N62 11490
NASA TN D-1252

NASA TN D-1252

TECHNICAL NOTE

D-1252

IDEAL-GAS TABLES FOR HELIUM FLOW IN THE MACH NUMBER RANGE FROM 40 TO 100

By James N. Mueller

Langley Research Center
Langley Station, Hampton, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON May 1962

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TECHNICAL NOTE D-1252

IDEAL-GAS TABLES FOR HELIUM FLOW IN THE MACH NUMBER RANGE FROM 40 TO 100

By James N. Mueller

L
2
0
1
2

SUMMARY

This report is an extension to NACA Technical Note 4063 and presents equations, tables, and figures at Mach numbers from 40 to 100 for use in the analyses of perfect-gas flows with a ratio of specific heats of 5/3. The tables present the values of useful dimensionless ratios for continuous one-dimensional flow and for normal-shock waves as functions of Mach number in increments of 0.10. Curves are shown for the Reynolds number per inch and the mass-flow rates as functions of Mach number and stagnation temperature, and for the helium viscosity as a function of temperature. Assumed stagnation temperatures are from 1,000° R to 14,000° R.

INTRODUCTION

Helium tunnels are now firmly established as an important research tool for the study of hypersonic-fluid-dynamic effects. (See, for example, refs. 1 to 12.) Moreover, continuing efforts are being made to extend the Mach number range of this type of facility to support research associated with return from lunar and planetary missions. An example of recent efforts in this direction is contained in reference 13, where tests in a Hotshot-type wind tunnel using helium as a test medium have been made at a Mach number of 65.

Reference 14 has recently been published and lends support for the analyses of helium flow at very high Mach numbers. However, reference 14 shows curves for only certain flow properties in the flow field and on the surface of cones and wedges. The purpose of the present report is to extend the tables and figures of NACA TN 4063 (ref. 15) from a Mach number of 40 up to 100 in order to provide a useful reference work for the perfect-gas flow properties of helium and to supplement existing work such as reference 14. The imperfect-gas effects which may occur in helium flow under certain test conditions are not accounted for. Examples of imperfect-gas effects are discussed in references 12 and 16.

SYMBOLS

A	cross-sectional area of stream tube or channel, sq ft
a	speed of sound, ft/sec
c_p	specific heat at constant pressure, $ft^2/sec^2\text{-}^oR$
c_v	specific heat at constant volume, $ft^2/sec^2\text{-}^oR$
l	characteristic reference length, ft unless otherwise indicated
M	Mach number, V/a
m	mass flow, ρAV, slugs/sec
N_{Re}	Reynolds number, $\rho Vl/\eta$
p	pressure, lb/sq ft absolute unless otherwise indicated
q	dynamic pressure, $\frac{\gamma}{2} pM^2$, lb/sq ft absolute
R	gas constant, $ft^2/sec^2\text{-}^oR$
T	absolute temperature, ^oR
V	speed of flow, ft/sec
V_0	maximum speed obtainable by expanding to zero absolute pressure, ft/sec
γ	ratio of specific heats, c_p/c_v
η	absolute viscosity, slugs/ft-sec
μ	Mach angle, $\sin^{-1} \frac{1}{M}$, deg
ν	Prandtl-Meyer angle (angle through which a supersonic stream is turned to expand from $M = 1$ to $M > 1$), deg
ρ	mass density, slugs/cu ft

Subscripts and superscripts:

t total conditions (that is, conditions that would exist if the gas were brought to rest isentropically)

1 condition just upstream of shock wave

2 condition just downstream of shock wave

∞ free-stream condition

L2012

* critical conditions (that is, conditions where local speed is equal to local speed of sound)

FUNDAMENTAL FLOW EQUATIONS

The fundamental flow equations are applicable for all perfect gases and have been given in many publications (notably, ref. 17). In reference 15 (NACA TN 4063) these flow equations were presented again for completeness, and the specific constants to use in the equations were given for $\gamma = 5/3$. Inasmuch as the present report is an extension to NACA TN 4063, the flow equations are not repeated in this report.

The values of the parameters calculated from the fundamental flow equations are given in table I for the Mach number range of 40 to 100 in Mach number increments of 0.10.

VISCOSITY RELATIONSHIP

The equation for the determination of the viscosity of helium was obtained from reference 18. This equation, converted to units of slugs per foot-second, is plotted in figure 1 for a range of temperatures from 1,000° R to 14,000° R. The converted form is as follows:

$$\eta = 7.173(T)^{0.647} \times 10^{-9} \tag{1}$$

Equation (1) is an empirical expression which represents the viscosity of helium to better than 1 percent in the temperature range from about 7.2° R up to about 2,000° R. Its applicability at higher temperatures is not known because of the absence of experimental viscosity measurements. Nevertheless, equation (1) has been used herein to calculate viscosities (and, subsequently, Reynolds numbers) at the high temperatures

considered in this report. The viscosity results (fig. 1) and the Reynolds number computations (fig. 2) should, therefore, be used with caution pending viscosity measurements at higher temperatures.

REYNOLDS NUMBER

The Reynolds number is defined as follows:

$$N_{Re} = \frac{\rho V l}{\eta}$$

L
2
0
1
2

The parameter can be put into the form

$$\frac{N_{Re}}{l} = \frac{1.938 M_\infty \times 10^7 \times p_t}{T_t^{1.147}\left(1 + \frac{M_\infty^2}{3}\right)^{1.353}} \tag{2}$$

through use of the helium-viscosity equation (eq. (1)) and other fundamental relationships. In equation (2), p_t is in pounds per square inch absolute, the characteristic length l is in inches, and T_t is in degrees Rankine. The graph of equation (2) for the Mach number range of 40 to 100 is presented for various stagnation temperatures in figure 2. The curves shown in figure 2 are based on the value of p_t of unity to facilitate their use.

MASS-FLOW RATE

The mass-flow rates per unit test-section area are presented in figure 3 as a function of the Mach number and stagnation temperature. The equation used to calculate the values of the mass-flow rates was derived from the continuity equation by using the ideal-gas law, the speed of sound relationship, and the perfect-gas expressions for the isentropic-flow ratios ρ/ρ_t and a/a_t. Substitution of the values of $\gamma = 5/3$, $R = 12{,}438$ ft^2/sec^2-$^\circ$R, and $p_t = 1$ lb/sq in. absolute in the derived equation yielded the following form for the mass-flow relationship in helium:

$$\frac{m}{A} = \rho V = 1.667 \frac{M_\infty}{\sqrt{T_t}}\left(1 + \frac{M_\infty^2}{3}\right)^{-2} \tag{3}$$

As a matter of interest, the hypersonic approximation for m/A is

$$\frac{m}{A} \approx \frac{15}{M_\infty^3\sqrt{T_t}} \tag{4}$$

L
2
0
1
2

Equation (4), obtained from equation (3) by omitting the numeral one from the parenthetical term, gives mass-flow-rate values within one-half of 1 percent of those calculated by using equation (3) for the range of temperatures and Mach numbers considered herein.

CONCLUDING REMARKS

This report is an extension to NACA Technical Note 4063 and presents equations, tables, and figures at Mach numbers from 40 to 100 for use in the analyses of perfect-gas flows with a ratio of specific heats of 5/3. The tables present the values of useful dimensionless ratios for continuous one-dimensional flow and for normal-shock waves as functions of Mach number in increments of 0.10. Curves are shown for the Reynolds number per inch and the mass-flow rates as functions of Mach number and stagnation temperature, and for the helium viscosity as a function of temperature. Assumed stagnation temperatures for calculative purposes are from 1,000° R to 14,000° R.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Air Force Base, Va., February 12, 1962.

REFERENCES

1. Faro, I. D. V., Small, T. R., and Hill, F. K.: Hypersonic Flow at a Mach Number of 10. Jour. Appl. Phys., vol. 22, no. 2, Feb. 1951, pp. 220-222.

2. Bogdonoff, S. M., and Hammitt, A. G.: The Princeton Helium Hypersonic Tunnel and Preliminary Results Above M = 11. WADC Tech. Rep. 54-124, Wright Air Dev. Center, U.S. Air Force, July 1954.

3. Bogdonoff, S. M., and Hammitt, A. G.: Fluid Dynamic Effects at Speeds From M = 11 to 15. Jour. Aero. Sci., vol. 23, no. 2, Feb. 1956, pp. 108-116, 145.

4. Munson, Albert G.: A Preliminary Experimental Investigation of the Flow Over Simple Bodies of Revolution at M = 18.4 in Helium. Memo. No. 35 (Army Ord. Contract No. DA-04-495-Ord-19), GALCIT, Dec. 15, 1956.

5. Erickson, Wayne D.: Study of Pressure Distributions on Simple Sharp-Nosed Models at Mach Numbers From 16 to 18 in Helium Flow. NACA TN 4113, 1957.

6. Johnson, Robert H.: A Hypersonic Helium Tunnel for Mach Numbers Above Twenty. Rep. No. 58-RL-2089, Gen. Elec. Res. Lab., Sept. 1958.

7. Henderson, Arthur, Jr., and Johnston, Patrick J.: Fluid-Dynamic Properties of Some Simple Sharp- and Blunt-Nosed Shapes at Mach Numbers From 16 to 24 in Helium Flow. NASA MEMO 5-8-59L, 1959.

8. Morgan, Homer G., and Miller, Robert W.: Flutter Tests of Some Simple Models at a Mach Number of 7.2 in Helium Flow. NASA MEMO 4-8-59L, 1959.

9. Johnston, Patrick J., and Witcofski, Robert D.: Effect of a Variable-Geometry Diffuser on the Operating Characteristics of a Helium Tunnel Designed for a Mach Number in Excess of 20. NASA TN D-237, 1960.

10. Mueller, James N., Close, William H., and Henderson, Arthur, Jr.: An Investigation of Induced-Pressure Phenomena on Axially Symmetric, Flow-Alined, Cylindrical Models Equipped With Different Nose Shapes at Free-Stream Mach Numbers From 15.6 to 21 in Helium. NASA TN D-373, 1960.

L
2
0
1
2

11. Marvin, Joseph G.: Surface Pressures and Heat Transfer on Unswept Blunt Plates in Helium at High Mach Numbers. NASA TN D-688, 1961.

12. Henderson, Arthur, Jr., and Baradell, Donald L.: Recent Work at Langley Research Center in the Development of Hypersonic Helium Tunnels. Proc. Nat. Symposium on Hypervelocity Techniques, Inst. Aero. Sci., Oct. 1960, pp. 131-141.

13. Masson, David J., Morris, Deane N., and Bloxom, Daniel E.: Measurements of Sphere Drag From Hypersonic Continuum to Free-Molecule Flow. Rarefied Gas Dynamics, L. Talbot, ed., Academic Press, Inc. (New York), 1961, pp. 643-661.

14. Henderson, Arthur, Jr., and Braswell, Dorothy O.: Charts for Conical and Two-Dimensional Oblique-Shock Flow Parameters in Helium at Mach Numbers From About 1 to 100. NASA TN D-819, 1961.

15. Mueller, James N.: Equations, Tables, and Figures for Use in the Analysis of Helium Flow at Supersonic and Hypersonic Speeds. NACA TN 4063, 1957.

16. Erickson, Wayne D.: Real-Gas Correction Factors for Hypersonic Flow Parameters in Helium. NASA TN D-462, 1960.

17. Ames Research Staff: Equations, Tables, and Charts for Compressible Flow. NACA Rep. 1135, 1953. (Supersedes NACA TN 1428.)

18. Akin, S. W.: The Thermodynamic Properties of Helium. Trans. A.S.M.E., vol. 72, no. 6, Aug. 1950, pp. 751-757.

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
40.00	0.1515E-06	0.8096E-04	0.1871E-02	0.4326E-01	0.2020E-03	0.2491E-03	0.9991	1.99813
40.10	0.1496E-06	0.8036E-04	0.1862E-02	0.4315E-01	0.2005E-03	0.2472E-03	0.9991	1.99814
40.20	0.1478E-06	0.7976E-04	0.1853E-02	0.4305E-01	0.1990E-03	0.2454E-03	0.9991	1.99815
40.30	0.1460E-06	0.7917E-04	0.1844E-02	0.4294E-01	0.1976E-03	0.2436E-03	0.9991	1.99816
40.40	0.1442E-06	0.7859E-04	0.1835E-02	0.4283E-01	0.1961E-03	0.2418E-03	0.9991	1.99816
40.50	0.1424E-06	0.7801E-04	0.1826E-02	0.4273E-01	0.1947E-03	0.2400E-03	0.9991	1.99817
40.60	0.1407E-06	0.7743E-04	0.1817E-02	0.4262E-01	0.1932E-03	0.2382E-03	0.9991	1.99818
40.70	0.1390E-06	0.7686E-04	0.1808E-02	0.4252E-01	0.1918E-03	0.2365E-03	0.9991	1.99819
40.80	0.1373E-06	0.7630E-04	0.1799E-02	0.4241E-01	0.1904E-03	0.2347E-03	0.9991	1.99820
40.90	0.1356E-06	0.7574E-04	0.1790E-02	0.4231E-01	0.1890E-03	0.2330E-03	0.9991	1.99821
41.00	0.1340E-06	0.7519E-04	0.1781E-02	0.4221E-01	0.1876E-03	0.2313E-03	0.9991	1.99822
41.10	0.1323E-06	0.7464E-04	0.1773E-02	0.4210E-01	0.1863E-03	0.2296E-03	0.9991	1.99823
41.20	0.1307E-06	0.7410E-04	0.1764E-02	0.4200E-01	0.1849E-03	0.2280E-03	0.9991	1.99823
41.30	0.1292E-06	0.7357E-04	0.1756E-02	0.4190E-01	0.1836E-03	0.2263E-03	0.9991	1.99824
41.40	0.1276E-06	0.7304E-04	0.1747E-02	0.4180E-01	0.1823E-03	0.2247E-03	0.9991	1.99825
41.50	0.1261E-06	0.7251E-04	0.1739E-02	0.4170E-01	0.1810E-03	0.2231E-03	0.9991	1.99826
41.60	0.1246E-06	0.7199E-04	0.1731E-02	0.4160E-01	0.1797E-03	0.2215E-03	0.9991	1.99827
41.70	0.1231E-06	0.7147E-04	0.1722E-02	0.4150E-01	0.1784E-03	0.2199E-03	0.9991	1.99828
41.80	0.1216E-06	0.7096E-04	0.1714E-02	0.4140E-01	0.1771E-03	0.2183E-03	0.9991	1.99829
41.90	0.1202E-06	0.7046E-04	0.1706E-02	0.4130E-01	0.1758E-03	0.2168E-03	0.9991	1.99829
42.00	0.1188E-06	0.6996E-04	0.1698E-02	0.4120E-01	0.1746E-03	0.2152E-03	0.9992	1.99830
42.10	0.1174E-06	0.6946E-04	0.1690E-02	0.4111E-01	0.1734E-03	0.2137E-03	0.9992	1.99831
42.20	0.1160E-06	0.6897E-04	0.1682E-02	0.4101E-01	0.1721E-03	0.2122E-03	0.9992	1.99832
42.30	0.1146E-06	0.6848E-04	0.1674E-02	0.4091E-01	0.1709E-03	0.2107E-03	0.9992	1.99833
42.40	0.1133E-06	0.6800E-04	0.1666E-02	0.4082E-01	0.1697E-03	0.2092E-03	0.9992	1.99833
42.50	0.1120E-06	0.6752E-04	0.1658E-02	0.4072E-01	0.1685E-03	0.2077E-03	0.9992	1.99834
42.60	0.1107E-06	0.6705E-04	0.1650E-02	0.4062E-01	0.1673E-03	0.2063E-03	0.9992	1.99835
42.70	0.1094E-06	0.6658E-04	0.1643E-02	0.4053E-01	0.1662E-03	0.2048E-03	0.9992	1.99836
42.80	0.1081E-06	0.6611E-04	0.1635E-02	0.4044E-01	0.1650E-03	0.2034E-03	0.9992	1.99836
42.90	0.1068E-06	0.6565E-04	0.1627E-02	0.4034E-01	0.1639E-03	0.2020E-03	0.9992	1.99837
43.00	0.1056E-06	0.6520E-04	0.1620E-02	0.4025E-01	0.1627E-03	0.2006E-03	0.9992	1.99838
43.10	0.1044E-06	0.6474E-04	0.1612E-02	0.4015E-01	0.1616E-03	0.1992E-03	0.9992	1.99839
43.20	0.1032E-06	0.6430E-04	0.1605E-02	0.4006E-01	0.1605E-03	0.1978E-03	0.9992	1.99839
43.30	0.1020E-06	0.6385E-04	0.1598E-02	0.3997E-01	0.1594E-03	0.1965E-03	0.9992	1.99840
43.40	0.1008E-06	0.6341E-04	0.1590E-02	0.3988E-01	0.1583E-03	0.1951E-03	0.9992	1.99841
43.50	0.9969E-07	0.6298E-04	0.1583E-02	0.3979E-01	0.1572E-03	0.1938E-03	0.9992	1.99842
43.60	0.9855E-07	0.6255E-04	0.1576E-02	0.3969E-01	0.1561E-03	0.1924E-03	0.9992	1.99842
43.70	0.9743E-07	0.6212E-04	0.1568E-02	0.3960E-01	0.1551E-03	0.1911E-03	0.9992	1.99843
43.80	0.9632E-07	0.6169E-04	0.1561E-02	0.3951E-01	0.1540E-03	0.1898E-03	0.9992	1.99844
43.90	0.9523E-07	0.6127E-04	0.1554E-02	0.3942E-01	0.1529E-03	0.1885E-03	0.9992	1.99845
44.00	0.9416E-07	0.6086E-04	0.1547E-02	0.3933E-01	0.1519E-03	0.1872E-03	0.9992	1.99845
44.10	0.9310E-07	0.6045E-04	0.1540E-02	0.3925E-01	0.1509E-03	0.1860E-03	0.9992	1.99846
44.20	0.9205E-07	0.6004E-04	0.1533E-02	0.3916E-01	0.1499E-03	0.1847E-03	0.9992	1.99847
44.30	0.9102E-07	0.5963E-04	0.1526E-02	0.3907E-01	0.1489E-03	0.1835E-03	0.9992	1.99847
44.40	0.9000E-07	0.5923E-04	0.1519E-02	0.3898E-01	0.1479E-03	0.1822E-03	0.9992	1.99848
44.50	0.8899E-07	0.5883E-04	0.1513E-02	0.3889E-01	0.1469E-03	0.1810E-03	0.9992	1.99849
44.60	0.8800E-07	0.5844E-04	0.1506E-02	0.3881E-01	0.1459E-03	0.1798E-03	0.9992	1.99849
44.70	0.8702E-07	0.5805E-04	0.1499E-02	0.3872E-01	0.1449E-03	0.1786E-03	0.9993	1.99850
44.80	0.8606E-07	0.5766E-04	0.1493E-02	0.3863E-01	0.1439E-03	0.1774E-03	0.9993	1.99851
44.90	0.8511E-07	0.5728E-04	0.1486E-02	0.3855E-01	0.1430E-03	0.1762E-03	0.9993	1.99851
45.00	0.8417E-07	0.5690E-04	0.1479E-02	0.3846E-01	0.1420E-03	0.1751E-03	0.9993	1.99852
45.10	0.8324E-07	0.5652E-04	0.1473E-02	0.3838E-01	0.1411E-03	0.1739E-03	0.9993	1.99853
45.20	0.8232E-07	0.5614E-04	0.1466E-02	0.3829E-01	0.1402E-03	0.1728E-03	0.9993	1.99853
45.30	0.8142E-07	0.5577E-04	0.1460E-02	0.3821E-01	0.1392E-03	0.1716E-03	0.9993	1.99854
45.40	0.8053E-07	0.5541E-04	0.1453E-02	0.3812E-01	0.1383E-03	0.1705E-03	0.9993	1.99855
45.50	0.7965E-07	0.5504E-04	0.1447E-02	0.3804E-01	0.1374E-03	0.1694E-03	0.9993	1.99855
45.60	0.7878E-07	0.5468E-04	0.1441E-02	0.3796E-01	0.1365E-03	0.1683E-03	0.9993	1.99856
45.70	0.7792E-07	0.5432E-04	0.1434E-02	0.3787E-01	0.1356E-03	0.1672E-03	0.9993	1.99857
45.80	0.7708E-07	0.5397E-04	0.1428E-02	0.3779E-01	0.1347E-03	0.1661E-03	0.9993	1.99857
45.90	0.7624E-07	0.5362E-04	0.1422E-02	0.3771E-01	0.1339E-03	0.1650E-03	0.9993	1.99858
46.00	0.7542E-07	0.5327E-04	0.1416E-02	0.3763E-01	0.1330E-03	0.1639E-03	0.9993	1.99858
46.10	0.7460E-07	0.5292E-04	0.1410E-02	0.3755E-01	0.1321E-03	0.1629E-03	0.9993	1.99859
46.20	0.7380E-07	0.5258E-04	0.1404E-02	0.3746E-01	0.1313E-03	0.1618E-03	0.9993	1.99860
46.30	0.7301E-07	0.5224E-04	0.1398E-02	0.3738E-01	0.1304E-03	0.1608E-03	0.9993	1.99860
46.40	0.7223E-07	0.5191E-04	0.1391E-02	0.3730E-01	0.1296E-03	0.1597E-03	0.9993	1.99861
46.50	0.7146E-07	0.5157E-04	0.1386E-02	0.3722E-01	0.1288E-03	0.1587E-03	0.9993	1.99861
46.60	0.7069E-07	0.5124E-04	0.1380E-02	0.3714E-01	0.1279E-03	0.1577E-03	0.9993	1.99862
46.70	0.6994E-07	0.5091E-04	0.1374E-02	0.3706E-01	0.1271E-03	0.1567E-03	0.9993	1.99863
46.80	0.6920E-07	0.5059E-04	0.1368E-02	0.3698E-01	0.1263E-03	0.1557E-03	0.9993	1.99863
46.90	0.6846E-07	0.5027E-04	0.1362E-02	0.3691E-01	0.1255E-03	0.1547E-03	0.9993	1.99864
47.00	0.6774E-07	0.4995E-04	0.1356E-02	0.3683E-01	0.1247E-03	0.1537E-03	0.9993	1.99864
47.10	0.6702E-07	0.4963E-04	0.1350E-02	0.3675E-01	0.1239E-03	0.1527E-03	0.9993	1.99865
47.20	0.6632E-07	0.4932E-04	0.1345E-02	0.3667E-01	0.1231E-03	0.1517E-03	0.9993	1.99865
47.30	0.6562E-07	0.4900E-04	0.1339E-02	0.3659E-01	0.1223E-03	0.1508E-03	0.9993	1.99866
47.40	0.6493E-07	0.4869E-04	0.1333E-02	0.3652E-01	0.1216E-03	0.1498E-03	0.9993	1.99867
47.50	0.6425E-07	0.4839E-04	0.1328E-02	0.3644E-01	0.1208E-03	0.1489E-03	0.9993	1.99867
47.60	0.6358E-07	0.4808E-04	0.1322E-02	0.3636E-01	0.1201E-03	0.1480E-03	0.9993	1.99868
47.70	0.6292E-07	0.4778E-04	0.1317E-02	0.3629E-01	0.1193E-03	0.1470E-03	0.9993	1.99868
47.80	0.6226E-07	0.4748E-04	0.1311E-02	0.3621E-01	0.1186E-03	0.1461E-03	0.9993	1.99869
47.90	0.6162E-07	0.4719E-04	0.1306E-02	0.3614E-01	0.1178E-03	0.1452E-03	0.9993	1.99869

