

EGT3
ENGINEERING TRIPOS PART IIB

Tuesday 26 April 2022 2 to 3.40

Module 4A3

TURBOMACHINERY 1

*Answer not more than **two** questions.*

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

*Write your candidate number **not** your name on the cover sheet.*

STATIONERY REQUIREMENTS

Single-sided script paper

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM

CUED approved calculator allowed

Attachment: Excerpt from Compressible Flow Data Book (pages 1-20 of 38 pages).

Engineering Data Book

10 minutes reading time is allowed for this paper at the start of the exam.

You may not start to read the questions printed on the subsequent pages of this question paper until instructed to do so.

You may not remove any stationery from the Examination Room.

- 1 (a) Sketch a graph showing how the exit flow angle of a turbine cascade varies with Mach number. Explain the causes of the variation. [15%]
- (b) A turbine cascade is tested using air with an inlet Mach number of 0.3 and an exit Mach number of 1.1. The inlet stagnation pressure to outlet static pressure ratio of the cascade is 2.2. Calculate the stagnation pressure loss coefficient of the cascade. [10%]
- (c) The inlet flow angle to the turbine cascade is -45° and the inlet Mach number is 0.3. Assuming the blade height is constant through the cascade and that the growth of the endwall boundary layers is negligible calculate the exit flow angle from the cascade. [15%]
- (d) Two thirds of the loss occurs downstream of the throat of the blade. Calculate the opening to pitch ratio of the cascade. Calculate the deviation in exit flow angle which is caused by the loss that occurs downstream of the throat of the blade. [20%]
- (e) The exit static pressure is lowered until the limit load condition occurs. At this condition the exit flow angle of the cascade is measured to be 54° . Explain what is meant by the limit load of a turbine cascade. Calculate the stagnation pressure loss coefficient of the cascade at the limit load condition. [20%]
- (f) Sketch the shock structure of a turbine cascade. Explain how the loss mechanisms in the cascade change as the exit Mach number changes. [20%]

Assume air behaves as a perfect gas with $\gamma = 1.4$ and $c_p = 1005 \text{ J kg}^{-1} \text{ K}^{-1}$.

2 (a) Derive the relationship

$$\psi = 2(1 - \Lambda - \phi \tan \alpha_1)$$

relating the stage loading ψ , the reaction Λ , the flow coefficient ϕ and the interstage swirl α_1 of an axial flow compressor with repeating stages. [30%]

(b) A multistage compressor has a constant mean radius and is designed with a repeating stage velocity triangle. The compressor draws air from the environment. There is no inlet guide vane and so the flow enters the first rotor axially (i.e. it has 0° of swirl). Each stage has a loading coefficient of 0.4 and a flow coefficient of 0.6. Calculate the stage reaction, the relative and absolute flow angles, and sketch the velocity triangle. Discuss the advantages or disadvantages of designing a multistage compressor with 0° interstage swirl. [30%]

(c) The stagnation temperature at the inlet of the compressor in Part (b) is 300 K. The blade speed is 250 m s^{-1} . Calculate the relative Mach number at the inlet and exit of the first rotor of the compressor. [15%]

(d) The rotor has a stagnation pressure loss coefficient of 6%. Calculate the percentage reduction in blade height from inlet to exit of the rotor. [15%]

(e) The whole multistage compressor has an overall stagnation pressure ratio of 5 and an isentropic efficiency of 90%. Calculate the number of compressor stages that are required. [10%]

Assume air behaves as a perfect gas with $\gamma = 1.4$ and $c_p = 1005 \text{ J kg}^{-1} \text{ K}^{-1}$.

3 A high bypass ratio turbofan engine is driven by a low pressure turbine (LPT) through a low speed spool. The bypass ratio (BPR) is defined as the ratio of bypass mass flow rate to that passing through the core: $BPR = \dot{m}_b / \dot{m}_c$. The total mass flow rate through the fan $\dot{m}_f = \dot{m}_b + \dot{m}_c$. The station numbers are indicated in Fig. 1.

(a) When the turbofan engine is at its design point the stator guide vane of the first stage of the LPT and the core exhaust nozzle are choked. Show that the specific work of the fan can be expressed as

$$\dot{w}_f = C_1 T_{045}$$

where T_{045} is the LPT inlet stagnation temperature. Find coefficient C_1 in terms of the exhaust gas properties c_{pe} and γ_e , area ratio A_5 / A_{45} , polytropic efficiency of the LPT and the BPR . State carefully any additional assumptions required. Over the past few decades, the bypass ratio of new turbofan engines has risen. Discuss the implications of this for the relationship between the specific work of the fan and the inlet stagnation temperature of the LPT. [30%]

(b) The high bypass ratio turbofan engine is operated at its design point on a static engine test bed. At its design point the fan has a stagnation pressure ratio $p_{02} / p_{01} = 1.35$, and a polytropic efficiency, η_{pf} , of 0.95. The inlet stagnation temperature, T_{01} , is 288 K and the inlet stagnation pressure, p_{01} , is 101330 Pa. Assume air behaves as a perfect gas with $\gamma = 1.4$ and $c_p = 1005 \text{ J kg}^{-1} \text{ K}^{-1}$.

(i) The turbofan is operated at its design point. The area ratio $A_1 / A_{19} = 1.2776$ and the Mach number at the fan inlet plane, M_1 , is 0.80. Calculate the Mach number at the exit of the bypass nozzle and the fan bypass ratio BPR . [25%]

(ii) The area $A_1 = 1.5 \text{ m}^2$. Calculate the mass flow rate through the fan, and the total power transmitted through the low speed spool. [20%]

(iii) The turbofan engine is flown at a cruise altitude of 12 km and a flight Mach number of 0.8. The Mach number at the fan inlet plane, M_1 , is 0.80 and the non-dimensional operating point of the fan is the same as it was in the static engine test. Calculate the bypass nozzle exit Mach number M_{19} . Comment on whether the stability margin of the fan in flight will be different from in the test. [25%]

