ELECTRICAL RESISTIVITY of ALUMINUM, Al

(Atomic Number 13)

Sources of Data:

Landolt-Börnstein Zahlenwerte und Funktionen aus Physik, Chemie, Astronomie, Geophysik und Technik, sechste Auflage, II Band, 6 Teil, Springer-Verlag, Berlin (1959) pp. 1-46

International Critical Tables of Numerical Data, Physics, Chemistry, and Technology, VI, 1st Edition, Published for the National Research Council by the McGraw-Hill Book Co. Inc. (1929) pp. 124-135

Other References:

Albert, P., Bull. inst. intern. froid, Annexe 1956-2, 41-49 (1956)

Alley, P. and Serin, B.; Phys. Rev. 116, No. 2, 334-338 (1959)

Boorse, H. A. and Niewodniczanski, H., Proc. Roy. Soc. (Loncon) A153, 463-475 (1936)

Caron, M., Bull. inst. intern froid, Annexe 1956-2, 51-62 (1956)

Caron, M., Compt. rend. 236, 1169 (1953)

Caron, M., Albert, P. and Chaudron, G., Compt. rend. 236, 686-688 (1954)

Chaudron, G., Nature 174, 923 (1954)

Grüneisen, E. and Goens, E.; Z. Physik. 44, 615 (1927)

Holborn, L.; Z. Instrumentenk. 22, 114 (1902)

Holborn, L.; Ann. Physik. 59, 145 (1919)

Justi, F. and Scheffers, H.; Physik. Z. 39, 105 (1938)

Meissner, W. and Voigt, B.; Ann. Physik. (5) 7, 761, 892 (1930)

Thomas, J. G. and Mendoza, E.; Phil. Mag. (7) 43, 900 (1952)

Comments:

Reference should be made to the preface at the beginning of the Electrical Resistivity section for an explanation of the graph. The value of electrical resistivity at 273°K (ρ_{273}) for aluminum to be used in calculating values of electrical resistivity (ρ_T) is listed below the authors' names labeling each individual curve on the graph. These curves should not be extrapolated to lower temperatures since aluminum becomes superconducting at 1.175°K.

The data for this graph were taken from the references cited above under "Sources of Data". The values listed in the Landolt-Börnstein tables are those reported by Grüneisen and Goens; Holborn (1919); Justi and Scheffers; Meissner and Voigt; and Thomas and Mendoza, while those values listed by the International Critical Tables are from Holborn (1902 and 1919). These primary sources are listed above under "Other References". The original authors are used in labeling the several curves on the graph.

Comments: (cont.)

The data reported in the Landolt-Börnstein tables, the International Critical Tables and tabulated here are listed as ratios of electrical resistivity with respect to the resistivity at a datum temperature of 273°K. The value of ρ_{273} to be used with the Holborn data in calculating values of electrical resistivity is $\rho_{273} = 2.53 \times 10^{-6}$ ohm-cm. The actual values of ρ_{273} are not available for the samples used by the other investigators so a datum value reported by Grüneisen and Goens ($\rho_{273} = 2.50 \times 10^{-6}$ ohm-cm) is suggested for calculating values of electrical resistivity from the remaining ratios.

The samples used by Holborn are reported in Landolt-Börnstein as polycrystalline with 0.4% impurities of unknown composition. The Holborn sample was annealed at 250°C. Grüneisen and Goens are reported to have used a polycrystalline sample with a small amount of impurities present. The sample used by Meissner and Voigt is reported as an annealed polycrystalline sample with undetermined impurities.

A single crystal with a small amount of impurities present is reported as the sample used by Justi and Scheffers. The sample used by Thomas and Mendoza was an annealed polycrystalline sample with 0.005% impurities of unknown composition. No other pertinent information was presented about any of the samples from any of the sources of data.

Tables of Values of Electrical Resistivity

ρ = Resistivity, (ohm-cm)

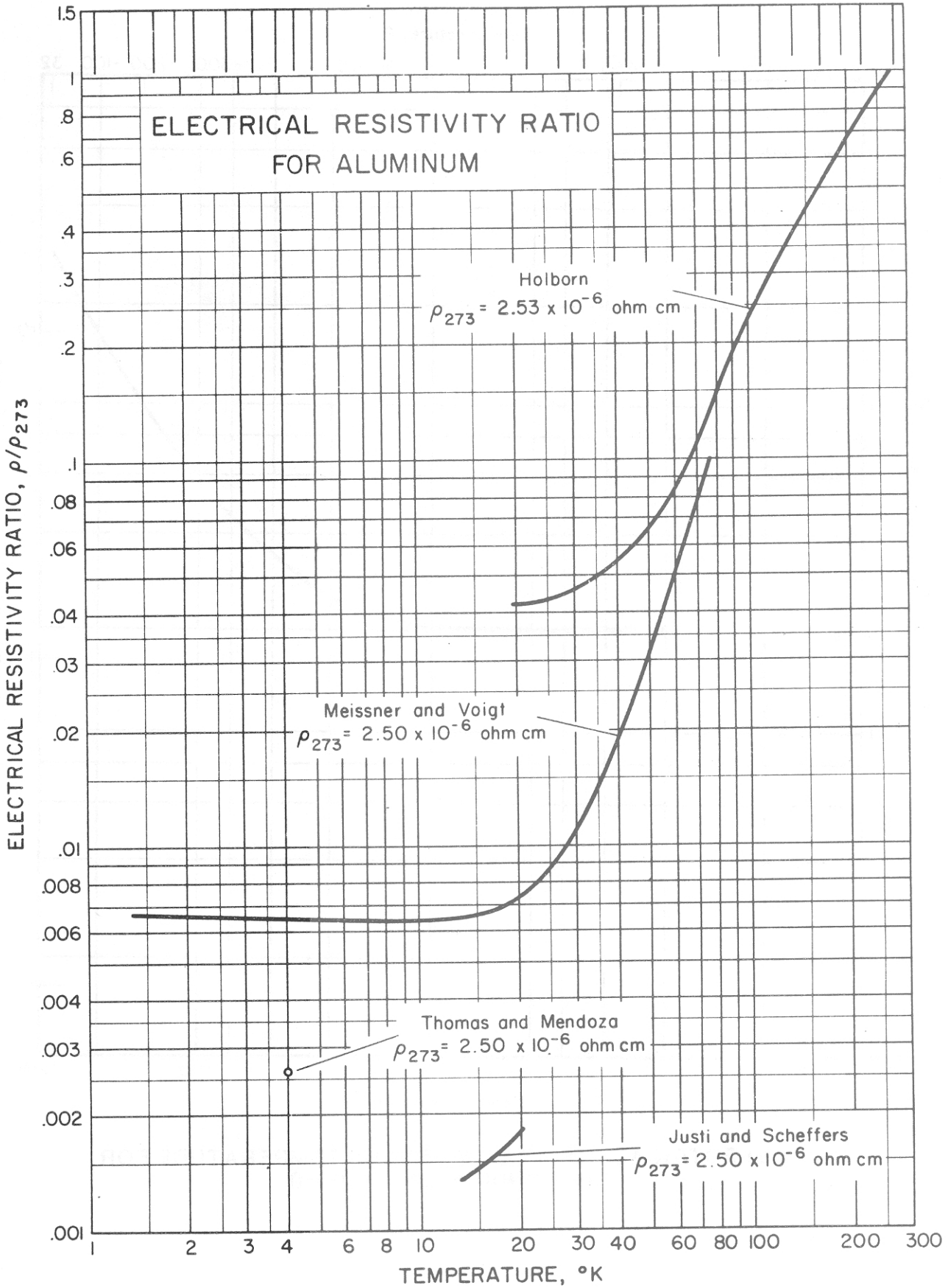
ρ_{273} = Resistivity at 273°K, (ohm-cm)