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
1.433	85.736	0.4477	1999.7	3.993	500.9	0.3562E-03	2350.6	40.00
1.429	85.747	0.4477	2009.8	3.993	503.4	0.3535E-03	2362.4	40.10
1.425	85.727	0.4477	2019.8	3.993	505.9	0.3509E-03	2374.2	40.20
1.422	85.738	0.4477	2029.9	3.993	508.4	0.3483E-03	2386.0	40.30
1.418	85.748	0.4477	2039.9	3.993	510.9	0.3457E-03	2397.9	40.40
1.415	85.759	0.4476	2050.1	3.993	513.5	0.3432E-03	2409.7	40.50
1.411	85.769	0.4476	2060.2	3.993	516.0	0.3407E-03	2421.7	40.60
1.408	85.780	0.4476	2070.4	3.993	518.5	0.3382E-03	2433.6	40.70
1.404	85.790	0.4476	2080.5	3.993	521.1	0.3357E-03	2445.6	40.80
1.401	85.800	0.4476	2090.8	3.993	523.6	0.3332E-03	2457.6	40.90
1.398	85.811	0.4476	2101.0	3.993	526.2	0.3308E-03	2469.6	41.00
1.394	85.821	0.4476	2111.3	3.993	528.8	0.3284E-03	2481.7	41.10
1.391	85.831	0.4476	2121.5	3.993	531.3	0.3260E-03	2493.7	41.20
1.387	85.841	0.4476	2131.9	3.993	533.9	0.3237E-03	2505.9	41.30
1.384	85.851	0.4476	2142.2	3.993	536.5	0.3213E-03	2518.0	41.40
1.381	85.861	0.4476	2152.6	3.993	539.1	0.3190E-03	2530.2	41.50
1.377	85.871	0.4476	2162.9	3.993	541.7	0.3167E-03	2542.4	41.60
1.374	85.881	0.4476	2173.4	3.993	544.3	0.3145E-03	2554.6	41.70
1.371	85.891	0.4476	2183.8	3.993	546.9	0.3122E-03	2566.9	41.80
1.368	85.900	0.4476	2194.3	3.993	549.5	0.3100E-03	2579.2	41.90
1.364	85.910	0.4476	2204.7	3.993	552.1	0.3078E-03	2591.5	42.00
1.361	85.920	0.4476	2215.3	3.993	554.8	0.3056E-03	2603.9	42.10
1.358	85.929	0.4476	2225.8	3.993	557.4	0.3035E-03	2616.3	42.20
1.355	85.939	0.4476	2236.4	3.993	560.0	0.3013E-03	2628.7	42.30
1.351	85.949	0.4476	2246.9	3.993	562.7	0.2992E-03	2641.1	42.40
1.348	85.958	0.4476	2257.6	3.993	565.3	0.2971E-03	2653.6	42.50
1.345	85.968	0.4476	2268.2	3.993	568.0	0.2950E-03	2666.1	42.60
1.342	85.977	0.4476	2278.9	3.993	570.7	0.2929E-03	2678.6	42.70
1.339	85.986	0.4476	2289.5	3.993	573.3	0.2909E-03	2691.2	42.80
1.336	85.996	0.4476	2300.3	3.993	576.0	0.2889E-03	2703.8	42.90
1.333	86.005	0.4476	2311.0	3.994	578.7	0.2869E-03	2716.4	43.00
1.329	86.014	0.4476	2321.8	3.994	581.4	0.2849E-03	2729.0	43.10
1.326	86.024	0.4476	2332.5	3.994	584.1	0.2829E-03	2741.7	43.20
1.323	86.033	0.4476	2343.4	3.994	586.8	0.2810E-03	2754.4	43.30
1.320	86.042	0.4476	2354.2	3.994	589.5	0.2790E-03	2767.1	43.40
1.317	86.051	0.4476	2365.1	3.994	592.2	0.2771E-03	2779.9	43.50
1.314	86.060	0.4476	2375.9	3.994	594.9	0.2752E-03	2792.7	43.60
1.311	86.069	0.4476	2386.9	3.994	597.7	0.2733E-03	2805.5	43.70
1.308	86.078	0.4476	2397.8	3.994	600.4	0.2715E-03	2818.4	43.80
1.305	86.087	0.4476	2408.8	3.994	603.1	0.2696E-03	2831.2	43.90
1.302	86.096	0.4476	2419.7	3.994	605.9	0.2678E-03	2844.2	44.00
1.299	86.105	0.4476	2430.8	3.994	608.6	0.2660E-03	2857.1	44.10
1.296	86.113	0.4476	2441.8	3.994	611.4	0.2642E-03	2870.1	44.20
1.293	86.122	0.4476	2452.9	3.994	614.2	0.2624E-03	2883.1	44.30
1.291	86.131	0.4476	2463.9	3.994	616.9	0.2606E-03	2896.1	44.40
1.288	86.140	0.4476	2475.1	3.994	619.7	0.2589E-03	2909.2	44.50
1.285	86.148	0.4476	2486.2	3.994	622.5	0.2572E-03	2922.2	44.60
1.282	86.157	0.4476	2497.4	3.994	625.3	0.2554E-03	2935.4	44.70
1.279	86.165	0.4476	2508.5	3.994	628.1	0.2537E-03	2948.5	44.80
1.276	86.174	0.4476	2519.8	3.994	630.9	0.2521E-03	2961.7	44.90
1.273	86.182	0.4476	2531.0	3.994	633.7	0.2504E-03	2974.9	45.00
1.271	86.191	0.4476	2542.3	3.994	636.5	0.2487E-03	2988.1	45.10
1.268	86.199	0.4476	2553.5	3.994	639.3	0.2471E-03	3001.4	45.20
1.265	86.208	0.4476	2564.9	3.994	642.2	0.2455E-03	3014.7	45.30
1.262	86.216	0.4476	2576.2	3.994	645.0	0.2438E-03	3028.0	45.40
1.259	86.224	0.4476	2587.6	3.994	647.8	0.2422E-03	3041.4	45.50
1.257	86.233	0.4476	2598.9	3.994	650.7	0.2407E-03	3054.7	45.60
1.254	86.241	0.4476	2610.4	3.994	653.5	0.2391E-03	3068.1	45.70
1.251	86.249	0.4476	2621.8	3.994	656.4	0.2375E-03	3081.6	45.80
1.248	86.257	0.4476	2633.3	3.994	659.3	0.2360E-03	3095.1	45.90
1.246	86.265	0.4476	2644.7	3.994	662.1	0.2344E-03	3108.6	46.00
1.243	86.273	0.4476	2656.3	3.994	665.0	0.2329E-03	3122.1	46.10
1.240	86.282	0.4475	2667.8	3.994	667.9	0.2314E-03	3135.6	46.20
1.238	86.290	0.4475	2679.4	3.994	670.8	0.2299E-03	3149.2	46.30
1.235	86.298	0.4475	2690.9	3.994	673.7	0.2284E-03	3162.8	46.40
1.232	86.305	0.4475	2702.6	3.994	676.6	0.2270E-03	3176.5	46.50
1.230	86.313	0.4475	2714.2	3.994	679.5	0.2255E-03	3190.2	46.60
1.227	86.321	0.4475	2725.9	3.995	682.4	0.2241E-03	3203.9	46.70
1.224	86.329	0.4475	2737.5	3.995	685.3	0.2226E-03	3217.6	46.80
1.222	86.337	0.4475	2749.3	3.995	688.3	0.2212E-03	3231.4	46.90
1.219	86.345	0.4475	2761.0	3.995	691.2	0.2198E-03	3245.2	47.00
1.217	86.352	0.4475	2772.8	3.995	694.1	0.2184E-03	3259.0	47.10
1.214	86.360	0.4475	2784.5	3.995	697.1	0.2170E-03	3272.8	47.20
1.211	86.368	0.4475	2796.4	3.995	700.0	0.2157E-03	3286.7	47.30
1.209	86.376	0.4475	2808.2	3.995	703.0	0.2143E-03	3300.6	47.40
1.206	86.383	0.4475	2820.1	3.995	706.0	0.2130E-03	3314.6	47.50
1.204	86.391	0.4475	2831.9	3.995	708.9	0.2116E-03	3328.5	47.60
1.201	86.398	0.4475	2843.9	3.995	711.9	0.2103E-03	3342.5	47.70
1.199	86.406	0.4475	2855.8	3.995	714.9	0.2090E-03	3356.6	47.80
1.196	86.413	0.4475	2867.8	3.995	717.9	0.2077E-03	3370.6	47.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
48.00	0.6098E-07	0.4689E-04	0.1300E-02	0.3606E-01	0.1171E-03	0.1443E-03	0.9995	1.99870
48.10	0.6035E-07	0.4660E-04	0.1295E-02	0.3599E-01	0.1164E-03	0.1434E-03	0.9994	1.99870
48.20	0.5973E-07	0.4631E-04	0.1290E-02	0.3591E-01	0.1156E-03	0.1425E-03	0.9994	1.99871
48.30	0.5911E-07	0.4603E-04	0.1284E-02	0.3584E-01	0.1149E-03	0.1416E-03	0.9994	1.99872
48.40	0.5850E-07	0.4574E-04	0.1279E-02	0.3576E-01	0.1142E-03	0.1408E-03	0.9994	1.99872
48.50	0.5790E-07	0.4546E-04	0.1274E-02	0.3569E-01	0.1135E-03	0.1399E-03	0.9994	1.99873
48.60	0.5731E-07	0.4518E-04	0.1269E-02	0.3562E-01	0.1128E-03	0.1390E-03	0.9994	1.99873
48.70	0.5673E-07	0.4490E-04	0.1263E-02	0.3554E-01	0.1121E-03	0.1382E-03	0.9994	1.99874
48.80	0.5615E-07	0.4463E-04	0.1258E-02	0.3547E-01	0.1114E-03	0.1373E-03	0.9994	1.99874
48.90	0.5558E-07	0.4435E-04	0.1253E-02	0.3540E-01	0.1107E-03	0.1365E-03	0.9994	1.99875
49.00	0.5501E-07	0.4408E-04	0.1248E-02	0.3533E-01	0.1101E-03	0.1357E-03	0.9994	1.99875
49.10	0.5446E-07	0.4382E-04	0.1243E-02	0.3525E-01	0.1094E-03	0.1348E-03	0.9994	1.99876
49.20	0.5391E-07	0.4355E-04	0.1238E-02	0.3518E-01	0.1087E-03	0.1340E-03	0.9994	1.99876
49.30	0.5336E-07	0.4329E-04	0.1233E-02	0.3511E-01	0.1081E-03	0.1332E-03	0.9994	1.99877
49.40	0.5282E-07	0.4302E-04	0.1228E-02	0.3504E-01	0.1074E-03	0.1324E-03	0.9994	1.99877
49.50	0.5229E-07	0.4276E-04	0.1223E-02	0.3497E-01	0.1068E-03	0.1316E-03	0.9994	1.99878
49.60	0.5177E-07	0.4251E-04	0.1218E-02	0.3490E-01	0.1061E-03	0.1308E-03	0.9994	1.99878
49.70	0.5125E-07	0.4225E-04	0.1213E-02	0.3483E-01	0.1055E-03	0.1300E-03	0.9994	1.99879
49.80	0.5074E-07	0.4200E-04	0.1208E-02	0.3476E-01	0.1049E-03	0.1292E-03	0.9994	1.99879
49.90	0.5023E-07	0.4174E-04	0.1203E-02	0.3469E-01	0.1042E-03	0.1285E-03	0.9994	1.99880
50.00	0.4973E-07	0.4149E-04	0.1199E-02	0.3462E-01	0.1036E-03	0.1277E-03	0.9994	1.99880
50.10	0.4924E-07	0.4125E-04	0.1194E-02	0.3455E-01	0.1030E-03	0.1269E-03	0.9994	1.99881
50.20	0.4875E-07	0.4100E-04	0.1189E-02	0.3448E-01	0.1024E-03	0.1262E-03	0.9994	1.99881
50.30	0.4827E-07	0.4076E-04	0.1184E-02	0.3441E-01	0.1018E-03	0.1254E-03	0.9994	1.99882
50.40	0.4779E-07	0.4052E-04	0.1180E-02	0.3435E-01	0.1012E-03	0.1247E-03	0.9994	1.99882
50.50	0.4732E-07	0.4028E-04	0.1175E-02	0.3428E-01	0.1006E-03	0.1239E-03	0.9994	1.99882
50.60	0.4686E-07	0.4004E-04	0.1170E-02	0.3421E-01	0.9998E-04	0.1232E-03	0.9994	1.99883
50.70	0.4640E-07	0.3980E-04	0.1166E-02	0.3414E-01	0.9939E-04	0.1225E-03	0.9994	1.99883
50.80	0.4594E-07	0.3957E-04	0.1161E-02	0.3408E-01	0.9880E-04	0.1218E-03	0.9994	1.99884
50.90	0.4549E-07	0.3933E-04	0.1157E-02	0.3401E-01	0.9822E-04	0.1210E-03	0.9994	1.99884
51.00	0.4505E-07	0.3910E-04	0.1152E-02	0.3394E-01	0.9765E-04	0.1203E-03	0.9994	1.99885
51.10	0.4461E-07	0.3888E-04	0.1148E-02	0.3388E-01	0.9708E-04	0.1196E-03	0.9994	1.99885
51.20	0.4418E-07	0.3865E-04	0.1143E-02	0.3381E-01	0.9651E-04	0.1189E-03	0.9994	1.99886
51.30	0.4375E-07	0.3842E-04	0.1139E-02	0.3374E-01	0.9595E-04	0.1182E-03	0.9994	1.99886
51.40	0.4333E-07	0.3820E-04	0.1134E-02	0.3368E-01	0.9539E-04	0.1176E-03	0.9994	1.99887
51.50	0.4291E-07	0.3798E-04	0.1130E-02	0.3361E-01	0.9484E-04	0.1169E-03	0.9994	1.99887
51.60	0.4249E-07	0.3776E-04	0.1125E-02	0.3355E-01	0.9429E-04	0.1162E-03	0.9994	1.99887
51.70	0.4209E-07	0.3754E-04	0.1121E-02	0.3348E-01	0.9374E-04	0.1155E-03	0.9994	1.99888
51.80	0.4168E-07	0.3732E-04	0.1117E-02	0.3342E-01	0.9320E-04	0.1149E-03	0.9994	1.99888
51.90	0.4128E-07	0.3711E-04	0.1113E-02	0.3335E-01	0.9266E-04	0.1142E-03	0.9994	1.99889
52.00	0.4089E-07	0.3689E-04	0.1108E-02	0.3329E-01	0.9213E-04	0.1135E-03	0.9994	1.99889
52.10	0.4050E-07	0.3668E-04	0.1104E-02	0.3323E-01	0.9160E-04	0.1129E-03	0.9994	1.99890
52.20	0.4011E-07	0.3647E-04	0.1100E-02	0.3316E-01	0.9108E-04	0.1122E-03	0.9994	1.99890
52.30	0.3973E-07	0.3626E-04	0.1096E-02	0.3310E-01	0.9056E-04	0.1116E-03	0.9995	1.99890
52.40	0.3935E-07	0.3606E-04	0.1091E-02	0.3304E-01	0.9004E-04	0.1110E-03	0.9995	1.99891
52.50	0.3898E-07	0.3585E-04	0.1087E-02	0.3297E-01	0.8953E-04	0.1103E-03	0.9995	1.99891
52.60	0.3861E-07	0.3565E-04	0.1083E-02	0.3291E-01	0.8902E-04	0.1097E-03	0.9995	1.99892
52.70	0.3825E-07	0.3544E-04	0.1079E-02	0.3285E-01	0.8852E-04	0.1091E-03	0.9995	1.99892
52.80	0.3788E-07	0.3524E-04	0.1075E-02	0.3279E-01	0.8801E-04	0.1085E-03	0.9995	1.99892
52.90	0.3753E-07	0.3504E-04	0.1071E-02	0.3272E-01	0.8752E-04	0.1079E-03	0.9995	1.99893
53.00	0.3718E-07	0.3485E-04	0.1067E-02	0.3266E-01	0.8702E-04	0.1072E-03	0.9995	1.99893
53.10	0.3683E-07	0.3465E-04	0.1063E-02	0.3260E-01	0.8653E-04	0.1066E-03	0.9995	1.99894
53.20	0.3648E-07	0.3446E-04	0.1059E-02	0.3254E-01	0.8605E-04	0.1060E-03	0.9995	1.99894
53.30	0.3614E-07	0.3426E-04	0.1055E-02	0.3248E-01	0.8556E-04	0.1054E-03	0.9995	1.99894
53.40	0.3581E-07	0.3407E-04	0.1051E-02	0.3242E-01	0.8509E-04	0.1049E-03	0.9995	1.99895
53.50	0.3547E-07	0.3388E-04	0.1047E-02	0.3236E-01	0.8461E-04	0.1043E-03	0.9995	1.99895
53.60	0.3514E-07	0.3369E-04	0.1043E-02	0.3230E-01	0.8414E-04	0.1037E-03	0.9995	1.99896
53.70	0.3482E-07	0.3350E-04	0.1039E-02	0.3224E-01	0.8367E-04	0.1031E-03	0.9995	1.99896
53.80	0.3450E-07	0.3332E-04	0.1035E-02	0.3218E-01	0.8321E-04	0.1025E-03	0.9995	1.99896
53.90	0.3418E-07	0.3313E-04	0.1032E-02	0.3212E-01	0.8274E-04	0.1020E-03	0.9995	1.99897
54.00	0.3386E-07	0.3295E-04	0.1028E-02	0.3206E-01	0.8229E-04	0.1014E-03	0.9995	1.99897
54.10	0.3355E-07	0.3277E-04	0.1024E-02	0.3200E-01	0.8183E-04	0.1008E-03	0.9995	1.99898
54.20	0.3324E-07	0.3259E-04	0.1020E-02	0.3194E-01	0.8138E-04	0.1003E-03	0.9995	1.99898
54.30	0.3294E-07	0.3241E-04	0.1016E-02	0.3188E-01	0.8093E-04	0.9973E-04	0.9995	1.99899
54.40	0.3264E-07	0.3223E-04	0.1013E-02	0.3182E-01	0.8049E-04	0.9918E-04	0.9995	1.99899
54.50	0.3234E-07	0.3205E-04	0.1009E-02	0.3176E-01	0.8005E-04	0.9864E-04	0.9995	1.99899
54.60	0.3204E-07	0.3187E-04	0.1005E-02	0.3171E-01	0.7961E-04	0.9810E-04	0.9995	1.99899
54.70	0.3175E-07	0.3170E-04	0.1002E-02	0.3165E-01	0.7917E-04	0.9756E-04	0.9995	1.99900
54.80	0.3146E-07	0.3153E-04	0.9980E-03	0.3159E-01	0.7874E-04	0.9703E-04	0.9995	1.99900
54.90	0.3118E-07	0.3136E-04	0.9944E-03	0.3153E-01	0.7831E-04	0.9650E-04	0.9995	1.99901
55.00	0.3090E-07	0.3119E-04	0.9908E-03	0.3148E-01	0.7789E-04	0.9598E-04	0.9995	1.99901
55.10	0.3062E-07	0.3102E-04	0.9872E-03	0.3142E-01	0.7746E-04	0.9546E-04	0.9995	1.99901
55.20	0.3034E-07	0.3085E-04	0.9836E-03	0.3136E-01	0.7704E-04	0.9494E-04	0.9995	1.99902
55.30	0.3007E-07	0.3068E-04	0.9800E-03	0.3131E-01	0.7663E-04	0.9443E-04	0.9995	1.99902
55.40	0.2980E-07	0.3052E-04	0.9765E-03	0.3125E-01	0.7621E-04	0.9392E-04	0.9995	1.99902
55.50	0.2953E-07	0.3035E-04	0.9730E-03	0.3119E-01	0.7580E-04	0.9341E-04	0.9995	1.99903
55.60	0.2927E-07	0.3019E-04	0.9695E-03	0.3114E-01	0.7540E-04	0.9291E-04	0.9995	1.99903
55.70	0.2901E-07	0.3003E-04	0.9660E-03	0.3108E-01	0.7499E-04	0.9241E-04	0.9995	1.99903
55.80	0.2875E-07	0.2986E-04	0.9626E-03	0.3103E-01	0.7459E-04	0.9191E-04	0.9995	1.99904
55.90	0.2849E-07	0.2970E-04	0.9591E-03	0.3097E-01	0.7419E-04	0.9142E-04	0.9995	1.99904