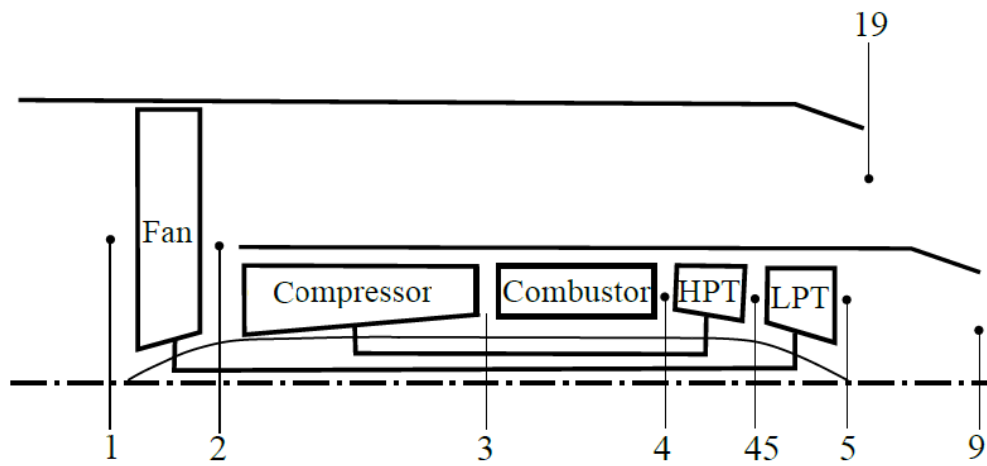


Fig. 1

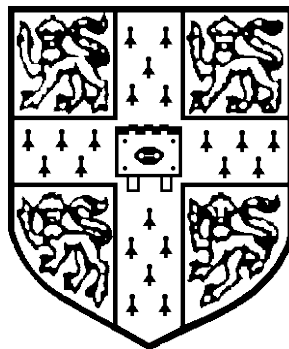
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Compressible Flow Data Book

for Part II of the
Engineering Tripos

2009 Edition



Cambridge University Engineering Department

PERFECT GAS RELATIONS FOR COMPRESSIBLE FLOW

Ratios of stagnation to static quantities

$$\frac{T}{T_0} = \left(1 + \frac{\gamma-1}{2} M^2\right)^{-1}$$

$$\frac{p}{p_0} = \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{\gamma}{\gamma-1}}$$

$$\frac{\rho}{\rho_0} = \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{1}{\gamma-1}}$$

Notes:

(1) $T_0 = \text{const.}$ in adiabatic flow with no shaft work

(2) If flow is isentropic, $p_0 = \text{const.}$ and $\rho_0 = \text{const.}$ when $T_0 = \text{const.}$

Mach number relations (see tables)

$$\frac{V}{\sqrt{c_p T_0}} = \sqrt{\gamma-1} M \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{1}{2}}$$

$$\frac{\dot{m} \sqrt{c_p T_0}}{A p_0} = \frac{\gamma}{\sqrt{\gamma-1}} M \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{1}{2} \left(\frac{\gamma+1}{\gamma-1}\right)}$$

$$\frac{\dot{m} \sqrt{c_p T_0}}{A p} = \frac{\gamma}{\sqrt{\gamma-1}} M \left(1 + \frac{\gamma-1}{2} M^2\right)^{\frac{1}{2}}$$

$$\frac{F}{\dot{m} \sqrt{c_p T_0}} = \frac{\sqrt{\gamma-1}}{\gamma} \frac{1 + \gamma M^2}{M} \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{1}{2}} \quad \text{where} \quad F = (p + \rho V^2) A$$

$$\frac{\frac{1}{2} \rho V^2}{p_0} = \frac{1}{2} \gamma M^2 \left(1 + \frac{\gamma-1}{2} M^2\right)^{-\frac{\gamma}{\gamma-1}}$$

ONE-DIMENSIONAL FLOW OF A PERFECT GAS

Isentropic flow

$$\frac{A}{A^*} = \frac{1}{M} \left\{ \frac{2}{\gamma+1} \left(1 + \frac{\gamma-1}{2} M^2 \right) \right\}^{\frac{1}{2} \left(\frac{\gamma+1}{\gamma-1} \right)}$$

Adiabatic constant area flow

$$\frac{4c_f L_{\max}}{D} = \frac{1-M^2}{\gamma M^2} + \frac{\gamma+1}{2\gamma} \ln \left(\frac{(\gamma+1)M^2}{2 \left(1 + \frac{\gamma-1}{2} M^2 \right)} \right)$$

Normal shock waves in perfect gases

$$VV_s = a^{*2}$$

$$M_s = \left(\frac{1 + \frac{\gamma-1}{2} M^2}{\gamma M^2 - \frac{\gamma-1}{2}} \right)^{\frac{1}{2}}$$

$$\frac{p_{0s}}{p_0} = \left(\frac{\frac{\gamma+1}{2} M^2}{1 + \frac{\gamma-1}{2} M^2} \right)^{\frac{\gamma}{\gamma-1}} \left(\frac{2\gamma}{\gamma+1} M^2 - \frac{\gamma-1}{\gamma+1} \right)^{\frac{1}{1-\gamma}}$$

$$\frac{p_s}{p} = 1 + \frac{2\gamma}{\gamma+1} (M^2 - 1)$$

$$\frac{p_{0s}}{p} = \left(\frac{\gamma+1}{2} M^2 \right)^{\frac{\gamma}{\gamma-1}} \left(\frac{2\gamma}{\gamma+1} M^2 - \frac{\gamma-1}{\gamma+1} \right)^{\frac{1}{1-\gamma}}$$

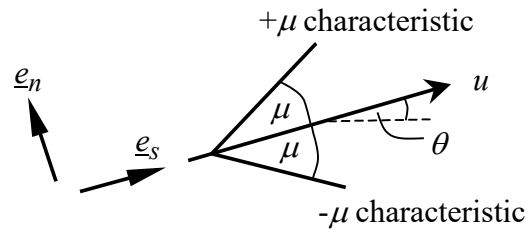
$$\frac{T_s}{T} = \frac{\gamma-1}{(\gamma+1)^2} \frac{2}{M^2} \left(1 + \frac{\gamma-1}{2} M^2 \right) \left(\frac{2\gamma}{\gamma-1} M^2 - 1 \right)$$

$$\frac{\rho_s}{\rho} = \frac{(\gamma+1)M^2}{2 \left(1 + \frac{\gamma-1}{2} M^2 \right)}$$

