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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mechanical Engineering
Cambridge 39, Massachusetts

[illegible] OF 347 STAINLESS STEEL AND ZIRCONIUM

47627
4267

DIC Project 66[illegible]
February 15, 1[illegible]

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I. Equipment

The equipment used in obtaining the above data normally consists of a one inch diameter specimen about one foot long. This specimen is heated at one end and the heat transferred along its axis is absorbed by a water calorimeter at the opposite end. Thermocouples are placed into the test material at measured intervals. A guard tube maintained at temperature equal to that of the specimen insures parallel heat flow in the specimen. For further details see "Heat Insulation," by G. B. Wilkes, p. 57-58, Fig. 3-9, Wiley, 1950.

II. Procedure

A period of several hours was allowed to establish equilibrium before any readings were made. Test runs were made of about ten minute duration about one hour apart. During the entire time of operation the temperature difference between the calorimeter and guard water outlets was maintained at 0°C ± 0.2°C. This degree of precision in control is necessary to insure proper measurement of temperature rise in the calorimeter. During the test runs water rates were measured, being approximately 50 cc/min. ± 1.0 for the stainless steel sample and 25 cc/min. ± 1.0 for the zirconium. This decrease in precision is due to the decrease in cross sectional area which had to be accepted since the zirconium specimen was not available in any larger size.

The temperature gradient along the axis of the specimen was

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measured by three calibrated thermocouples at three inch intervals. The electromotive force of these couples was observed with a Leeds and Northrup portable precision potentiometer. These temperatures are precise to ± 5 per cent. Calorimeter rise was measured in similar fashion.

This arrangement of thermocouples enabled the determination of three gradients and three mean temperatures, thus three values of K for each run.

The following is a complete report of the work done in the Heat Measurements Laboratory on metal samples consisting of 347 stainless and zirconium.

I. Stainless Steel - No. 347

Obtained from: Carpenter Steel Company, Reading, Pa.

Analysis		
	Ni.	11.12%
	Cr.	18.00
	C.	0.07
	Mn.	1.77
	P.	0.016
	S.	0.007
	Nb.	0.88

Thermal Conductivity

	K.	t_{mean} (°F)	t_{hot} (°F)	t_{cold} (°F)
Run#1	10.2	385	518	253
	9.67	528	802	253
	9.25	660	802	518
Run#2	10.6	434	585	284
	10.3	594	905	284
	10.0	745	905	585
Run#3	10.8	406	547	264
	10.5	557	849	264
	10.2	698	849	547
Check	9.75	477	644	309
	9.57	651	993	309
	9.25	818	993	644

II. Zirconium* - "Crystal Bar," Lot No. D-151

Obtained from: Argonne National Laboratory, Box 5207, Chicago 80, Ill.

Analysis: - assumed to be pure Zr.

Thermal Conductivity:

	K.	t_{mean} (°F)	t_{hot} (°F)	t_{cold} (°F)
Run#1	14.8	263	360	165
	14.0	371	577	165
	13.4	468	577	360
Run#2	15.0	264	360	168
	14.3	372	579	165
	13.7	470	579	362
Run#3	12.7	369	517	222
	12.0	524	845	222
	11.4	681	845	517
Run#4	13.9	373	521	226
	13.2	540	851	228
	12.4	690	854	526

*The zirconium bar furnished for this work was much smaller in diameter (0.626 inches) than is usually employed in our equipment (1.00) inches. This leads to inaccuracies in the results due to very small total heat flow which was available to measure.