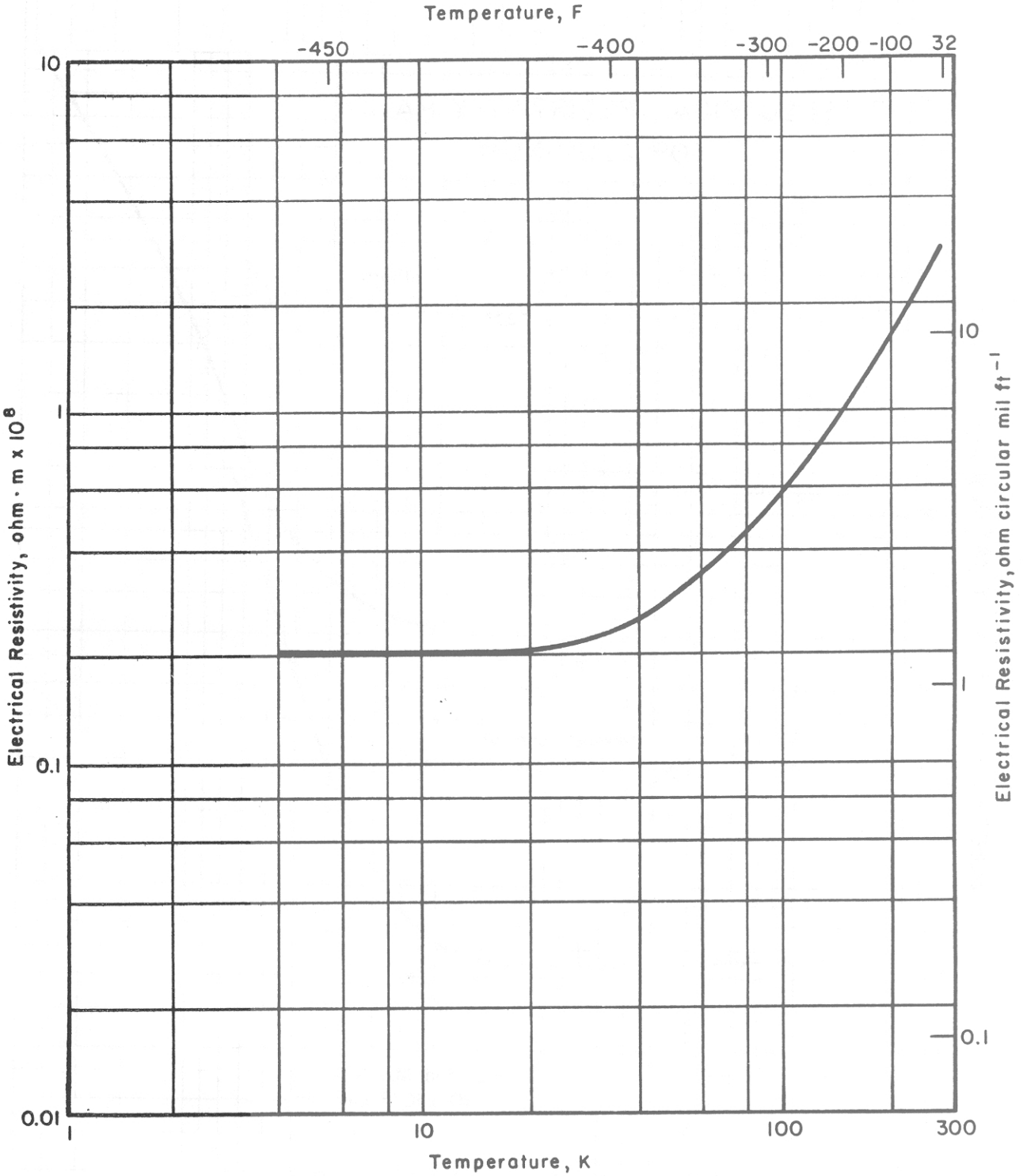
Holborn					
Temp. °C	$100\rho/\rho_{273}$	Temp. °C	$100\rho/\rho_{273}$	Temp. °C	$100\rho/\rho_{273}$
- 78.3*	64.80*	-140	37.7	-200	12.0
- 80	64.1	-160	28.9	-220	7.1
-100	55.2	-180	20.2	-240	4.9
-120	46.4	-191.9*	14.85*	-253*	4.27*
		-192.9*	14.49*		

* Observed values. All other values have been interpolated.

Justi and Scheffers		Meissner and Voigt		Thomas and Mendoza	
Temp. °K	ρ/ρ_{273}	Temp.* °K	ρ/ρ_{273}	Temp. °K	ρ/ρ_{273}
14	0.0014	1.35	0.0067	4	0.0026
20	0.0018	4.21	0.0065		
		20.44	0.0075		
		77.7	0.1008		

* The second decimal place of the temperature values is somewhat in doubt.