TWO DIMENSIONAL SUPERSONIC FLOW

Method of Characteristics for 2-D supersonic flow

Applicable to adiabatic ($h_0 = \text{constant}$), isentropic flow



Mach Number $M = u/c$

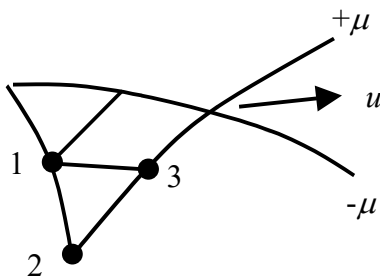
Mach angle $\mu = \sin^{-1}\left(\frac{1}{M}\right)$

Prandtl-Meyer function $\nu = \int_1^M \sqrt{M^2 - 1} \frac{du}{u}$

$$\nu = \sqrt{\frac{\gamma+1}{\gamma-1}} \tan^{-1} \sqrt{\frac{\gamma-1}{\gamma+1} (M^2 - 1)} - \tan^{-1} \sqrt{M^2 - 1} \quad \text{for a perfect gas}$$

Calculations

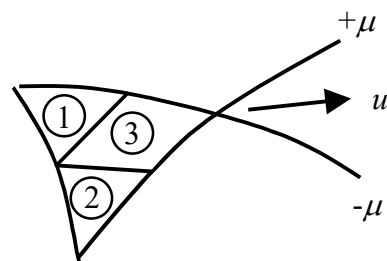
Lattice Method



$\nu_3 - \theta_3 = \nu_2 - \theta_2$ along $+\mu$

$\nu_3 + \theta_3 = \nu_1 + \theta_1$ along $-\mu$

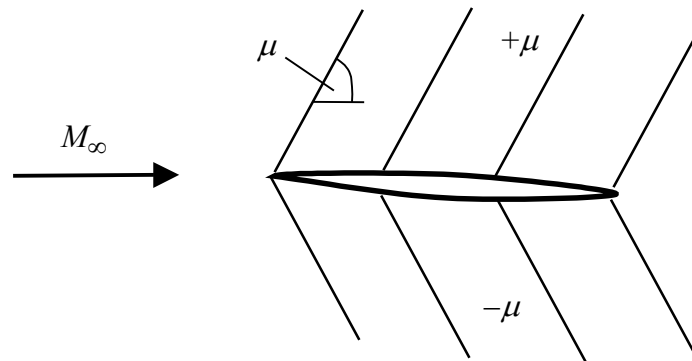
Field (or wave) method



$\nu_3 + \theta_3 = \nu_1 + \theta_1$ across $+\mu$

$\nu_3 - \theta_3 = \nu_2 - \theta_2$ across $-\mu$

Linearised Method of Characteristics (thin film theory)

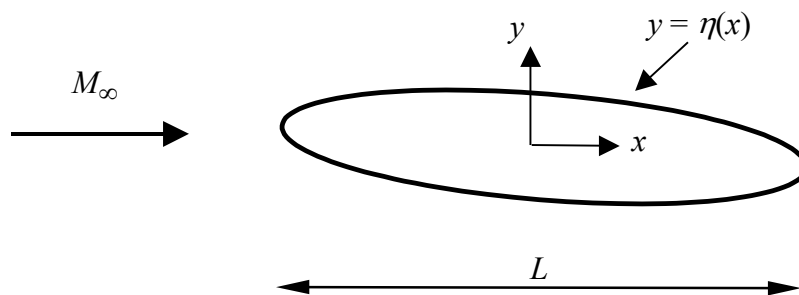


$$\mu \approx \sin^{-1}(1/M_\infty)$$

$$\Delta p \approx \pm \frac{\rho_\infty u_\infty^2 \Delta \theta}{\sqrt{M_\infty^2 - 1}} \quad \text{across } \pm \mu \text{ waves}$$

$$\text{Pressure coefficient } c_p = \frac{p - p_\infty}{\frac{1}{2} \rho_\infty u_\infty^2} = \pm \frac{2\theta}{\sqrt{M_\infty^2 - 1}} \quad \text{on upper/lower surface}$$

Prandtl-Glauert rule for linearised potential flow past geometrically similar bodies



$$\text{Pressure coefficient } c_p = \frac{p - p_\infty}{\frac{1}{2} \rho_\infty u_\infty^2}$$

For geometrically similar bodies with $\frac{\eta}{L} = f\left(\frac{x}{L}\right)$ and $c_p(M_\infty = 0) = c_{p0}$,

$$c_p = \frac{c_{p0}}{\sqrt{1 - M_\infty^2}} \quad \text{in subsonic flow}$$

$$c_p \propto \frac{1}{\sqrt{M_\infty^2 - 1}} \quad \text{in supersonic flow}$$

Oblique Shock Relations (see tables)