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
1.194	86.421	0.4475	2879.7	3.995	720.9	0.2064E-03	3384.7	48.00
1.191	86.428	0.4475	2891.8	3.995	723.9	0.2051E-03	3398.8	48.10
1.189	86.436	0.4475	2903.8	3.995	726.9	0.2038E-03	3413.0	48.20
1.186	86.443	0.4475	2915.9	3.995	729.9	0.2026E-03	3427.1	48.30
1.184	86.450	0.4475	2927.9	3.995	732.9	0.2013E-03	3441.3	48.40
1.181	86.458	0.4475	2940.1	3.995	736.0	0.2001E-03	3455.6	48.50
1.179	86.465	0.4475	2952.2	3.995	739.0	0.1989E-03	3469.8	48.60
1.177	86.472	0.4475	2964.4	3.995	742.0	0.1976E-03	3484.1	48.70
1.174	86.479	0.4475	2976.5	3.995	745.1	0.1964E-03	3498.5	48.80
1.172	86.487	0.4475	2988.8	3.995	748.1	0.1952E-03	3512.8	48.90
1.169	86.494	0.4475	3001.0	3.995	751.2	0.1940E-03	3527.2	49.00
1.167	86.501	0.4475	3013.3	3.995	754.3	0.1929E-03	3541.6	49.10
1.165	86.508	0.4475	3025.5	3.995	757.3	0.1917E-03	3556.0	49.20
1.162	86.515	0.4475	3037.9	3.995	760.4	0.1905E-03	3570.5	49.30
1.160	86.522	0.4475	3050.2	3.995	763.5	0.1894E-03	3585.0	49.40
1.158	86.529	0.4475	3062.6	3.995	766.6	0.1882E-03	3599.5	49.50
1.155	86.536	0.4475	3074.9	3.995	769.7	0.1871E-03	3614.1	49.60
1.153	86.543	0.4475	3087.4	3.995	772.8	0.1860E-03	3628.7	49.70
1.151	86.550	0.4475	3099.8	3.995	775.9	0.1849E-03	3643.3	49.80
1.148	86.557	0.4475	3112.3	3.995	779.0	0.1838E-03	3657.9	49.90
1.146	86.564	0.4475	3124.7	3.995	782.1	0.1827E-03	3672.6	50.00
1.144	86.571	0.4475	3137.3	3.995	785.3	0.1816E-03	3687.3	50.10
1.141	86.578	0.4475	3149.8	3.995	788.4	0.1805E-03	3702.0	50.20
1.139	86.584	0.4475	3162.4	3.995	791.5	0.1794E-03	3716.8	50.30
1.137	86.591	0.4475	3174.9	3.995	794.7	0.1783E-03	3731.6	50.40
1.135	86.598	0.4475	3187.6	3.995	797.8	0.1773E-03	3746.4	50.50
1.132	86.605	0.4475	3200.2	3.995	801.0	0.1762E-03	3761.3	50.60
1.130	86.611	0.4475	3212.9	3.995	804.2	0.1752E-03	3776.1	50.70
1.128	86.618	0.4475	3225.5	3.995	807.3	0.1742E-03	3791.0	50.80
1.126	86.625	0.4475	3238.3	3.995	810.5	0.1732E-03	3806.0	50.90
1.124	86.631	0.4475	3251.0	3.995	813.7	0.1721E-03	3821.0	51.00
1.121	86.638	0.4475	3263.8	3.995	816.9	0.1711E-03	3836.0	51.10
1.119	86.644	0.4475	3276.5	3.995	820.1	0.1701E-03	3851.0	51.20
1.117	86.651	0.4475	3289.4	3.995	823.3	0.1691E-03	3866.0	51.30
1.115	86.657	0.4475	3302.2	3.995	826.5	0.1682E-03	3881.1	51.40
1.113	86.664	0.4475	3315.1	3.995	829.7	0.1672E-03	3896.2	51.50
1.110	86.670	0.4475	3327.9	3.995	832.9	0.1662E-03	3911.4	51.60
1.108	86.677	0.4475	3340.9	3.996	836.2	0.1653E-03	3926.6	51.70
1.106	86.683	0.4475	3353.8	3.996	839.4	0.1643E-03	3941.8	51.80
1.104	86.690	0.4475	3366.8	3.996	842.6	0.1634E-03	3957.0	51.90
1.102	86.696	0.4475	3379.7	3.996	845.9	0.1624E-03	3972.2	52.00
1.100	86.702	0.4475	3392.8	3.996	849.1	0.1615E-03	3987.5	52.10
1.098	86.709	0.4475	3405.8	3.996	852.4	0.1606E-03	4002.9	52.20
1.096	86.715	0.4475	3418.9	3.996	855.7	0.1596E-03	4018.2	52.30
1.093	86.721	0.4475	3431.9	3.996	858.9	0.1587E-03	4033.6	52.40
1.091	86.727	0.4475	3445.1	3.996	862.2	0.1578E-03	4049.0	52.50
1.089	86.734	0.4475	3458.2	3.996	865.5	0.1569E-03	4064.4	52.60
1.087	86.740	0.4475	3471.4	3.996	868.8	0.1560E-03	4079.9	52.70
1.085	86.746	0.4475	3484.5	3.996	872.1	0.1552E-03	4095.4	52.80
1.083	86.752	0.4475	3497.8	3.996	875.4	0.1543E-03	4110.9	52.90
1.081	86.758	0.4475	3511.0	3.996	878.7	0.1534E-03	4126.5	53.00
1.079	86.764	0.4475	3524.3	3.996	882.0	0.1525E-03	4142.1	53.10
1.077	86.770	0.4475	3537.5	3.996	885.3	0.1517E-03	4157.7	53.20
1.075	86.776	0.4475	3550.9	3.996	888.7	0.1508E-03	4173.3	53.30
1.073	86.782	0.4475	3564.2	3.996	892.0	0.1500E-03	4189.0	53.40
1.071	86.788	0.4475	3577.6	3.996	895.3	0.1492E-03	4204.7	53.50
1.069	86.794	0.4475	3590.9	3.996	898.7	0.1483E-03	4220.4	53.60
1.067	86.800	0.4475	3604.4	3.996	902.0	0.1475E-03	4236.2	53.70
1.065	86.806	0.4475	3617.8	3.996	905.4	0.1467E-03	4252.0	53.80
1.063	86.812	0.4475	3631.3	3.996	908.8	0.1459E-03	4267.8	53.90
1.061	86.818	0.4475	3644.7	3.996	912.1	0.1451E-03	4283.6	54.00
1.059	86.824	0.4475	3658.3	3.996	915.5	0.1443E-03	4299.5	54.10
1.057	86.830	0.4475	3671.8	3.996	918.9	0.1435E-03	4315.4	54.20
1.055	86.836	0.4475	3685.4	3.996	922.3	0.1427E-03	4331.4	54.30
1.053	86.842	0.4475	3698.9	3.996	925.7	0.1419E-03	4347.3	54.40
1.051	86.847	0.4475	3712.6	3.996	929.1	0.1411E-03	4363.3	54.50
1.049	86.853	0.4475	3726.2	3.996	932.5	0.1403E-03	4379.4	54.60
1.048	86.859	0.4475	3739.9	3.996	935.9	0.1396E-03	4395.4	54.70
1.046	86.865	0.4475	3753.5	3.996	939.3	0.1388E-03	4411.5	54.80
1.044	86.870	0.4475	3767.8	3.996	942.8	0.1380E-03	4427.6	54.90
1.042	86.876	0.4475	3781.0	3.996	946.2	0.1373E-03	4443.8	55.00
1.040	86.882	0.4474	3794.8	3.996	949.6	0.1366E-03	4459.9	55.10
1.038	86.887	0.4474	3809.5	3.996	953.1	0.1359E-03	4476.1	55.20
1.036	86.893	0.4474	3822.4	3.996	956.5	0.1351E-03	4492.4	55.30
1.034	86.899	0.4474	3836.2	3.996	960.0	0.1344E-03	4508.6	55.40
1.032	86.904	0.4474	3850.1	3.996	963.5	0.1336E-03	4524.9	55.50
1.031	86.910	0.4474	3863.9	3.996	966.9	0.1329E-03	4541.2	55.60
1.029	86.915	0.4474	3877.9	3.996	970.4	0.1322E-03	4557.6	55.70
1.027	86.921	0.4474	3891.8	3.996	973.9	0.1315E-03	4574.0	55.80
1.025	86.926	0.4474	3905.8	3.996	977.4	0.1308E-03	4590.4	55.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
56.00	0.2924E-07	0.2955E-04	0.9557E-03	0.3091E-01	0.7379E-04	0.9093E-04	0.9995	1.99904
56.10	0.2799E-07	0.2939E-04	0.9523E-03	0.3086E-01	0.7340E-04	0.9045E-04	0.9995	1.99905
56.20	0.2774E-07	0.2923E-04	0.9489E-03	0.3080E-01	0.7301E-04	0.8997E-04	0.9995	1.99905
56.30	0.2749E-07	0.2908E-04	0.9456E-03	0.3075E-01	0.7262E-04	0.8949E-04	0.9995	1.99905
56.40	0.2725E-07	0.2892E-04	0.9422E-03	0.3070E-01	0.7224E-04	0.8902E-04	0.9995	1.99906
56.50	0.2701E-07	0.2877E-04	0.9389E-03	0.3064E-01	0.7186E-04	0.8854E-04	0.9995	1.99906
56.60	0.2677E-07	0.2862E-04	0.9356E-03	0.3059E-01	0.7148E-04	0.8808E-04	0.9995	1.99906
56.70	0.2654E-07	0.2847E-04	0.9323E-03	0.3053E-01	0.7110E-04	0.8761E-04	0.9995	1.99907
56.80	0.2631E-07	0.2832E-04	0.9290E-03	0.3048E-01	0.7072E-04	0.8715E-04	0.9995	1.99907
56.90	0.2608E-07	0.2817E-04	0.9258E-03	0.3043E-01	0.7035E-04	0.8669E-04	0.9995	1.99907
57.00	0.2585E-07	0.2802E-04	0.9225E-03	0.3037E-01	0.6998E-04	0.8624E-04	0.9995	1.99908
57.10	0.2562E-07	0.2787E-04	0.9193E-03	0.3032E-01	0.6962E-04	0.8579E-04	0.9995	1.99908
57.20	0.2540E-07	0.2773E-04	0.9161E-03	0.3027E-01	0.6925E-04	0.8534E-04	0.9995	1.99908
57.30	0.2518E-07	0.2758E-04	0.9129E-03	0.3021E-01	0.6889E-04	0.8489E-04	0.9995	1.99909
57.40	0.2496E-07	0.2744E-04	0.9097E-03	0.3016E-01	0.6853E-04	0.8445E-04	0.9995	1.99909
57.50	0.2474E-07	0.2730E-04	0.9066E-03	0.3011E-01	0.6818E-04	0.8401E-04	0.9995	1.99909
57.60	0.2453E-07	0.2715E-04	0.9034E-03	0.3006E-01	0.6782E-04	0.8357E-04	0.9995	1.99910
57.70	0.2432E-07	0.2701E-04	0.9003E-03	0.3000E-01	0.6747E-04	0.8314E-04	0.9995	1.99910
57.80	0.2411E-07	0.2687E-04	0.8972E-03	0.2995E-01	0.6712E-04	0.8271E-04	0.9996	1.99910
57.90	0.2390E-07	0.2673E-04	0.8941E-03	0.2990E-01	0.6678E-04	0.8228E-04	0.9996	1.99911
58.00	0.2370E-07	0.2660E-04	0.8910E-03	0.2985E-01	0.6643E-04	0.8186E-04	0.9996	1.99911
58.10	0.2349E-07	0.2646E-04	0.8879E-03	0.2980E-01	0.6609E-04	0.8144E-04	0.9996	1.99911
58.20	0.2329E-07	0.2632E-04	0.8849E-03	0.2975E-01	0.6575E-04	0.8102E-04	0.9996	1.99911
58.30	0.2309E-07	0.2619E-04	0.8819E-03	0.2970E-01	0.6541E-04	0.8060E-04	0.9996	1.99912
58.40	0.2290E-07	0.2605E-04	0.8788E-03	0.2965E-01	0.6508E-04	0.8019E-04	0.9996	1.99912
58.50	0.2270E-07	0.2592E-04	0.8758E-03	0.2959E-01	0.6474E-04	0.7978E-04	0.9996	1.99912
58.60	0.2251E-07	0.2579E-04	0.8729E-03	0.2954E-01	0.6441E-04	0.7937E-04	0.9996	1.99913
58.70	0.2232E-07	0.2566E-04	0.8699E-03	0.2949E-01	0.6409E-04	0.7897E-04	0.9996	1.99913
58.80	0.2213E-07	0.2553E-04	0.8669E-03	0.2944E-01	0.6376E-04	0.7857E-04	0.9996	1.99913
58.90	0.2194E-07	0.2540E-04	0.8640E-03	0.2939E-01	0.6344E-04	0.7817E-04	0.9996	1.99914
59.00	0.2176E-07	0.2527E-04	0.8611E-03	0.2934E-01	0.6311E-04	0.7777E-04	0.9996	1.99914
59.10	0.2157E-07	0.2514E-04	0.8582E-03	0.2929E-01	0.6280E-04	0.7738E-04	0.9996	1.99914
59.20	0.2139E-07	0.2501E-04	0.8553E-03	0.2925E-01	0.6248E-04	0.7699E-04	0.9996	1.99914
59.30	0.2121E-07	0.2489E-04	0.8524E-03	0.2920E-01	0.6216E-04	0.7660E-04	0.9996	1.99915
59.40	0.2104E-07	0.2476E-04	0.8495E-03	0.2915E-01	0.6185E-04	0.7621E-04	0.9996	1.99915
59.50	0.2086E-07	0.2464E-04	0.8467E-03	0.2910E-01	0.6154E-04	0.7583E-04	0.9996	1.99915
59.60	0.2069E-07	0.2451E-04	0.8438E-03	0.2905E-01	0.6123E-04	0.7545E-04	0.9996	1.99916
59.70	0.2051E-07	0.2439E-04	0.8410E-03	0.2900E-01	0.6092E-04	0.7507E-04	0.9996	1.99916
59.80	0.2034E-07	0.2427E-04	0.8382E-03	0.2895E-01	0.6062E-04	0.7469E-04	0.9996	1.99916
59.90	0.2017E-07	0.2415E-04	0.8354E-03	0.2890E-01	0.6032E-04	0.7432E-04	0.9996	1.99916
60.00	0.2001E-07	0.2405E-04	0.8326E-03	0.2886E-01	0.6002E-04	0.7395E-04	0.9996	1.99917
60.10	0.1984E-07	0.2391E-04	0.8299E-03	0.2881E-01	0.5972E-04	0.7358E-04	0.9996	1.99917
60.20	0.1968E-07	0.2379E-04	0.8271E-03	0.2876E-01	0.5942E-04	0.7322E-04	0.9996	1.99917
60.30	0.1951E-07	0.2367E-04	0.8244E-03	0.2871E-01	0.5913E-04	0.7285E-04	0.9996	1.99918
60.40	0.1935E-07	0.2355E-04	0.8217E-03	0.2866E-01	0.5883E-04	0.7249E-04	0.9996	1.99918
60.50	0.1919E-07	0.2344E-04	0.8189E-03	0.2862E-01	0.5854E-04	0.7213E-04	0.9996	1.99918
60.60	0.1904E-07	0.2332E-04	0.8162E-03	0.2857E-01	0.5825E-04	0.7178E-04	0.9996	1.99918
60.70	0.1888E-07	0.2321E-04	0.8135E-03	0.2852E-01	0.5797E-04	0.7142E-04	0.9996	1.99919
60.80	0.1872E-07	0.2309E-04	0.8109E-03	0.2848E-01	0.5768E-04	0.7107E-04	0.9996	1.99919
60.90	0.1857E-07	0.2298E-04	0.8082E-03	0.2843E-01	0.5740E-04	0.7072E-04	0.9996	1.99919
61.00	0.1842E-07	0.2286E-04	0.8056E-03	0.2838E-01	0.5712E-04	0.7038E-04	0.9996	1.99919
61.10	0.1827E-07	0.2275E-04	0.8030E-03	0.2834E-01	0.5684E-04	0.7003E-04	0.9996	1.99920
61.20	0.1812E-07	0.2264E-04	0.8003E-03	0.2829E-01	0.5656E-04	0.6969E-04	0.9996	1.99920
61.30	0.1797E-07	0.2253E-04	0.7977E-03	0.2824E-01	0.5628E-04	0.6935E-04	0.9996	1.99920
61.40	0.1783E-07	0.2242E-04	0.7951E-03	0.2820E-01	0.5601E-04	0.6901E-04	0.9996	1.99920
61.50	0.1768E-07	0.2231E-04	0.7926E-03	0.2815E-01	0.5574E-04	0.6868E-04	0.9996	1.99921
61.60	0.1754E-07	0.2220E-04	0.7900E-03	0.2811E-01	0.5547E-04	0.6834E-04	0.9996	1.99921
61.70	0.1740E-07	0.2210E-04	0.7874E-03	0.2806E-01	0.5520E-04	0.6801E-04	0.9996	1.99921
61.80	0.1726E-07	0.2199E-04	0.7849E-03	0.2802E-01	0.5493E-04	0.6768E-04	0.9996	1.99921
61.90	0.1712E-07	0.2188E-04	0.7823E-03	0.2797E-01	0.5466E-04	0.6735E-04	0.9996	1.99922
62.00	0.1698E-07	0.2178E-04	0.7798E-03	0.2793E-01	0.5440E-04	0.6703E-04	0.9996	1.99922
62.10	0.1685E-07	0.2167E-04	0.7773E-03	0.2788E-01	0.5414E-04	0.6671E-04	0.9996	1.99922
62.20	0.1671E-07	0.2157E-04	0.7748E-03	0.2784E-01	0.5388E-04	0.6639E-04	0.9996	1.99922
62.30	0.1658E-07	0.2146E-04	0.7723E-03	0.2779E-01	0.5362E-04	0.6607E-04	0.9996	1.99923
62.40	0.1645E-07	0.2136E-04	0.7699E-03	0.2775E-01	0.5336E-04	0.6575E-04	0.9996	1.99923
62.50	0.1631E-07	0.2126E-04	0.7674E-03	0.2770E-01	0.5311E-04	0.6544E-04	0.9996	1.99923
62.60	0.1618E-07	0.2116E-04	0.7650E-03	0.2766E-01	0.5285E-04	0.6512E-04	0.9996	1.99923
62.70	0.1606E-07	0.2106E-04	0.7625E-03	0.2761E-01	0.5260E-04	0.6481E-04	0.9996	1.99924
62.80	0.1593E-07	0.2096E-04	0.7601E-03	0.2757E-01	0.5235E-04	0.6450E-04	0.9996	1.99924
62.90	0.1580E-07	0.2086E-04	0.7577E-03	0.2753E-01	0.5210E-04	0.6420E-04	0.9996	1.99924
63.00	0.1568E-07	0.2076E-04	0.7553E-03	0.2748E-01	0.5185E-04	0.6389E-04	0.9996	1.99924
63.10	0.1555E-07	0.2066E-04	0.7529E-03	0.2744E-01	0.5161E-04	0.6359E-04	0.9996	1.99925
63.20	0.1543E-07	0.2056E-04	0.7505E-03	0.2740E-01	0.5136E-04	0.6329E-04	0.9996	1.99925
63.30	0.1531E-07	0.2046E-04	0.7482E-03	0.2735E-01	0.5112E-04	0.6299E-04	0.9996	1.99925
63.40	0.1519E-07	0.2037E-04	0.7458E-03	0.2731E-01	0.5088E-04	0.6269E-04	0.9996	1.99925
63.50	0.1507E-07	0.2027E-04	0.7434E-03	0.2727E-01	0.5064E-04	0.6240E-04	0.9996	1.99926
63.60	0.1495E-07	0.2018E-04	0.7411E-03	0.2722E-01	0.5040E-04	0.6210E-04	0.9996	1.99926
63.70	0.1484E-07	0.2008E-04	0.7388E-03	0.2718E-01	0.5017E-04	0.6181E-04	0.9996	1.99926
63.80	0.1472E-07	0.1999E-04	0.7365E-03	0.2714E-01	0.4993E-04	0.6152E-04	0.9996	1.99926
63.90	0.1461E-07	0.1989E-04	0.7342E-03	0.2710E-01	0.4970E-04	0.6123E-04	0.9996	1.99927