ELECTRICAL RESISTIVITY RATIO
FOR ALUMINUM
Holborn
ρ_{273} = 2.53 x 10^{-6} ohm cm
Meissner and Voigt
ρ_{273} = 2.50 x 10^{-6} ohm cm
Thomas and Mendoza
ρ_{273} = 2.50 x 10^{-6} ohm cm
Justi and Scheffers
ρ_{273} = 2.50 x 10^{-6} ohm cm
ELECTRICAL RESISTIVITY RATIO, ρ/ρ_{273}
1.5
1
.8
.6
.4
.3
.2
.1
.08
.06
.04
.03
.02
.01
.008
.006
.004
.003
.002
.001
1
2
3
4
6
8
10
20
30
40
60
80
100
200
300
TEMPERATURE, °K



ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 1100-0

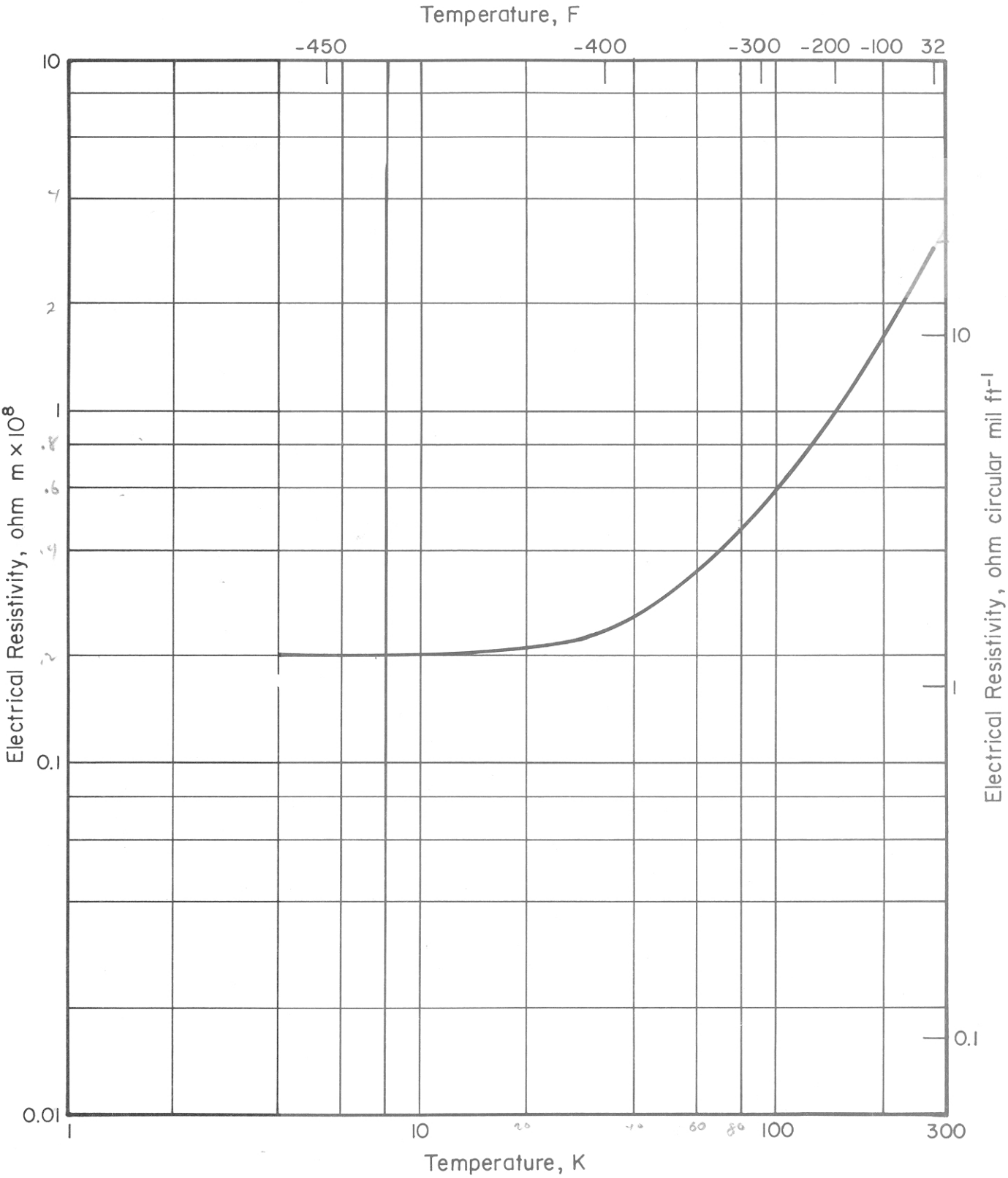


FIGURE 4.1.4-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 1100-0