$$\frac{p_2}{p_1} = 1 + \frac{2\gamma}{\gamma+1} (M_1^2 \sin^2 \beta - 1)$$

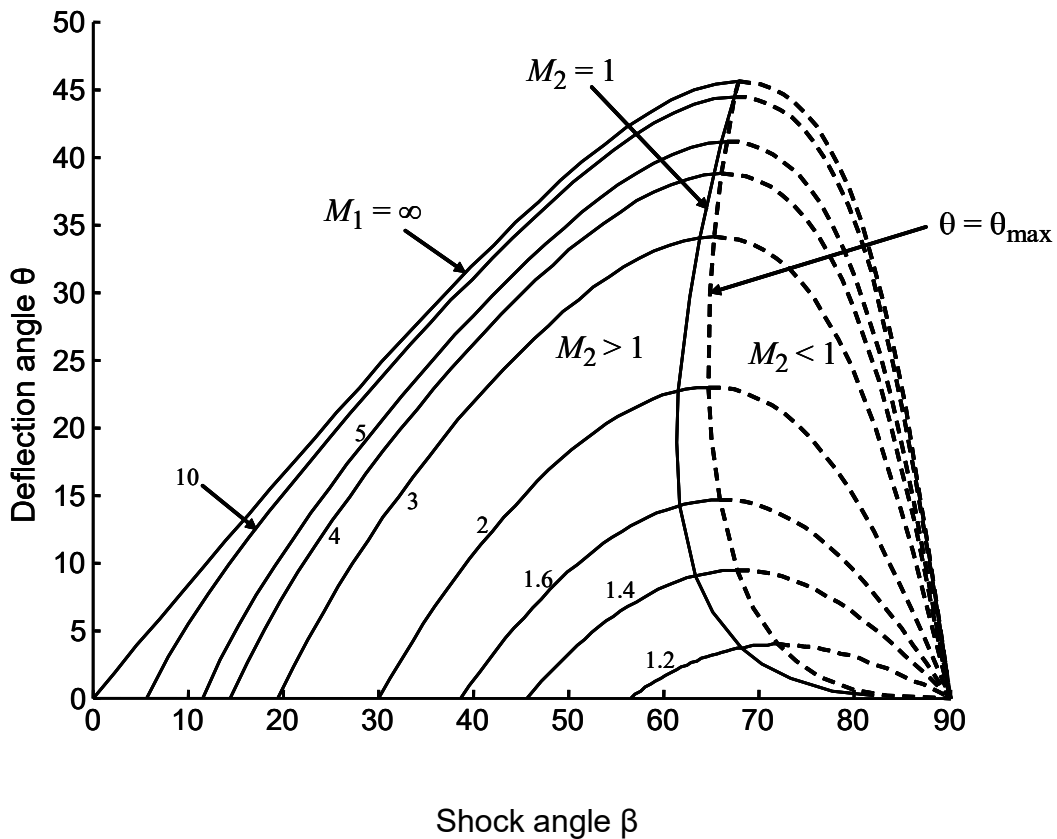
$$\frac{T_2}{T_1} = \frac{\gamma-1}{(\gamma+1)^2} \frac{2}{M_1^2 \sin^2 \beta} \left(1 + \frac{\gamma-1}{2} M_1^2 \sin^2 \beta \right) \left(\frac{2\gamma}{\gamma-1} M_1^2 \sin^2 \beta - 1 \right)$$

$$\frac{\rho_2}{\rho_1} = \frac{(\gamma+1)M_1^2 \sin^2 \beta}{2 \left[1 + \frac{\gamma-1}{2} M_1^2 \sin^2 \beta \right]}$$

$$M_2 \sin(\beta - \theta) = \left[\frac{1 + \frac{\gamma-1}{2} M_1^2 \sin^2 \beta}{\gamma M_1^2 \sin^2 \beta - \frac{\gamma-1}{2}} \right]^{\frac{1}{2}}$$

$$\frac{p_{02}}{p_{01}} = \left(\frac{\frac{\gamma+1}{2} M_1^2 \sin^2 \beta}{1 + \frac{\gamma-1}{2} M_1^2 \sin^2 \beta} \right)^{\frac{\gamma}{\gamma-1}} \left(\frac{2\gamma}{\gamma+1} M_1^2 \sin^2 \beta - \frac{\gamma-1}{\gamma+1} \right)^{\frac{1}{1-\gamma}}$$

$$\tan \theta = \frac{2 \cot \beta (M_1^2 \sin^2 \beta - 1)}{(\gamma+1)M_1^2 - 2(M_1^2 \sin^2 \beta - 1)}$$



