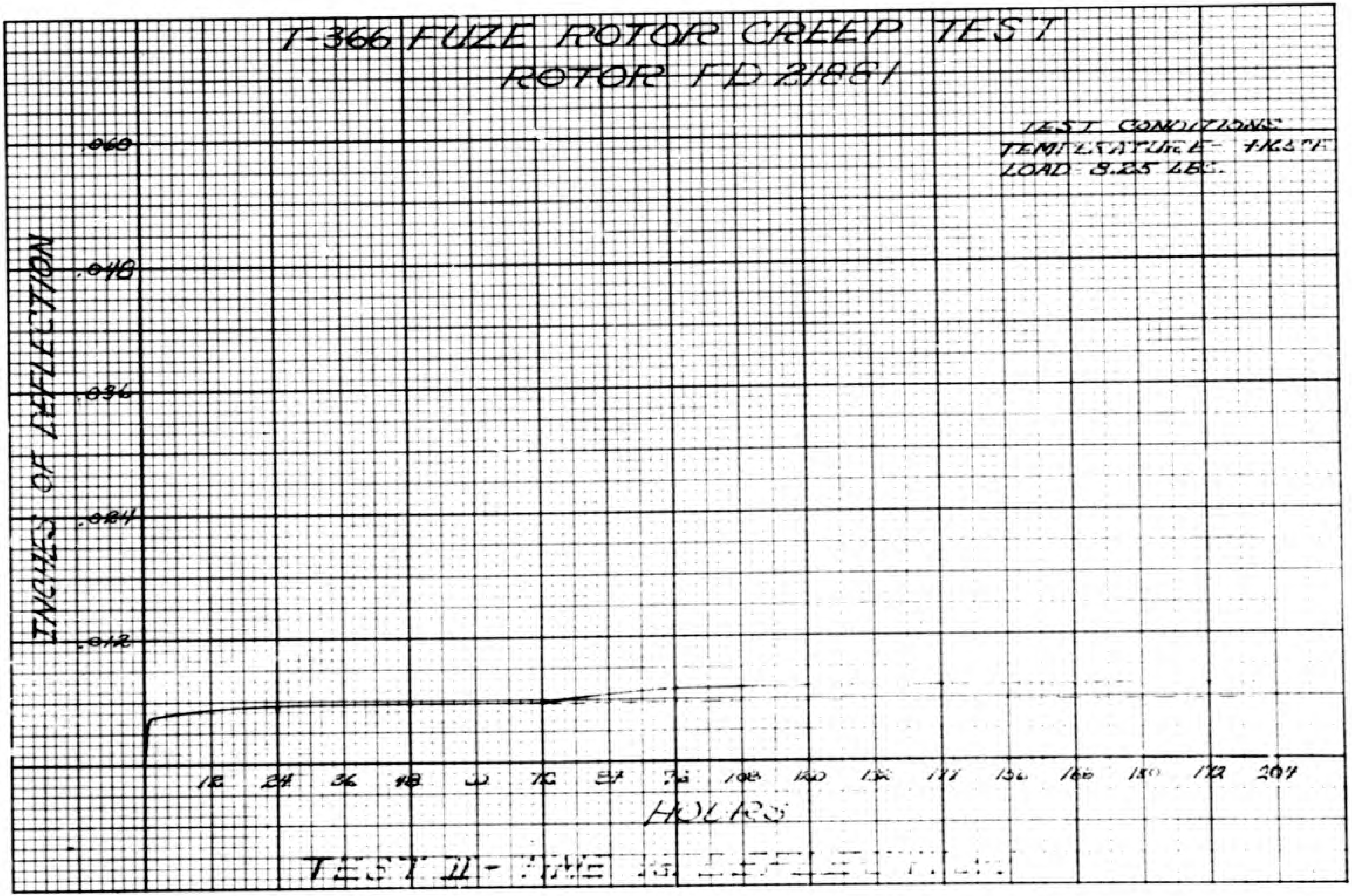

T366 FUZE ROTOR CREEP TEST
TEST CONDITIONS
HOURS
INCHES OF DEFLECTION

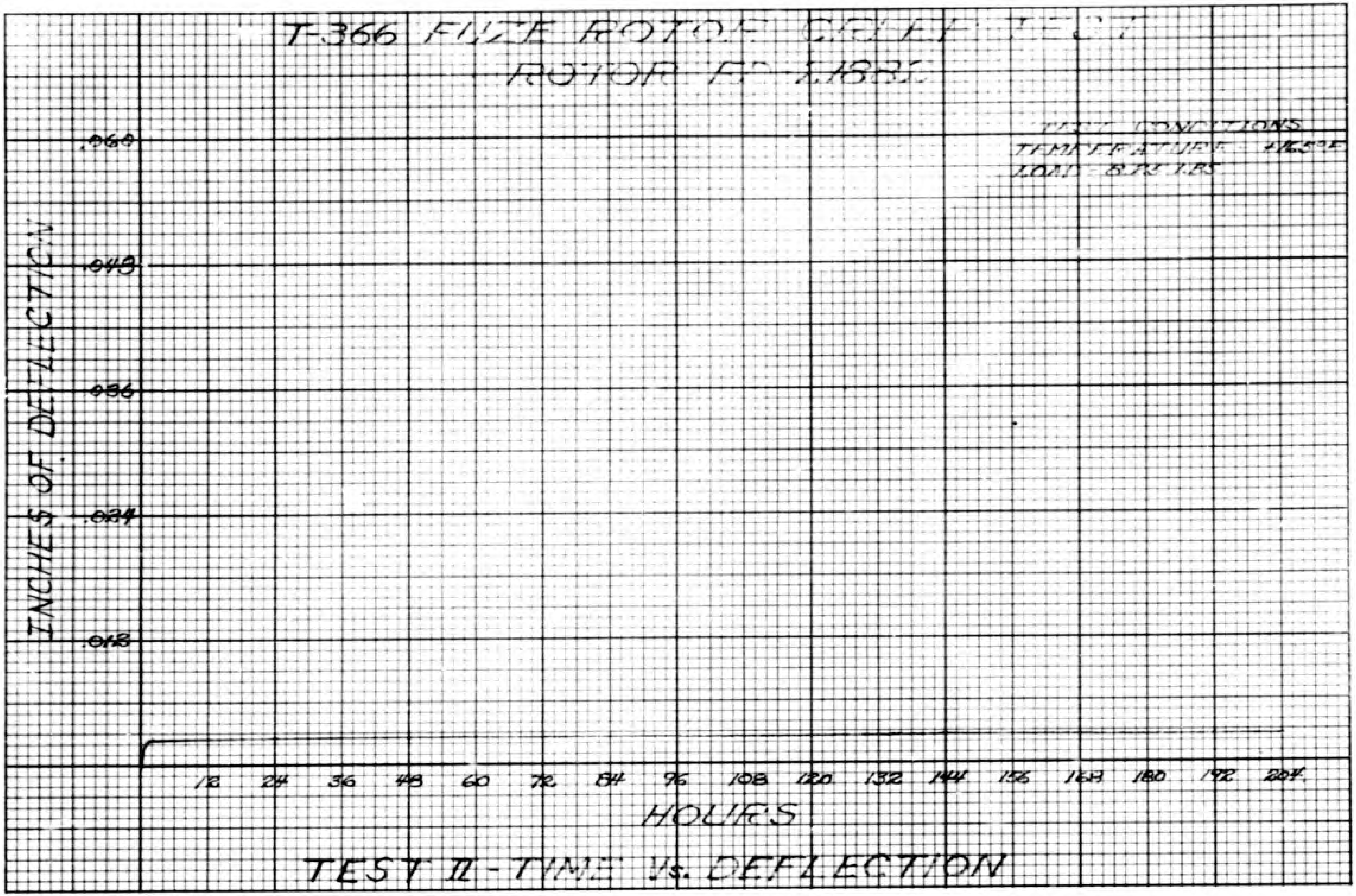

T366 FUZE ROTOR CREEP TEST
ROTOR FD 21882
TEST CONDITIONS
TEMPERATURE +70°F
LOAD- 8.25 LBS.
INCHES OF DEFLECTION
.0120
.0096
.0072
.0048
.0024
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST I - TIME Vs. DEFLECTION



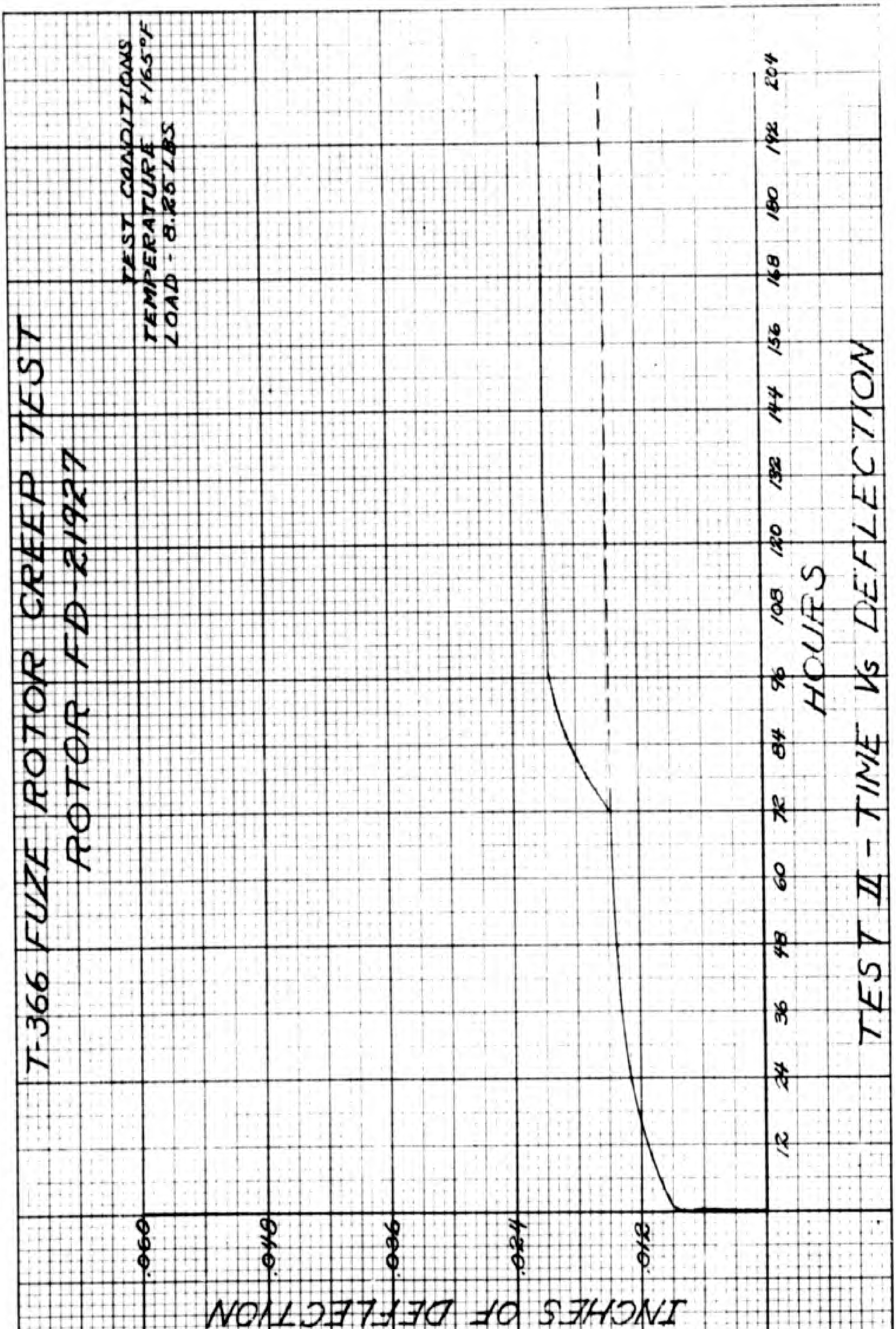
T366 FUZE ROTOR CREEP TEST
ROTOR FD 21926
TEST CONDITIONS
TEMPERATURE +70°F
LOAD - 8.25 LBS.
INCHES OF DEFLECTION
.0120
.0096
.0072
.0048
.0024
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST I - TIME Vs. DEFLECTION