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
1.023	86.932	3.4474	3919.7	3.996	980.9	0.1301E-03	4606.8	56.00
1.021	86.937	3.4474	3933.8	3.996	984.4	0.1294E-03	4623.3	56.10
1.020	86.943	3.4474	3947.8	3.996	987.9	0.1287E-03	4639.8	56.20
1.018	86.948	3.4474	3961.9	3.996	991.4	0.1280E-03	4656.3	56.30
1.016	86.953	3.4474	3975.9	3.996	994.9	0.1273E-03	4672.8	56.40
1.014	86.959	3.4474	3990.1	3.996	998.5	0.1267E-03	4689.4	56.50
1.012	86.964	3.4474	4004.2	3.996	1002.0	0.1260E-03	4706.0	56.60
1.011	86.970	3.4474	4018.4	3.996	1005.5	0.1253E-03	4722.7	56.70
1.009	86.975	3.4474	4032.5	3.996	1009.1	0.1247E-03	4739.3	56.80
1.007	86.980	3.4474	4046.8	3.996	1012.6	0.1240E-03	4756.0	56.90
1.005	86.986	3.4474	4061.0	3.996	1016.2	0.1234E-03	4772.8	57.00
1.003	86.991	3.4474	4075.3	3.996	1019.8	0.1227E-03	4789.5	57.10
1.002	86.996	3.4474	4089.5	3.996	1023.3	0.1221E-03	4806.3	57.20
1.000	87.001	3.4474	4103.9	3.996	1026.9	0.1214E-03	4823.1	57.30
0.998	87.006	3.4474	4118.2	3.996	1030.5	0.1208E-03	4840.0	57.40
0.996	87.012	3.4474	4132.6	3.996	1034.1	0.1202E-03	4856.9	57.50
0.995	87.017	3.4474	4146.9	3.996	1037.7	0.1196E-03	4873.8	57.60
0.993	87.022	3.4474	4161.4	3.996	1041.3	0.1189E-03	4890.7	57.70
0.991	87.027	3.4474	4175.8	3.996	1044.9	0.1183E-03	4907.7	57.80
0.990	87.032	3.4474	4190.3	3.996	1048.5	0.1177E-03	4924.7	57.90
0.988	87.037	3.4474	4204.7	3.996	1052.1	0.1171E-03	4941.7	58.00
0.986	87.043	3.4474	4219.3	3.996	1055.8	0.1165E-03	4958.8	58.10
0.985	87.048	3.4474	4233.8	3.996	1059.4	0.1159E-03	4975.8	58.20
0.983	87.053	3.4474	4248.4	3.996	1063.0	0.1153E-03	4992.9	58.30
0.981	87.058	3.4474	4262.9	3.996	1066.7	0.1147E-03	5010.1	58.40
0.979	87.063	3.4474	4277.6	3.996	1070.3	0.1141E-03	5027.3	58.50
0.978	87.068	3.4474	4292.2	3.997	1074.0	0.1135E-03	5044.5	58.60
0.976	87.073	3.4474	4306.9	3.997	1077.7	0.1130E-03	5061.7	58.70
0.974	87.078	3.4474	4321.5	3.997	1081.3	0.1124E-03	5078.9	58.80
0.973	87.083	3.4474	4336.3	3.997	1085.0	0.1118E-03	5096.2	58.90
0.971	87.088	3.4474	4351.0	3.997	1088.7	0.1113E-03	5113.6	59.00
0.970	87.093	3.4474	4365.8	3.997	1092.4	0.1107E-03	5130.9	59.10
0.968	87.097	3.4474	4380.5	3.997	1096.1	0.1101E-03	5148.3	59.20
0.966	87.102	3.4474	4395.4	3.997	1099.8	0.1096E-03	5165.7	59.30
0.965	87.107	3.4474	4410.2	3.997	1103.5	0.1090E-03	5183.1	59.40
0.963	87.112	3.4474	4425.1	3.997	1107.2	0.1085E-03	5200.6	59.50
0.961	87.117	3.4474	4439.9	3.997	1110.9	0.1079E-03	5218.1	59.60
0.960	87.122	3.4474	4454.9	3.997	1114.7	0.1074E-03	5235.6	59.70
0.958	87.127	3.4474	4469.8	3.997	1118.4	0.1069E-03	5253.2	59.80
0.957	87.131	3.4474	4484.8	3.997	1122.1	0.1063E-03	5270.7	59.90
0.955	87.136	3.4474	4499.7	3.997	1125.9	0.1058E-03	5288.3	60.00
0.953	87.141	3.4474	4514.8	3.997	1129.6	0.1053E-03	5306.0	60.10
0.952	87.146	3.4474	4529.8	3.997	1133.4	0.1047E-03	5323.7	60.20
0.950	87.150	3.4474	4544.9	3.997	1137.2	0.1042E-03	5341.4	60.30
0.949	87.155	3.4474	4559.9	3.997	1140.9	0.1037E-03	5359.1	60.40
0.947	87.160	3.4474	4575.1	3.997	1144.7	0.1032E-03	5376.8	60.50
0.946	87.164	3.4474	4590.2	3.997	1148.5	0.1027E-03	5394.6	60.60
0.944	87.169	3.4474	4605.4	3.997	1152.3	0.1022E-03	5412.5	60.70
0.942	87.174	3.4474	4620.5	3.997	1156.1	0.1017E-03	5430.3	60.80
0.941	87.178	3.4474	4635.8	3.997	1159.9	0.1012E-03	5448.2	60.90
0.939	87.183	3.4474	4651.0	3.997	1163.7	0.1007E-03	5466.1	61.00
0.938	87.188	3.4474	4666.3	3.997	1167.5	0.1002E-03	5484.0	61.10
0.936	87.192	3.4474	4681.5	3.997	1171.3	0.9970E-04	5502.0	61.20
0.935	87.197	3.4474	4696.9	3.997	1175.2	0.9921E-04	5520.0	61.30
0.933	87.201	3.4474	4712.2	3.997	1179.0	0.9873E-04	5538.0	61.40
0.932	87.206	3.4474	4727.6	3.997	1182.8	0.9825E-04	5556.0	61.50
0.930	87.210	3.4474	4742.9	3.997	1186.7	0.9777E-04	5574.1	61.60
0.929	87.215	3.4474	4758.4	3.997	1190.5	0.9730E-04	5592.2	61.70
0.927	87.219	3.4474	4773.8	3.997	1194.4	0.9683E-04	5610.4	61.80
0.926	87.224	3.4474	4789.3	3.997	1198.3	0.9636E-04	5628.6	61.90
0.924	87.228	3.4474	4804.7	3.997	1202.1	0.9590E-04	5646.8	62.00
0.923	87.233	3.4474	4820.3	3.997	1206.0	0.9543E-04	5665.0	62.10
0.921	87.237	3.4474	4835.8	3.997	1209.9	0.9497E-04	5683.2	62.20
0.920	87.242	3.4474	4851.4	3.997	1213.8	0.9452E-04	5701.5	62.30
0.918	87.246	3.4474	4866.9	3.997	1217.7	0.9407E-04	5719.8	62.40
0.917	87.251	3.4474	4882.6	3.997	1221.6	0.9361E-04	5738.2	62.50
0.915	87.255	3.4474	4898.2	3.997	1225.5	0.9317E-04	5756.6	62.60
0.914	87.259	3.4474	4913.9	3.997	1229.4	0.9272E-04	5775.0	62.70
0.912	87.264	3.4474	4929.5	3.997	1233.3	0.9228E-04	5793.4	62.80
0.911	87.268	3.4474	4945.3	3.997	1237.3	0.9184E-04	5811.9	62.90
0.909	87.272	3.4474	4961.0	3.997	1241.2	0.9141E-04	5830.4	63.00
0.908	87.277	3.4474	4976.8	3.997	1245.1	0.9097E-04	5848.9	63.10
0.907	87.281	3.4474	4992.5	3.997	1249.1	0.9054E-04	5867.4	63.20
0.905	87.285	3.4474	5008.4	3.997	1253.0	0.9011E-04	5886.0	63.30
0.904	87.290	3.4474	5024.2	3.997	1257.0	0.8969E-04	5904.6	63.40
0.902	87.294	3.4474	5040.1	3.997	1261.0	0.8927E-04	5923.3	63.50
0.901	87.298	3.4474	5055.9	3.997	1264.9	0.8885E-04	5941.9	63.60
0.900	87.302	3.4474	5071.9	3.997	1268.9	0.8843E-04	5960.6	63.70
0.898	87.307	3.4474	5087.8	3.997	1272.9	0.8801E-04	5979.4	63.80
0.897	87.311	3.4474	5103.8	3.997	1276.9	0.8760E-04	5998.1	63.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
64.00	0.1449E-07	0.1980E-04	0.7319E-03	0.2705E-01	0.4946E-04	0.6095E-04	0.9996	1.99927
64.10	0.1438E-07	0.1971E-04	0.7296E-03	0.2701E-01	0.4923E-04	0.6066E-04	0.9996	1.99927
64.20	0.1427E-07	0.1962E-04	0.7273E-03	0.2697E-01	0.4900E-04	0.6038E-04	0.9996	1.99927
64.30	0.1416E-07	0.1952E-04	0.7251E-03	0.2693E-01	0.4878E-04	0.6010E-04	0.9996	1.99927
64.40	0.1405E-07	0.1943E-04	0.7228E-03	0.2689E-01	0.4855E-04	0.5982E-04	0.9996	1.99928
64.50	0.1394E-07	0.1934E-04	0.7206E-03	0.2684E-01	0.4832E-04	0.5954E-04	0.9996	1.99928
64.60	0.1383E-07	0.1925E-04	0.7184E-03	0.2680E-01	0.4810E-04	0.5927E-04	0.9996	1.99928
64.70	0.1372E-07	0.1916E-04	0.7161E-03	0.2676E-01	0.4788E-04	0.5899E-04	0.9996	1.99928
64.80	0.1362E-07	0.1908E-04	0.7139E-03	0.2672E-01	0.4766E-04	0.5872E-04	0.9996	1.99929
64.90	0.1351E-07	0.1899E-04	0.7117E-03	0.2668E-01	0.4744E-04	0.5845E-04	0.9996	1.99929
65.00	0.1341E-07	0.1890E-04	0.7096E-03	0.2664E-01	0.4722E-04	0.5818E-04	0.9996	1.99929
65.10	0.1331E-07	0.1881E-04	0.7074E-03	0.2660E-01	0.4700E-04	0.5791E-04	0.9996	1.99929
65.20	0.1321E-07	0.1873E-04	0.7052E-03	0.2656E-01	0.4679E-04	0.5765E-04	0.9996	1.99929
65.30	0.1311E-07	0.1864E-04	0.7031E-03	0.2652E-01	0.4657E-04	0.5738E-04	0.9996	1.99930
65.40	0.1301E-07	0.1856E-04	0.7009E-03	0.2647E-01	0.4636E-04	0.5712E-04	0.9996	1.99930
65.50	0.1291E-07	0.1847E-04	0.6988E-03	0.2643E-01	0.4615E-04	0.5686E-04	0.9997	1.99930
65.60	0.1281E-07	0.1839E-04	0.6966E-03	0.2639E-01	0.4594E-04	0.5660E-04	0.9997	1.99930
65.70	0.1271E-07	0.1830E-04	0.6945E-03	0.2635E-01	0.4573E-04	0.5634E-04	0.9997	1.99931
65.80	0.1262E-07	0.1822E-04	0.6924E-03	0.2631E-01	0.4552E-04	0.5608E-04	0.9997	1.99931
65.90	0.1252E-07	0.1814E-04	0.6903E-03	0.2627E-01	0.4531E-04	0.5583E-04	0.9997	1.99931
66.00	0.1243E-07	0.1806E-04	0.6882E-03	0.2623E-01	0.4511E-04	0.5558E-04	0.9997	1.99931
66.10	0.1233E-07	0.1797E-04	0.6862E-03	0.2619E-01	0.4490E-04	0.5532E-04	0.9997	1.99931
66.20	0.1224E-07	0.1789E-04	0.6841E-03	0.2615E-01	0.4470E-04	0.5507E-04	0.9997	1.99932
66.30	0.1215E-07	0.1781E-04	0.6820E-03	0.2612E-01	0.4450E-04	0.5483E-04	0.9997	1.99932
66.40	0.1206E-07	0.1773E-04	0.6800E-03	0.2608E-01	0.4430E-04	0.5458E-04	0.9997	1.99932
66.50	0.1197E-07	0.1765E-04	0.6779E-03	0.2604E-01	0.4410E-04	0.5433E-04	0.9997	1.99932
66.60	0.1188E-07	0.1757E-04	0.6759E-03	0.2600E-01	0.4390E-04	0.5409E-04	0.9997	1.99932
66.70	0.1179E-07	0.1749E-04	0.6739E-03	0.2596E-01	0.4370E-04	0.5385E-04	0.9997	1.99933
66.80	0.1170E-07	0.1741E-04	0.6719E-03	0.2592E-01	0.4351E-04	0.5361E-04	0.9997	1.99933
66.90	0.1161E-07	0.1734E-04	0.6699E-03	0.2588E-01	0.4331E-04	0.5337E-04	0.9997	1.99933
67.00	0.1153E-07	0.1726E-04	0.6679E-03	0.2584E-01	0.4312E-04	0.5313E-04	0.9997	1.99933
67.10	0.1144E-07	0.1718E-04	0.6659E-03	0.2580E-01	0.4293E-04	0.5289E-04	0.9997	1.99933
67.20	0.1136E-07	0.1711E-04	0.6639E-03	0.2577E-01	0.4274E-04	0.5265E-04	0.9997	1.99934
67.30	0.1127E-07	0.1703E-04	0.6619E-03	0.2573E-01	0.4255E-04	0.5242E-04	0.9997	1.99934
67.40	0.1119E-07	0.1695E-04	0.6600E-03	0.2569E-01	0.4236E-04	0.5219E-04	0.9997	1.99934
67.50	0.1111E-07	0.1688E-04	0.6580E-03	0.2565E-01	0.4217E-04	0.5196E-04	0.9997	1.99934
67.60	0.1102E-07	0.1680E-04	0.6561E-03	0.2561E-01	0.4198E-04	0.5173E-04	0.9997	1.99934
67.70	0.1094E-07	0.1673E-04	0.6541E-03	0.2558E-01	0.4180E-04	0.5150E-04	0.9997	1.99935
67.80	0.1086E-07	0.1666E-04	0.6522E-03	0.2554E-01	0.4161E-04	0.5127E-04	0.9997	1.99935
67.90	0.1078E-07	0.1658E-04	0.6503E-03	0.2550E-01	0.4143E-04	0.5104E-04	0.9997	1.99935
68.00	0.1070E-07	0.1651E-04	0.6484E-03	0.2546E-01	0.4125E-04	0.5082E-04	0.9997	1.99935
68.10	0.1063E-07	0.1644E-04	0.6465E-03	0.2543E-01	0.4107E-04	0.5060E-04	0.9997	1.99935
68.20	0.1055E-07	0.1636E-04	0.6446E-03	0.2539E-01	0.4089E-04	0.5037E-04	0.9997	1.99936
68.30	0.1047E-07	0.1629E-04	0.6427E-03	0.2535E-01	0.4071E-04	0.5015E-04	0.9997	1.99936
68.40	0.1040E-07	0.1622E-04	0.6408E-03	0.2531E-01	0.4053E-04	0.4993E-04	0.9997	1.99936
68.50	0.1032E-07	0.1615E-04	0.6389E-03	0.2528E-01	0.4035E-04	0.4972E-04	0.9997	1.99936
68.60	0.1024E-07	0.1608E-04	0.6371E-03	0.2524E-01	0.4018E-04	0.4950E-04	0.9997	1.99936
68.70	0.1017E-07	0.1601E-04	0.6352E-03	0.2520E-01	0.4000E-04	0.4928E-04	0.9997	1.99936
68.80	0.1010E-07	0.1594E-04	0.6334E-03	0.2517E-01	0.3983E-04	0.4907E-04	0.9997	1.99937
68.90	0.1002E-07	0.1587E-04	0.6316E-03	0.2513E-01	0.3965E-04	0.4886E-04	0.9997	1.99937
69.00	0.9951E-08	0.1580E-04	0.6297E-03	0.2509E-01	0.3948E-04	0.4864E-04	0.9997	1.99937
69.10	0.9879E-08	0.1573E-04	0.6279E-03	0.2506E-01	0.3931E-04	0.4843E-04	0.9997	1.99937
69.20	0.9808E-08	0.1567E-04	0.6261E-03	0.2502E-01	0.3914E-04	0.4822E-04	0.9997	1.99937
69.30	0.9738E-08	0.1560E-04	0.6243E-03	0.2499E-01	0.3897E-04	0.4802E-04	0.9997	1.99938
69.40	0.9668E-08	0.1553E-04	0.6225E-03	0.2495E-01	0.3880E-04	0.4781E-04	0.9997	1.99938
69.50	0.9599E-08	0.1546E-04	0.6207E-03	0.2491E-01	0.3864E-04	0.4760E-04	0.9997	1.99938
69.60	0.9530E-08	0.1540E-04	0.6189E-03	0.2488E-01	0.3847E-04	0.4740E-04	0.9997	1.99938
69.70	0.9462E-08	0.1533E-04	0.6171E-03	0.2484E-01	0.3830E-04	0.4719E-04	0.9997	1.99938
69.80	0.9394E-08	0.1527E-04	0.6154E-03	0.2481E-01	0.3814E-04	0.4699E-04	0.9997	1.99938
69.90	0.9327E-08	0.1520E-04	0.6136E-03	0.2477E-01	0.3798E-04	0.4679E-04	0.9997	1.99939
70.00	0.9261E-08	0.1514E-04	0.6119E-03	0.2474E-01	0.3782E-04	0.4659E-04	0.9997	1.99939
70.10	0.9195E-08	0.1507E-04	0.6101E-03	0.2470E-01	0.3765E-04	0.4639E-04	0.9997	1.99939
70.20	0.9130E-08	0.1501E-04	0.6084E-03	0.2467E-01	0.3749E-04	0.4619E-04	0.9997	1.99939
70.30	0.9065E-08	0.1494E-04	0.6067E-03	0.2463E-01	0.3733E-04	0.4600E-04	0.9997	1.99939
70.40	0.9001E-08	0.1488E-04	0.6049E-03	0.2460E-01	0.3717E-04	0.4580E-04	0.9997	1.99939
70.50	0.8937E-08	0.1482E-04	0.6032E-03	0.2456E-01	0.3702E-04	0.4561E-04	0.9997	1.99940
70.60	0.8874E-08	0.1475E-04	0.6015E-03	0.2453E-01	0.3686E-04	0.4541E-04	0.9997	1.99940
70.70	0.8812E-08	0.1469E-04	0.5998E-03	0.2449E-01	0.3670E-04	0.4522E-04	0.9997	1.99940
70.80	0.8750E-08	0.1463E-04	0.5981E-03	0.2446E-01	0.3655E-04	0.4503E-04	0.9997	1.99940
70.90	0.8688E-08	0.1457E-04	0.5964E-03	0.2442E-01	0.3639E-04	0.4484E-04	0.9997	1.99940
71.00	0.8627E-08	0.1451E-04	0.5948E-03	0.2439E-01	0.3624E-04	0.4465E-04	0.9997	1.99941
71.10	0.8567E-08	0.1444E-04	0.5931E-03	0.2435E-01	0.3609E-04	0.4446E-04	0.9997	1.99941
71.20	0.8507E-08	0.1438E-04	0.5914E-03	0.2432E-01	0.3594E-04	0.4428E-04	0.9997	1.99941
71.30	0.8447E-08	0.1432E-04	0.5898E-03	0.2429E-01	0.3579E-04	0.4409E-04	0.9997	1.99941
71.40	0.8388E-08	0.1426E-04	0.5881E-03	0.2425E-01	0.3564E-04	0.4391E-04	0.9997	1.99941
71.50	0.8330E-08	0.1420E-04	0.5865E-03	0.2422E-01	0.3549E-04	0.4372E-04	0.9997	1.99941
71.60	0.8272E-08	0.1414E-04	0.5848E-03	0.2418E-01	0.3534E-04	0.4354E-04	0.9997	1.99942
71.70	0.8214E-08	0.1408E-04	0.5832E-03	0.2415E-01	0.3519E-04	0.4336E-04	0.9997	1.99942
71.80	0.8157E-08	0.1403E-04	0.5816E-03	0.2412E-01	0.3504E-04	0.4318E-04	0.9997	1.99942
71.90	0.8101E-08	0.1397E-04	0.5800E-03	0.2408E-01	0.3490E-04	0.4300E-04	0.9997	1.99942

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
0.895	87.315	0.4474	5119.7	3.997	1280.9	0.8719E-04	6016.9	64.00
0.894	87.319	0.4474	5135.8	3.997	1284.9	0.8679E-04	6035.7	64.10
0.892	87.323	0.4474	5151.8	3.997	1288.9	0.8638E-04	6054.6	64.20
0.891	87.328	0.4474	5167.9	3.997	1292.9	0.8598E-04	6073.4	64.30
0.890	87.332	0.4474	5183.9	3.997	1296.9	0.8558E-04	6092.3	64.40
0.888	87.336	0.4474	5200.1	3.997	1301.0	0.8518E-04	6111.3	64.50
0.887	87.340	0.4474	5216.2	3.997	1305.0	0.8479E-04	6130.2	64.60
0.886	87.344	0.4474	5232.4	3.997	1309.0	0.8440E-04	6149.2	64.70
0.884	87.348	0.4474	5248.5	3.997	1313.1	0.8401E-04	6168.3	64.80
0.883	87.352	0.4474	5264.8	3.997	1317.1	0.8362E-04	6187.3	64.90
0.882	87.356	0.4474	5281.0	3.997	1321.2	0.8323E-04	6206.4	65.00
0.880	87.360	0.4474	5297.3	3.997	1325.3	0.8285E-04	6225.5	65.10
0.879	87.364	0.4474	5313.5	3.997	1329.3	0.8247E-04	6244.6	65.20
0.877	87.368	0.4474	5329.9	3.997	1333.4	0.8209E-04	6263.8	65.30
0.876	87.372	0.4474	5346.2	3.997	1337.5	0.8172E-04	6283.0	65.40
0.875	87.376	0.4474	5362.6	3.997	1341.6	0.8135E-04	6302.2	65.50
0.873	87.380	0.4474	5378.9	3.997	1345.7	0.8097E-04	6321.5	65.60
0.872	87.384	0.4474	5395.4	3.997	1349.8	0.8061E-04	6340.8	65.70
0.871	87.388	0.4474	5411.8	3.997	1353.9	0.8024E-04	6360.1	65.80
0.869	87.392	0.4474	5428.3	3.997	1358.0	0.7987E-04	6379.4	65.90
0.868	87.396	0.4474	5444.7	3.997	1362.1	0.7951E-04	6398.8	66.00
0.867	87.400	0.4474	5461.3	3.997	1366.3	0.7915E-04	6418.2	66.10
0.866	87.404	0.4474	5477.8	3.997	1370.4	0.7879E-04	6437.6	66.20
0.864	87.408	0.4474	5494.4	3.997	1374.5	0.7844E-04	6457.1	66.30
0.863	87.412	0.4474	5510.9	3.997	1378.7	0.7809E-04	6476.6	66.40
0.862	87.416	0.4474	5527.6	3.997	1382.8	0.7773E-04	6496.1	66.50
0.860	87.420	0.4474	5544.2	3.997	1387.0	0.7739E-04	6515.7	66.60
0.859	87.424	0.4474	5560.9	3.997	1391.2	0.7704E-04	6535.2	66.70
0.858	87.427	0.4474	5577.5	3.997	1395.3	0.7669E-04	6554.9	66.80
0.856	87.431	0.4474	5594.3	3.997	1399.5	0.7685E-04	6574.5	66.90
0.855	87.435	0.4474	5611.0	3.997	1403.7	0.7601E-04	6594.2	67.00
0.854	87.439	0.4474	5627.8	3.997	1407.9	0.7567E-04	6613.9	67.10
0.853	87.443	0.4474	5644.5	3.997	1412.1	0.7533E-04	6633.6	67.20
0.851	87.447	0.4474	5661.4	3.997	1416.3	0.7500E-04	6653.3	67.30
0.850	87.450	0.4474	5678.2	3.997	1420.5	0.7467E-04	6673.1	67.40
0.849	87.454	0.4474	5695.1	3.997	1424.7	0.7433E-04	6692.9	67.50
0.848	87.458	0.4474	5711.9	3.997	1428.9	0.7401E-04	6712.8	67.60
0.846	87.462	0.4474	5728.9	3.997	1433.2	0.7368E-04	6732.7	67.70
0.845	87.465	0.4474	5745.8	3.997	1437.4	0.7335E-04	6752.6	67.80
0.844	87.469	0.4474	5762.8	3.997	1441.6	0.7303E-04	6772.5	67.90
0.843	87.473	0.4474	5779.7	3.997	1445.9	0.7271E-04	6792.5	68.00
0.841	87.477	0.4474	5796.8	3.997	1450.1	0.7239E-04	6812.5	68.10
0.840	87.480	0.4474	5813.8	3.997	1454.4	0.7207E-04	6832.5	68.20
0.839	87.484	0.4474	5830.9	3.997	1458.7	0.7176E-04	6852.5	68.30
0.838	87.488	0.4474	5847.9	3.997	1462.9	0.7144E-04	6872.6	68.40
0.836	87.491	0.4474	5865.1	3.997	1467.2	0.7113E-04	6892.7	68.50
0.835	87.495	0.4474	5882.2	3.997	1471.5	0.7082E-04	6912.8	68.60
0.834	87.499	0.4474	5899.4	3.997	1475.8	0.7051E-04	6933.0	68.70
0.833	87.502	0.4474	5916.5	3.997	1480.1	0.7020E-04	6953.2	68.80
0.832	87.506	0.4474	5933.8	3.997	1484.4	0.6990E-04	6973.4	68.90
0.830	87.509	0.4474	5951.0	3.997	1488.7	0.6960E-04	6993.7	69.00
0.829	87.513	0.4474	5968.3	3.997	1493.0	0.6929E-04	7014.0	69.10
0.828	87.517	0.4474	5985.5	3.997	1497.3	0.6899E-04	7034.3	69.20
0.827	87.520	0.4474	6002.9	3.998	1501.7	0.6870E-04	7054.6	69.30
0.826	87.524	0.4474	6020.2	3.998	1506.0	0.6840E-04	7075.0	69.40
0.824	87.527	0.4474	6037.6	3.998	1510.3	0.6811E-04	7095.4	69.50
0.823	87.531	0.4474	6054.9	3.998	1514.7	0.6781E-04	7115.8	69.60
0.822	87.534	0.4474	6072.4	3.998	1519.0	0.6752E-04	7136.3	69.70
0.821	87.538	0.4474	6089.8	3.998	1523.4	0.6723E-04	7156.8	69.80
0.820	87.542	0.4474	6107.3	3.998	1527.8	0.6694E-04	7177.3	69.90
0.819	87.545	0.4474	6124.7	3.998	1532.1	0.6666E-04	7197.9	70.00
0.817	87.549	0.4474	6142.3	3.998	1536.5	0.6637E-04	7218.4	70.10
0.816	87.552	0.4474	6159.8	3.998	1540.9	0.6609E-04	7239.1	70.20
0.815	87.556	0.4474	6177.4	3.998	1545.3	0.6581E-04	7259.7	70.30
0.814	87.559	0.4474	6194.9	3.998	1549.7	0.6553E-04	7280.4	70.40
0.813	87.562	0.4474	6212.6	3.998	1554.1	0.6525E-04	7301.1	70.50
0.812	87.566	0.4474	6230.2	3.998	1558.5	0.6497E-04	7321.8	70.60
0.810	87.569	0.4474	6247.9	3.998	1562.9	0.6470E-04	7342.5	70.70
0.809	87.573	0.4474	6265.5	3.998	1567.3	0.6443E-04	7363.3	70.80
0.808	87.576	0.4474	6283.3	3.998	1571.8	0.6415E-04	7384.1	70.90
0.807	87.580	0.4474	6301.0	3.998	1576.2	0.6388E-04	7405.0	71.00
0.806	87.583	0.4474	6318.8	3.998	1580.6	0.6361E-04	7425.8	71.10
0.805	87.586	0.4474	6336.5	3.998	1585.1	0.6335E-04	7446.7	71.20
0.804	87.590	0.4474	6354.4	3.998	1589.5	0.6308E-04	7467.7	71.30
0.802	87.593	0.4474	6372.2	3.998	1594.0	0.6282E-04	7488.6	71.40
0.801	87.597	0.4474	6390.1	3.998	1598.5	0.6255E-04	7509.6	71.50
0.800	87.600	0.4474	6407.9	3.998	1602.9	0.6229E-04	7530.6	71.60
0.799	87.603	0.4474	6425.9	3.998	1607.4	0.6203E-04	7551.7	71.70
0.798	87.607	0.4474	6443.8	3.998	1611.9	0.6177E-04	7572.8	71.80
0.797	87.610	0.4474	6461.8	3.998	1616.4	0.6152E-04	7593.9	71.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
72.00	0.8045E-08	0.1391E-04	0.5784E-03	0.2405E-01	0.3475E-04	0.4282E-04	0.9997	1.99942
72.10	0.7989E-08	0.1385E-04	0.5768E-03	0.2402E-01	0.3461E-04	0.4264E-04	0.9997	1.99942
72.20	0.7934E-08	0.1379E-04	0.5752E-03	0.2398E-01	0.3447E-04	0.4246E-04	0.9997	1.99942
72.30	0.7879E-08	0.1374E-04	0.5736E-03	0.2395E-01	0.3432E-04	0.4229E-04	0.9997	1.99943
72.40	0.7825E-08	0.1368E-04	0.5720E-03	0.2392E-01	0.3418E-04	0.4211E-04	0.9997	1.99943
72.50	0.7771E-08	0.1362E-04	0.5704E-03	0.2388E-01	0.3404E-04	0.4194E-04	0.9997	1.99943
72.60	0.7718E-08	0.1357E-04	0.5689E-03	0.2385E-01	0.3390E-04	0.4177E-04	0.9997	1.99943
72.70	0.7665E-08	0.1351E-04	0.5673E-03	0.2382E-01	0.3376E-04	0.4159E-04	0.9997	1.99943
72.80	0.7613E-08	0.1346E-04	0.5657E-03	0.2379E-01	0.3362E-04	0.4142E-04	0.9997	1.99943
72.90	0.7561E-08	0.1340E-04	0.5642E-03	0.2375E-01	0.3348E-04	0.4125E-04	0.9997	1.99944
73.00	0.7509E-08	0.1335E-04	0.5626E-03	0.2372E-01	0.3335E-04	0.4108E-04	0.9997	1.99944
73.10	0.7458E-08	0.1329E-04	0.5611E-03	0.2369E-01	0.3321E-04	0.4091E-04	0.9997	1.99944
73.20	0.7407E-08	0.1324E-04	0.5596E-03	0.2366E-01	0.3307E-04	0.4075E-04	0.9997	1.99944
73.30	0.7357E-08	0.1318E-04	0.5580E-03	0.2362E-01	0.3294E-04	0.4058E-04	0.9997	1.99944
73.40	0.7307E-08	0.1313E-04	0.5565E-03	0.2359E-01	0.3280E-04	0.4042E-04	0.9997	1.99944
73.50	0.7257E-08	0.1308E-04	0.5550E-03	0.2356E-01	0.3267E-04	0.4025E-04	0.9997	1.99944
73.60	0.7208E-08	0.1302E-04	0.5535E-03	0.2353E-01	0.3254E-04	0.4009E-04	0.9997	1.99945
73.70	0.7159E-08	0.1297E-04	0.5520E-03	0.2349E-01	0.3241E-04	0.3992E-04	0.9997	1.99945
73.80	0.7111E-08	0.1292E-04	0.5505E-03	0.2346E-01	0.3227E-04	0.3976E-04	0.9997	1.99945
73.90	0.7063E-08	0.1286E-04	0.5490E-03	0.2343E-01	0.3214E-04	0.3960E-04	0.9997	1.99945
74.00	0.7015E-08	0.1281E-04	0.5475E-03	0.2340E-01	0.3201E-04	0.3944E-04	0.9997	1.99945
74.10	0.6968E-08	0.1276E-04	0.5461E-03	0.2337E-01	0.3188E-04	0.3928E-04	0.9997	1.99945
74.20	0.6921E-08	0.1271E-04	0.5446E-03	0.2334E-01	0.3176E-04	0.3912E-04	0.9997	1.99946
74.30	0.6875E-08	0.1266E-04	0.5431E-03	0.2331E-01	0.3163E-04	0.3897E-04	0.9997	1.99946
74.40	0.6829E-08	0.1261E-04	0.5417E-03	0.2327E-01	0.3150E-04	0.3881E-04	0.9997	1.99946
74.50	0.6783E-08	0.1256E-04	0.5402E-03	0.2324E-01	0.3137E-04	0.3865E-04	0.9997	1.99946
74.60	0.6738E-08	0.1251E-04	0.5388E-03	0.2321E-01	0.3125E-04	0.3850E-04	0.9997	1.99946
74.70	0.6693E-08	0.1246E-04	0.5373E-03	0.2318E-01	0.3112E-04	0.3834E-04	0.9997	1.99946
74.80	0.6648E-08	0.1241E-04	0.5359E-03	0.2315E-01	0.3100E-04	0.3819E-04	0.9997	1.99946
74.90	0.6604E-08	0.1236E-04	0.5345E-03	0.2312E-01	0.3087E-04	0.3804E-04	0.9997	1.99947
75.00	0.6560E-08	0.1231E-04	0.5331E-03	0.2309E-01	0.3075E-04	0.3789E-04	0.9997	1.99947
75.10	0.6517E-08	0.1226E-04	0.5316E-03	0.2306E-01	0.3063E-04	0.3773E-04	0.9997	1.99947
75.20	0.6474E-08	0.1221E-04	0.5302E-03	0.2303E-01	0.3051E-04	0.3758E-04	0.9997	1.99947
75.30	0.6431E-08	0.1216E-04	0.5288E-03	0.2300E-01	0.3039E-04	0.3743E-04	0.9997	1.99947
75.40	0.6388E-08	0.1211E-04	0.5274E-03	0.2297E-01	0.3026E-04	0.3729E-04	0.9997	1.99947
75.50	0.6346E-08	0.1206E-04	0.5260E-03	0.2294E-01	0.3014E-04	0.3714E-04	0.9997	1.99947
75.60	0.6304E-08	0.1202E-04	0.5246E-03	0.2290E-01	0.3003E-04	0.3699E-04	0.9997	1.99948
75.70	0.6263E-08	0.1197E-04	0.5232E-03	0.2287E-01	0.2991E-04	0.3685E-04	0.9997	1.99948
75.80	0.6221E-08	0.1192E-04	0.5219E-03	0.2284E-01	0.2979E-04	0.3670E-04	0.9997	1.99948
75.90	0.6181E-08	0.1187E-04	0.5205E-03	0.2281E-01	0.2967E-04	0.3655E-04	0.9997	1.99948
76.00	0.6140E-08	0.1183E-04	0.5191E-03	0.2278E-01	0.2955E-04	0.3641E-04	0.9997	1.99948
76.10	0.6100E-08	0.1178E-04	0.5178E-03	0.2275E-01	0.2944E-04	0.3627E-04	0.9997	1.99948
76.20	0.6060E-08	0.1173E-04	0.5164E-03	0.2272E-01	0.2932E-04	0.3613E-04	0.9997	1.99948
76.30	0.6020E-08	0.1169E-04	0.5151E-03	0.2269E-01	0.2921E-04	0.3598E-04	0.9997	1.99948
76.40	0.5981E-08	0.1164E-04	0.5137E-03	0.2267E-01	0.2909E-04	0.3584E-04	0.9997	1.99949
76.50	0.5942E-08	0.1160E-04	0.5124E-03	0.2264E-01	0.2898E-04	0.3570E-04	0.9997	1.99949
76.60	0.5903E-08	0.1155E-04	0.5110E-03	0.2261E-01	0.2887E-04	0.3556E-04	0.9997	1.99949
76.70	0.5865E-08	0.1151E-04	0.5097E-03	0.2258E-01	0.2875E-04	0.3542E-04	0.9997	1.99949
76.80	0.5827E-08	0.1146E-04	0.5084E-03	0.2255E-01	0.2864E-04	0.3529E-04	0.9997	1.99949
76.90	0.5789E-08	0.1142E-04	0.5070E-03	0.2252E-01	0.2853E-04	0.3515E-04	0.9997	1.99949
77.00	0.5752E-08	0.1137E-04	0.5057E-03	0.2249E-01	0.2842E-04	0.3501E-04	0.9997	1.99949
77.10	0.5715E-08	0.1133E-04	0.5044E-03	0.2246E-01	0.2831E-04	0.3488E-04	0.9997	1.99950
77.20	0.5678E-08	0.1129E-04	0.5031E-03	0.2243E-01	0.2820E-04	0.3474E-04	0.9997	1.99950
77.30	0.5641E-08	0.1124E-04	0.5018E-03	0.2240E-01	0.2809E-04	0.3461E-04	0.9997	1.99950
77.40	0.5605E-08	0.1120E-04	0.5005E-03	0.2237E-01	0.2798E-04	0.3447E-04	0.9997	1.99950
77.50	0.5569E-08	0.1115E-04	0.4992E-03	0.2234E-01	0.2787E-04	0.3434E-04	0.9998	1.99950
77.60	0.5533E-08	0.1111E-04	0.4979E-03	0.2231E-01	0.2777E-04	0.3421E-04	0.9998	1.99950
77.70	0.5497E-08	0.1107E-04	0.4967E-03	0.2229E-01	0.2766E-04	0.3407E-04	0.9998	1.99950
77.80	0.5462E-08	0.1103E-04	0.4954E-03	0.2226E-01	0.2755E-04	0.3394E-04	0.9998	1.99950
77.90	0.5427E-08	0.1098E-04	0.4941E-03	0.2223E-01	0.2745E-04	0.3381E-04	0.9998	1.99951
78.00	0.5393E-08	0.1094E-04	0.4929E-03	0.2220E-01	0.2734E-04	0.3368E-04	0.9998	1.99951
78.10	0.5359E-08	0.1090E-04	0.4916E-03	0.2217E-01	0.2724E-04	0.3355E-04	0.9998	1.99951
78.20	0.5324E-08	0.1086E-04	0.4903E-03	0.2214E-01	0.2713E-04	0.3343E-04	0.9998	1.99951
78.30	0.5290E-08	0.1082E-04	0.4891E-03	0.2212E-01	0.2703E-04	0.3330E-04	0.9998	1.99951
78.40	0.5256E-08	0.1078E-04	0.4878E-03	0.2209E-01	0.2692E-04	0.3317E-04	0.9998	1.99951
78.50	0.5223E-08	0.1073E-04	0.4866E-03	0.2206E-01	0.2682E-04	0.3304E-04	0.9998	1.99951
78.60	0.5190E-08	0.1069E-04	0.4854E-03	0.2203E-01	0.2672E-04	0.3292E-04	0.9998	1.99951
78.70	0.5157E-08	0.1065E-04	0.4841E-03	0.2200E-01	0.2662E-04	0.3279E-04	0.9998	1.99952
78.80	0.5124E-08	0.1061E-04	0.4829E-03	0.2198E-01	0.2652E-04	0.3267E-04	0.9998	1.99952
78.90	0.5092E-08	0.1057E-04	0.4817E-03	0.2195E-01	0.2642E-04	0.3254E-04	0.9998	1.99952
79.00	0.5060E-08	0.1053E-04	0.4805E-03	0.2192E-01	0.2632E-04	0.3242E-04	0.9998	1.99952
79.10	0.5028E-08	0.1049E-04	0.4792E-03	0.2189E-01	0.2622E-04	0.3230E-04	0.9998	1.99952
79.20	0.4996E-08	0.1045E-04	0.4780E-03	0.2186E-01	0.2612E-04	0.3218E-04	0.9998	1.99952
79.30	0.4965E-08	0.1041E-04	0.4768E-03	0.2184E-01	0.2602E-04	0.3205E-04	0.9998	1.99952
79.40	0.4934E-08	0.1037E-04	0.4756E-03	0.2181E-01	0.2592E-04	0.3193E-04	0.9998	1.99952
79.50	0.4903E-08	0.1033E-04	0.4744E-03	0.2178E-01	0.2582E-04	0.3181E-04	0.9998	1.99953
79.60	0.4872E-08	0.1030E-04	0.4733E-03	0.2175E-01	0.2573E-04	0.3169E-04	0.9998	1.99953
79.70	0.4842E-08	0.1026E-04	0.4721E-03	0.2173E-01	0.2563E-04	0.3157E-04	0.9998	1.99953
79.80	0.4812E-08	0.1022E-04	0.4709E-03	0.2170E-01	0.2553E-04	0.3146E-04	0.9998	1.99953
79.90	0.4781E-08	0.1018E-04	0.4697E-03	0.2167E-01	0.2544E-04	0.3134E-04	0.9998	1.99953