GAS FLOW TABLES ($\gamma=1.400$): SUBSONIC FLOW

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
0.010	1.0000	0.9999	1.0000	0.0063	0.0221	0.0221	45.1813	7134.405	0.0001
0.020	0.9999	0.9997	0.9998	0.0126	0.0443	0.0443	22.5994	1778.450	0.0003
0.030	0.9998	0.9994	0.9996	0.0190	0.0664	0.0664	15.0761	787.0814	0.0006
0.040	0.9997	0.9989	0.9992	0.0253	0.0885	0.0886	11.3173	440.3522	0.0011
0.050	0.9995	0.9983	0.9988	0.0316	0.1105	0.1107	9.0644	280.0203	0.0017
0.060	0.9993	0.9975	0.9982	0.0379	0.1325	0.1329	7.5645	193.0311	0.0025
0.070	0.9990	0.9966	0.9976	0.0443	0.1545	0.1550	6.4947	140.6550	0.0034
0.080	0.9987	0.9955	0.9968	0.0506	0.1764	0.1772	5.6939	106.7182	0.0045
0.090	0.9984	0.9944	0.9960	0.0569	0.1983	0.1994	5.0723	83.4961	0.0056
0.100	0.9980	0.9930	0.9950	0.0632	0.2200	0.2216	4.5762	66.9216	0.0070
0.110	0.9976	0.9916	0.9940	0.0695	0.2417	0.2438	4.1714	54.6879	0.0084
0.120	0.9971	0.9900	0.9928	0.0758	0.2633	0.2660	3.8350	45.4080	0.0100
0.130	0.9966	0.9883	0.9916	0.0821	0.2849	0.2883	3.5513	38.2070	0.0117
0.140	0.9961	0.9864	0.9903	0.0884	0.3063	0.3105	3.3089	32.5113	0.0135
0.150	0.9955	0.9844	0.9888	0.0947	0.3276	0.3328	3.0996	27.9320	0.0155
0.160	0.9949	0.9823	0.9873	0.1009	0.3488	0.3551	2.9172	24.1978	0.0176
0.170	0.9943	0.9800	0.9857	0.1072	0.3699	0.3774	2.7569	21.1152	0.0198
0.180	0.9936	0.9776	0.9840	0.1135	0.3908	0.3997	2.6151	18.5427	0.0222
0.190	0.9928	0.9751	0.9822	0.1197	0.4116	0.4221	2.4889	16.3752	0.0246
0.200	0.9921	0.9725	0.9803	0.1260	0.4323	0.4445	2.3758	14.5333	0.0272
0.210	0.9913	0.9697	0.9783	0.1322	0.4528	0.4669	2.2740	12.9560	0.0299
0.220	0.9904	0.9668	0.9762	0.1385	0.4731	0.4893	2.1820	11.5961	0.0328
0.230	0.9895	0.9638	0.9740	0.1447	0.4933	0.5118	2.0985	10.4161	0.0357
0.240	0.9886	0.9607	0.9718	0.1509	0.5133	0.5343	2.0225	9.3865	0.0387
0.250	0.9877	0.9575	0.9694	0.1571	0.5332	0.5568	1.9530	8.4834	0.0419
0.260	0.9867	0.9541	0.9670	0.1633	0.5528	0.5794	1.8892	7.6876	0.0451
0.270	0.9856	0.9506	0.9645	0.1695	0.5723	0.6020	1.8306	6.9832	0.0485
0.280	0.9846	0.9470	0.9619	0.1757	0.5915	0.6246	1.7766	6.3572	0.0520
0.290	0.9835	0.9433	0.9592	0.1819	0.6106	0.6473	1.7267	5.7989	0.0555
0.300	0.9823	0.9395	0.9564	0.1881	0.6295	0.6700	1.6805	5.2993	0.0592
0.310	0.9811	0.9355	0.9535	0.1942	0.6481	0.6928	1.6377	4.8507	0.0629
0.320	0.9799	0.9315	0.9506	0.2003	0.6666	0.7156	1.5978	4.4467	0.0668
0.330	0.9787	0.9274	0.9476	0.2065	0.6848	0.7384	1.5608	4.0821	0.0707
0.340	0.9774	0.9231	0.9445	0.2126	0.7027	0.7613	1.5262	3.7520	0.0747
0.350	0.9761	0.9188	0.9413	0.2187	0.7205	0.7842	1.4939	3.4525	0.0788
0.360	0.9747	0.9143	0.9380	0.2248	0.7380	0.8072	1.4637	3.1801	0.0829
0.370	0.9733	0.9098	0.9347	0.2309	0.7553	0.8302	1.4354	2.9320	0.0872
0.380	0.9719	0.9052	0.9313	0.2369	0.7723	0.8532	1.4090	2.7054	0.0915
0.390	0.9705	0.9004	0.9278	0.2430	0.7891	0.8763	1.3841	2.4983	0.0959
0.400	0.9690	0.8956	0.9243	0.2490	0.8056	0.8995	1.3608	2.3085	0.1003
0.410	0.9675	0.8907	0.9207	0.2551	0.8219	0.9227	1.3388	2.1344	0.1048
0.420	0.9659	0.8857	0.9170	0.2611	0.8379	0.9460	1.3182	1.9744	0.1094
0.430	0.9643	0.8807	0.9132	0.2671	0.8536	0.9693	1.2988	1.8272	0.1140
0.440	0.9627	0.8755	0.9094	0.2730	0.8691	0.9927	1.2804	1.6915	0.1186
0.450	0.9611	0.8703	0.9055	0.2790	0.8843	1.0161	1.2632	1.5664	0.1234
0.460	0.9594	0.8650	0.9016	0.2850	0.8992	1.0396	1.2469	1.4509	0.1281
0.470	0.9577	0.8596	0.8976	0.2909	0.9138	1.0631	1.2315	1.3441	0.1329
0.480	0.9559	0.8541	0.8935	0.2968	0.9282	1.0867	1.2170	1.2453	0.1378
0.490	0.9542	0.8486	0.8894	0.3027	0.9423	1.1104	1.2033	1.1539	0.1426
0.500	0.9524	0.8430	0.8852	0.3086	0.9561	1.1341	1.1903	1.0691	0.1475