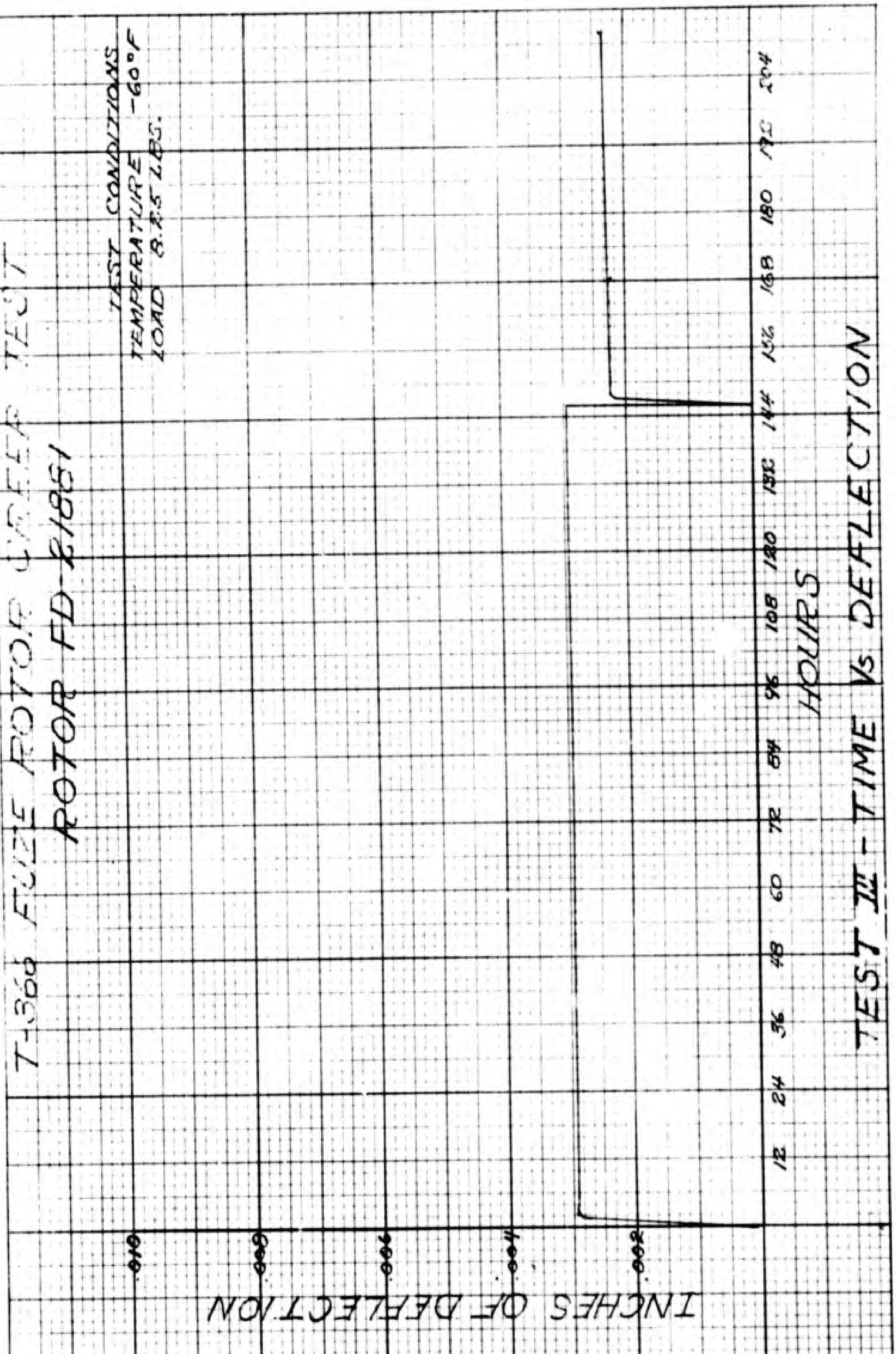

T 366 FUZE ROTOR TEST
ROTOR
TEST CONDITIONS
INCHES OF DEFLECTION
.0120
.0096
.0072
.0048
.0024
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST I - TIME Vs. DEFLECTION

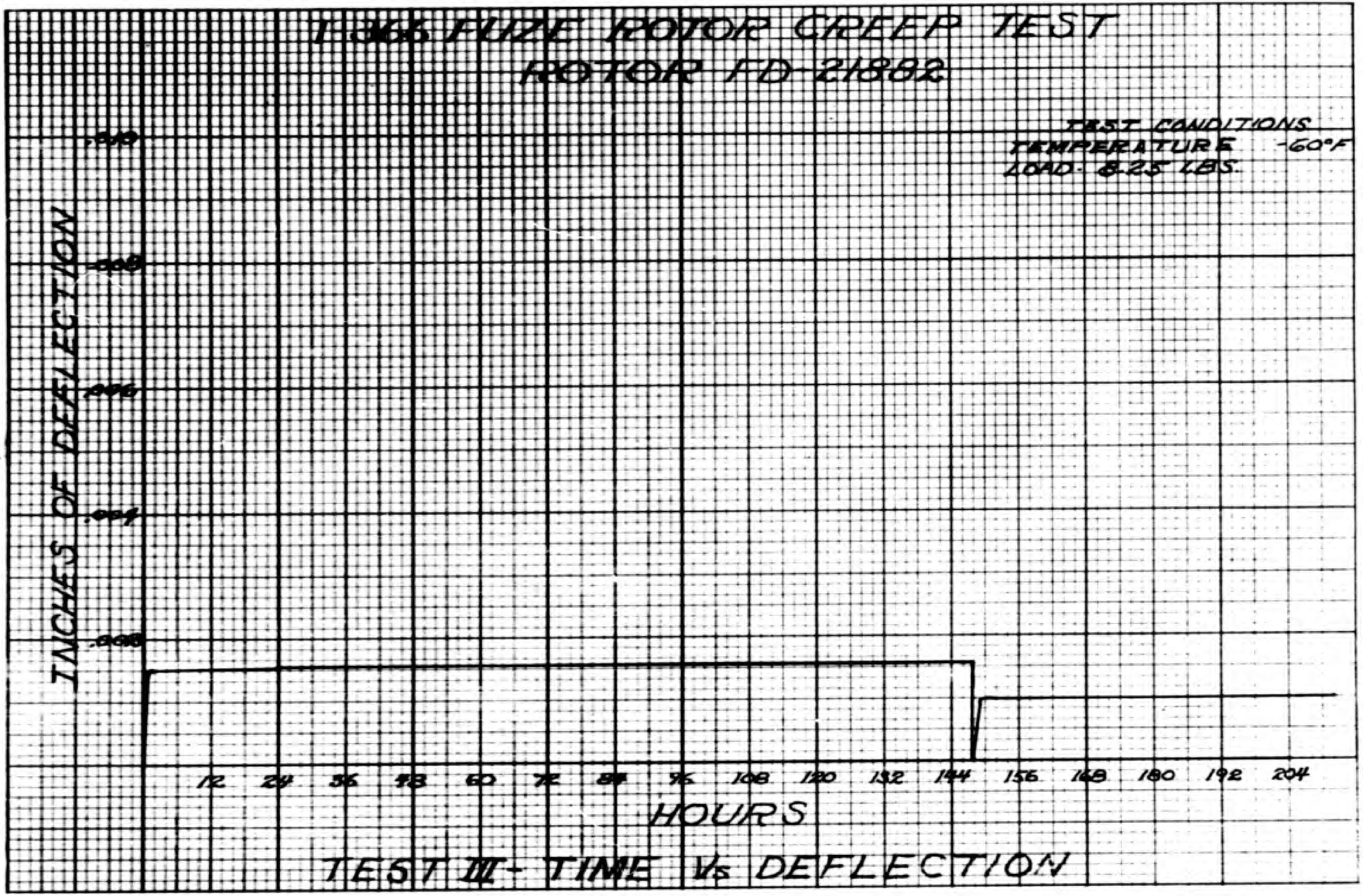

T-366 FUZE ROTOR CREEP TEST
ROTOR FD 21881
TEST CONDITIONS
LOAD 8.25 LBS.
INCHES OF DEFLECTION
.060
.048
.036
.024
.012
12
24
36
48
72
HOURS
TEST II -