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
0.796	87.613	0.4474	6479.7	3.998	1620.9	0.6126E-04	7615.0	72.00
0.795	87.617	0.4474	6497.7	3.998	1625.4	0.6101E-04	7636.2	72.10
0.794	87.620	0.4474	6515.8	3.998	1629.9	0.6075E-04	7657.4	72.20
0.792	87.623	0.4474	6533.8	3.998	1634.4	0.6050E-04	7678.6	72.30
0.791	87.626	0.4474	6551.9	3.998	1638.9	0.6025E-04	7699.9	72.40
0.790	87.630	0.4473	6570.0	3.998	1643.4	0.6000E-04	7721.1	72.50
0.789	87.633	0.4473	6588.2	3.998	1648.0	0.5976E-04	7742.5	72.60
0.788	87.636	0.4473	6606.3	3.998	1652.5	0.5951E-04	7763.8	72.70
0.787	87.639	0.4473	6624.5	3.998	1657.1	0.5927E-04	7785.2	72.80
0.786	87.643	0.4473	6642.7	3.998	1661.6	0.5902E-04	7806.6	72.90
0.785	87.646	0.4473	6661.0	3.998	1666.2	0.5878E-04	7828.0	73.00
0.784	87.649	0.4473	6679.2	3.998	1670.7	0.5854E-04	7849.5	73.10
0.783	87.652	0.4473	6697.5	3.998	1675.3	0.5830E-04	7871.0	73.20
0.732	87.656	0.4473	6715.8	3.998	1679.9	0.5806E-04	7892.5	73.30
0.781	87.659	0.4473	6734.2	3.998	1684.5	0.5783E-04	7914.0	73.40
0.780	87.662	0.4473	6752.5	3.998	1689.1	0.5759E-04	7935.6	73.50
0.779	87.665	0.4473	6770.9	3.998	1693.7	0.5736E-04	7957.2	73.60
0.777	87.668	0.4473	6789.3	3.998	1698.3	0.5712E-04	7978.8	73.70
0.776	87.671	0.4473	6807.8	3.998	1702.9	0.5689E-04	8000.5	73.80
0.775	87.675	0.4473	6826.2	3.998	1707.5	0.5666E-04	8022.2	73.90
0.774	87.678	0.4473	6844.7	3.998	1712.1	0.5643E-04	8043.9	74.00
0.773	87.681	0.4473	6863.2	3.998	1716.7	0.5620E-04	8065.7	74.10
0.772	87.684	0.4473	6881.8	3.998	1721.4	0.5598E-04	8087.5	74.20
0.771	87.687	0.4473	6900.3	3.998	1726.0	0.5575E-04	8109.3	74.30
0.770	87.690	0.4473	6918.9	3.998	1730.7	0.5553E-04	8131.1	74.40
0.769	87.693	0.4473	6937.5	3.998	1735.3	0.5530E-04	8153.0	74.50
0.768	87.696	0.4473	6956.2	3.998	1740.0	0.5508E-04	8174.9	74.60
0.767	87.699	0.4473	6974.8	3.998	1744.6	0.5486E-04	8196.8	74.70
0.766	87.703	0.4473	6993.5	3.998	1749.3	0.5464E-04	8218.8	74.80
0.765	87.706	0.4473	7012.2	3.998	1754.0	0.5442E-04	8240.8	74.90
0.764	87.709	0.4473	7031.0	3.998	1758.7	0.5421E-04	8262.8	75.00
0.763	87.712	0.4473	7049.7	3.998	1763.4	0.5399E-04	8284.8	75.10
0.762	87.715	0.4473	7068.5	3.998	1768.1	0.5377E-04	8306.9	75.20
0.761	87.718	0.4473	7087.3	3.998	1772.8	0.5356E-04	8829.0	75.30
0.760	87.721	0.4473	7106.2	3.998	1777.5	0.5335E-04	8351.2	75.40
0.759	87.724	0.4473	7125.0	3.998	1782.2	0.5314E-04	8373.3	75.50
0.758	87.727	0.4473	7143.9	3.998	1786.9	0.5293E-04	8395.5	75.60
0.757	87.730	0.4473	7162.8	3.998	1791.6	0.5272E-04	8417.7	75.70
0.756	87.733	0.4473	7181.8	3.998	1796.4	0.5251E-04	8440.0	75.80
0.755	87.736	0.4473	7200.7	3.998	1801.1	0.5230E-04	8462.3	75.90
0.754	87.739	0.4473	7219.7	3.998	1805.9	0.5210E-04	8484.6	76.00
0.753	87.742	0.4473	7238.7	3.998	1810.6	0.5189E-04	8506.9	76.10
0.752	87.745	0.4473	7257.8	3.998	1815.4	0.5169E-04	8529.3	76.20
0.751	87.748	0.4473	7276.8	3.998	1820.1	0.5148E-04	8651.7	76.30
0.750	87.751	0.4473	7295.9	3.998	1824.9	0.5128E-04	8574.1	76.40
0.749	87.754	0.4473	7315.0	3.998	1829.7	0.5108E-04	8596.6	76.50
0.748	87.756	0.4473	7334.2	3.998	1834.5	0.5088E-04	8619.1	76.60
0.747	87.759	0.4473	7353.3	3.998	1839.3	0.5068E-04	8641.6	76.70
0.746	87.762	0.4473	7372.5	3.998	1844.1	0.5049E-04	8664.1	76.80
0.745	87.765	0.4473	7391.7	3.998	1848.9	0.5029E-04	8686.7	76.90
0.744	87.768	0.4473	7411.0	3.998	1853.7	0.5009E-04	8709.3	77.00
0.743	87.771	0.4473	7430.2	3.998	1858.5	0.4990E-04	8732.0	77.10
0.742	87.774	0.4473	7449.5	3.998	1863.3	0.4971E-04	8754.6	77.20
0.741	87.777	0.4473	7468.8	3.998	1868.1	0.4951E-04	8777.3	77.30
0.740	87.780	0.4473	7488.2	3.998	1873.0	0.4932E-04	8800.0	77.40
0.739	87.783	0.4473	7507.5	3.998	1877.8	0.4913E-04	8822.8	77.50
0.738	87.785	0.4473	7526.9	3.998	1882.7	0.4894E-04	8845.6	77.60
0.737	87.788	0.4473	7546.3	3.998	1887.5	0.4875E-04	8868.4	77.70
0.736	87.791	0.4473	7565.8	3.998	1892.4	0.4857E-04	8891.2	77.80
0.736	87.794	0.4473	7585.2	3.998	1897.2	0.4838E-04	8914.1	77.90
0.735	87.797	0.4473	7604.7	3.998	1902.1	0.4819E-04	8937.0	78.00
0.734	87.800	0.4473	7624.2	3.998	1907.0	0.4801E-04	8959.9	78.10
0.733	87.802	0.4473	7643.8	3.998	1911.9	0.4783E-04	8982.9	78.20
0.732	87.805	0.4473	7663.3	3.998	1916.8	0.4764E-04	9005.9	78.30
0.731	87.808	0.4473	7682.9	3.998	1921.7	0.4746E-04	9028.9	78.40
0.730	87.811	0.4473	7702.5	3.998	1926.6	0.4728E-04	9051.9	78.50
0.729	87.814	0.4473	7722.2	3.998	1931.5	0.4710E-04	9075.0	78.60
0.728	87.816	0.4473	7741.8	3.998	1936.4	0.4692E-04	9098.1	78.70
0.727	87.819	0.4473	7761.5	3.998	1941.3	0.4674E-04	9121.2	78.80
0.726	87.822	0.4473	7781.2	3.998	1946.2	0.4656E-04	9144.4	78.90
0.725	87.825	0.4473	7801.0	3.998	1951.2	0.4639E-04	9167.6	79.00
0.724	87.827	0.4473	7820.7	3.998	1956.1	0.4621E-04	9190.8	79.10
0.723	87.830	0.4473	7840.5	3.998	1961.1	0.4604E-04	9214.1	79.20
0.723	87.833	0.4473	7860.3	3.998	1966.0	0.4586E-04	9237.4	79.30
0.722	87.836	0.4473	7880.2	3.998	1971.0	0.4569E-04	9260.7	79.40
0.721	87.838	0.4473	7900.0	3.998	1975.9	0.4552E-04	9284.0	79.50
0.720	87.841	0.4473	7919.9	3.998	1980.9	0.4535E-04	9307.4	79.60
0.719	87.844	0.4473	7939.8	3.998	1985.9	0.4518E-04	9330.8	79.70
0.718	87.846	0.4473	7959.8	3.998	1990.9	0.4501E-04	9354.2	79.80
0.717	87.849	0.4473	7979.7	3.998	1995.9	0.4484E-04	9377.7	79.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
80.00	0.4752E-08	0.1014E-04	0.4685E-03	0.2165E-01	0.2534E-04	0.3122E-04	0.9998	1.99953
80.10	0.4722E-08	0.1010E-04	0.4674E-03	0.2162E-01	0.2525E-04	0.3110E-04	0.9998	1.99953
80.20	0.4693E-08	0.1007E-04	0.4662E-03	0.2159E-01	0.2515E-04	0.3099E-04	0.9998	1.99953
80.30	0.4664E-08	0.1003E-04	0.4650E-03	0.2156E-01	0.2506E-04	0.3087E-04	0.9998	1.99953
80.40	0.4635E-08	0.9991E-05	0.4639E-03	0.2154E-01	0.2497E-04	0.3076E-04	0.9998	1.99954
80.50	0.4606E-08	0.9954E-05	0.4627E-03	0.2151E-01	0.2487E-04	0.3064E-04	0.9999	1.99954
80.60	0.4578E-08	0.9917E-05	0.4616E-03	0.2148E-01	0.2478E-04	0.3053E-04	0.9998	1.99954
80.70	0.4549E-08	0.9880E-05	0.4604E-03	0.2146E-01	0.2469E-04	0.3042E-04	0.9998	1.99954
80.80	0.4521E-08	0.9844E-05	0.4593E-03	0.2143E-01	0.2460E-04	0.3030E-04	0.9998	1.99954
80.90	0.4493E-08	0.9807E-05	0.4582E-03	0.2140E-01	0.2451E-04	0.3019E-04	0.9998	1.99954
81.00	0.4466E-08	0.9771E-05	0.4570E-03	0.2138E-01	0.2442E-04	0.3008E-04	0.9998	1.99954
81.10	0.4438E-08	0.9735E-05	0.4559E-03	0.2135E-01	0.2433E-04	0.2997E-04	0.9998	1.99954
81.20	0.4411E-08	0.9699E-05	0.4548E-03	0.2133E-01	0.2424E-04	0.2986E-04	0.9998	1.99955
81.30	0.4384E-08	0.9663E-05	0.4537E-03	0.2130E-01	0.2415E-04	0.2975E-04	0.9998	1.99955
81.40	0.4357E-08	0.9628E-05	0.4526E-03	0.2127E-01	0.2406E-04	0.2964E-04	0.9998	1.99955
81.50	0.4330E-08	0.9592E-05	0.4515E-03	0.2125E-01	0.2397E-04	0.2953E-04	0.9998	1.99955
81.60	0.4304E-08	0.9557E-05	0.4503E-03	0.2122E-01	0.2388E-04	0.2942E-04	0.9998	1.99955
81.70	0.4278E-08	0.9522E-05	0.4492E-03	0.2120E-01	0.2379E-04	0.2931E-04	0.9998	1.99955
81.80	0.4252E-08	0.9487E-05	0.4481E-03	0.2117E-01	0.2371E-04	0.2921E-04	0.9998	1.99955
81.90	0.4226E-08	0.9452E-05	0.4471E-03	0.2114E-01	0.2362E-04	0.2910E-04	0.9998	1.99955
82.00	0.4200E-08	0.9418E-05	0.4460E-03	0.2112E-01	0.2353E-04	0.2899E-04	0.9998	1.99955
82.10	0.4175E-08	0.9383E-05	0.4449E-03	0.2109E-01	0.2345E-04	0.2889E-04	0.9998	1.99956
82.20	0.4149E-08	0.9349E-05	0.4438E-03	0.2107E-01	0.2336E-04	0.2878E-04	0.9998	1.99956
82.30	0.4124E-08	0.9315E-05	0.4427E-03	0.2104E-01	0.2328E-04	0.2868E-04	0.9998	1.99956
82.40	0.4099E-08	0.9281E-05	0.4416E-03	0.2102E-01	0.2319E-04	0.2857E-04	0.9998	1.99956
82.50	0.4074E-08	0.9248E-05	0.4406E-03	0.2099E-01	0.2311E-04	0.2847E-04	0.9998	1.99956
82.60	0.4050E-08	0.9214E-05	0.4395E-03	0.2096E-01	0.2303E-04	0.2837E-04	0.9998	1.99956
82.70	0.4025E-08	0.9181E-05	0.4385E-03	0.2094E-01	0.2294E-04	0.2826E-04	0.9998	1.99956
82.80	0.4001E-08	0.9148E-05	0.4374E-03	0.2091E-01	0.2286E-04	0.2816E-04	0.9998	1.99956
82.90	0.3977E-08	0.9115E-05	0.4363E-03	0.2089E-01	0.2278E-04	0.2806E-04	0.9998	1.99956
83.00	0.3953E-08	0.9082E-05	0.4353E-03	0.2086E-01	0.2269E-04	0.2796E-04	0.9998	1.99956
83.10	0.3929E-08	0.9049E-05	0.4342E-03	0.2084E-01	0.2261E-04	0.2786E-04	0.9998	1.99957
83.20	0.3906E-08	0.9016E-05	0.4332E-03	0.2081E-01	0.2253E-04	0.2776E-04	0.9998	1.99957
83.30	0.3883E-08	0.8984E-05	0.4322E-03	0.2079E-01	0.2245E-04	0.2766E-04	0.9998	1.99957
83.40	0.3859E-08	0.8952E-05	0.4311E-03	0.2076E-01	0.2237E-04	0.2756E-04	0.9998	1.99957
83.50	0.3836E-08	0.8920E-05	0.4301E-03	0.2074E-01	0.2229E-04	0.2746E-04	0.9998	1.99957
83.60	0.3813E-08	0.8888E-05	0.4291E-03	0.2071E-01	0.2221E-04	0.2736E-04	0.9998	1.99957
83.70	0.3791E-08	0.8855E-05	0.4280E-03	0.2069E-01	0.2213E-04	0.2726E-04	0.9998	1.99957
83.80	0.3768E-08	0.8824E-05	0.4270E-03	0.2066E-01	0.2205E-04	0.2717E-04	0.9998	1.99957
83.90	0.3746E-08	0.8793E-05	0.4260E-03	0.2064E-01	0.2197E-04	0.2707E-04	0.9998	1.99957
84.00	0.3723E-08	0.8761E-05	0.4250E-03	0.2062E-01	0.2189E-04	0.2697E-04	0.9998	1.99957
84.10	0.3701E-08	0.8730E-05	0.4240E-03	0.2059E-01	0.2182E-04	0.2688E-04	0.9998	1.99958
84.20	0.3679E-08	0.8699E-05	0.4230E-03	0.2057E-01	0.2174E-04	0.2678E-04	0.9998	1.99958
84.30	0.3658E-08	0.8668E-05	0.4220E-03	0.2054E-01	0.2166E-04	0.2669E-04	0.9998	1.99958
84.40	0.3636E-08	0.8637E-05	0.4210E-03	0.2052E-01	0.2158E-04	0.2659E-04	0.9998	1.99958
84.50	0.3615E-08	0.8607E-05	0.4200E-03	0.2049E-01	0.2151E-04	0.2650E-04	0.9998	1.99958
84.60	0.3593E-08	0.8576E-05	0.4190E-03	0.2047E-01	0.2143E-04	0.2640E-04	0.9998	1.99958
84.70	0.3572E-08	0.8546E-05	0.4180E-03	0.2045E-01	0.2136E-04	0.2631E-04	0.9998	1.99958
84.80	0.3551E-08	0.8516E-05	0.4170E-03	0.2042E-01	0.2128E-04	0.2622E-04	0.9998	1.99958
84.90	0.3530E-08	0.8486E-05	0.4160E-03	0.2040E-01	0.2121E-04	0.2612E-04	0.9998	1.99958
85.00	0.3510E-08	0.8456E-05	0.4151E-03	0.2037E-01	0.2113E-04	0.2603E-04	0.9998	1.99958
85.10	0.3489E-08	0.8426E-05	0.4141E-03	0.2035E-01	0.2106E-04	0.2594E-04	0.9998	1.99959
85.20	0.3469E-08	0.8396E-05	0.4131E-03	0.2033E-01	0.2098E-04	0.2585E-04	0.9998	1.99959
85.30	0.3448E-08	0.8367E-05	0.4121E-03	0.2030E-01	0.2091E-04	0.2576E-04	0.9998	1.99959
85.40	0.3428E-08	0.8338E-05	0.4112E-03	0.2028E-01	0.2084E-04	0.2567E-04	0.9998	1.99959
85.50	0.3408E-08	0.8308E-05	0.4102E-03	0.2025E-01	0.2076E-04	0.2558E-04	0.9998	1.99959
85.60	0.3388E-08	0.8279E-05	0.4093E-03	0.2023E-01	0.2069E-04	0.2549E-04	0.9998	1.99959
85.70	0.3369E-08	0.8250E-05	0.4083E-03	0.2021E-01	0.2062E-04	0.2540E-04	0.9998	1.99959
85.80	0.3349E-08	0.8222E-05	0.4074E-03	0.2018E-01	0.2055E-04	0.2531E-04	0.9998	1.99959
85.90	0.3330E-08	0.8193E-05	0.4064E-03	0.2016E-01	0.2047E-04	0.2522E-04	0.9998	1.99959
86.00	0.3310E-08	0.8164E-05	0.4055E-03	0.2014E-01	0.2040E-04	0.2513E-04	0.9998	1.99959
86.10	0.3291E-08	0.8136E-05	0.4045E-03	0.2011E-01	0.2033E-04	0.2505E-04	0.9998	1.99960
86.20	0.3272E-08	0.8108E-05	0.4036E-03	0.2009E-01	0.2026E-04	0.2496E-04	0.9998	1.99960
86.30	0.3253E-08	0.8080E-05	0.4026E-03	0.2007E-01	0.2019E-04	0.2487E-04	0.9998	1.99960
86.40	0.3234E-08	0.8052E-05	0.4017E-03	0.2004E-01	0.2012E-04	0.2479E-04	0.9998	1.99960
86.50	0.3216E-08	0.8024E-05	0.4008E-03	0.2002E-01	0.2005E-04	0.2470E-04	0.9998	1.99960
86.60	0.3197E-08	0.7996E-05	0.3999E-03	0.2000E-01	0.1998E-04	0.2462E-04	0.9998	1.99960
86.70	0.3179E-08	0.7968E-05	0.3989E-03	0.1997E-01	0.1991E-04	0.2453E-04	0.9998	1.99960
86.80	0.3161E-08	0.7941E-05	0.3980E-03	0.1995E-01	0.1984E-04	0.2445E-04	0.9998	1.99960
86.90	0.3143E-08	0.7913E-05	0.3971E-03	0.1993E-01	0.1978E-04	0.2436E-04	0.9998	1.99960
87.00	0.3125E-08	0.7886E-05	0.3962E-03	0.1990E-01	0.1971E-04	0.2428E-04	0.9998	1.99960
87.10	0.3107E-08	0.7859E-05	0.3953E-03	0.1988E-01	0.1964E-04	0.2419E-04	0.9998	1.99960
87.20	0.3089E-08	0.7832E-05	0.3944E-03	0.1986E-01	0.1957E-04	0.2411E-04	0.9998	1.99961
87.30	0.3071E-08	0.7805E-05	0.3935E-03	0.1984E-01	0.1951E-04	0.2403E-04	0.9998	1.99961
87.40	0.3054E-08	0.7778E-05	0.3926E-03	0.1981E-01	0.1944E-04	0.2395E-04	0.9998	1.99961
87.50	0.3036E-08	0.7752E-05	0.3917E-03	0.1979E-01	0.1937E-04	0.2386E-04	0.9998	1.99961
87.60	0.3019E-08	0.7725E-05	0.3908E-03	0.1977E-01	0.1931E-04	0.2378E-04	0.9998	1.99961
87.70	0.3002E-08	0.7699E-05	0.3899E-03	0.1975E-01	0.1924E-04	0.2370E-04	0.9998	1.99961
87.80	0.2985E-08	0.7673E-05	0.3890E-03	0.1972E-01	0.1917E-04	0.2362E-04	0.9998	1.99961
87.90	0.2968E-08	0.7647E-05	0.3881E-03	0.1970E-01	0.1911E-04	0.2354E-04	0.9998	1.99961