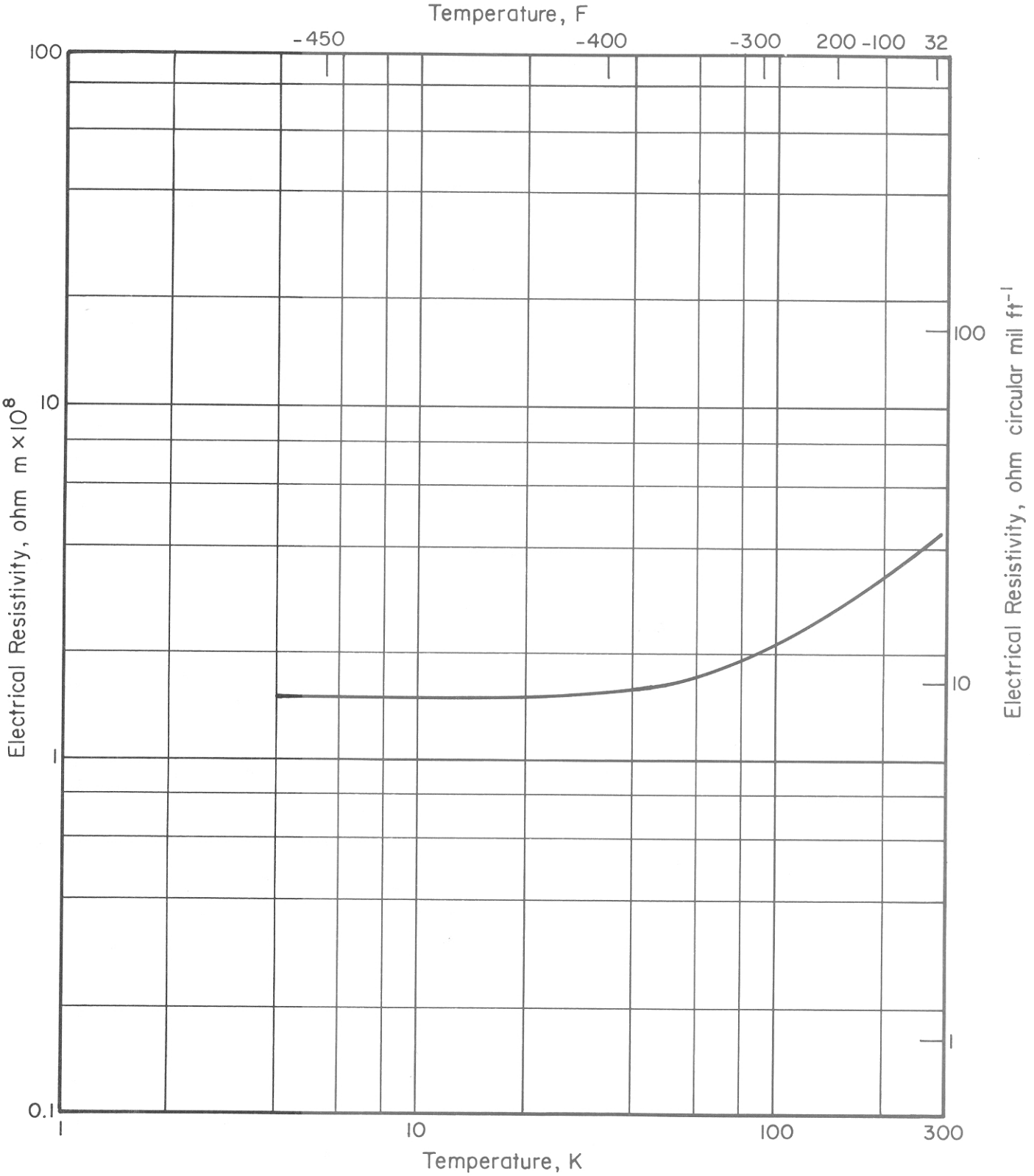


FIGURE 4.2.1-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 2014-T651

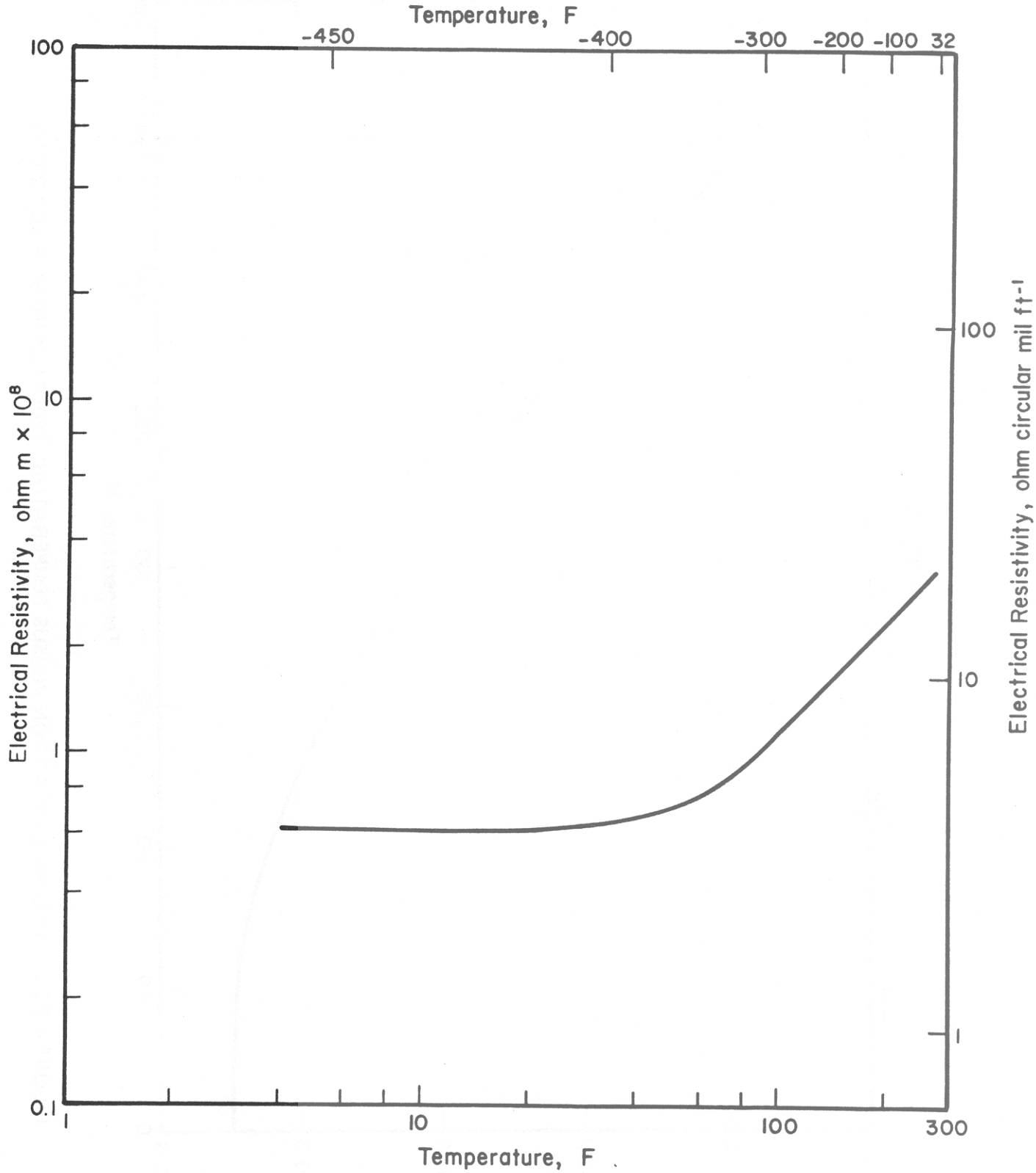


FIGURE 4.2.3-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 2024-0