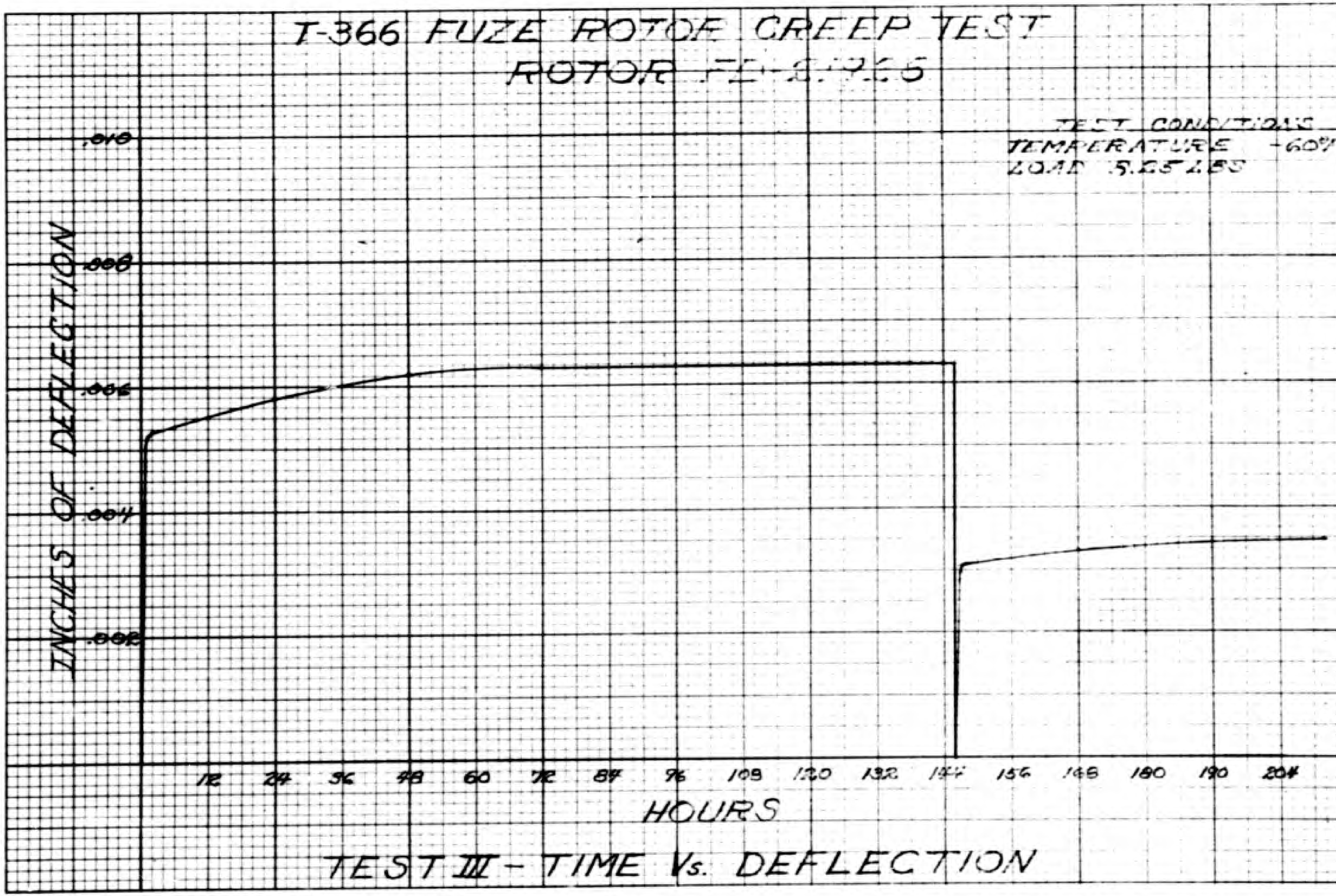

T-366
.060
.048
.036
.024
.012
INCHES OF DEFLECTION
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST II - TIME Vs. DEFLECTION

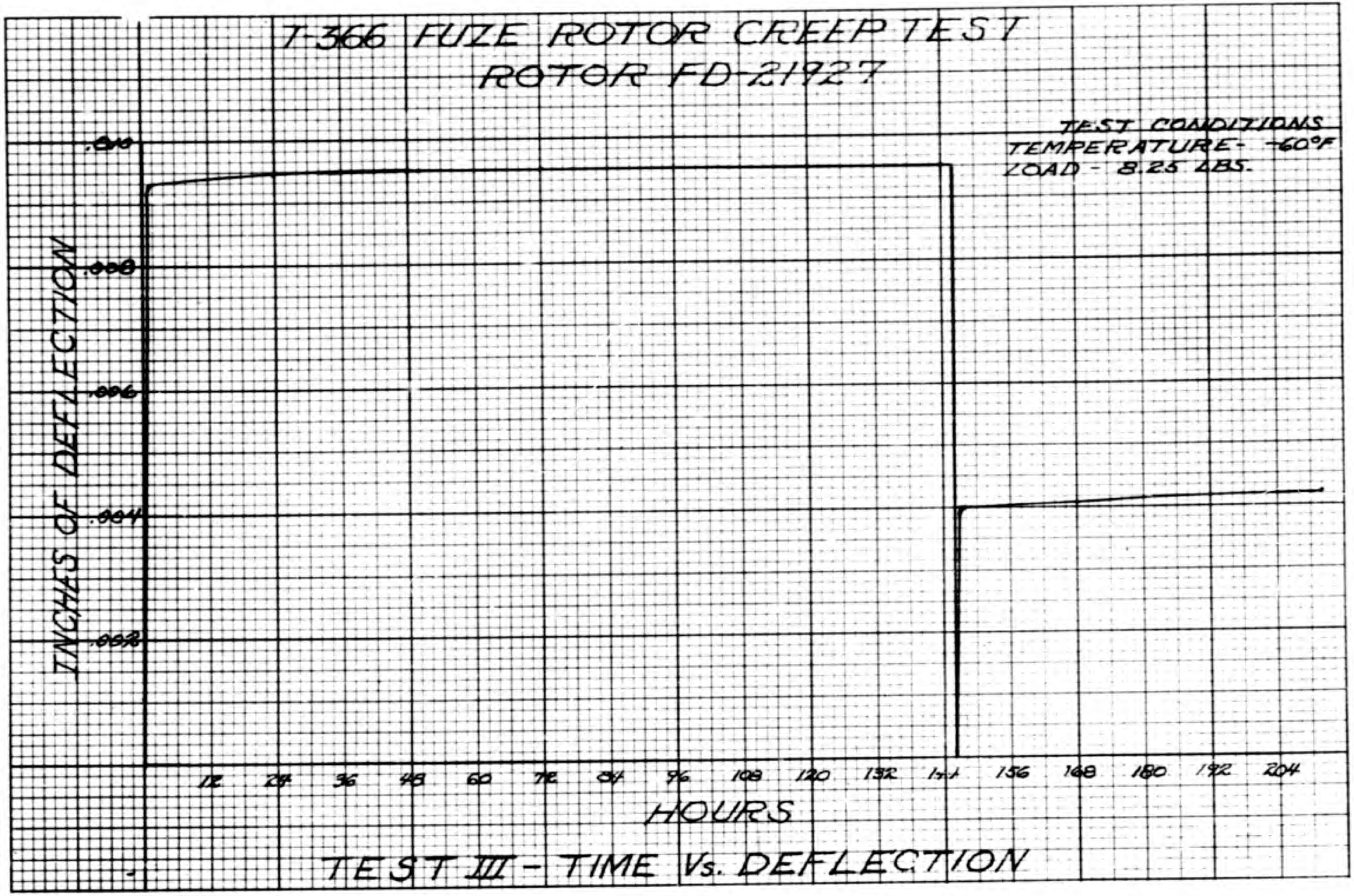
TEST II - TIME Vs DEFLECTION
HOURS
INCHES OF DEFLECTION
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
.010 .020 .030 .040 .050
TEMPERATURE

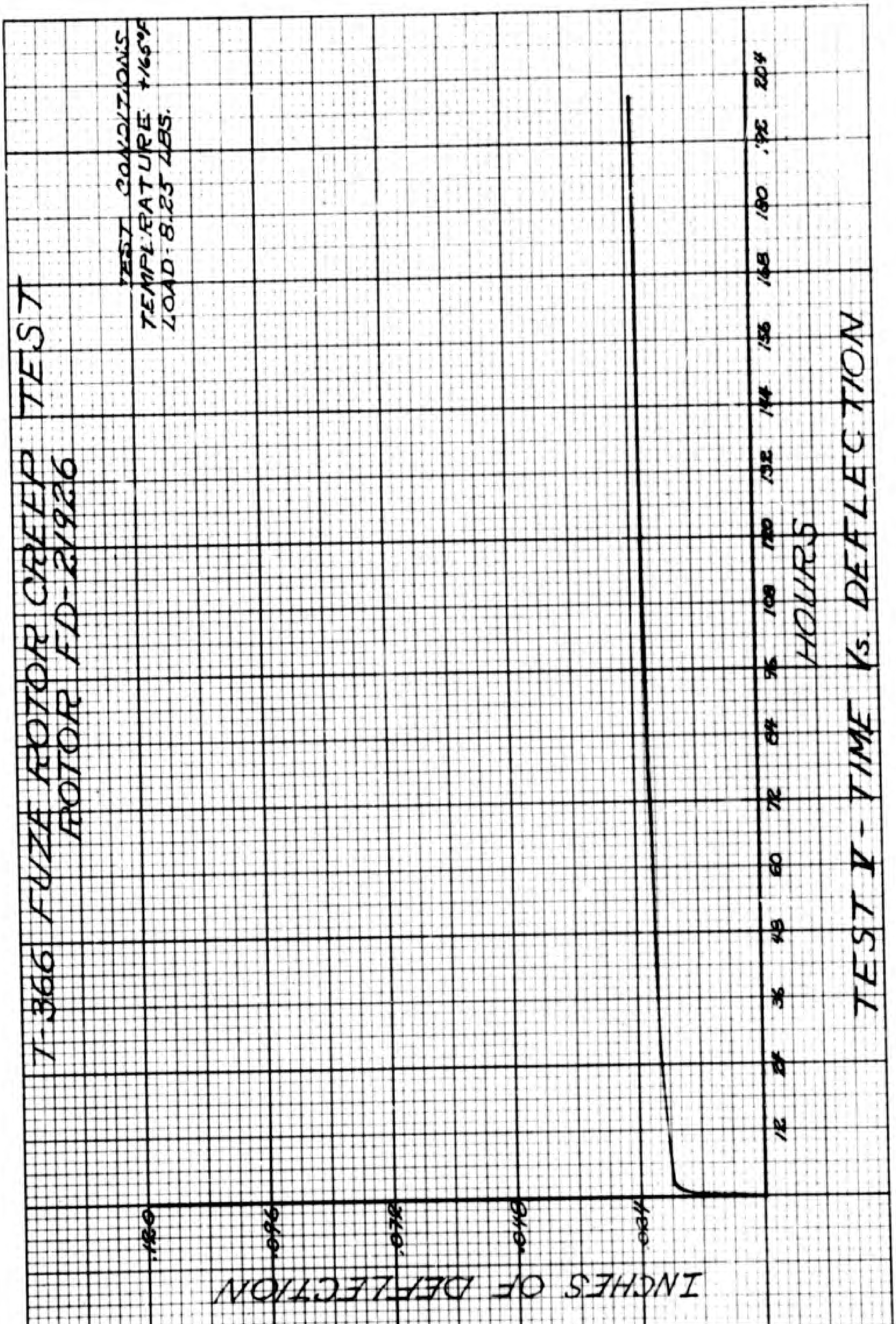

T-366 FUZE ROTOR CREEP TEST
ROTOR FD 21927
TEST CONDITIONS
TEMPERATURE +165°F
LOAD - 8.25 LBS
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST II - TIME Vs DEFLECTION
.060 .048 .036 .024 .012
INCHES OF DEFLECTION