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
0.510	0.9506	0.8374	0.8809	0.3145	0.9696	1.1579	1.1781	0.9904	0.1525
0.520	0.9487	0.8317	0.8766	0.3203	0.9828	1.1818	1.1665	0.9174	0.1574
0.530	0.9468	0.8259	0.8723	0.3262	0.9958	1.2057	1.1556	0.8496	0.1624
0.540	0.9449	0.8201	0.8679	0.3320	1.0084	1.2297	1.1452	0.7866	0.1674
0.550	0.9430	0.8142	0.8634	0.3378	1.0208	1.2538	1.1354	0.7281	0.1724
0.560	0.9410	0.8082	0.8589	0.3436	1.0328	1.2779	1.1261	0.6736	0.1774
0.570	0.9390	0.8022	0.8544	0.3493	1.0446	1.3021	1.1173	0.6229	0.1825
0.580	0.9370	0.7962	0.8498	0.3551	1.0561	1.3264	1.1090	0.5757	0.1875
0.590	0.9349	0.7901	0.8451	0.3608	1.0672	1.3507	1.1011	0.5317	0.1925
0.600	0.9328	0.7840	0.8405	0.3665	1.0781	1.3751	1.0937	0.4908	0.1976
0.610	0.9307	0.7778	0.8357	0.3722	1.0887	1.3996	1.0867	0.4527	0.2026
0.620	0.9286	0.7716	0.8310	0.3779	1.0990	1.4242	1.0800	0.4172	0.2076
0.630	0.9265	0.7654	0.8262	0.3835	1.1090	1.4489	1.0737	0.3841	0.2127
0.640	0.9243	0.7591	0.8213	0.3891	1.1186	1.4736	1.0678	0.3533	0.2177
0.650	0.9221	0.7528	0.8164	0.3948	1.1280	1.4984	1.0621	0.3246	0.2226
0.660	0.9199	0.7465	0.8115	0.4003	1.1371	1.5233	1.0568	0.2979	0.2276
0.670	0.9176	0.7401	0.8066	0.4059	1.1459	1.5483	1.0518	0.2730	0.2326
0.680	0.9153	0.7338	0.8016	0.4115	1.1544	1.5733	1.0471	0.2498	0.2375
0.690	0.9131	0.7274	0.7966	0.4170	1.1626	1.5984	1.0426	0.2282	0.2424
0.700	0.9107	0.7209	0.7916	0.4225	1.1705	1.6237	1.0384	0.2081	0.2473
0.710	0.9084	0.7145	0.7865	0.4280	1.1782	1.6490	1.0344	0.1895	0.2521
0.720	0.9061	0.7080	0.7814	0.4335	1.1855	1.6744	1.0307	0.1721	0.2569
0.730	0.9037	0.7016	0.7763	0.4389	1.1925	1.6999	1.0272	0.1561	0.2617
0.740	0.9013	0.6951	0.7712	0.4443	1.1993	1.7254	1.0239	0.1411	0.2664
0.750	0.8989	0.6886	0.7660	0.4497	1.2058	1.7511	1.0208	0.1273	0.2711
0.760	0.8964	0.6821	0.7609	0.4551	1.2119	1.7768	1.0179	0.1145	0.2758
0.770	0.8940	0.6756	0.7557	0.4605	1.2178	1.8027	1.0152	0.1026	0.2804
0.780	0.8915	0.6691	0.7505	0.4658	1.2234	1.8286	1.0126	0.0917	0.2849
0.790	0.8890	0.6625	0.7452	0.4711	1.2288	1.8547	1.0103	0.0816	0.2894
0.800	0.8865	0.6560	0.7400	0.4764	1.2338	1.8808	1.0081	0.0723	0.2939
0.810	0.8840	0.6495	0.7347	0.4817	1.2386	1.9070	1.0060	0.0638	0.2983
0.820	0.8815	0.6430	0.7295	0.4869	1.2431	1.9333	1.0041	0.0559	0.3026
0.830	0.8789	0.6365	0.7242	0.4921	1.2474	1.9598	1.0024	0.0488	0.3069
0.840	0.8763	0.6300	0.7189	0.4973	1.2514	1.9863	1.0008	0.0423	0.3112
0.850	0.8737	0.6235	0.7136	0.5025	1.2551	2.0129	0.9993	0.0363	0.3153
0.860	0.8711	0.6170	0.7083	0.5077	1.2585	2.0396	0.9979	0.0310	0.3195
0.870	0.8685	0.6106	0.7030	0.5128	1.2617	2.0665	0.9967	0.0261	0.3235
0.880	0.8659	0.6041	0.6977	0.5179	1.2646	2.0934	0.9956	0.0218	0.3275
0.890	0.8632	0.5977	0.6924	0.5230	1.2673	2.1204	0.9946	0.0179	0.3314
0.900	0.8606	0.5913	0.6870	0.5280	1.2698	2.1476	0.9937	0.0145	0.3352
0.910	0.8579	0.5849	0.6817	0.5331	1.2719	2.1748	0.9929	0.0115	0.3390
0.920	0.8552	0.5785	0.6764	0.5381	1.2739	2.2021	0.9922	0.0089	0.3427
0.930	0.8525	0.5721	0.6711	0.5431	1.2756	2.2296	0.9916	0.0067	0.3464
0.940	0.8498	0.5658	0.6658	0.5481	1.2770	2.2572	0.9911	0.0048	0.3499
0.950	0.8471	0.5595	0.6604	0.5530	1.2783	2.2848	0.9907	0.0033	0.3534
0.960	0.8444	0.5532	0.6551	0.5579	1.2793	2.3126	0.9903	0.0021	0.3569
0.970	0.8416	0.5469	0.6498	0.5628	1.2800	2.3405	0.9901	0.0011	0.3602
0.980	0.8389	0.5407	0.6445	0.5677	1.2806	2.3685	0.9899	0.0005	0.3635
0.990	0.8361	0.5345	0.6392	0.5725	1.2809	2.3966	0.9898	0.0001	0.3667
1.000	0.8333	0.5283	0.6339	0.5774	1.2810	2.4249	0.9897	0.0000	0.3698