L. R. Vianey

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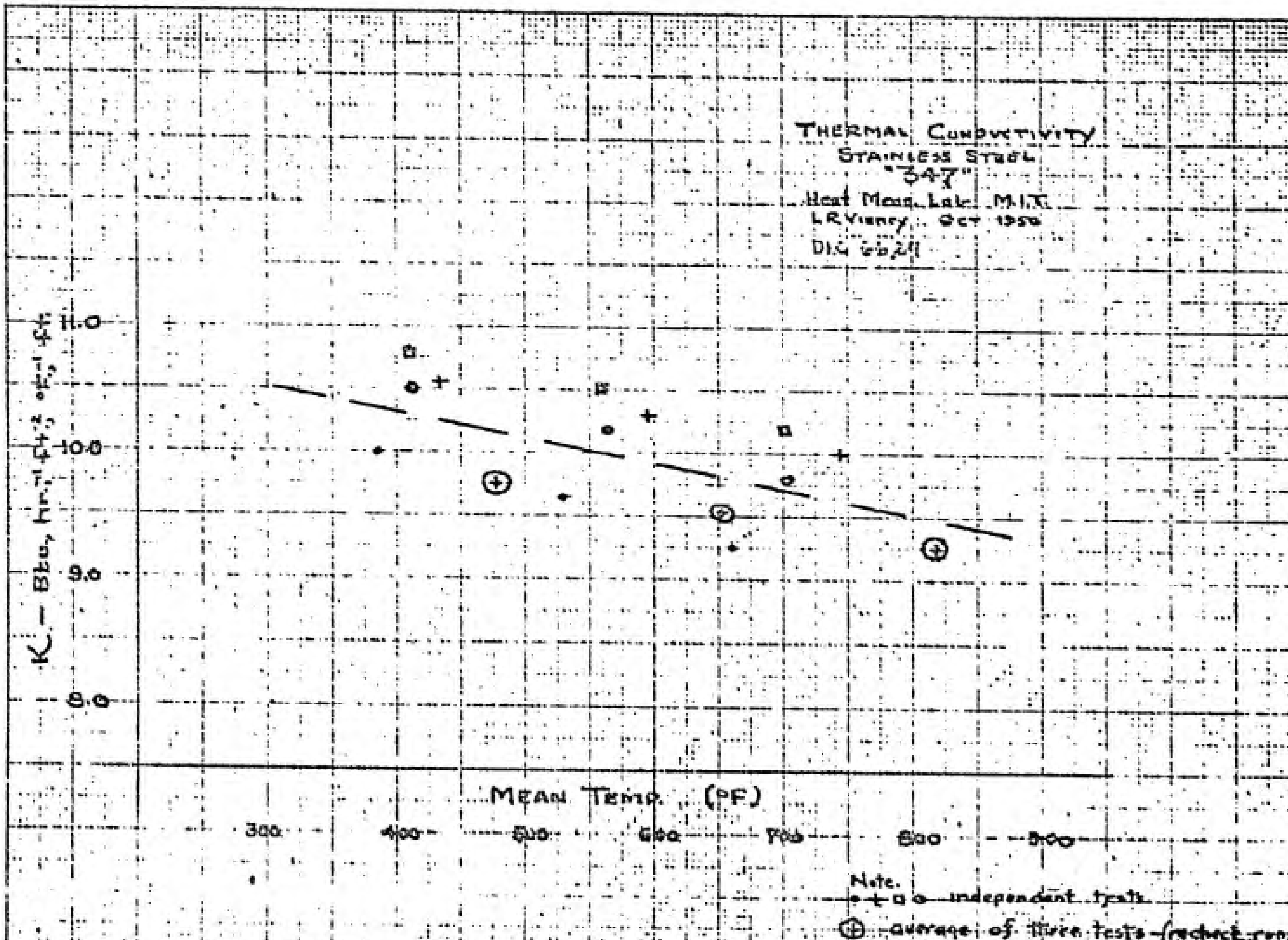
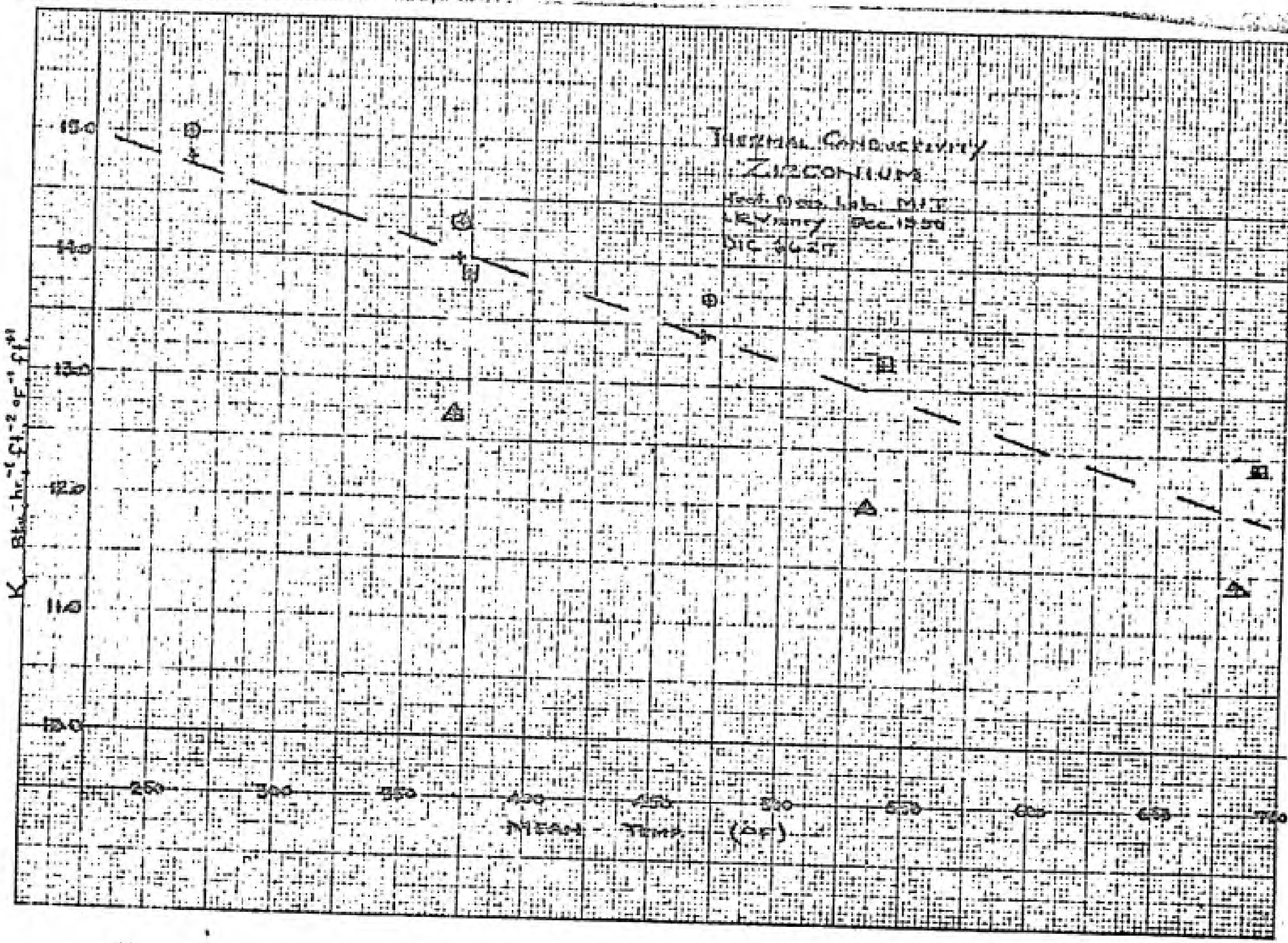

THERMAL CONDUCTIVITY
STAINLESS STEEL
"347"
Heat Meas. Lab. M.I.T.
L.R.Vienry Oct 1950
D.L.G. 66,21
K — Btu, hr.$^{-1}$ ft.$^{-2}$, °F.$^{-1}$ ft.
11.0
10.0
9.0
8.0
MEAN TEMP. (°F)
300
400
500
600
700
800
900
Note.
• + □ o independent tests
⊕ average of three tests (recheck runs)


THERMAL CONDUCTIVITY
ZIRCONIUM
Heat Trans. Lab. M.I.T.
L.E. Vianey Dec. 1950
DIC 6427
K Btu hr.⁻¹ ft.⁻² °F⁻¹ ft.
15.0
14.0
13.0
12.0
11.0
10.0
250
300
350
400
450
500
550
600
650
700
MEAN TEMP. (°F)