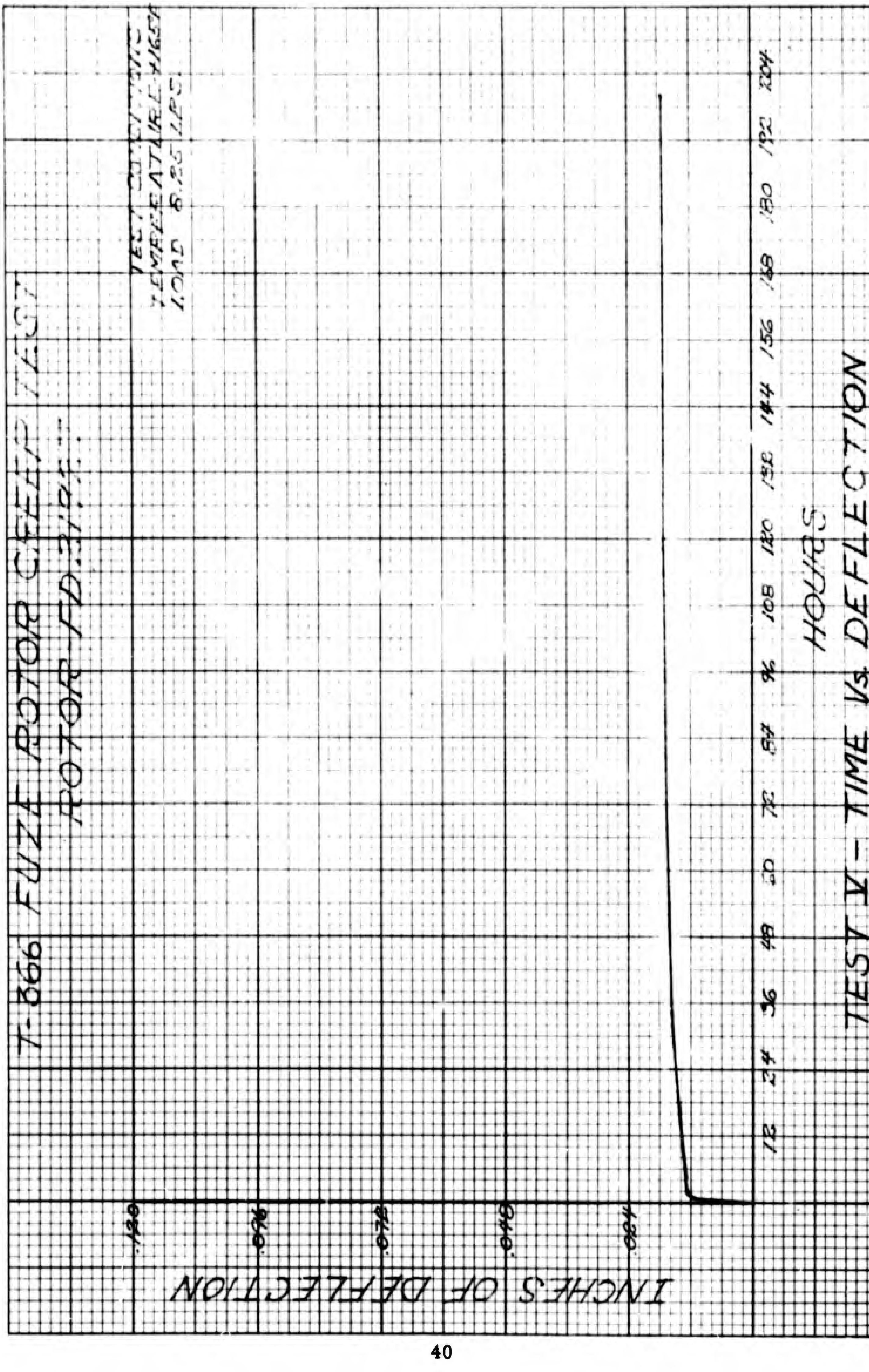

T-300 FUZE ROTOR CREEP TEST
ROTOR FD-21881
TEST CONDITIONS
TEMPERATURE -60°F
LOAD 8.25 LBS.
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST III - TIME Vs DEFLECTION
.002 .004 .006 .008 .010
INCHES OF DEFLECTION

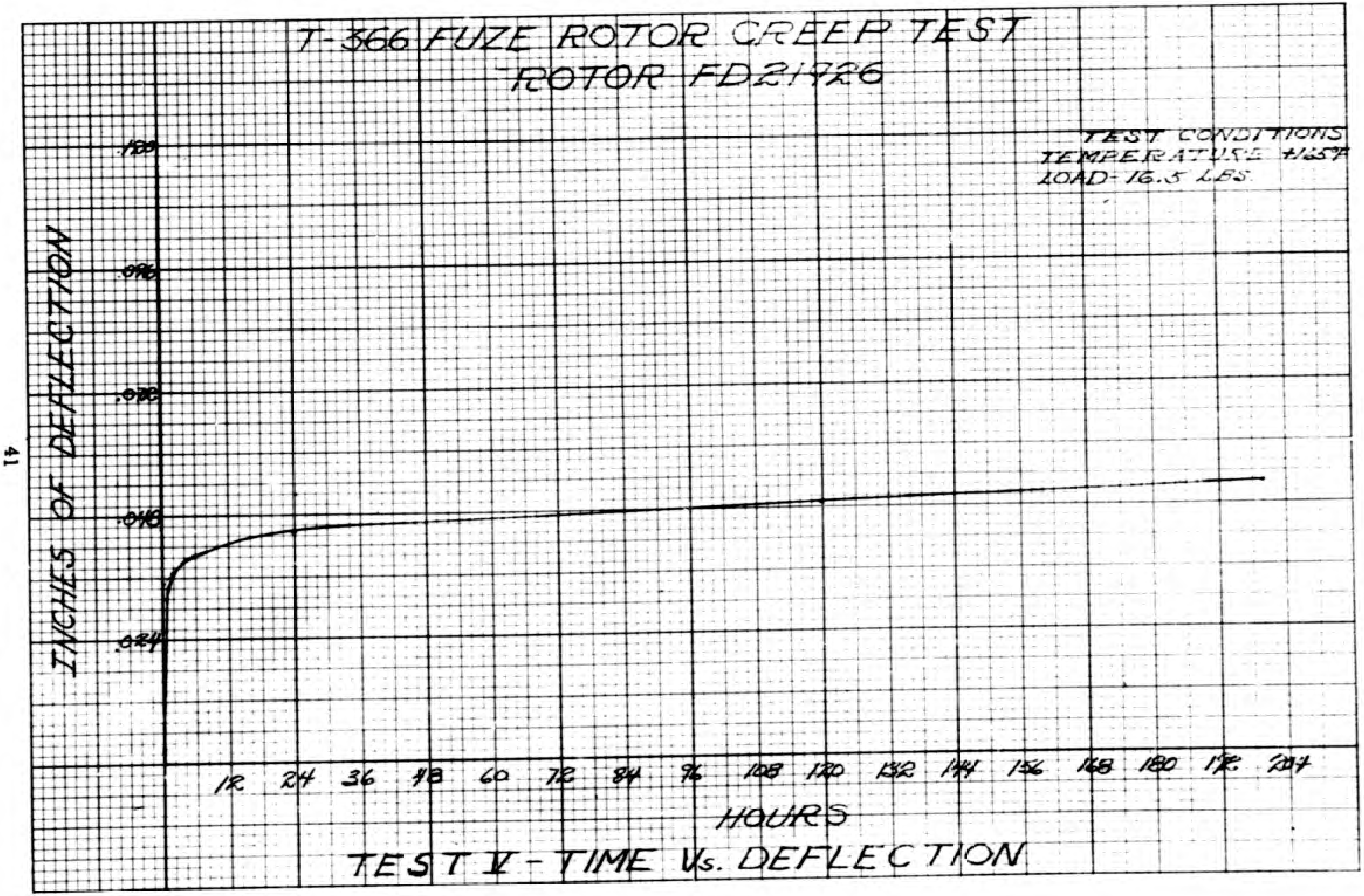

T-366 FUZE ROTOR CREEP TEST
ROTOR FD-21882
TEST CONDITIONS
TEMPERATURE -60°F
LOAD- 8.25 LBS.
INCHES OF DEFLECTION
.010
.008
.006
.004
.002
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST III - TIME Vs DEFLECTION

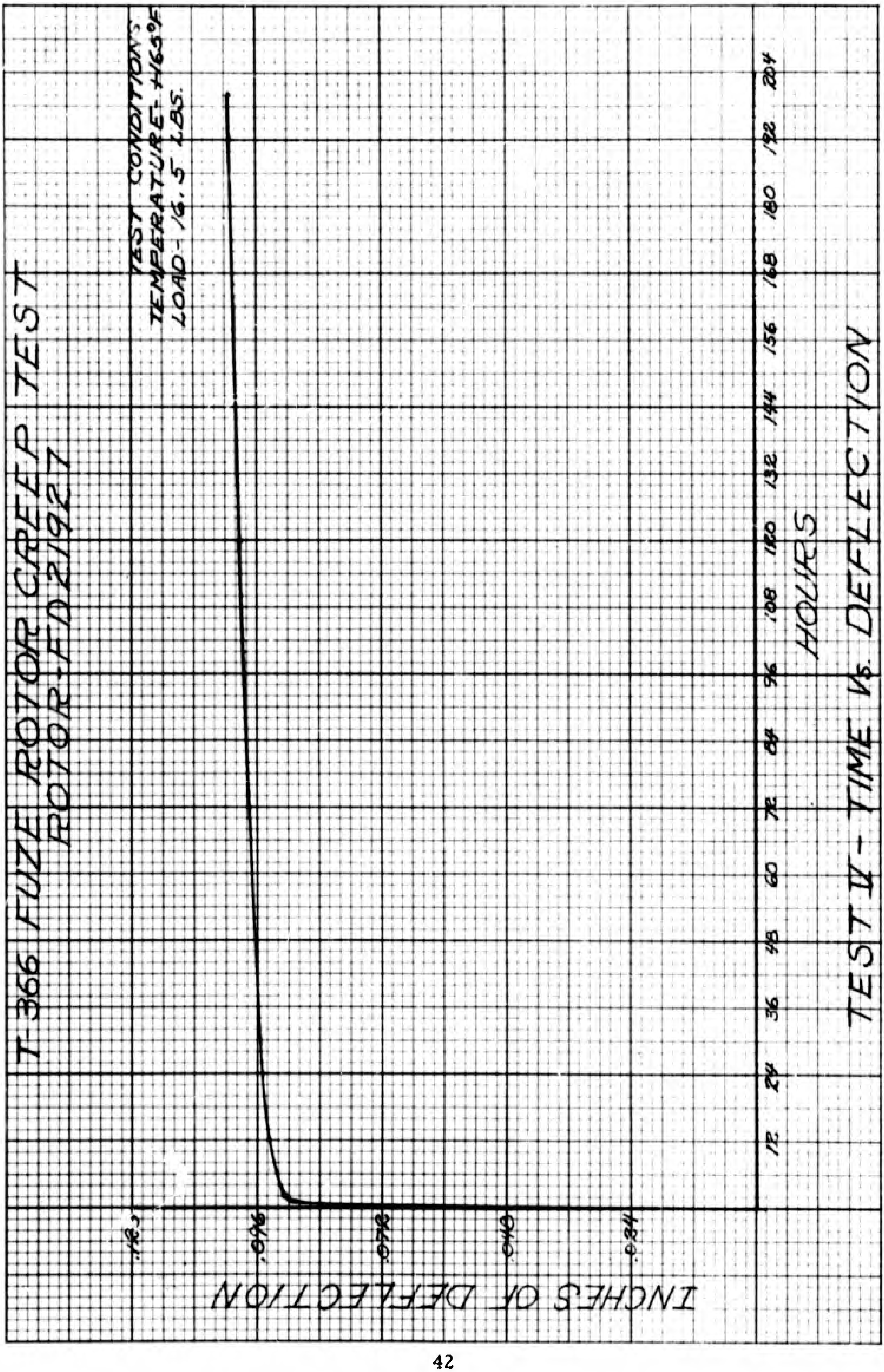

T-366 FUZE ROTOR CREEP TEST
TEST CONDITIONS
TEMPERATURE -60°F
LOAD 5.25 LBS
INCHES OF DEFLECTION
.010
.008
.006
.004
.002
12
24
36
48
60
72
84
96
108
120
132
156
168
180
190
204
HOURS
TEST III - TIME Vs. DEFLECTION