GAS FLOW TABLES ($\gamma=1.400$): SUPERSONIC FLOW

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
1.010	0.8306	0.5221	0.6287	0.5821	1.2809	2.4532	0.9898	0.0001	0.3728	0.9901	1.0000	1.0235	1.9152	1.0066	0.04	1.010
1.020	0.8278	0.5160	0.6234	0.5869	1.2806	2.4817	0.9899	0.0005	0.3758	0.9805	1.0000	1.0471	1.9379	1.0132	0.13	1.020
1.030	0.8250	0.5099	0.6181	0.5917	1.2801	2.5103	0.9900	0.0010	0.3787	0.9712	1.0000	1.0711	1.9610	1.0198	0.23	1.030
1.040	0.8222	0.5039	0.6129	0.5964	1.2793	2.5390	0.9903	0.0018	0.3815	0.9620	0.9999	1.0952	1.9844	1.0263	0.35	1.040
1.050	0.8193	0.4979	0.6077	0.6011	1.2784	2.5678	0.9905	0.0027	0.3842	0.9531	0.9999	1.1196	2.0083	1.0328	0.49	1.050
1.060	0.8165	0.4919	0.6024	0.6058	1.2773	2.5967	0.9909	0.0038	0.3869	0.9444	0.9998	1.1442	2.0325	1.0393	0.64	1.060
1.070	0.8137	0.4860	0.5972	0.6104	1.2760	2.6258	0.9913	0.0051	0.3895	0.9360	0.9996	1.1691	2.0570	1.0458	0.80	1.070
1.080	0.8108	0.4800	0.5920	0.6151	1.2745	2.6549	0.9917	0.0066	0.3919	0.9277	0.9994	1.1941	2.0819	1.0522	0.97	1.080
1.090	0.8080	0.4742	0.5869	0.6197	1.2728	2.6842	0.9922	0.0082	0.3944	0.9196	0.9992	1.2195	2.1072	1.0586	1.15	1.090
1.100	0.8052	0.4684	0.5817	0.6243	1.2709	2.7136	0.9928	0.0099	0.3967	0.9118	0.9989	1.2450	2.1328	1.0649	1.34	1.100
1.110	0.8023	0.4626	0.5766	0.6288	1.2689	2.7432	0.9934	0.0118	0.3990	0.9041	0.9986	1.2708	2.1588	1.0713	1.53	1.110
1.120	0.7994	0.4568	0.5714	0.6333	1.2667	2.7728	0.9940	0.0138	0.4011	0.8966	0.9982	1.2968	2.1851	1.0776	1.74	1.120
1.130	0.7966	0.4511	0.5663	0.6379	1.2643	2.8026	0.9947	0.0159	0.4032	0.8892	0.9978	1.3231	2.2118	1.0840	1.94	1.130
1.140	0.7937	0.4455	0.5612	0.6423	1.2618	2.8325	0.9954	0.0182	0.4052	0.8820	0.9973	1.3495	2.2388	1.0903	2.16	1.140
1.150	0.7908	0.4398	0.5562	0.6468	1.2590	2.8626	0.9961	0.0205	0.4072	0.8750	0.9967	1.3763	2.2661	1.0966	2.38	1.150
1.160	0.7879	0.4343	0.5511	0.6512	1.2562	2.8927	0.9969	0.0230	0.4090	0.8682	0.9961	1.4032	2.2937	1.1029	2.61	1.160
1.170	0.7851	0.4287	0.5461	0.6556	1.2531	2.9230	0.9978	0.0255	0.4108	0.8615	0.9953	1.4304	2.3217	1.1092	2.84	1.170
1.180	0.7822	0.4232	0.5411	0.6600	1.2500	2.9534	0.9986	0.0281	0.4125	0.8549	0.9946	1.4578	2.3500	1.1154	3.07	1.180
1.190	0.7793	0.4178	0.5361	0.6644	1.2466	2.9840	0.9995	0.0309	0.4141	0.8485	0.9937	1.4855	2.3786	1.1217	3.31	1.190
1.200	0.7764	0.4124	0.5311	0.6687	1.2432	3.0147	1.0004	0.0336	0.4157	0.8422	0.9928	1.5133	2.4075	1.1280	3.56	1.200
1.210	0.7735	0.4070	0.5262	0.6730	1.2396	3.0455	1.0014	0.0365	0.4171	0.8360	0.9918	1.5415	2.4367	1.1343	3.81	1.210
1.220	0.7706	0.4017	0.5213	0.6773	1.2358	3.0764	1.0024	0.0394	0.4185	0.8300	0.9907	1.5698	2.4663	1.1405	4.06	1.220
1.230	0.7677	0.3964	0.5164	0.6816	1.2319	3.1075	1.0034	0.0424	0.4198	0.8241	0.9896	1.5984	2.4961	1.1468	4.31	1.230
1.240	0.7648	0.3912	0.5115	0.6858	1.2279	3.1387	1.0045	0.0455	0.4211	0.8183	0.9884	1.6272	2.5263	1.1531	4.57	1.240
1.250	0.7619	0.3861	0.5067	0.6901	1.2238	3.1700	1.0055	0.0486	0.4223	0.8126	0.9871	1.6563	2.5568	1.1594	4.83	1.250

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
1.260	0.7590	0.3809	0.5019	0.6943	1.2195	3.2015	1.0066	0.0517	0.4233	0.8071	0.9857	1.6855	2.5875	1.1657	5.09	1.260
1.270	0.7561	0.3759	0.4971	0.6984	1.2152	3.2331	1.0077	0.0549	0.4244	0.8016	0.9842	1.7151	2.6186	1.1720	5.36	1.270
1.280	0.7532	0.3708	0.4923	0.7026	1.2107	3.2648	1.0089	0.0582	0.4253	0.7963	0.9827	1.7448	2.6500	1.1783	5.63	1.280
1.290	0.7503	0.3658	0.4876	0.7067	1.2061	3.2967	1.0100	0.0615	0.4262	0.7911	0.9811	1.7748	2.6816	1.1846	5.90	1.290
1.300	0.7474	0.3609	0.4829	0.7108	1.2014	3.3287	1.0112	0.0648	0.4270	0.7860	0.9794	1.8050	2.7136	1.1909	6.17	1.300
1.310	0.7445	0.3560	0.4782	0.7149	1.1965	3.3608	1.0124	0.0682	0.4277	0.7809	0.9776	1.8355	2.7459	1.1972	6.44	1.310
1.320	0.7416	0.3512	0.4736	0.7189	1.1916	3.3931	1.0136	0.0716	0.4283	0.7760	0.9758	1.8661	2.7784	1.2035	6.72	1.320
1.330	0.7387	0.3464	0.4690	0.7229	1.1866	3.4255	1.0149	0.0750	0.4289	0.7712	0.9738	1.8971	2.8112	1.2099	7.00	1.330
1.340	0.7358	0.3417	0.4644	0.7270	1.1815	3.4581	1.0161	0.0785	0.4294	0.7664	0.9718	1.9282	2.8444	1.2162	7.28	1.340
1.350	0.7329	0.3370	0.4598	0.7309	1.1763	3.4907	1.0174	0.0820	0.4299	0.7618	0.9697	1.9596	2.8778	1.2226	7.56	1.350
1.360	0.7300	0.3323	0.4553	0.7349	1.1710	3.5236	1.0187	0.0855	0.4303	0.7572	0.9676	1.9912	2.9115	1.2290	7.84	1.360
1.370	0.7271	0.3277	0.4508	0.7388	1.1656	3.5566	1.0200	0.0890	0.4306	0.7527	0.9653	2.0231	2.9455	1.2354	8.13	1.370
1.380	0.7242	0.3232	0.4463	0.7427	1.1601	3.5897	1.0213	0.0926	0.4308	0.7483	0.9630	2.0551	2.9798	1.2418	8.41	1.380
1.390	0.7213	0.3187	0.4418	0.7466	1.1546	3.6229	1.0226	0.0962	0.4310	0.7440	0.9607	2.0875	3.0144	1.2482	8.70	1.390
1.400	0.7184	0.3142	0.4374	0.7505	1.1490	3.6563	1.0240	0.0997	0.4311	0.7397	0.9582	2.1200	3.0492	1.2547	8.99	1.400
1.410	0.7155	0.3098	0.4330	0.7543	1.1433	3.6899	1.0253	0.1033	0.4312	0.7355	0.9557	2.1528	3.0844	1.2612	9.28	1.410
1.420	0.7126	0.3055	0.4287	0.7581	1.1375	3.7236	1.0267	0.1069	0.4312	0.7314	0.9531	2.1858	3.1198	1.2676	9.57	1.420
1.430	0.7097	0.3012	0.4244	0.7619	1.1317	3.7574	1.0281	0.1106	0.4311	0.7274	0.9504	2.2191	3.1555	1.2741	9.86	1.430
1.440	0.7069	0.2969	0.4201	0.7657	1.1258	3.7914	1.0295	0.1142	0.4310	0.7235	0.9476	2.2525	3.1915	1.2807	10.15	1.440
1.450	0.7040	0.2927	0.4158	0.7694	1.1198	3.8255	1.0308	0.1178	0.4308	0.7196	0.9448	2.2863	3.2278	1.2872	10.44	1.450
1.460	0.7011	0.2886	0.4116	0.7732	1.1138	3.8598	1.0323	0.1215	0.4306	0.7157	0.9420	2.3202	3.2643	1.2938	10.73	1.460
1.470	0.6982	0.2845	0.4074	0.7769	1.1077	3.8942	1.0337	0.1251	0.4303	0.7120	0.9390	2.3544	3.3011	1.3003	11.02	1.470
1.480	0.6954	0.2804	0.4032	0.7805	1.1016	3.9287	1.0351	0.1288	0.4299	0.7083	0.9360	2.3888	3.3382	1.3069	11.32	1.480
1.490	0.6925	0.2764	0.3991	0.7842	1.0954	3.9634	1.0365	0.1324	0.4295	0.7047	0.9329	2.4235	3.3756	1.3136	11.61	1.490
1.500	0.6897	0.2724	0.3950	0.7878	1.0891	3.9983	1.0379	0.1361	0.4290	0.7011	0.9298	2.4583	3.4133	1.3202	11.91	1.500