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
0.716	87.852	3.4473	7999.7	3.998	2000.9	0.4467E-04	9401.1	80.00
0.715	87.854	3.4473	8019.7	3.998	2005.9	0.4450E-04	9424.7	80.10
0.714	87.857	3.4473	8039.8	3.998	2010.9	0.4434E-04	9448.2	80.20
0.714	87.860	3.4473	8059.8	3.998	2015.9	0.4417E-04	9471.8	80.30
0.713	87.862	3.4473	8079.9	3.998	2020.9	0.4401E-04	9495.4	80.40
0.712	87.865	3.4473	8100.0	3.998	2025.9	0.4384E-04	9519.0	80.50
0.711	87.868	3.4473	8120.2	3.998	2031.0	0.4368E-04	9542.7	80.60
0.710	87.870	3.4473	8140.3	3.998	2036.0	0.4352E-04	9566.4	80.70
0.709	87.873	3.4473	8160.5	3.998	2041.1	0.4336E-04	9590.1	80.80
0.708	87.876	3.4473	8180.7	3.998	2046.1	0.4320E-04	9613.9	80.90
0.707	87.878	3.4473	8201.0	3.998	2051.2	0.4304E-04	9637.6	81.00
0.707	87.881	3.4473	8221.2	3.998	2056.2	0.4288E-04	9661.4	81.10
0.706	87.884	3.4473	8241.5	3.998	2061.3	0.4272E-04	9685.3	81.20
0.705	87.886	3.4473	8261.8	3.998	2066.4	0.4256E-04	9709.1	81.30
0.704	87.889	3.4473	8282.2	3.998	2071.5	0.4241E-04	9733.0	81.40
0.703	87.891	3.4473	8302.5	3.998	2076.6	0.4225E-04	9757.0	81.50
0.702	87.894	3.4473	8322.9	3.998	2081.7	0.4210E-04	9780.9	81.60
0.701	87.896	3.4473	8343.3	3.998	2086.8	0.4194E-04	9804.9	81.70
0.700	87.899	3.4473	8363.8	3.998	2091.9	0.4179E-04	9828.9	81.80
0.700	87.902	3.4473	8384.2	3.998	2097.0	0.4164E-04	9853.0	81.90
0.699	87.904	3.4473	8404.7	3.998	2102.1	0.4148E-04	9877.1	82.00
0.698	87.907	3.4473	8425.2	3.998	2107.2	0.4133E-04	9901.2	82.10
0.697	87.909	3.4473	8445.8	3.998	2112.4	0.4118E-04	9925.3	82.20
0.696	87.912	3.4473	8466.3	3.998	2117.5	0.4103E-04	9949.5	82.30
0.695	87.914	3.4473	8486.9	3.998	2122.7	0.4088E-04	9973.6	82.40
0.695	87.917	3.4473	8507.5	3.998	2127.8	0.4073E-04	9997.9	82.50
0.694	87.919	3.4473	8528.2	3.998	2133.0	0.4059E-04	10022.1	82.60
0.693	87.922	3.4473	8548.8	3.998	2138.1	0.4044E-04	10046.4	82.70
0.692	87.924	3.4473	8569.5	3.998	2143.3	0.4029E-04	10070.7	82.80
0.691	87.927	3.4473	8590.2	3.998	2148.5	0.4015E-04	10095.0	82.90
0.690	87.929	3.4473	8611.0	3.998	2153.7	0.4000E-04	10119.4	83.00
0.689	87.932	3.4473	8631.7	3.998	2159.9	0.3986E-04	10143.8	83.10
0.689	87.934	3.4473	8652.5	3.998	2164.1	0.3972E-04	10168.2	83.20
0.688	87.937	3.4473	8673.3	3.998	2169.3	0.3957E-04	10192.7	83.30
0.687	87.939	3.4473	8694.2	3.998	2174.5	0.3943E-04	10217.2	83.40
0.686	87.942	3.4473	8715.0	3.998	2179.7	0.3929E-04	10241.7	83.50
0.685	87.944	3.4473	8735.9	3.998	2184.9	0.3915E-04	10266.2	83.60
0.685	87.947	3.4473	8756.8	3.998	2190.1	0.3901E-04	10290.8	83.70
0.684	87.949	3.4473	8777.8	3.998	2195.4	0.3887E-04	10315.4	83.80
0.683	87.952	3.4473	8798.7	3.998	2200.6	0.3873E-04	10340.1	83.90
0.682	87.954	3.4473	8819.7	3.998	2205.9	0.3859E-04	10364.7	84.00
0.681	87.956	3.4473	8840.7	3.998	2211.1	0.3846E-04	10389.4	84.10
0.680	87.959	3.4473	8861.8	3.998	2216.4	0.3832E-04	10414.1	84.20
0.680	87.961	3.4473	8882.8	3.998	2221.6	0.3818E-04	10438.9	84.30
0.679	87.964	3.4473	8903.9	3.998	2226.9	0.3805E-04	10463.7	84.40
0.678	87.966	3.4473	8925.0	3.998	2232.2	0.3791E-04	10488.5	84.50
0.677	87.969	3.4473	8946.2	3.998	2237.5	0.3778E-04	10513.3	84.60
0.676	87.971	3.4473	8967.3	3.998	2242.8	0.3764E-04	10538.2	84.70
0.676	87.973	3.4473	8988.5	3.998	2248.1	0.3751E-04	10563.1	84.80
0.675	87.976	3.4473	9009.7	3.998	2253.4	0.3738E-04	10588.0	84.90
0.674	87.978	3.4473	9031.0	3.998	2258.7	0.3725E-04	10612.9	85.00
0.673	87.980	3.4473	9052.2	3.998	2264.0	0.3712E-04	10637.9	85.10
0.673	87.983	3.4473	9073.5	3.998	2269.3	0.3699E-04	10662.9	85.20
0.672	87.985	3.4473	9094.8	3.998	2274.6	0.3686E-04	10688.0	85.30
0.671	87.988	3.4473	9116.2	3.998	2280.0	0.3673E-04	10713.1	85.40
0.670	87.990	3.4473	9137.5	3.998	2285.3	0.3660E-04	10738.2	85.50
0.669	87.992	3.4473	9158.9	3.998	2290.7	0.3647E-04	10763.3	85.60
0.669	87.995	3.4473	9180.3	3.998	2296.0	0.3634E-04	10788.5	85.70
0.668	87.997	3.4473	9201.8	3.998	2301.4	0.3622E-04	10813.7	85.80
0.667	87.999	3.4473	9223.2	3.998	2306.7	0.3609E-04	10838.9	85.90
0.666	88.002	3.4473	9244.7	3.998	2312.1	0.3596E-04	10864.1	86.00
0.665	88.004	3.4473	9266.2	3.998	2317.5	0.3584E-04	10889.4	86.10
0.665	88.006	3.4473	9287.8	3.998	2322.9	0.3571E-04	10914.7	86.20
0.664	88.009	3.4473	9309.3	3.998	2328.3	0.3559E-04	10940.0	86.30
0.663	88.011	3.4473	9330.9	3.998	2333.7	0.3547E-04	10965.4	86.40
0.662	88.013	3.4473	9352.5	3.998	2339.1	0.3534E-04	10990.8	86.50
0.662	88.015	3.4473	9374.2	3.998	2344.5	0.3522E-04	11016.2	86.60
0.661	88.018	3.4473	9395.8	3.998	2349.9	0.3510E-04	11041.7	86.70
0.660	88.020	3.4473	9417.5	3.998	2355.3	0.3498E-04	11067.2	86.80
0.659	88.022	3.4473	9439.2	3.998	2360.7	0.3486E-04	11092.7	86.90
0.659	88.025	3.4473	9461.0	3.998	2366.2	0.3474E-04	11118.2	87.00
0.658	88.027	3.4473	9482.7	3.998	2371.6	0.3462E-04	11143.8	87.10
0.657	88.029	3.4473	9504.5	3.998	2377.1	0.3450E-04	11169.4	87.20
0.656	88.031	3.4473	9526.3	3.998	2382.5	0.3438E-04	11195.0	87.30
0.656	88.034	3.4473	9548.2	3.998	2388.0	0.3426E-04	11220.7	87.40
0.655	88.036	3.4473	9570.0	3.998	2393.4	0.3415E-04	11246.4	87.50
0.654	88.038	3.4473	9591.9	3.998	2398.9	0.3403E-04	11272.1	87.60
0.653	88.040	3.4473	9613.8	3.998	2404.4	0.3391E-04	11297.9	87.70
0.653	88.043	3.4473	9635.9	3.998	2409.9	0.3380E-04	11323.6	87.80
0.652	88.045	3.4473	9657.7	3.998	2415.4	0.3368E-04	11349.4	87.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
88.00	0.2951E-08	0.7621E-05	0.3872E-03	0.1968E-01	0.1904E-04	0.2346E-04	0.9998	1.99961
88.10	0.2934E-08	0.7595E-05	0.3864E-03	0.1966E-01	0.1898E-04	0.2338E-04	0.9998	1.99961
88.20	0.2918E-08	0.7569E-05	0.3855E-03	0.1963E-01	0.1891E-04	0.2330E-04	0.9998	1.99961
88.30	0.2901E-08	0.7543E-05	0.3846E-03	0.1961E-01	0.1885E-04	0.2322E-04	0.9998	1.99962
88.40	0.2885E-08	0.7518E-05	0.3838E-03	0.1959E-01	0.1879E-04	0.2314E-04	0.9998	1.99962
88.50	0.2869E-08	0.7492E-05	0.3829E-03	0.1957E-01	0.1872E-04	0.2307E-04	0.9998	1.99962
88.60	0.2852E-08	0.7467E-05	0.3820E-03	0.1955E-01	0.1866E-04	0.2299E-04	0.9998	1.99962
88.70	0.2836E-08	0.7442E-05	0.3812E-03	0.1952E-01	0.1860E-04	0.2291E-04	0.9998	1.99962
88.80	0.2821E-08	0.7416E-05	0.3803E-03	0.1950E-01	0.1853E-04	0.2283E-04	0.9998	1.99962
88.90	0.2805E-08	0.7391E-05	0.3794E-03	0.1948E-01	0.1847E-04	0.2276E-04	0.9998	1.99962
89.00	0.2789E-08	0.7367E-05	0.3786E-03	0.1946E-01	0.1841E-04	0.2268E-04	0.9998	1.99962
89.10	0.2773E-08	0.7342E-05	0.3777E-03	0.1944E-01	0.1835E-04	0.2260E-04	0.9998	1.99962
89.20	0.2758E-08	0.7317E-05	0.3769E-03	0.1941E-01	0.1829E-04	0.2253E-04	0.9998	1.99962
89.30	0.2742E-08	0.7293E-05	0.3761E-03	0.1939E-01	0.1822E-04	0.2245E-04	0.9998	1.99962
89.40	0.2727E-08	0.7268E-05	0.3752E-03	0.1937E-01	0.1816E-04	0.2238E-04	0.9998	1.99962
89.50	0.2712E-08	0.7244E-05	0.3744E-03	0.1935E-01	0.1810E-04	0.2230E-04	0.9998	1.99963
89.60	0.2697E-08	0.7220E-05	0.3735E-03	0.1933E-01	0.1804E-04	0.2223E-04	0.9998	1.99963
89.70	0.2682E-08	0.7196E-05	0.3727E-03	0.1931E-01	0.1798E-04	0.2215E-04	0.9998	1.99963
89.80	0.2667E-08	0.7172E-05	0.3719E-03	0.1928E-01	0.1792E-04	0.2208E-04	0.9998	1.99963
89.90	0.2652E-08	0.7148E-05	0.3711E-03	0.1926E-01	0.1786E-04	0.2200E-04	0.9998	1.99963
90.00	0.2638E-08	0.7124E-05	0.3702E-03	0.1924E-01	0.1780E-04	0.2193E-04	0.9998	1.99963
90.10	0.2623E-08	0.7100E-05	0.3694E-03	0.1922E-01	0.1774E-04	0.2186E-04	0.9998	1.99963
90.20	0.2609E-08	0.7077E-05	0.3686E-03	0.1920E-01	0.1768E-04	0.2179E-04	0.9998	1.99963
90.30	0.2594E-08	0.7053E-05	0.3678E-03	0.1918E-01	0.1763E-04	0.2171E-04	0.9998	1.99963
90.40	0.2580E-08	0.7030E-05	0.3670E-03	0.1916E-01	0.1757E-04	0.2164E-04	0.9998	1.99963
90.50	0.2565E-08	0.7006E-05	0.3662E-03	0.1914E-01	0.1751E-04	0.2157E-04	0.9998	1.99963
90.60	0.2551E-08	0.6983E-05	0.3653E-03	0.1911E-01	0.1745E-04	0.2150E-04	0.9998	1.99963
90.70	0.2537E-08	0.6960E-05	0.3645E-03	0.1909E-01	0.1739E-04	0.2143E-04	0.9998	1.99964
90.80	0.2523E-08	0.6937E-05	0.3637E-03	0.1907E-01	0.1734E-04	0.2136E-04	0.9998	1.99964
90.90	0.2510E-08	0.6914E-05	0.3629E-03	0.1905E-01	0.1728E-04	0.2129E-04	0.9998	1.99964
91.00	0.2496E-08	0.6892E-05	0.3621E-03	0.1903E-01	0.1722E-04	0.2122E-04	0.9998	1.99964
91.10	0.2482E-08	0.6869E-05	0.3614E-03	0.1901E-01	0.1717E-04	0.2115E-04	0.9998	1.99964
91.20	0.2469E-08	0.6846E-05	0.3606E-03	0.1899E-01	0.1711E-04	0.2108E-04	0.9998	1.99964
91.30	0.2455E-08	0.6824E-05	0.3598E-03	0.1897E-01	0.1705E-04	0.2101E-04	0.9998	1.99964
91.40	0.2442E-08	0.6802E-05	0.3590E-03	0.1895E-01	0.1700E-04	0.2094E-04	0.9998	1.99964
91.50	0.2428E-08	0.6779E-05	0.3582E-03	0.1893E-01	0.1694E-04	0.2087E-04	0.9998	1.99964
91.60	0.2415E-08	0.6757E-05	0.3574E-03	0.1891E-01	0.1689E-04	0.2080E-04	0.9998	1.99964
91.70	0.2402E-08	0.6735E-05	0.3566E-03	0.1888E-01	0.1683E-04	0.2074E-04	0.9998	1.99964
91.80	0.2389E-08	0.6713E-05	0.3559E-03	0.1886E-01	0.1678E-04	0.2067E-04	0.9998	1.99964
91.90	0.2376E-08	0.6691E-05	0.3551E-03	0.1884E-01	0.1672E-04	0.2060E-04	0.9998	1.99964
92.00	0.2363E-08	0.6669E-05	0.3543E-03	0.1882E-01	0.1667E-04	0.2053E-04	0.9998	1.99965
92.10	0.2350E-08	0.6648E-05	0.3535E-03	0.1880E-01	0.1661E-04	0.2047E-04	0.9998	1.99965
92.20	0.2338E-08	0.6626E-05	0.3528E-03	0.1878E-01	0.1656E-04	0.2040E-04	0.9998	1.99965
92.30	0.2325E-08	0.6605E-05	0.3520E-03	0.1876E-01	0.1651E-04	0.2033E-04	0.9998	1.99965
92.40	0.2312E-08	0.6583E-05	0.3513E-03	0.1874E-01	0.1645E-04	0.2027E-04	0.9998	1.99965
92.50	0.2300E-08	0.6562E-05	0.3505E-03	0.1872E-01	0.1640E-04	0.2020E-04	0.9998	1.99965
92.60	0.2288E-08	0.6541E-05	0.3497E-03	0.1870E-01	0.1635E-04	0.2014E-04	0.9998	1.99965
92.70	0.2275E-08	0.6520E-05	0.3490E-03	0.1868E-01	0.1629E-04	0.2007E-04	0.9998	1.99965
92.80	0.2263E-08	0.6499E-05	0.3482E-03	0.1866E-01	0.1624E-04	0.2001E-04	0.9998	1.99965
92.90	0.2251E-08	0.6478E-05	0.3475E-03	0.1864E-01	0.1619E-04	0.1994E-04	0.9998	1.99965
93.00	0.2239E-08	0.6457E-05	0.3467E-03	0.1862E-01	0.1614E-04	0.1988E-04	0.9998	1.99965
93.10	0.2227E-08	0.6436E-05	0.3460E-03	0.1860E-01	0.1608E-04	0.1981E-04	0.9998	1.99965
93.20	0.2215E-08	0.6415E-05	0.3453E-03	0.1858E-01	0.1603E-04	0.1975E-04	0.9998	1.99965
93.30	0.2203E-08	0.6395E-05	0.3445E-03	0.1856E-01	0.1598E-04	0.1969E-04	0.9998	1.99966
93.40	0.2191E-08	0.6374E-05	0.3438E-03	0.1854E-01	0.1593E-04	0.1962E-04	0.9998	1.99966
93.50	0.2180E-08	0.6354E-05	0.3430E-03	0.1852E-01	0.1588E-04	0.1956E-04	0.9998	1.99966
93.60	0.2168E-08	0.6333E-05	0.3423E-03	0.1850E-01	0.1583E-04	0.1950E-04	0.9998	1.99966
93.70	0.2156E-08	0.6313E-05	0.3416E-03	0.1848E-01	0.1578E-04	0.1944E-04	0.9998	1.99966
93.80	0.2145E-08	0.6293E-05	0.3409E-03	0.1846E-01	0.1573E-04	0.1937E-04	0.9998	1.99966
93.90	0.2134E-08	0.6273E-05	0.3401E-03	0.1844E-01	0.1568E-04	0.1931E-04	0.9998	1.99966
94.00	0.2122E-08	0.6253E-05	0.3394E-03	0.1842E-01	0.1563E-04	0.1925E-04	0.9998	1.99966
94.10	0.2111E-08	0.6233E-05	0.3387E-03	0.1840E-01	0.1558E-04	0.1919E-04	0.9998	1.99966
94.20	0.2100E-08	0.6213E-05	0.3380E-03	0.1838E-01	0.1553E-04	0.1913E-04	0.9998	1.99966
94.30	0.2089E-08	0.6193E-05	0.3373E-03	0.1836E-01	0.1548E-04	0.1907E-04	0.9998	1.99966
94.40	0.2079E-08	0.6174E-05	0.3365E-03	0.1834E-01	0.1543E-04	0.1901E-04	0.9998	1.99966
94.50	0.2067E-08	0.6154E-05	0.3358E-03	0.1833E-01	0.1538E-04	0.1895E-04	0.9998	1.99966
94.60	0.2056E-08	0.6135E-05	0.3351E-03	0.1831E-01	0.1533E-04	0.1889E-04	0.9998	1.99966
94.70	0.2045E-08	0.6115E-05	0.3344E-03	0.1829E-01	0.1528E-04	0.1883E-04	0.9998	1.99967
94.80	0.2034E-08	0.6096E-05	0.3337E-03	0.1827E-01	0.1523E-04	0.1877E-04	0.9998	1.99967
94.90	0.2024E-08	0.6077E-05	0.3330E-03	0.1825E-01	0.1519E-04	0.1871E-04	0.9998	1.99967
95.00	0.2013E-08	0.6058E-05	0.3323E-03	0.1823E-01	0.1514E-04	0.1865E-04	0.9998	1.99967
95.10	0.2002E-08	0.6038E-05	0.3316E-03	0.1821E-01	0.1509E-04	0.1859E-04	0.9998	1.99967
95.20	0.1992E-08	0.6019E-05	0.3309E-03	0.1819E-01	0.1504E-04	0.1853E-04	0.9998	1.99967
95.30	0.1981E-08	0.6001E-05	0.3302E-03	0.1817E-01	0.1500E-04	0.1847E-04	0.9998	1.99967
95.40	0.1971E-08	0.5982E-05	0.3295E-03	0.1815E-01	0.1495E-04	0.1842E-04	0.9998	1.99967
95.50	0.1961E-08	0.5963E-05	0.3288E-03	0.1813E-01	0.1490E-04	0.1836E-04	0.9998	1.99967
95.60	0.1951E-08	0.5944E-05	0.3281E-03	0.1811E-01	0.1486E-04	0.1830E-04	0.9998	1.99967
95.70	0.1940E-08	0.5926E-05	0.3275E-03	0.1810E-01	0.1481E-04	0.1824E-04	0.9998	1.99967
95.80	0.1930E-08	0.5907E-05	0.3268E-03	0.1808E-01	0.1476E-04	0.1819E-04	0.9998	1.99967
95.90	0.1920E-08	0.5889E-05	0.3261E-03	0.1806E-01	0.1472E-04	0.1813E-04	0.9998	1.99967