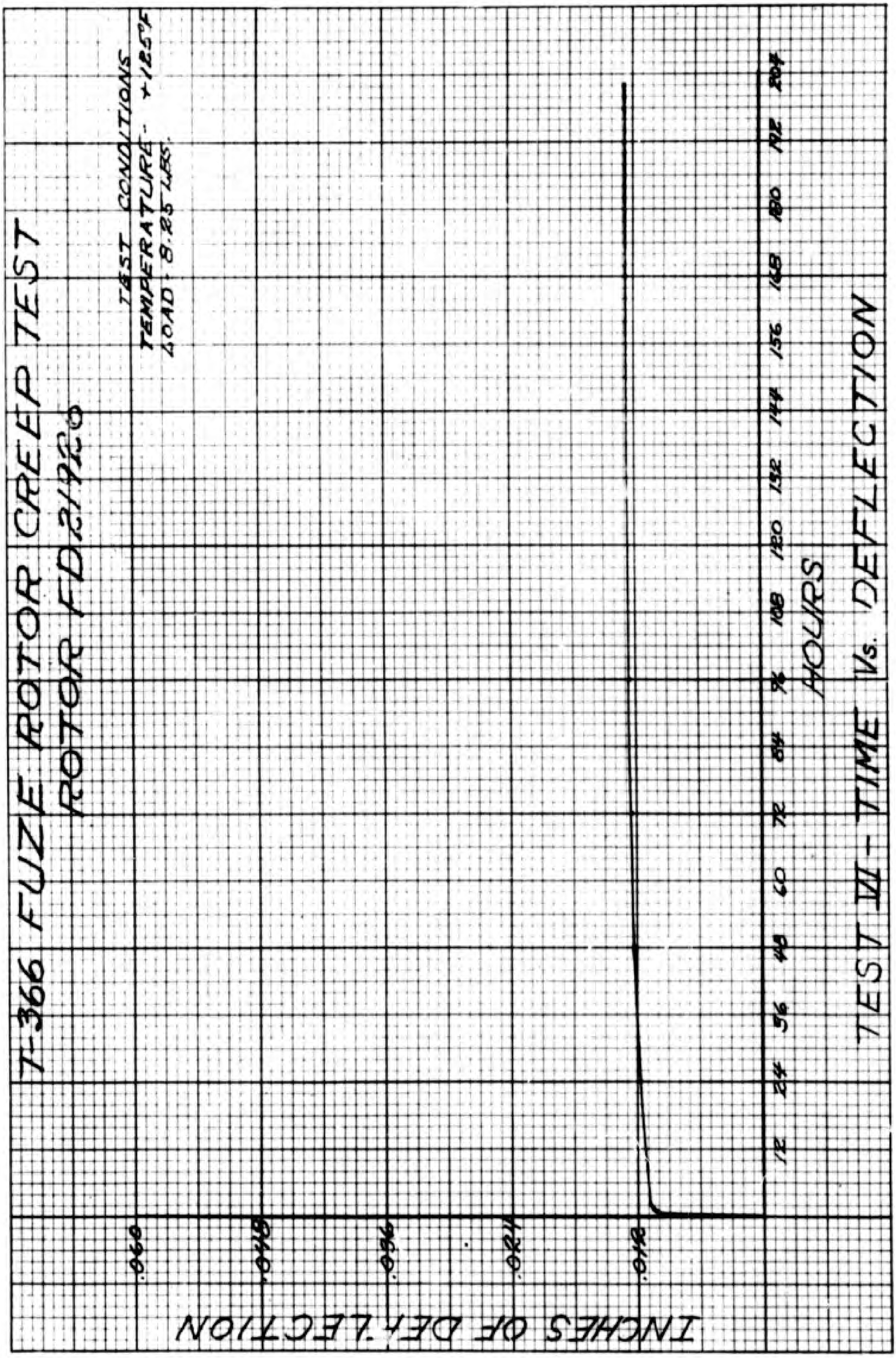

T-366 FUZE ROTOR CREEP TEST
ROTOR FD-21927
TEST CONDITIONS
TEMPERATURE- -60°F
LOAD - 8.25 LBS.
INCHES OF DEFLECTION
.010
.008
.006
.004
.002
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST III - TIME Vs. DEFLECTION

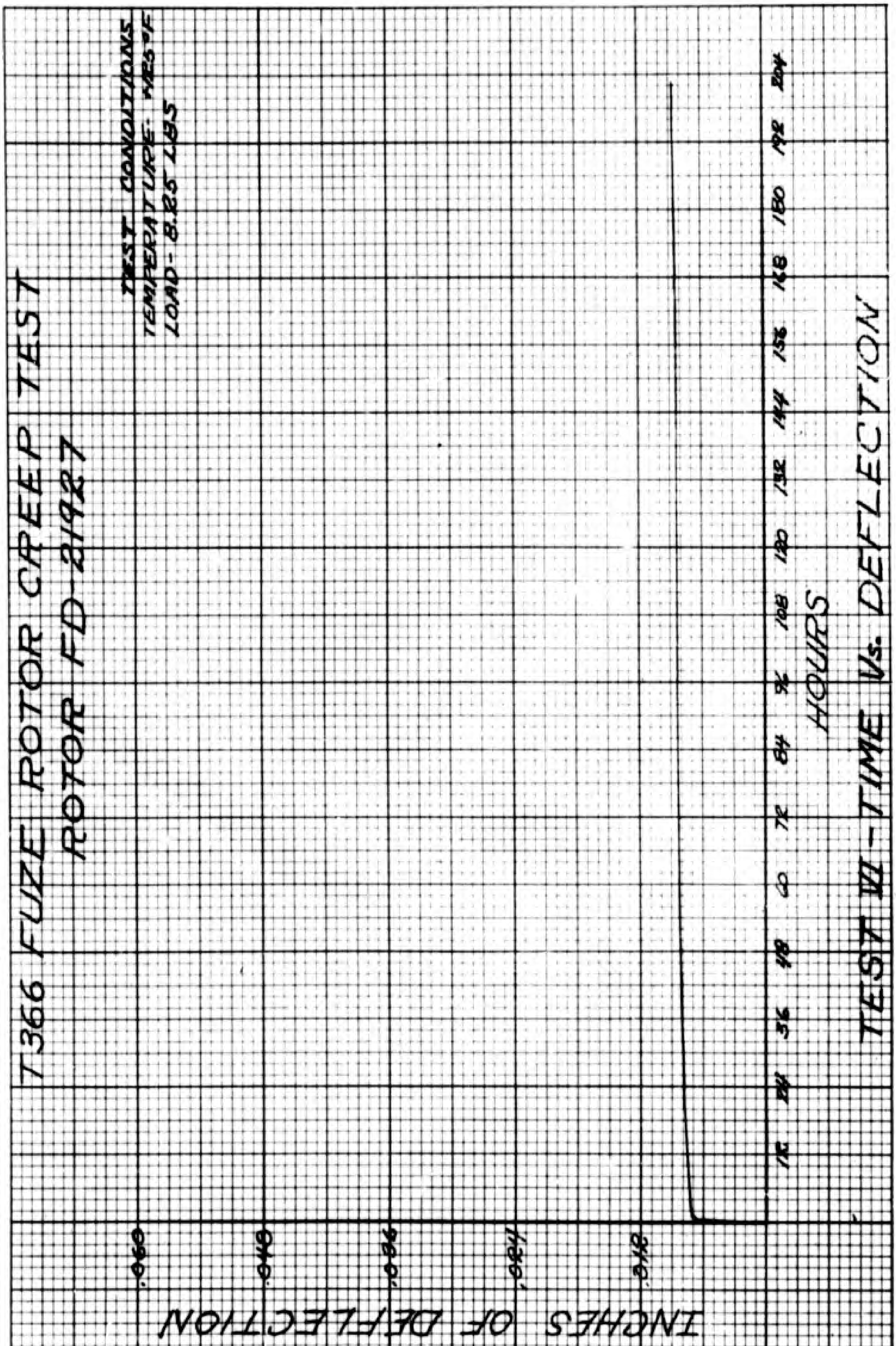

T-366 FUZE ROTOR CREEP TEST
ROTOR FD-21926
TEST CONDITIONS
TEMPERATURE +165°F
LOAD: 8.25 LBS.
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST II - TIME Vs. DEFLECTION
.120
.096
.072
.048
.024
INCHES OF DEFLECTION


T-366 FUZE ROTOR CREEP TEST
ROTOR FD.31
TEMPERATURE-165F
LOAD 8.25 LBS.
HOURS
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
INCHES OF DEFLECTION
TEST VI - TIME Vs. DEFLECTION