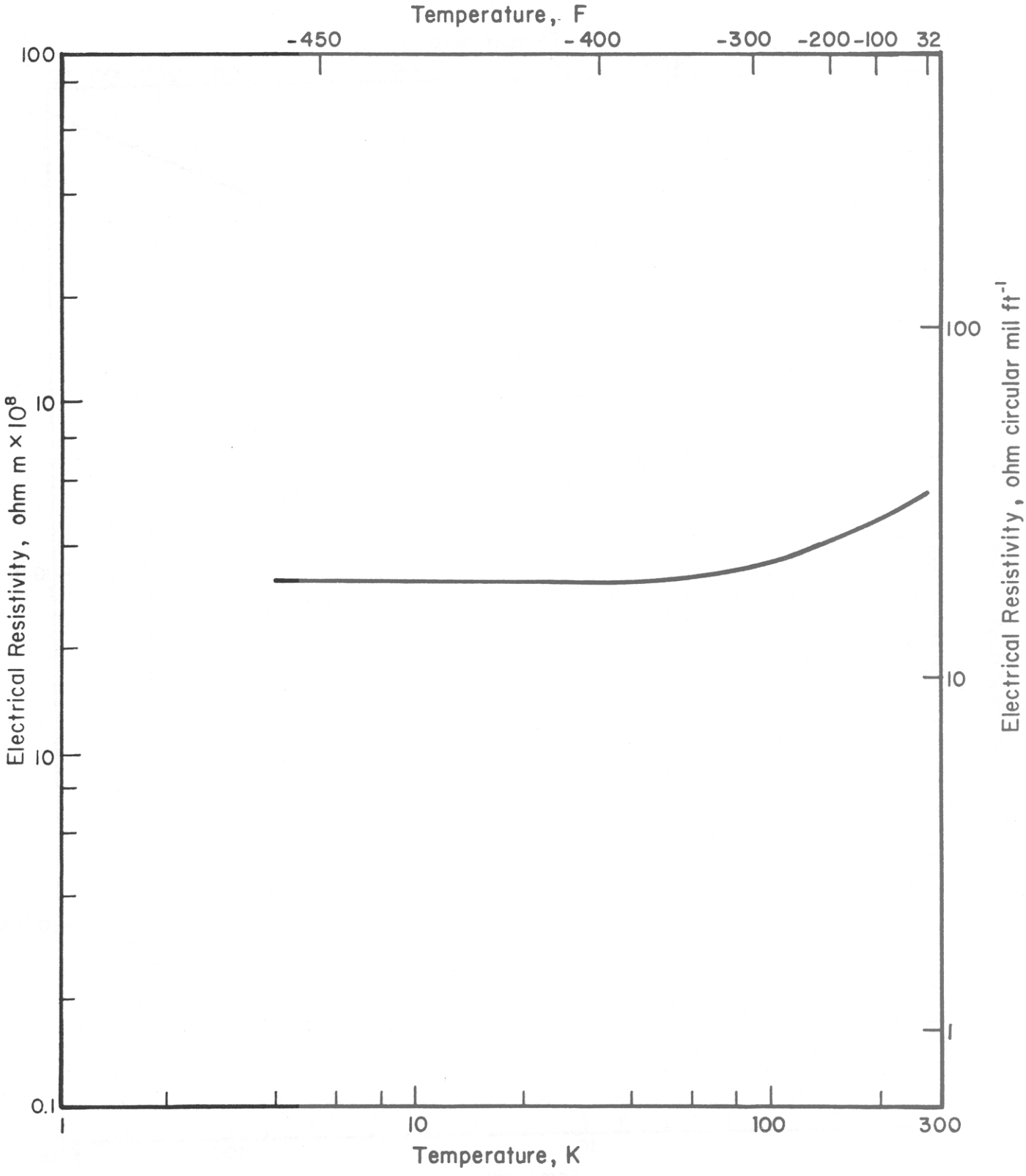


FIGURE 4.2.3-R2. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 2024-T4

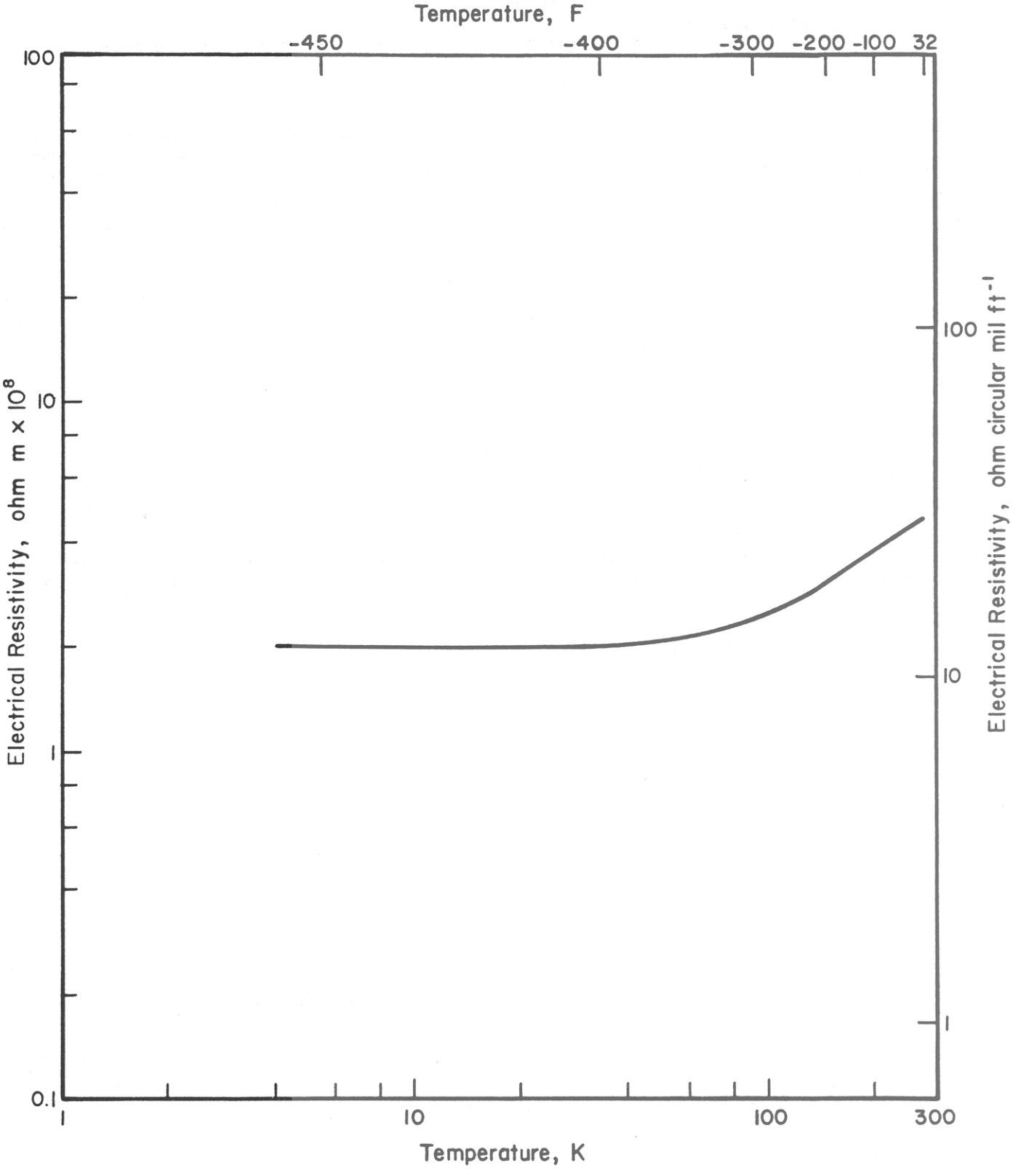


FIGURE 4.2.3-R3. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 2024-T6

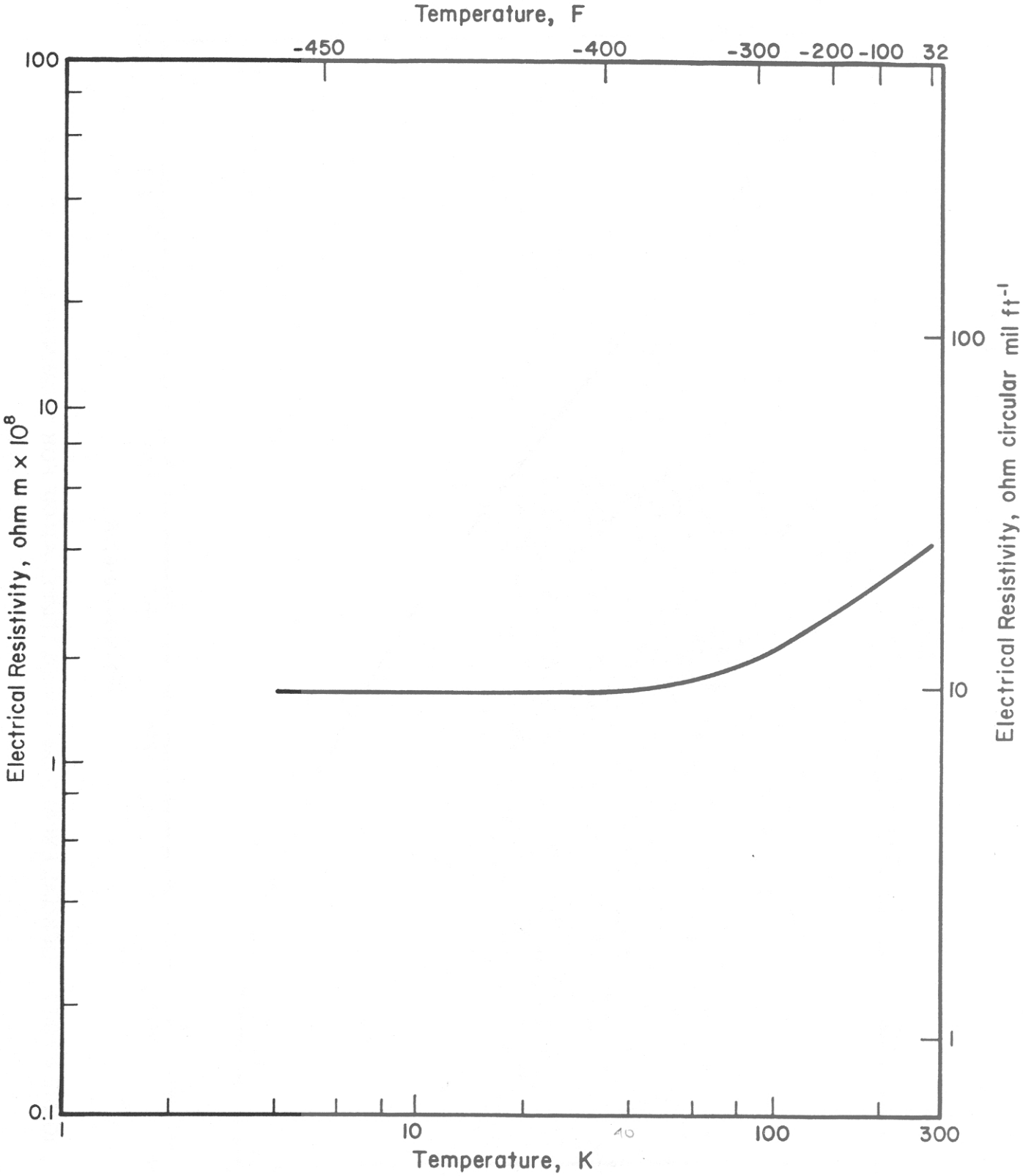