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
0.651	88.047	0.4473	9679.7	3.998	2420.9	0.3357E-04	11375.3	88.00
0.650	88.049	0.4473	9701.7	3.998	2426.4	0.3345E-04	11401.1	88.10
0.650	88.051	0.4473	9723.8	3.998	2431.9	0.3334E-04	11427.0	88.20
0.649	88.054	0.4473	9745.8	3.998	2437.4	0.3323E-04	11453.0	88.30
0.648	88.056	0.4473	9767.9	3.998	2442.9	0.3312E-04	11478.9	88.40
0.647	88.058	0.4473	9790.0	3.998	2448.4	0.3300E-04	11504.9	88.50
0.647	88.060	0.4473	9812.2	3.998	2454.0	0.3289E-04	11530.9	88.60
0.646	88.062	0.4473	9834.3	3.998	2459.5	0.3278E-04	11557.0	88.70
0.645	88.065	0.4473	9856.5	3.998	2465.1	0.3267E-04	11583.0	88.80
0.645	88.067	0.4473	9878.7	3.998	2470.6	0.3266E-04	11609.1	88.90
0.644	88.069	0.4473	9901.0	3.998	2476.2	0.3245E-04	11635.3	89.00
0.643	88.071	0.4473	9923.2	3.998	2481.7	0.3234E-04	11661.4	89.10
0.642	88.073	0.4473	9945.5	3.998	2487.3	0.3223E-04	11687.6	89.20
0.642	88.075	0.4473	9967.8	3.998	2492.9	0.3212E-04	11713.8	89.30
0.641	88.078	0.4473	9990.2	3.998	2498.5	0.3202E-04	11740.1	89.40
0.640	88.080	0.4473	10012.5	3.999	2504.1	0.3191E-04	11766.4	89.50
0.639	88.082	0.4473	10034.9	3.999	2509.7	0.3180E-04	11792.7	89.60
0.639	88.084	0.4473	10057.3	3.999	2515.3	0.3170E-04	11819.0	89.70
0.638	88.086	0.4473	10079.8	3.999	2520.9	0.3159E-04	11845.4	89.80
0.637	88.088	0.4473	10102.2	3.999	2526.5	0.3149E-04	11871.8	89.90
0.637	88.090	0.4473	10124.7	3.999	2532.1	0.3138E-04	11898.2	90.00
0.636	88.093	0.4473	10147.2	3.999	2537.7	0.3128E-04	11924.6	90.10
0.635	88.095	0.4473	10169.8	3.999	2543.4	0.3117E-04	11951.1	90.20
0.635	88.097	0.4473	10192.3	3.999	2549.0	0.3107E-04	11977.6	90.30
0.634	88.099	0.4473	10214.9	3.999	2554.7	0.3097E-04	12004.2	90.40
0.633	88.101	0.4473	10237.5	3.999	2560.3	0.3086E-04	12030.8	90.50
0.632	88.103	0.4473	10260.2	3.999	2566.0	0.3076E-04	12057.4	90.60
0.632	88.105	0.4473	10282.8	3.999	2571.6	0.3066E-04	12084.0	90.70
0.631	88.107	0.4473	10305.5	3.999	2577.3	0.3056E-04	12110.6	90.80
0.630	88.109	0.4473	10328.2	3.999	2583.0	0.3046E-04	12137.3	90.90
0.630	88.111	0.4473	10351.0	3.999	2588.7	0.3036E-04	12164.1	91.00
0.629	88.113	0.4473	10373.7	3.999	2594.4	0.3026E-04	12190.8	91.10
0.628	88.116	0.4473	10396.5	3.999	2600.1	0.3016E-04	12217.6	91.20
0.628	88.118	0.4473	10419.3	3.999	2605.8	0.3006E-04	12244.4	91.30
0.627	88.120	0.4473	10442.2	3.999	2611.5	0.2996E-04	12271.2	91.40
0.626	88.122	0.4473	10465.0	3.999	2617.2	0.2986E-04	12298.1	91.50
0.626	88.124	0.4473	10487.9	3.999	2622.9	0.2977E-04	12325.0	91.60
0.625	88.126	0.4473	10510.8	3.999	2628.6	0.2967E-04	12351.9	91.70
0.624	88.128	0.4473	10533.8	3.999	2634.4	0.2957E-04	12378.9	91.80
0.623	88.130	0.4473	10556.7	3.999	2640.1	0.2948E-04	12405.8	91.90
0.623	88.132	0.4473	10579.7	3.999	2645.9	0.2938E-04	12432.9	92.00
0.622	88.134	0.4473	10602.7	3.999	2651.6	0.2928E-04	12459.9	92.10
0.621	88.136	0.4473	10625.8	3.999	2657.4	0.2919E-04	12487.0	92.20
0.621	88.138	0.4473	10648.8	3.999	2663.1	0.2909E-04	12514.1	92.30
0.620	88.140	0.4473	10671.9	3.999	2668.9	0.2900E-04	12541.2	92.40
0.619	88.142	0.4473	10695.0	3.999	2674.7	0.2891E-04	12568.4	92.50
0.619	88.144	0.4473	10718.2	3.999	2680.5	0.2881E-04	12595.5	92.60
0.618	88.146	0.4473	10741.3	3.999	2686.3	0.2872E-04	12622.8	92.70
0.617	88.148	0.4473	10764.5	3.999	2692.1	0.2863E-04	12650.0	92.80
0.617	88.150	0.4473	10787.7	3.999	2697.9	0.2854E-04	12677.3	92.90
0.616	88.152	0.4473	10811.0	3.999	2703.7	0.2844E-04	12704.6	93.00
0.615	88.154	0.4473	10834.2	3.999	2709.5	0.2835E-04	12731.9	93.10
0.615	88.156	0.4473	10857.5	3.999	2715.3	0.2826E-04	12759.3	93.20
0.614	88.158	0.4473	10880.8	3.999	2721.1	0.2817E-04	12786.7	93.30
0.613	88.160	0.4473	10904.2	3.999	2727.0	0.2808E-04	12814.1	93.40
0.613	88.162	0.4473	10927.5	3.999	2732.8	0.2799E-04	12841.6	93.50
0.612	88.164	0.4473	10950.9	3.999	2738.7	0.2790E-04	12869.0	93.60
0.611	88.166	0.4473	10974.3	3.999	2744.5	0.2781E-04	12896.6	93.70
0.611	88.168	0.4473	10997.8	3.999	2750.4	0.2772E-04	12924.1	93.80
0.610	88.170	0.4473	11021.2	3.999	2756.2	0.2763E-04	12951.7	93.90
0.610	88.172	0.4473	11044.7	3.999	2762.1	0.2755E-04	12979.3	94.00
0.609	88.174	0.4473	11068.2	3.999	2768.0	0.2746E-04	13006.9	94.10
0.608	88.176	0.4473	11091.8	3.999	2773.9	0.2737E-04	13034.6	94.20
0.608	88.177	0.4473	11115.3	3.999	2779.8	0.2728E-04	13062.2	94.30
0.607	88.179	0.4473	11138.9	3.999	2785.7	0.2720E-04	13090.0	94.40
0.606	88.181	0.4473	11162.5	3.999	2791.6	0.2711E-04	13117.7	94.50
0.606	88.183	0.4473	11186.2	3.999	2797.5	0.2702E-04	13145.5	94.60
0.605	88.185	0.4473	11209.8	3.999	2803.4	0.2694E-04	13173.3	94.70
0.604	88.187	0.4473	11233.5	3.999	2809.3	0.2685E-04	13201.1	94.80
0.604	88.189	0.4473	11257.2	3.999	2815.2	0.2677E-04	13229.0	94.90
0.603	88.191	0.4473	11281.0	3.999	2821.2	0.2669E-04	13256.9	95.00
0.602	88.193	0.4473	11304.7	3.999	2827.1	0.2660E-04	13284.8	95.10
0.602	88.195	0.4473	11328.5	3.999	2833.1	0.2652E-04	13312.8	95.20
0.601	88.197	0.4473	11352.3	3.999	2839.0	0.2643E-04	13340.7	95.30
0.601	88.198	0.4473	11376.2	3.999	2845.0	0.2635E-04	13368.8	95.40
0.600	88.200	0.4473	11400.0	3.999	2850.9	0.2627E-04	13396.8	95.50
0.599	88.202	0.4473	11423.9	3.999	2856.9	0.2619E-04	13424.9	95.60
0.599	88.204	0.4473	11447.8	3.999	2862.9	0.2610E-04	13453.0	95.70
0.598	88.206	0.4473	11471.8	3.999	2868.9	0.2602E-04	13481.1	95.80
0.597	88.208	0.4473	11495.7	3.999	2874.9	0.2594E-04	13509.2	95.90

TABLE I.- VALUES FOR RATIOS OF

M	p/p_t	ρ/ρ_t	T/T_t	a/a_t	q/p_t	A^*/A	V/V_0	V/a^*
96.00	0.1910E-08	0.5870E-05	0.3254E-03	0.1804E-01	0.1467E-04	0.1807E-04	0.9998	1.99967
96.10	0.1900E-08	0.5852E-05	0.3247E-03	0.1802E-01	0.1463E-04	0.1802E-04	0.9998	1.99968
96.20	0.1891E-08	0.5834E-05	0.3241E-03	0.1800E-01	0.1458E-04	0.1796E-04	0.9998	1.99968
96.30	0.1881E-08	0.5816E-05	0.5234E-03	0.1798E-01	0.1453E-04	0.1790E-04	0.9998	1.99968
96.40	0.1871E-08	0.5798E-05	0.5227E-03	0.1796E-01	0.1449E-04	0.1785E-04	0.9998	1.99968
96.50	0.1861E-08	0.5780E-05	0.5221E-03	0.1795E-01	0.1444E-04	0.1779E-04	0.9998	1.99968
96.60	0.1852E-08	0.5762E-05	0.3214E-03	0.1793E-01	0.1440E-04	0.1774E-04	0.9998	1.99968
96.70	0.1842E-08	0.5744E-05	0.3207E-03	0.1791E-01	0.1435E-04	0.1768E-04	0.9998	1.99968
96.80	0.1833E-08	0.5726E-05	0.3201E-03	0.1789E-01	0.1431E-04	0.1763E-04	0.9998	1.99968
96.90	0.1823E-08	0.5708E-05	0.3194E-03	0.1787E-01	0.1427E-04	0.1757E-04	0.9998	1.99968
97.00	0.1814E-08	0.5693E-05	0.3187E-03	0.1785E-01	0.1422E-04	0.1752E-04	0.9998	1.99968
97.10	0.1805E-08	0.5675E-05	0.3181E-03	0.1784E-01	0.1418E-04	0.1747E-04	0.9998	1.99968
97.20	0.1795E-08	0.5656E-05	0.3174E-03	0.1782E-01	0.1413E-04	0.1741E-04	0.9998	1.99968
97.30	0.1786E-08	0.5638E-05	0.3168E-03	0.1780E-01	0.1409E-04	0.1736E-04	0.9998	1.99968
97.40	0.1777E-08	0.5621E-05	0.3161E-03	0.1778E-01	0.1405E-04	0.1731E-04	0.9998	1.99968
97.50	0.1768E-08	0.5604E-05	0.3155E-03	0.1776E-01	0.1400E-04	0.1725E-04	0.9998	1.99968
97.60	0.1759E-08	0.5586E-05	0.3148E-03	0.1774E-01	0.1396E-04	0.1720E-04	0.9998	1.99969
97.70	0.1750E-08	0.5569E-05	0.3142E-03	0.1773E-01	0.1392E-04	0.1715E-04	0.9998	1.99969
97.80	0.1741E-08	0.5552E-05	0.3136E-03	0.1771E-01	0.1388E-04	0.1709E-04	0.9998	1.99969
97.90	0.1732E-08	0.5535E-05	0.3129E-03	0.1769E-01	0.1383E-04	0.1704E-04	0.9998	1.99969
98.00	0.1723E-08	0.5518E-05	0.3123E-03	0.1767E-01	0.1379E-04	0.1699E-04	0.9998	1.99969
98.10	0.1714E-08	0.5501E-05	0.3116E-03	0.1765E-01	0.1375E-04	0.1694E-04	0.9998	1.99969
98.20	0.1706E-08	0.5485E-05	0.3110E-03	0.1764E-01	0.1371E-04	0.1689E-04	0.9998	1.99969
98.30	0.1697E-08	0.5468E-05	0.3104E-03	0.1762E-01	0.1367E-04	0.1683E-04	0.9998	1.99969
98.40	0.1688E-08	0.5451E-05	0.3097E-03	0.1760E-01	0.1362E-04	0.1678E-04	0.9998	1.99969
98.50	0.1680E-08	0.5435E-05	0.3091E-03	0.1758E-01	0.1358E-04	0.1673E-04	0.9998	1.99969
98.60	0.1671E-08	0.5418E-05	0.3085E-03	0.1756E-01	0.1354E-04	0.1668E-04	0.9998	1.99969
98.70	0.1663E-08	0.5402E-05	0.3079E-03	0.1755E-01	0.1350E-04	0.1663E-04	0.9998	1.99969
98.80	0.1655E-08	0.5385E-05	0.3072E-03	0.1753E-01	0.1346E-04	0.1658E-04	0.9998	1.99969
98.90	0.1646E-08	0.5369E-05	0.3066E-03	0.1751E-01	0.1342E-04	0.1653E-04	0.9998	1.99969
99.00	0.1638E-08	0.5353E-05	0.3060E-03	0.1749E-01	0.1338E-04	0.1648E-04	0.9998	1.99969
99.10	0.1630E-08	0.5337E-05	0.3054E-03	0.1748E-01	0.1334E-04	0.1643E-04	0.9998	1.99969
99.20	0.1622E-08	0.5320E-05	0.3048E-03	0.1746E-01	0.1330E-04	0.1638E-04	0.9998	1.99970
99.30	0.1613E-08	0.5304E-05	0.3042E-03	0.1744E-01	0.1326E-04	0.1633E-04	0.9998	1.99970
99.40	0.1605E-08	0.5288E-05	0.3036E-03	0.1742E-01	0.1322E-04	0.1628E-04	0.9998	1.99970
99.50	0.1597E-08	0.5273E-05	0.3029E-03	0.1740E-01	0.1318E-04	0.1623E-04	0.9998	1.99970
99.60	0.1589E-08	0.5257E-05	0.3023E-03	0.1739E-01	0.1314E-04	0.1618E-04	0.9998	1.99970
99.70	0.1581E-08	0.5241E-05	0.3017E-03	0.1737E-01	0.1310E-04	0.1614E-04	0.9998	1.99970
99.80	0.1573E-08	0.5225E-05	0.3011E-03	0.1735E-01	0.1306E-04	0.1609E-04	0.9998	1.99970
99.90	0.1566E-08	0.5209E-05	0.3005E-03	0.1734E-01	0.1302E-04	0.1604E-04	0.9998	1.99970
100.00	0.1558E-08	0.5194E-05	0.2999E-03	0.1732E-01	0.1298E-04	0.1599E-04	0.9999	1.99970

Note: In these machine-tabulated values, the notation E-06, for example, indicates a multiplication factor of 10^{-6}.

L-2012

L-2012

FUNDAMENTAL FLOW EQUATIONS

μ, deg	ν, deg	M_2	p_2/p_1	ρ_2/ρ_1	T_2/T_1	$p_{t,2}/p_{t,1}$	$p_{t,2}/p_1$	M
0.597	88.210	0.4473	11519.7	3.999	2880.9	0.2586E-04	13537.4	96.00
0.596	88.212	0.4473	11543.7	3.999	2886.9	0.2578E-04	13565.7	96.10
0.596	88.213	0.4473	11567.8	3.999	2892.9	0.2570E-04	13593.9	96.20
0.595	88.215	0.4473	11591.8	3.999	2898.9	0.2562E-04	13622.2	96.30
0.594	88.217	0.4473	11615.9	3.999	2904.9	0.2554E-04	13650.5	96.40
0.594	88.219	0.4473	11640.0	3.999	2910.9	0.2546E-04	13678.8	96.50
0.593	88.221	0.4473	11664.1	3.999	2917.0	0.2538E-04	13707.2	96.60
0.593	88.223	0.4473	11688.3	3.999	2923.0	0.2530E-04	13735.6	96.70
0.592	88.225	0.4473	11712.5	3.999	2929.1	0.2522E-04	13764.0	96.80
0.591	88.226	0.4473	11736.7	3.999	2935.1	0.2515E-04	13792.4	96.90
0.591	88.228	0.4473	11760.9	3.999	2941.2	0.2507E-04	13820.9	97.00
0.590	88.230	0.4473	11785.2	3.999	2947.2	0.2499E-04	13849.4	97.10
0.589	88.232	0.4473	11809.5	3.999	2953.3	0.2491E-04	13878.0	97.20
0.589	88.234	0.4473	11833.8	3.999	2959.4	0.2484E-04	13906.5	97.30
0.588	88.235	0.4473	11858.1	3.999	2965.5	0.2476E-04	13935.1	97.40
0.588	88.237	0.4473	11882.5	3.999	2971.6	0.2469E-04	13963.8	97.50
0.587	88.239	0.4473	11906.9	3.999	2977.7	0.2461E-04	13992.4	97.60
0.586	88.241	0.4473	11931.3	3.999	2983.8	0.2453E-04	14021.1	97.70
0.586	88.243	0.4473	11955.7	3.999	2989.9	0.2446E-04	14049.8	97.80
0.585	88.244	0.4473	11980.2	3.999	2996.0	0.2438E-04	14078.6	97.90
0.585	88.246	0.4473	12004.7	3.999	3002.1	0.2431E-04	14107.4	98.00
0.584	88.248	0.4473	12029.2	3.999	3008.2	0.2424E-04	14136.2	98.10
0.583	88.250	0.4473	12053.7	3.999	3014.4	0.2416E-04	14165.0	98.20
0.583	88.252	0.4473	12078.3	3.999	3020.5	0.2409E-04	14193.9	98.30
0.582	88.253	0.4473	12102.9	3.999	3026.7	0.2401E-04	14222.7	98.40
0.582	88.255	0.4473	12127.5	3.999	3032.8	0.2394E-04	14251.7	98.50
0.581	88.257	0.4473	12152.1	3.999	3039.0	0.2387E-04	14280.6	98.60
0.581	88.259	0.4473	12176.8	3.999	3045.1	0.2380E-04	14309.6	98.70
0.580	88.260	0.4473	12201.5	3.999	3051.3	0.2372E-04	14338.6	98.80
0.579	88.262	0.4473	12226.2	3.999	3057.5	0.2365E-04	14367.6	98.90
0.579	88.264	0.4473	12250.9	3.999	3063.7	0.2358E-04	14396.7	99.00
0.578	88.266	0.4473	12275.7	3.999	3069.9	0.2351E-04	14425.8	99.10
0.578	88.267	0.4473	12300.5	3.999	3076.1	0.2344E-04	14454.9	99.20
0.577	88.269	0.4473	12325.3	3.999	3082.3	0.2337E-04	14484.1	99.30
0.576	88.271	0.4473	12350.1	3.999	3088.5	0.2330E-04	14513.3	99.40
0.576	88.273	0.4473	12375.0	3.999	3094.7	0.2323E-04	14542.5	99.50
0.575	88.274	0.4473	12399.9	3.999	3100.9	0.2316E-04	14571.7	99.60
0.575	88.276	0.4473	12424.8	3.999	3107.1	0.2309E-04	14601.0	99.70
0.574	88.278	0.4473	12449.7	3.999	3113.4	0.2302E-04	14630.3	99.80
0.574	88.280	0.4473	12474.7	3.999	3119.6	0.2295E-04	14659.7	99.90
0.573	88.281	0.4473	12499.7	3.999	3125.9	0.2288E-04	14689.0	100.00

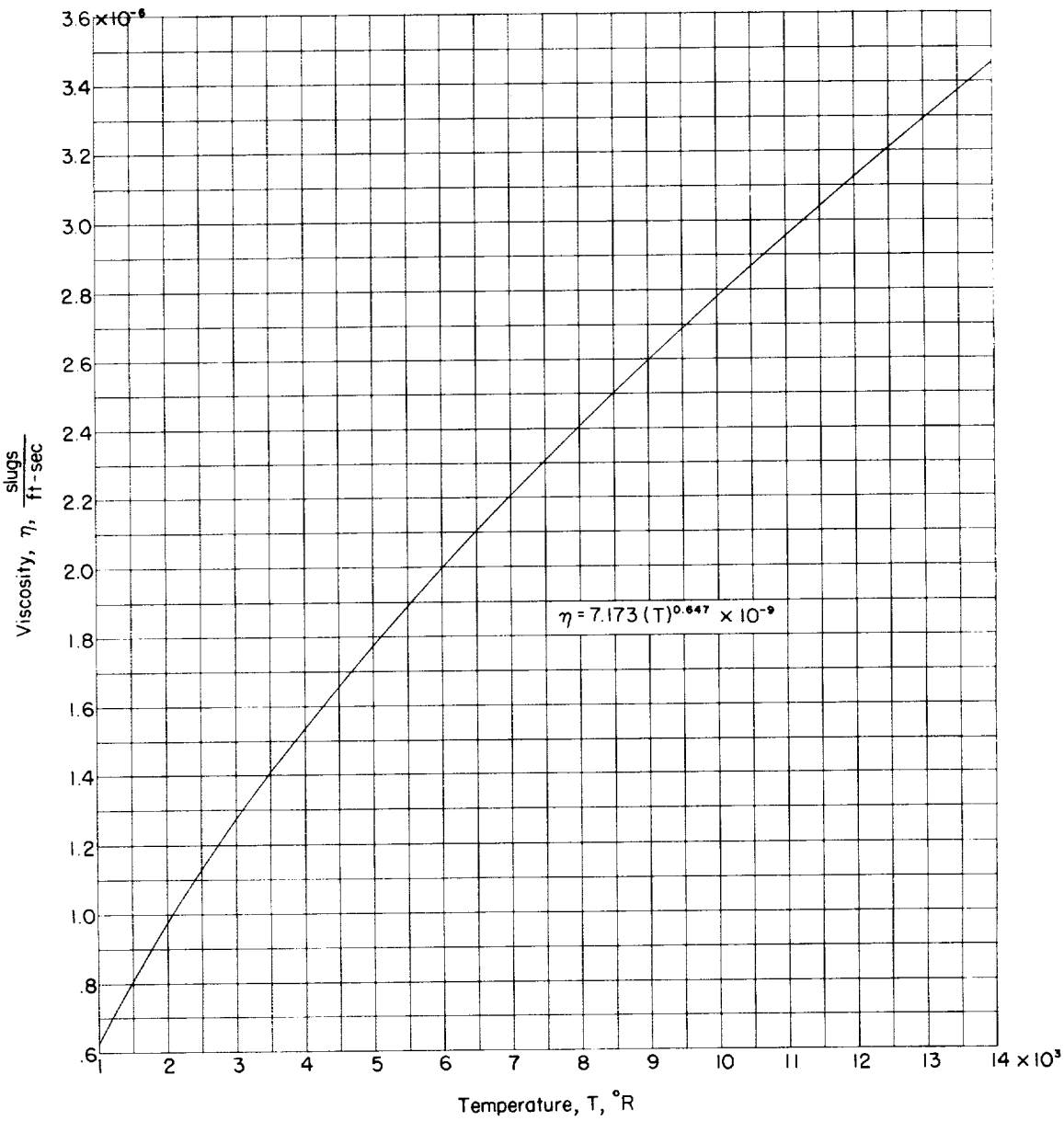
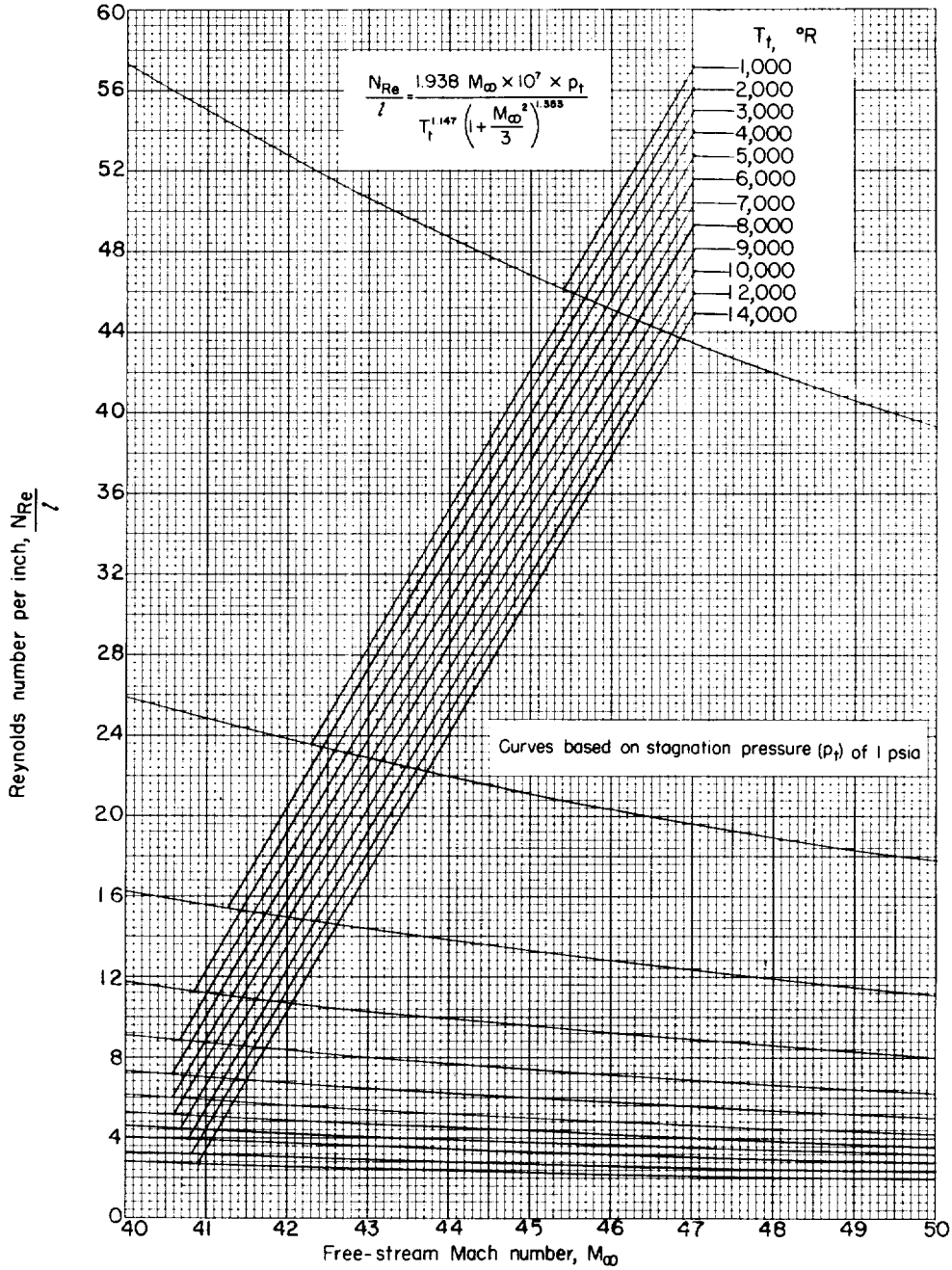


Figure 1.- Viscosity of helium as a function of temperature.