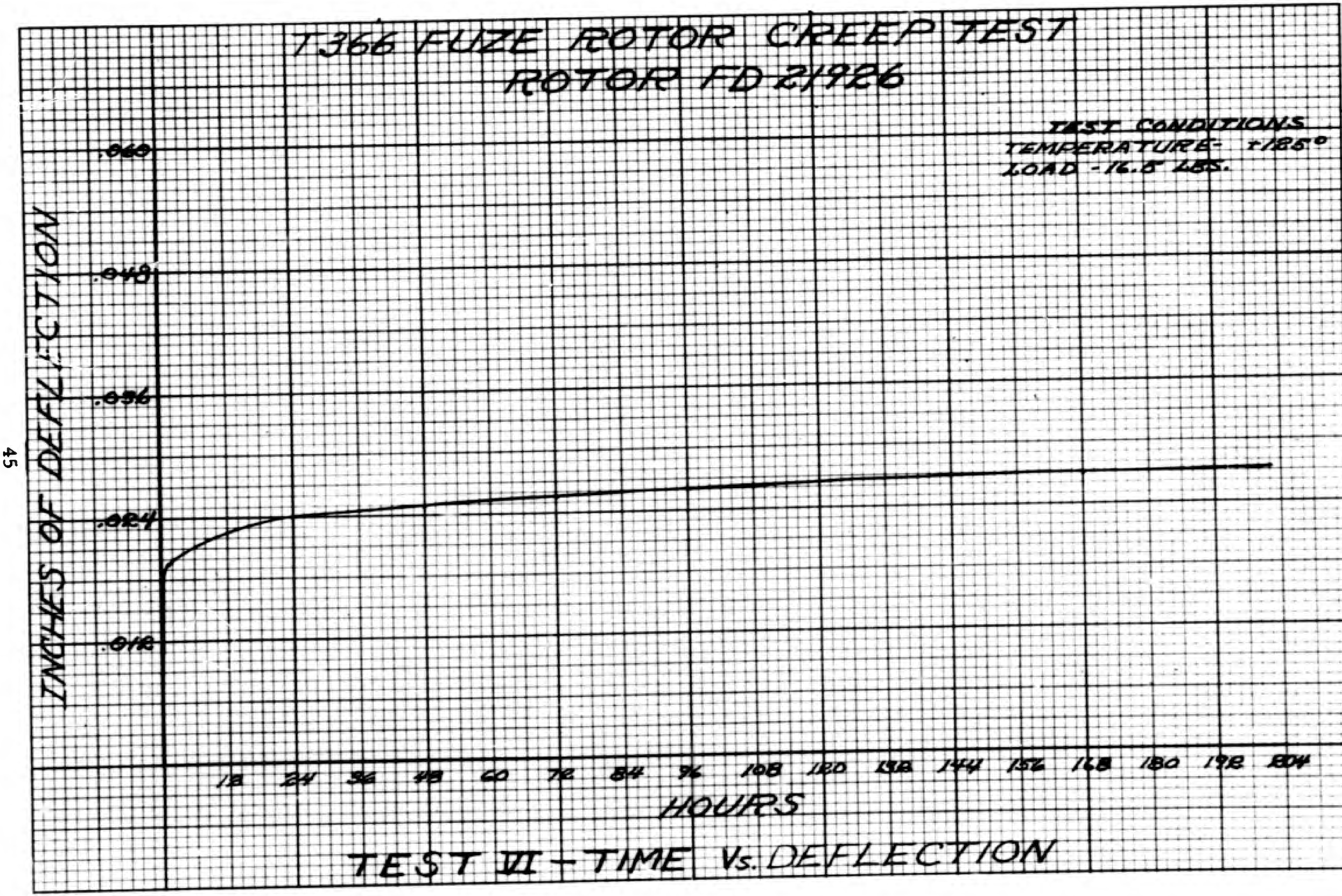

T-366 FUZE ROTOR CREEP TEST
ROTOR FD21926
TEST CONDITIONS
TEMPERATURE +125°F
LOAD-16.5 LBS.
INCHES OF DEFLECTION
.120
.096
.072
.048
.024
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST V - TIME Vs. DEFLECTION

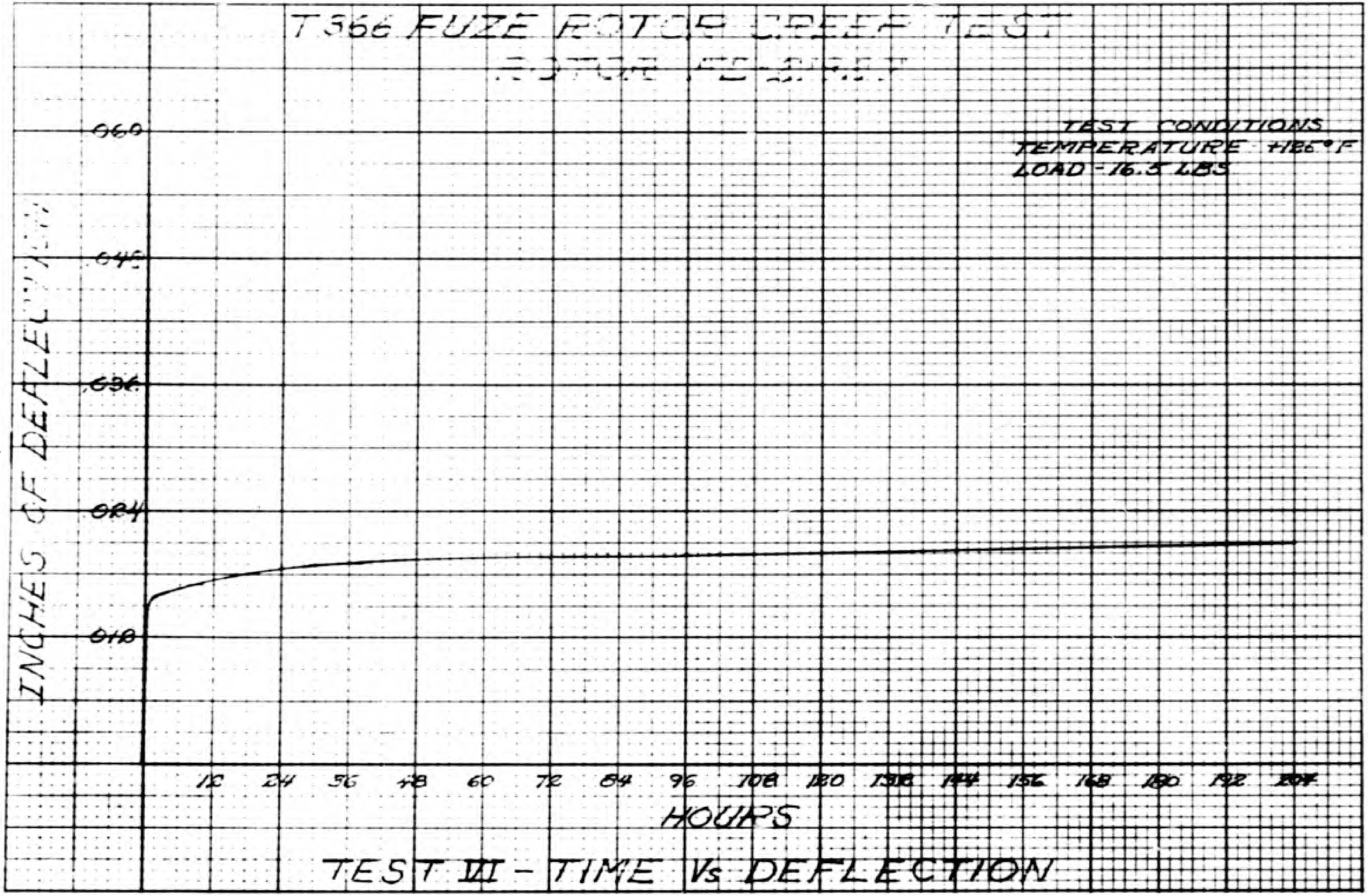

T-366 FUZE ROTOR CREEP TEST
ROTOR-FD21927
TEST CONDITIONS:
TEMPERATURE-+165°F
LOAD-16.5 LBS.
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST II - TIME Vs. DEFLECTION
INCHES OF DEFLECTION


T-366 FUZE ROTOR CREEP TEST
ROTOR FD21920
TEST CONDITIONS
TEMPERATURE - +125°F
LOAD - 8.25 LBS.
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST VII - TIME Vs. DEFLECTION
.012 .024 .036 .048 .060
INCHES OF DEFLECTION