FIGURE 4.2.3-R4. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 2024-T86

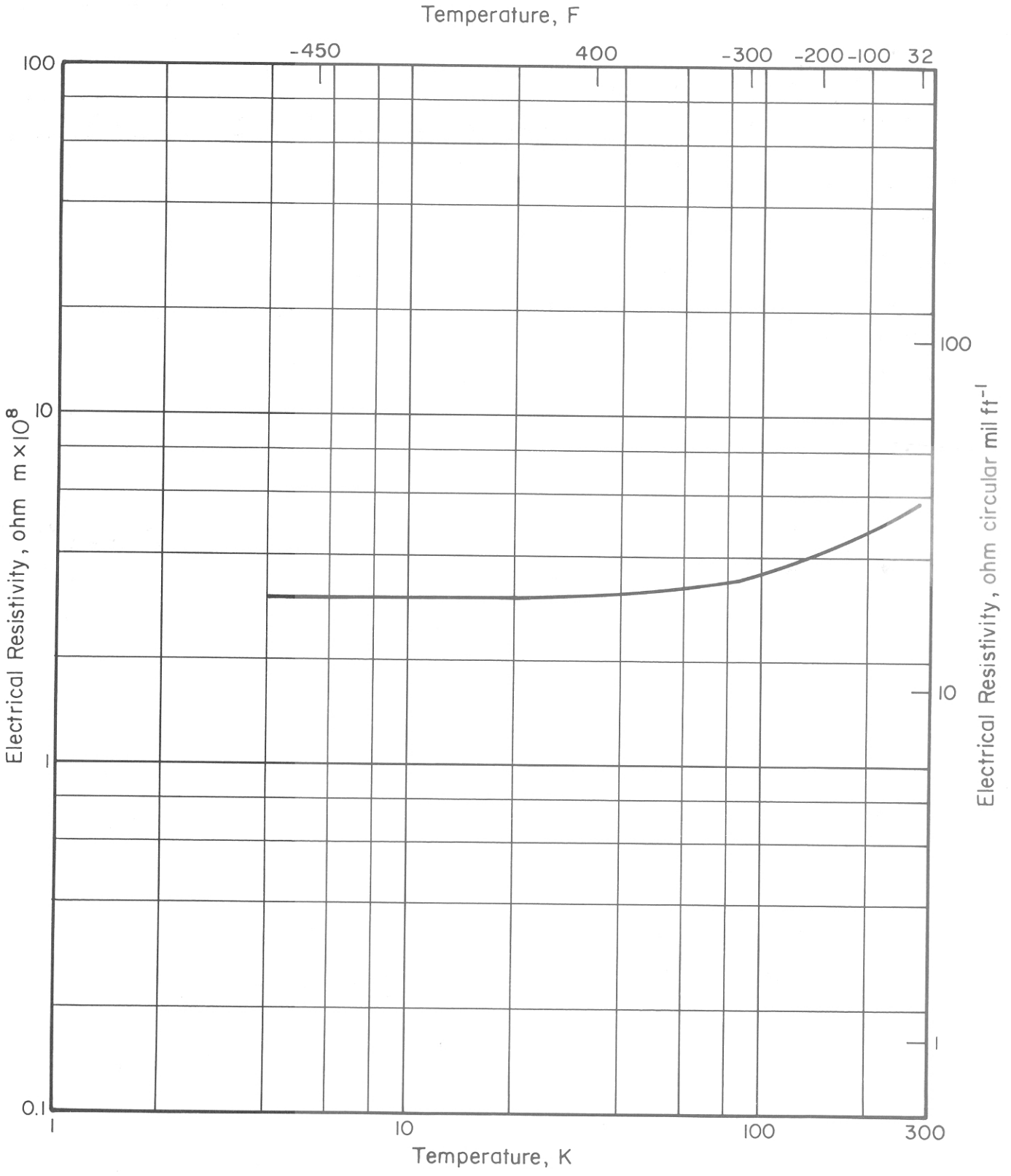


FIGURE 4.3.1-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 5083-0, -H113

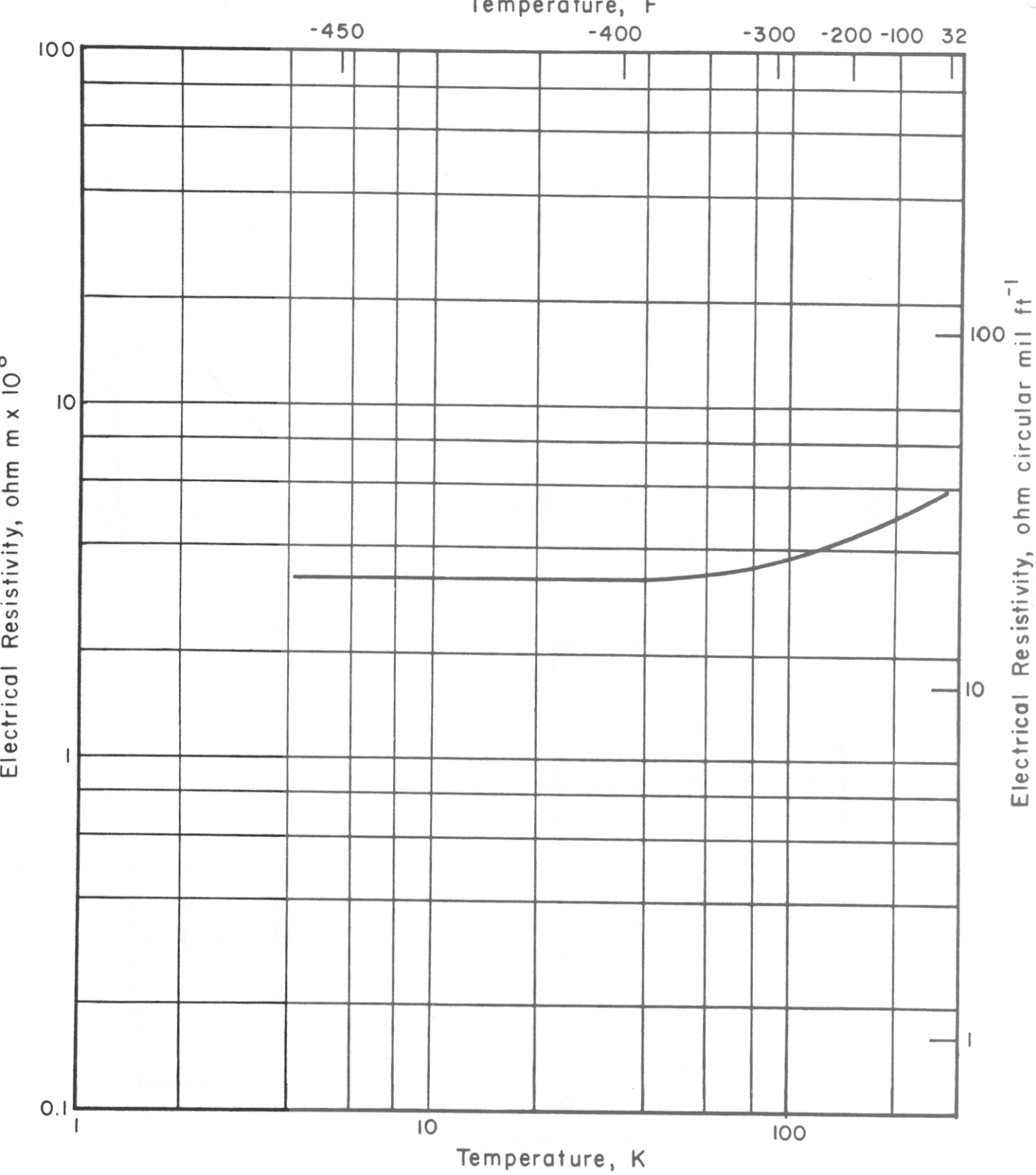


FIGURE 4.2.3-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 5456