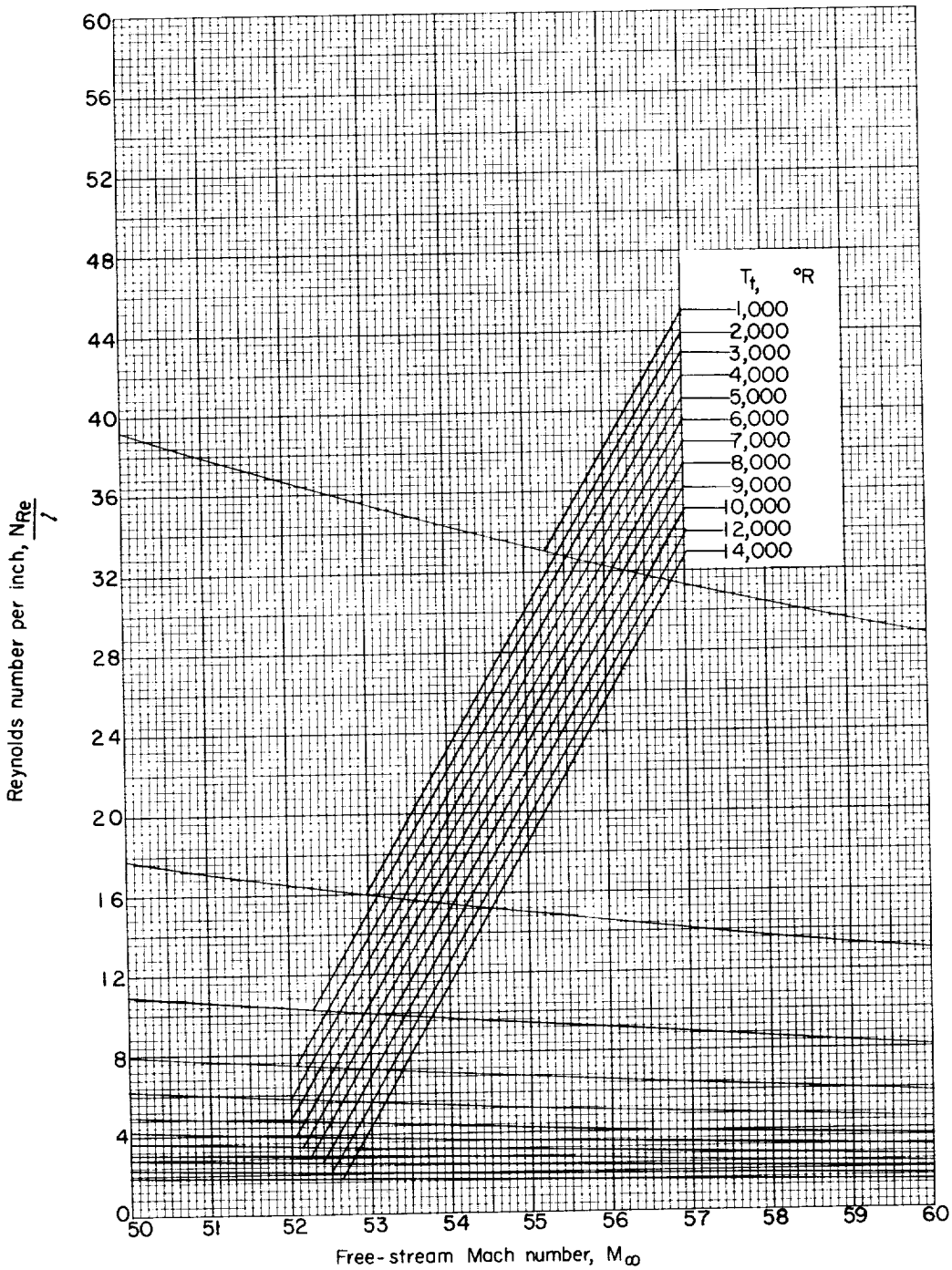
L-2012

L-2012



(a) M = 40 to 50.

Figure 2.- Reynolds number per inch as a function of free-stream Mach number and stagnation temperature.

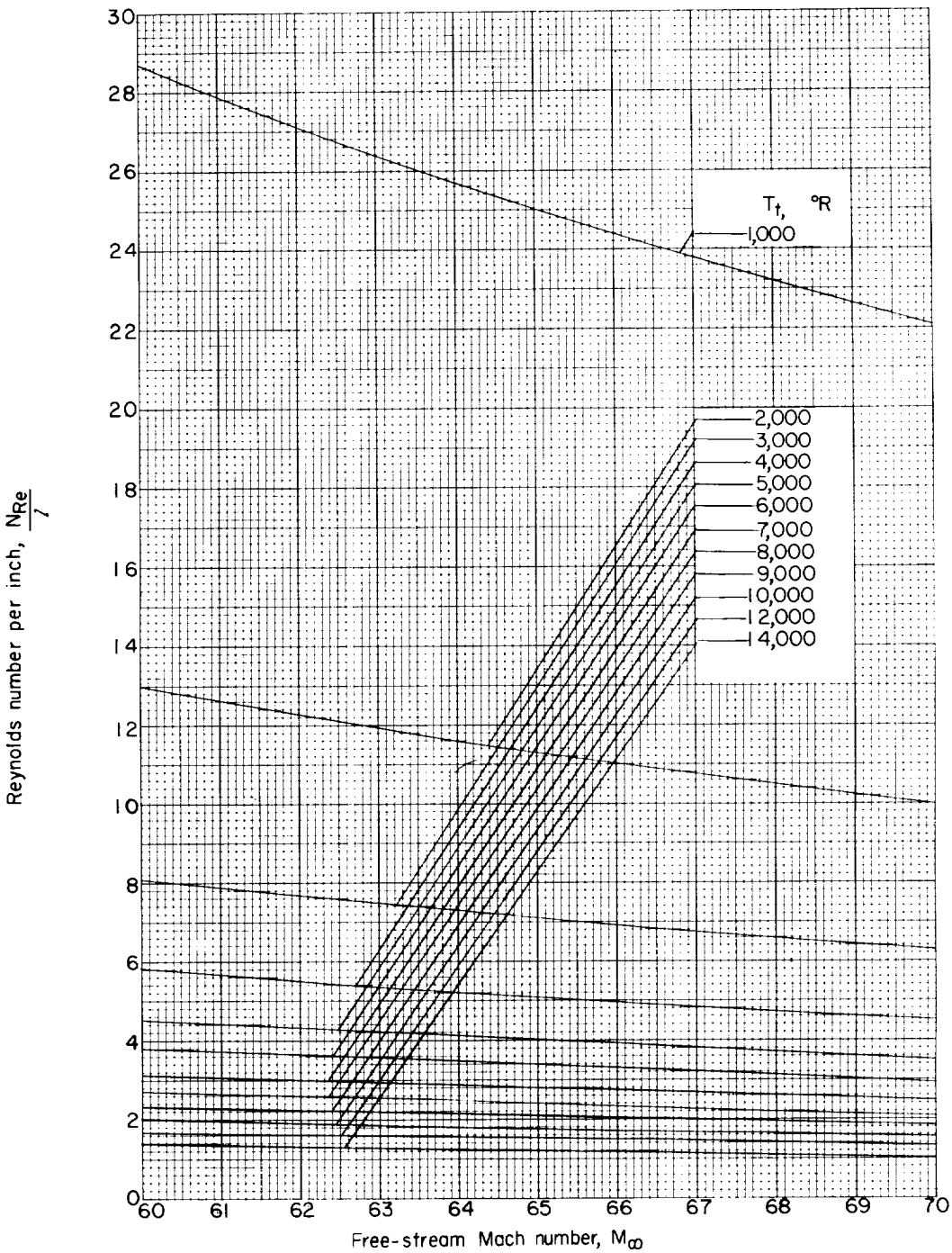


(b) M = 50 to 60.

Figure 2.- Continued.

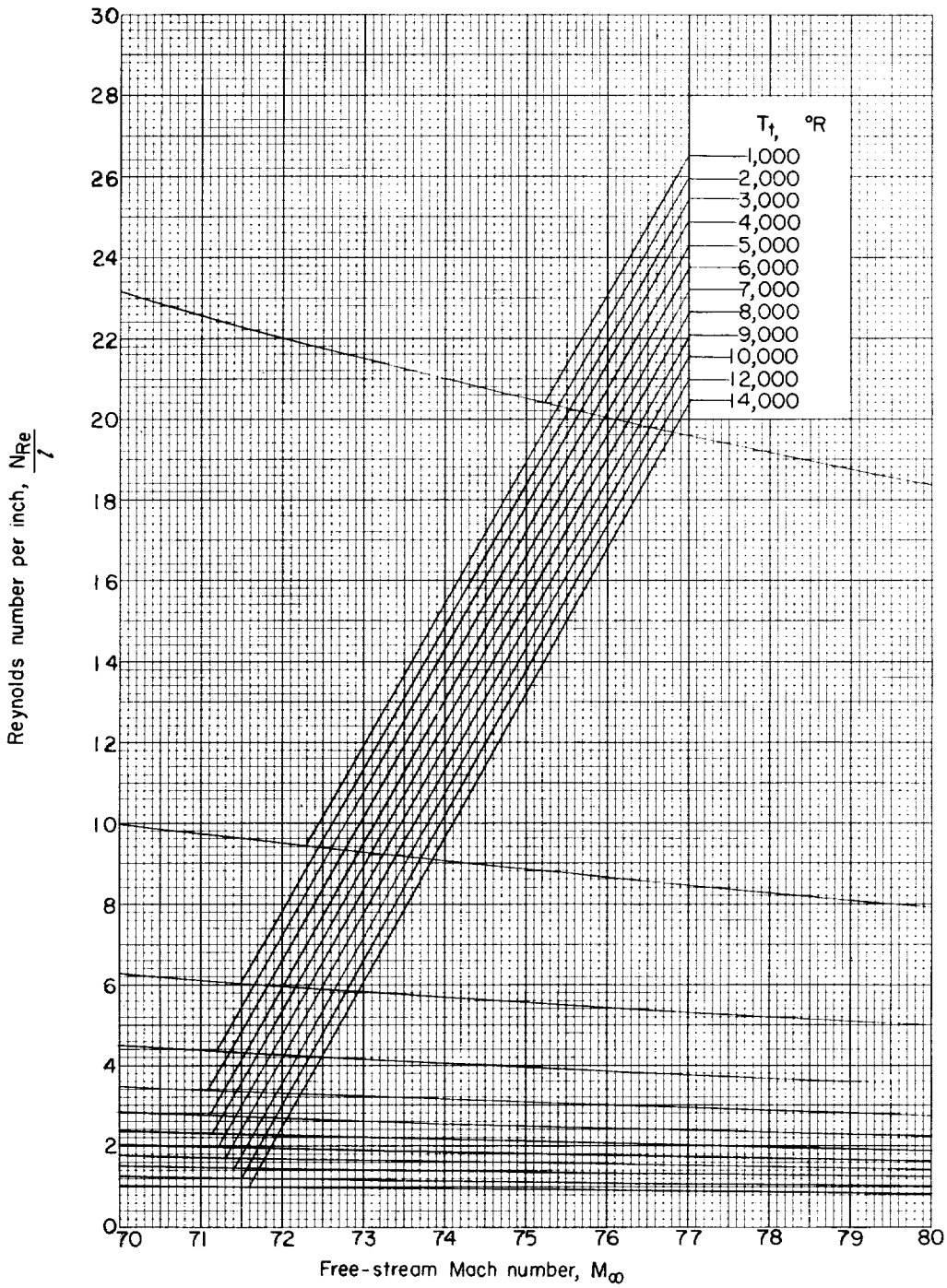
L-2012

L-2012



(c) M = 60 to 70.

Figure 2.- Continued.

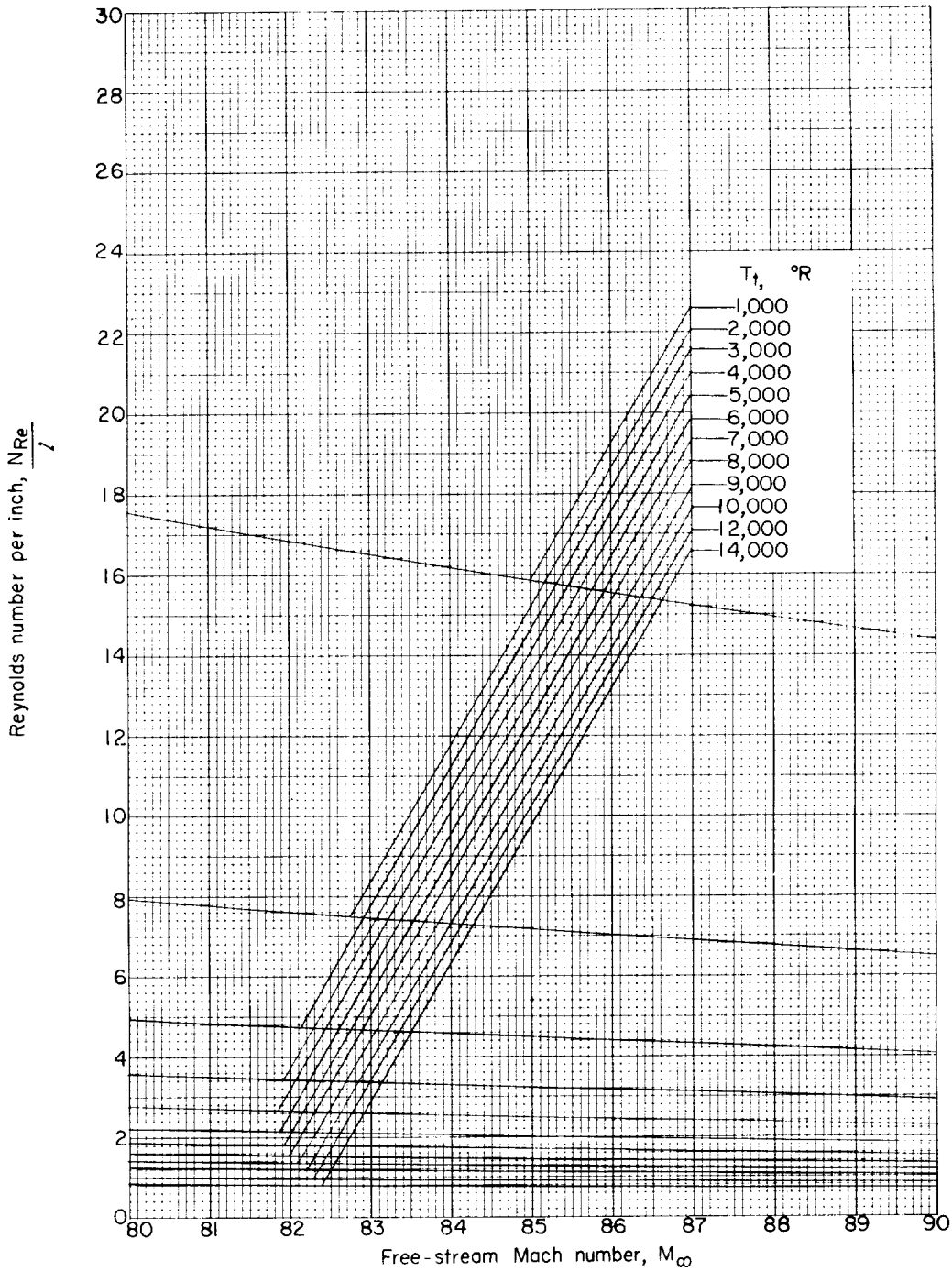


(d) M = 70 to 80.

Figure 2.- Continued.

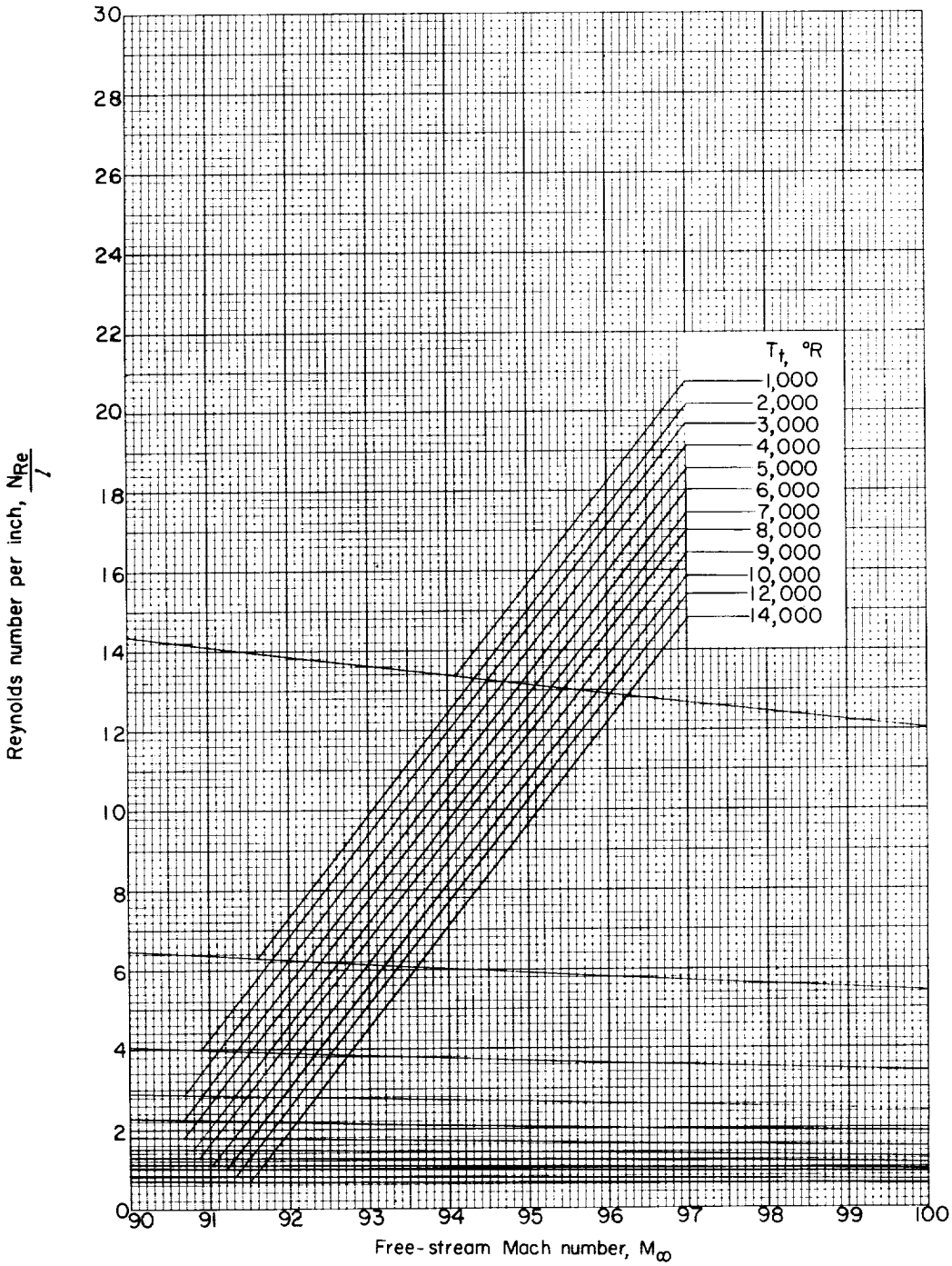
L-2012

L-2012



(e) M = 80 to 90.

Figure 2.- Continued.



(f) M = 90 to 100.

Figure 2.- Concluded.

L-2012

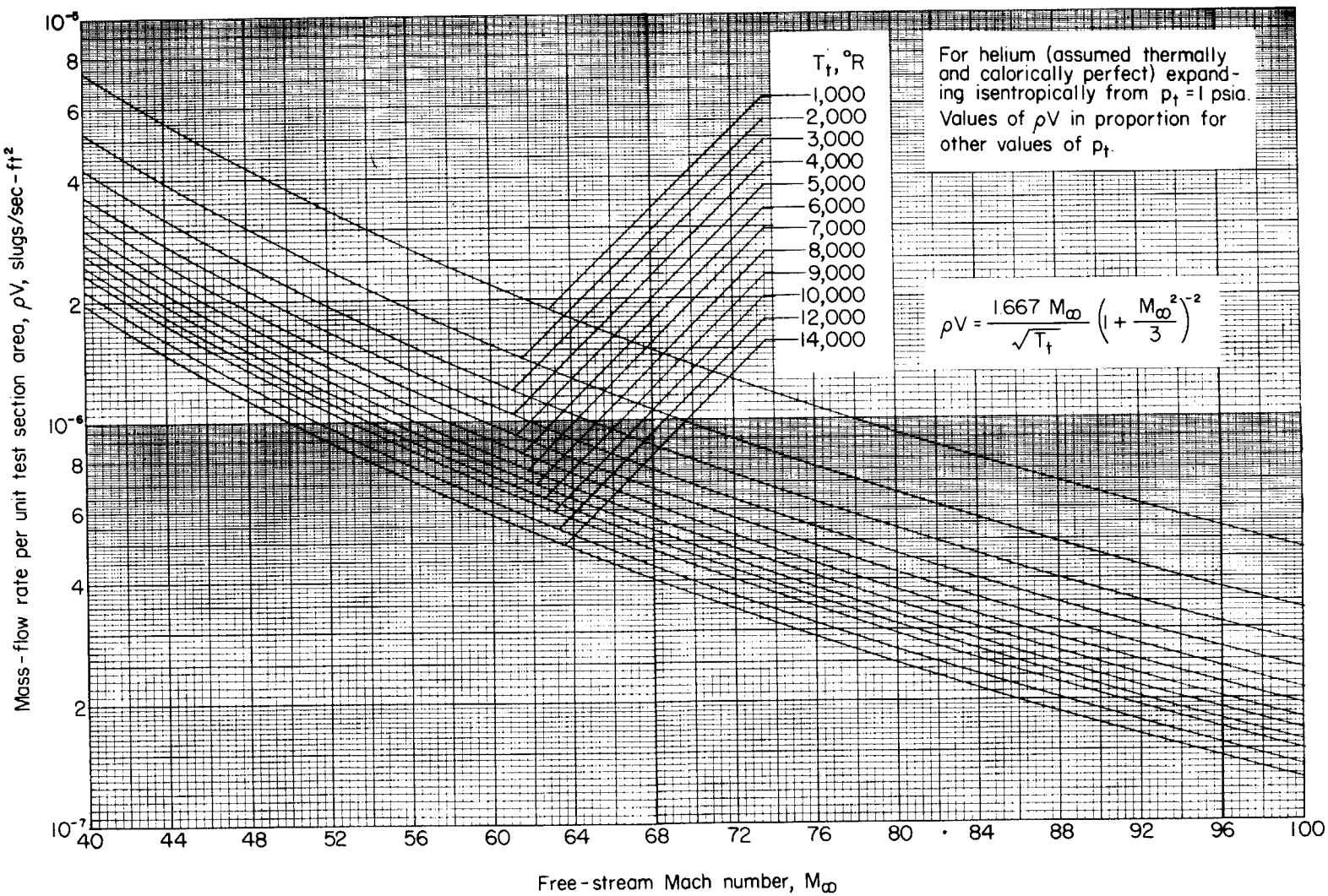


Figure 3.- Variation of mass-flow rate per unit test-section area with Mach number at constant stagnation temperatures.

NASA-Langley, 1962 L-2012