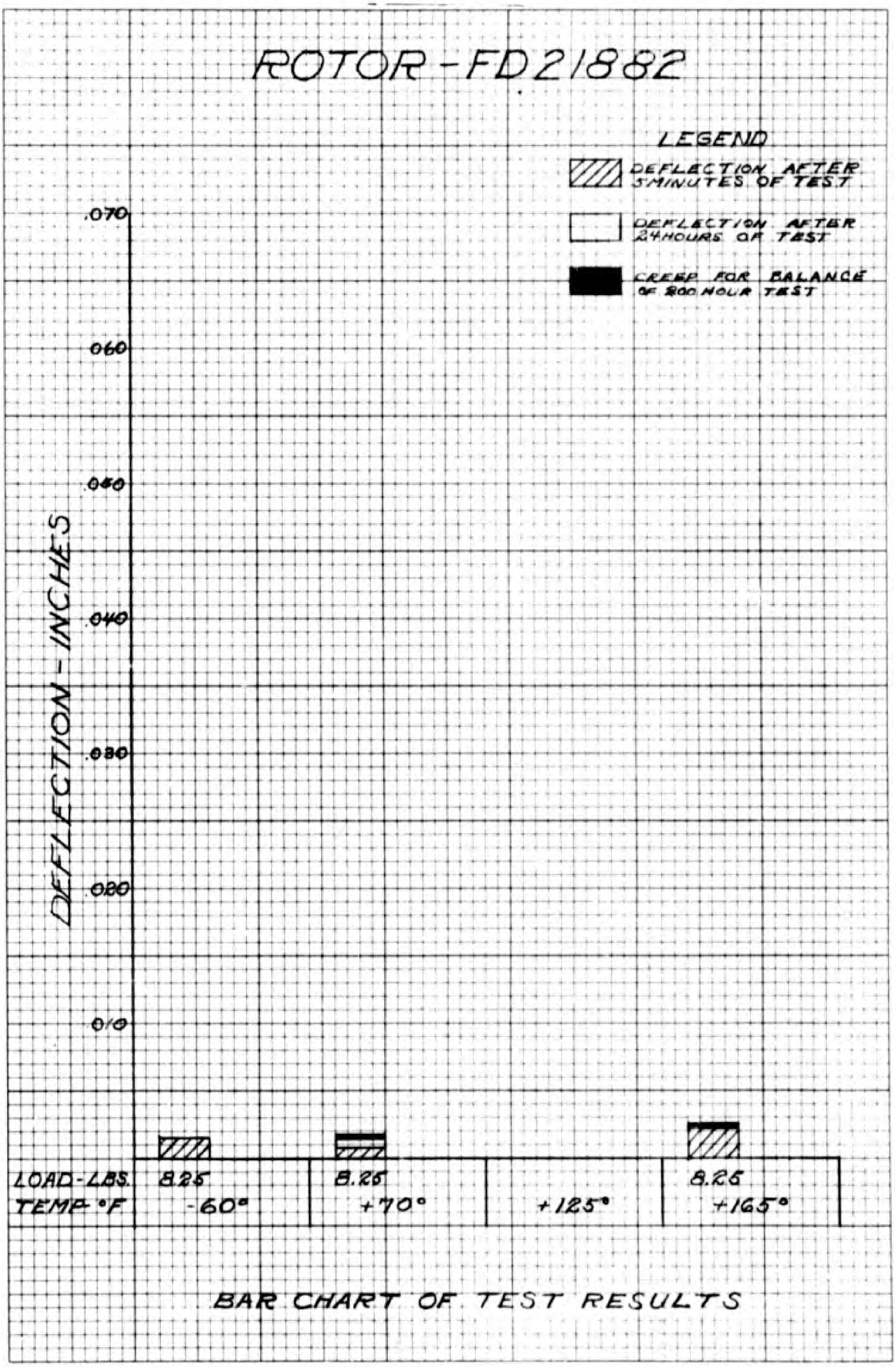


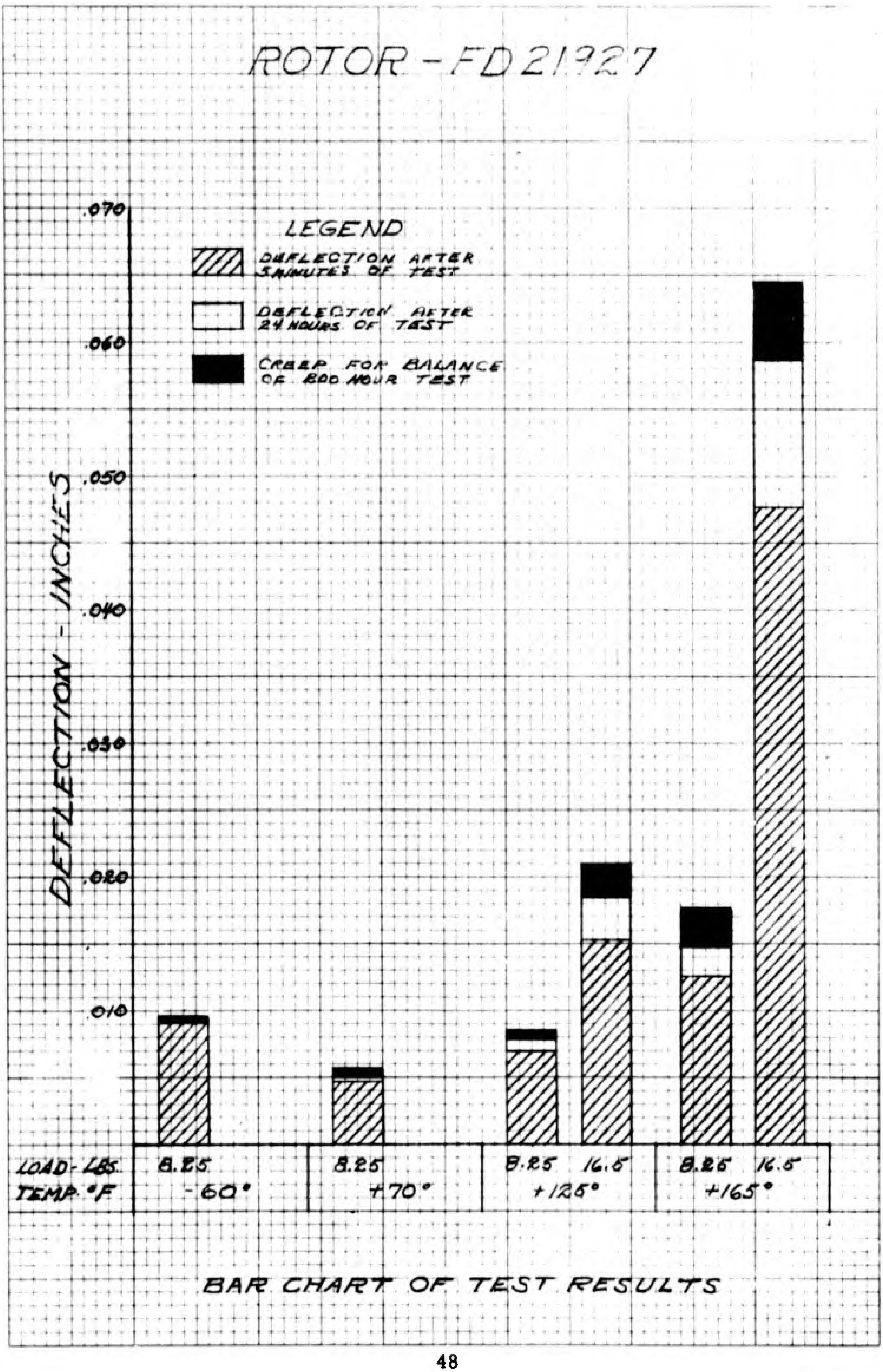
T366 FUZE ROTOR CREEP TEST
ROTOR FD-21927
TEST CONDITIONS
TEMPERATURE: +125°F
LOAD - 8.25 LBS
.060
.048
.036
.024
.012
INCHES OF DEFLECTION
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST VI - TIME Vs. DEFLECTION

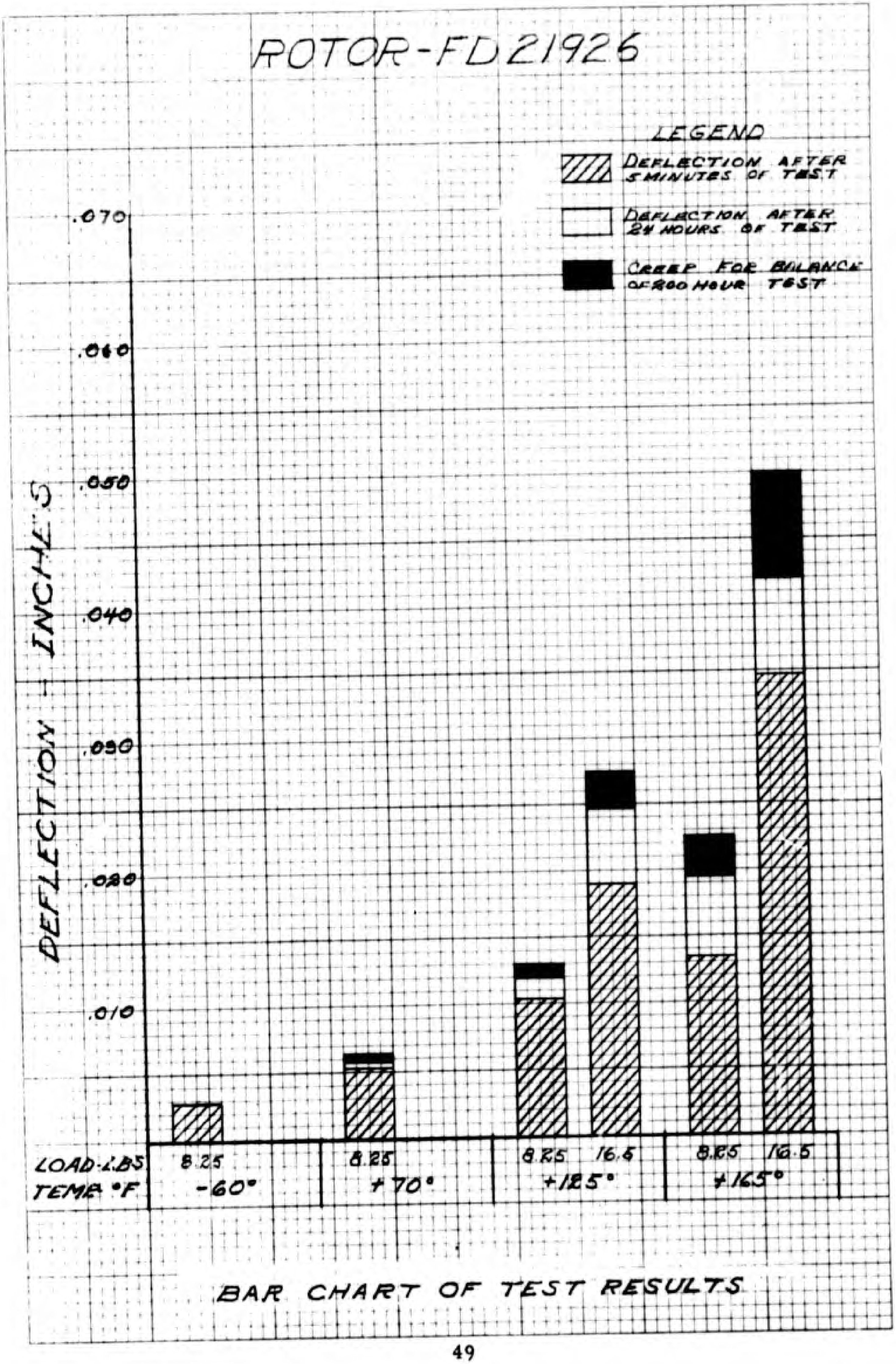

T366 FUZE ROTOR CREEP TEST
ROTOR FD 21926
TEST CONDITIONS
TEMPERATURE- +185°
LOAD -16.5 LBS.
INCHES OF DEFLECTION
.060
.048
.036
.024
.012
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
HOURS
TEST VI - TIME Vs. DEFLECTION

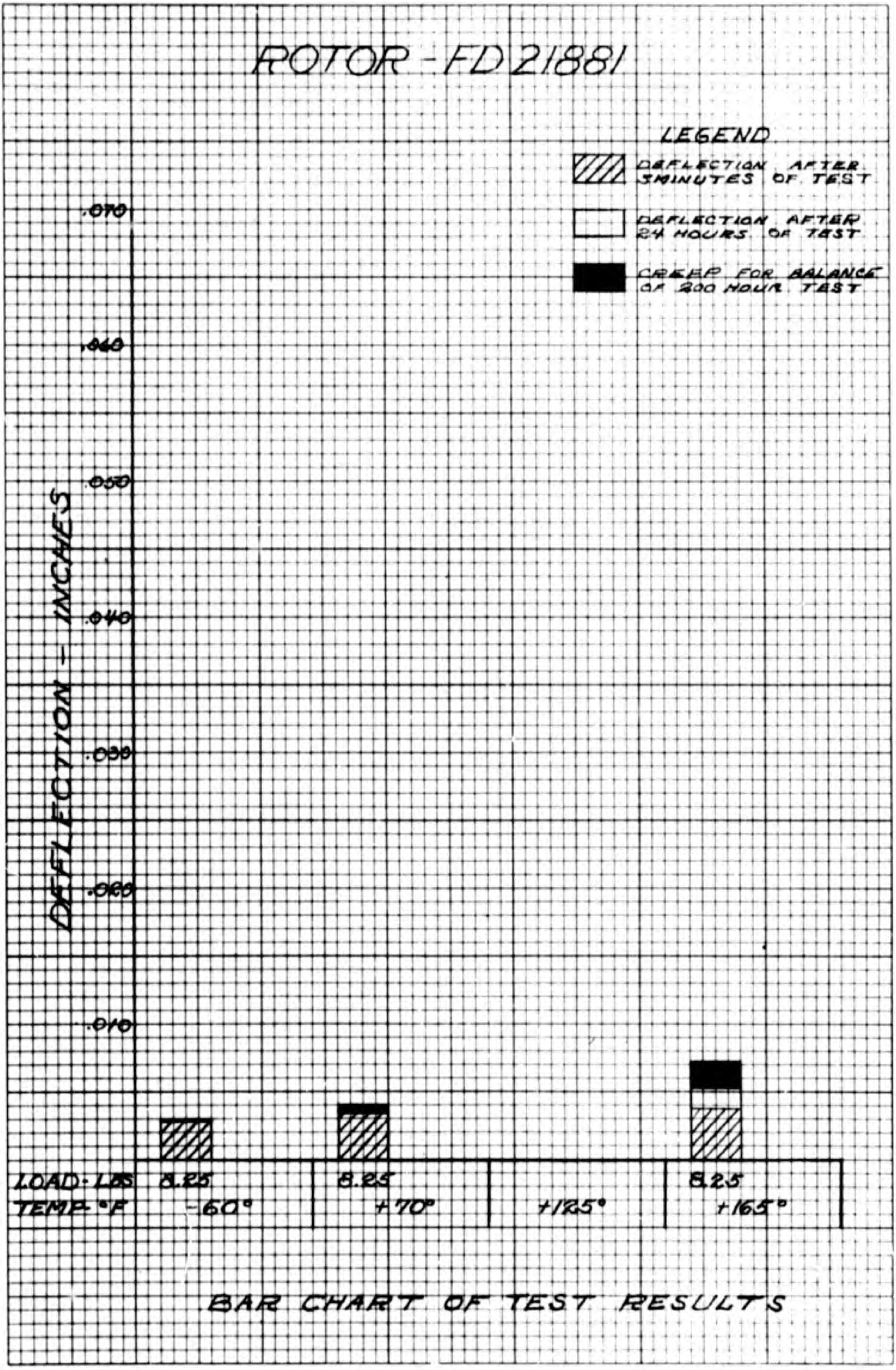

T366 FUZE ROTOR CREEP TEST
TEST CONDITIONS
TEMPERATURE +125°F
LOAD - 16.5 LBS
INCHES OF DEFLECTION
.060
.048
.036
.024
.012
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204
HOURS
TEST VI - TIME Vs DEFLECTION