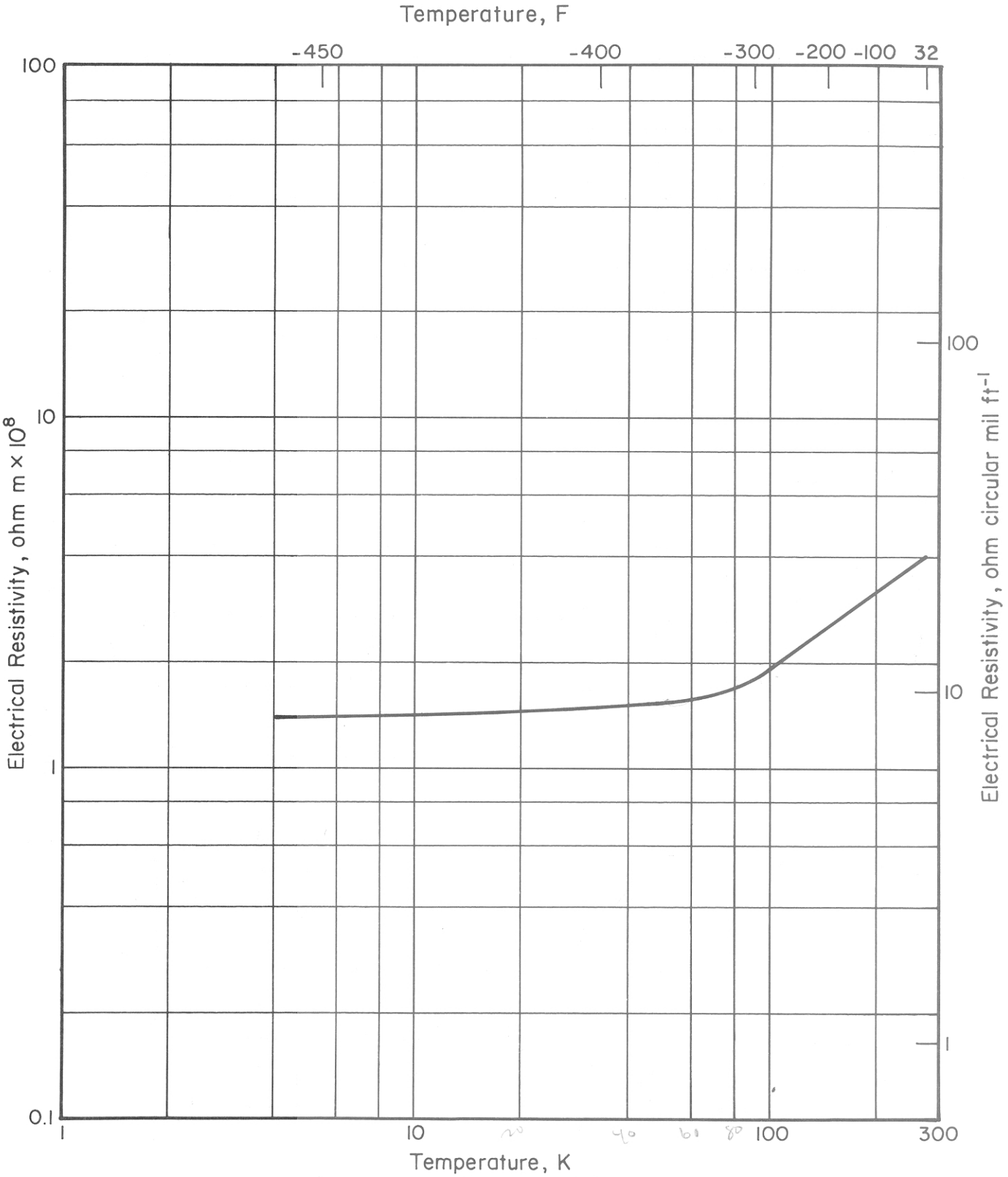


FIGURE 4.4.1-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 6061-T6

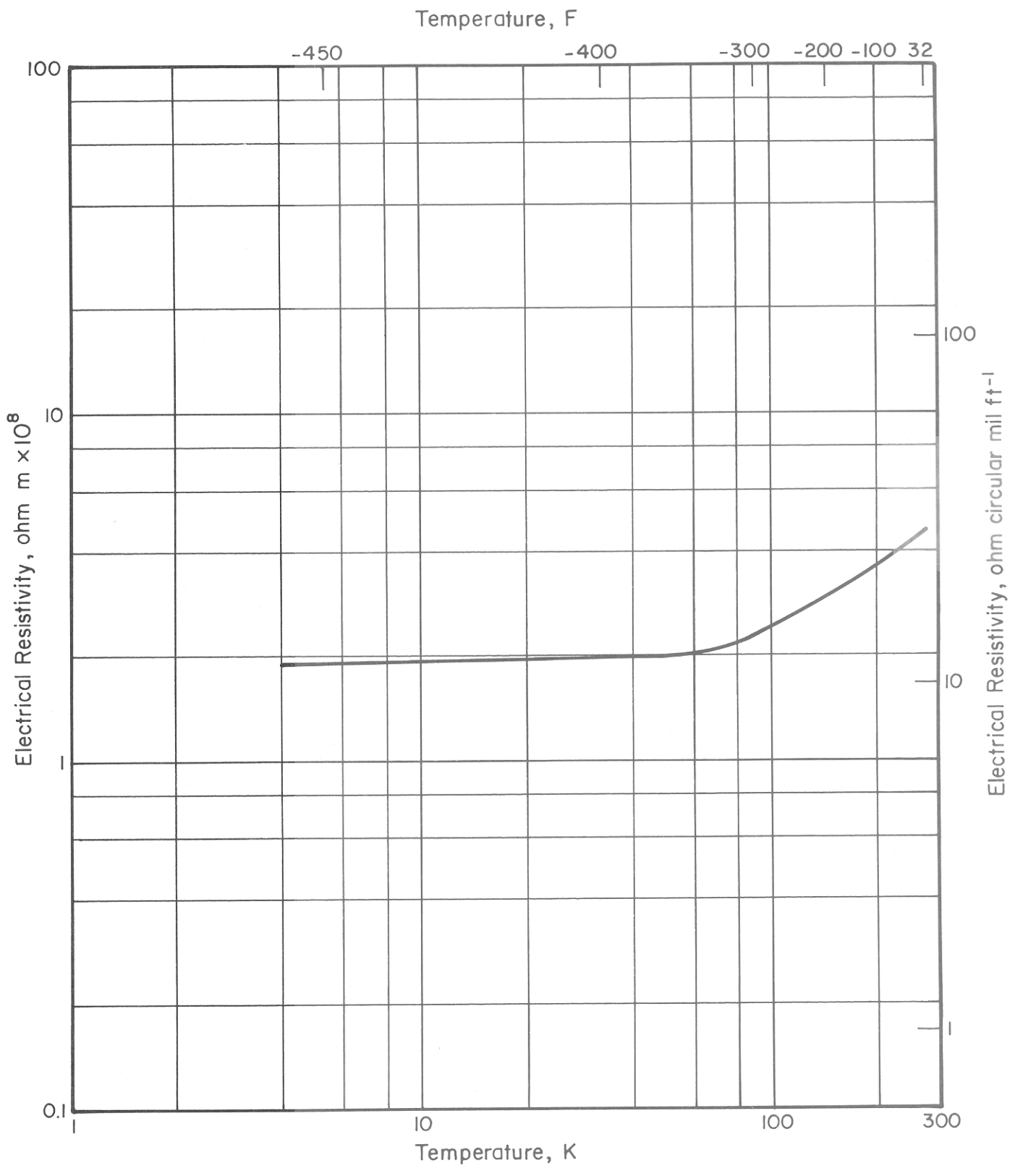


FIGURE 4.5.1-R1. ELECTRICAL RESISTIVITY VERSUS TEMPERATURE FOR ALUMINUM ALLOY 7039-T61