APPENDIX D

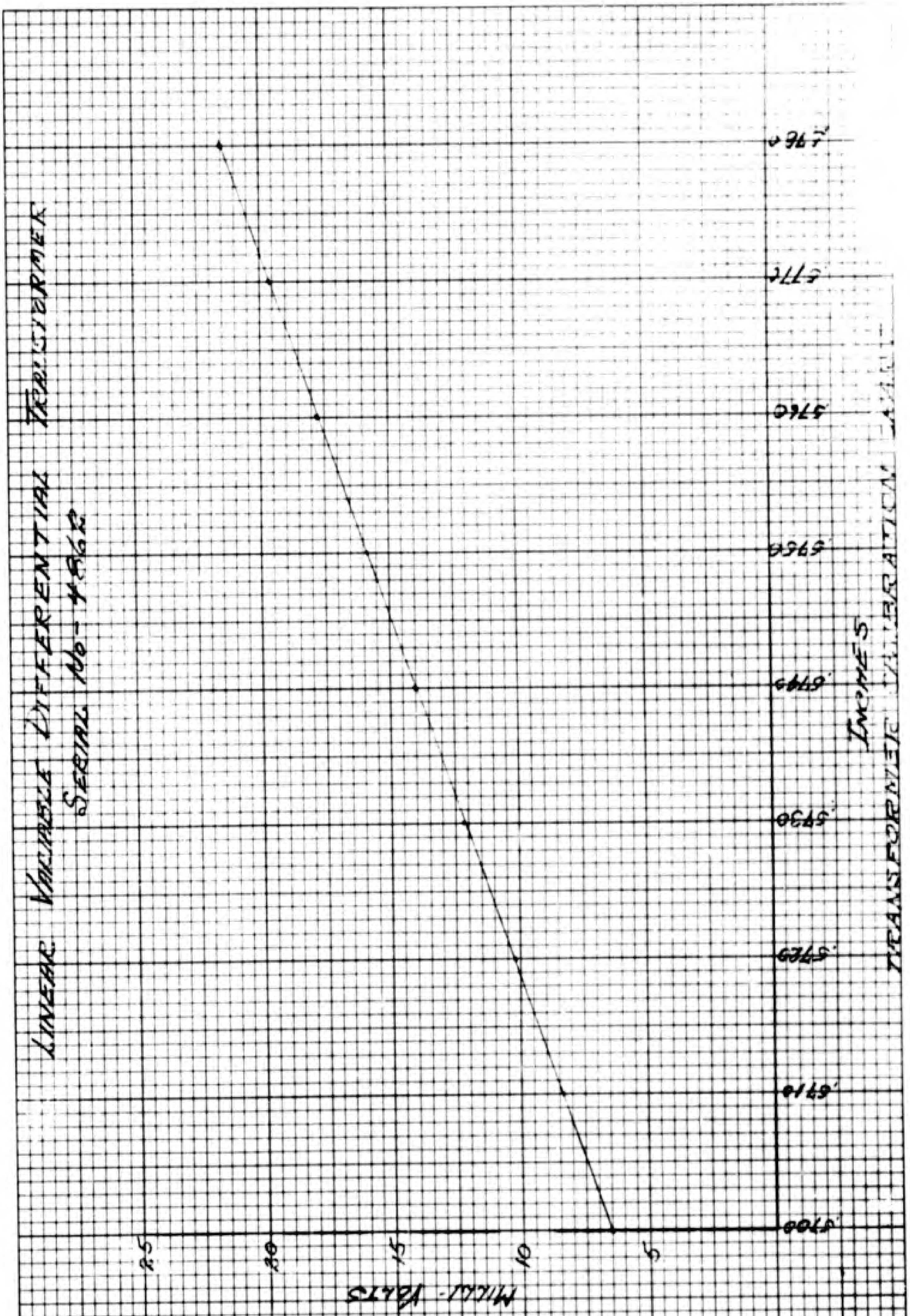

ROTOR - FD21882
LEGEND
DEFLECTION AFTER 5 MINUTES OF TEST
DEFLECTION AFTER 24 HOURS OF TEST
CREEP FOR BALANCE OF 200 HOUR TEST
.070
.060
.050
.040
.030
.020
.010
DEFLECTION - INCHES
LOAD-LBS.
TEMP °F
8.25
-60°
8.25
+70°
+125°
8.25
+165°
BAR CHART OF TEST RESULTS

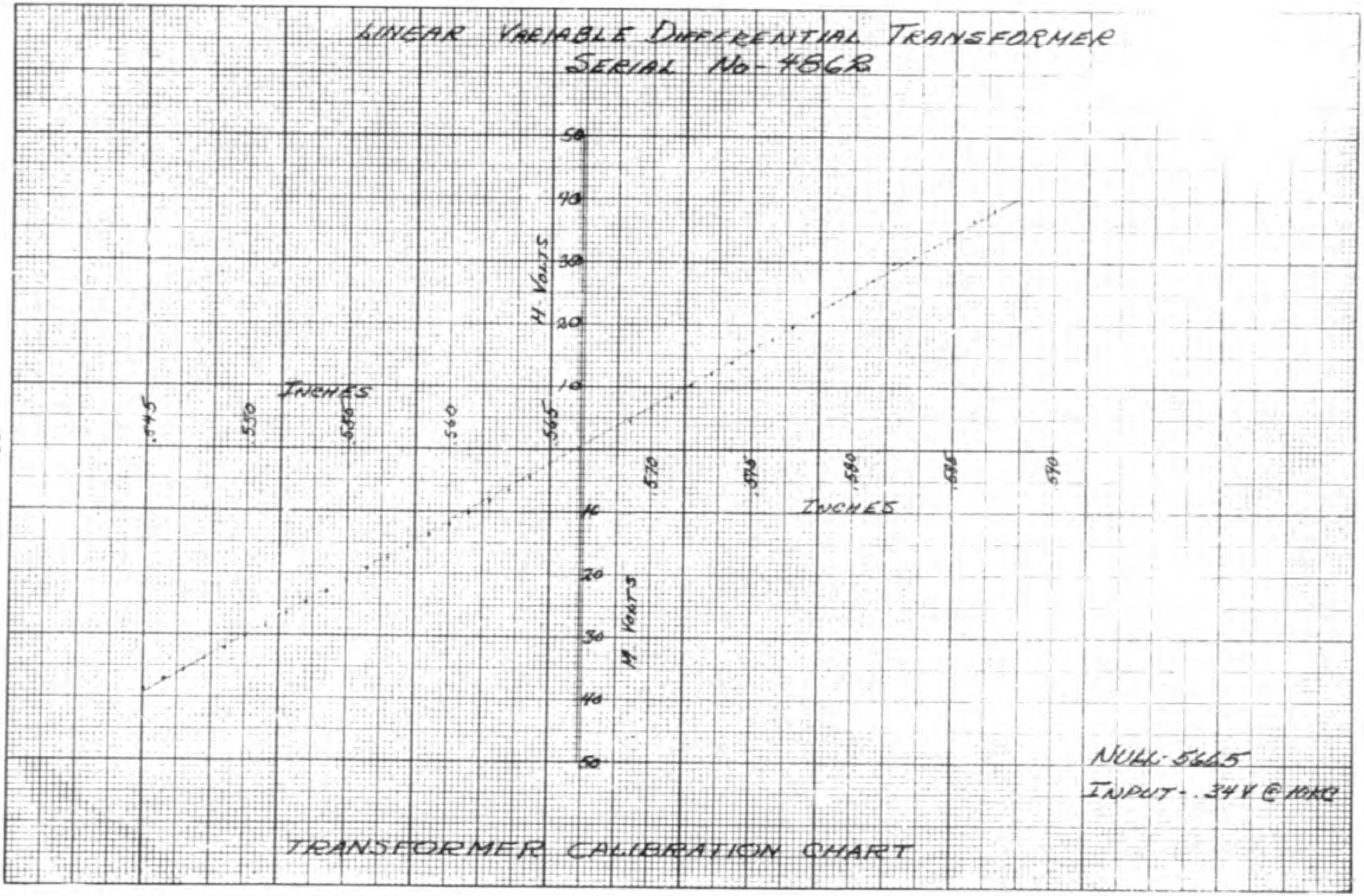

ROTOR - FD 21927
LEGEND
DEFLECTION AFTER 5 MINUTES OF TEST
DEFLECTION AFTER 24 HOURS OF TEST
CREEP FOR BALANCE OF 800 HOUR TEST
DEFLECTION - INCHES
.070
.060
.050
.040
.030
.020
.010
LOAD - LBS.
TEMP. °F
8.25
-60°
8.25
+70°
8.25 16.5
+125°
8.25 16.5
+165°
BAR CHART OF TEST RESULTS


ROTOR-FD21926
LEGEND
DEFLECTION AFTER 5 MINUTES OF TEST
DEFLECTION AFTER 24 HOURS OF TEST
CREEP FOR BALANCE OF 200 HOUR TEST
.070
.060
.050
.040
.030
.020
.010
DEFLECTION - INCHES
LOAD-LBS
TEMP °F
8.25
-60°
8.25
+70°
8.25
16.5
+125°
8.25
16.5
+165°
BAR CHART OF TEST RESULTS


ROTOR - FD 21881
LEGEND
DEFLECTION AFTER 5 MINUTES OF TEST
DEFLECTION AFTER 24 HOURS OF TEST
CREEP FOR BALANCE OF 200 HOUR TEST
DEFLECTION - INCHES
.070
.060
.050
.040
.030
.020
.010
LOAD-LBS
TEMP-°F
8.25
-60°
8.25
+70°
+125°
8.25
+165°
BAR CHART OF TEST RESULTS

APPENDIX E


LINEAR VARIABLE DIFFERENTIAL TRANSFORMER
SERIAL No- 4862
INCHES
MILLI-VOLTS
25
15
10
5


LINEAR VARIABLE DIFFERENTIAL TRANSFORMER
SERIAL No- 486R
H. VOLTS
INCHES
.545
.550
.555
.560
.565
.570
.575
.580
.585
.590
10
20
30
40
50
M. VOLTS
NULL-.5665
TRANSFORMER CALIBRATION CHART