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
1.510	0.6868	0.2685	0.3909	0.7914	1.0829	4.0333	1.0394	0.1397	0.4285	0.6976	0.9266	2.4935	3.4512	1.3269	12.20	1.510
1.520	0.6840	0.2646	0.3869	0.7950	1.0765	4.0684	1.0408	0.1433	0.4279	0.6941	0.9233	2.5288	3.4894	1.3336	12.49	1.520
1.530	0.6811	0.2608	0.3829	0.7986	1.0702	4.1037	1.0423	0.1470	0.4273	0.6907	0.9200	2.5644	3.5279	1.3403	12.79	1.530
1.540	0.6783	0.2570	0.3789	0.8021	1.0638	4.1392	1.0437	0.1506	0.4266	0.6874	0.9166	2.6002	3.5667	1.3470	13.09	1.540
1.550	0.6754	0.2533	0.3750	0.8057	1.0573	4.1748	1.0452	0.1543	0.4259	0.6841	0.9132	2.6363	3.6057	1.3538	13.38	1.550
1.560	0.6726	0.2496	0.3710	0.8092	1.0508	4.2105	1.0467	0.1579	0.4252	0.6809	0.9097	2.6725	3.6450	1.3606	13.68	1.560
1.570	0.6698	0.2459	0.3672	0.8126	1.0443	4.2464	1.0481	0.1615	0.4243	0.6777	0.9062	2.7091	3.6846	1.3674	13.97	1.570
1.580	0.6670	0.2423	0.3633	0.8161	1.0378	4.2825	1.0496	0.1651	0.4235	0.6746	0.9026	2.7458	3.7244	1.3742	14.27	1.580
1.590	0.6642	0.2388	0.3595	0.8195	1.0312	4.3187	1.0511	0.1688	0.4226	0.6715	0.8989	2.7828	3.7646	1.3811	14.56	1.590
1.600	0.6614	0.2353	0.3557	0.8230	1.0246	4.3551	1.0526	0.1724	0.4216	0.6684	0.8952	2.8200	3.8050	1.3880	14.86	1.600
1.610	0.6586	0.2318	0.3520	0.8263	1.0180	4.3916	1.0541	0.1760	0.4206	0.6655	0.8915	2.8575	3.8456	1.3949	15.16	1.610
1.620	0.6558	0.2284	0.3483	0.8297	1.0114	4.4282	1.0555	0.1795	0.4196	0.6625	0.8877	2.8951	3.8866	1.4018	15.45	1.620
1.630	0.6530	0.2250	0.3446	0.8331	1.0047	4.4651	1.0570	0.1831	0.4185	0.6596	0.8838	2.9331	3.9278	1.4088	15.75	1.630
1.640	0.6502	0.2217	0.3409	0.8364	0.9980	4.5020	1.0585	0.1867	0.4174	0.6568	0.8799	2.9712	3.9693	1.4158	16.04	1.640
1.650	0.6475	0.2184	0.3373	0.8397	0.9913	4.5392	1.0600	0.1902	0.4162	0.6540	0.8760	3.0096	4.0110	1.4228	16.34	1.650
1.660	0.6447	0.2151	0.3337	0.8430	0.9846	4.5765	1.0615	0.1938	0.4150	0.6512	0.8720	3.0482	4.0531	1.4299	16.63	1.660
1.670	0.6419	0.2119	0.3302	0.8462	0.9779	4.6139	1.0630	0.1973	0.4138	0.6485	0.8680	3.0871	4.0953	1.4369	16.93	1.670
1.680	0.6392	0.2088	0.3266	0.8495	0.9712	4.6515	1.0645	0.2008	0.4125	0.6458	0.8639	3.1261	4.1379	1.4440	17.22	1.680
1.690	0.6364	0.2057	0.3232	0.8527	0.9644	4.6892	1.0660	0.2043	0.4112	0.6431	0.8599	3.1655	4.1807	1.4512	17.52	1.690
1.700	0.6337	0.2026	0.3197	0.8559	0.9577	4.7272	1.0674	0.2078	0.4098	0.6405	0.8557	3.2050	4.2238	1.4583	17.81	1.700
1.710	0.6310	0.1996	0.3163	0.8591	0.9509	4.7652	1.0689	0.2113	0.4085	0.6380	0.8516	3.2448	4.2672	1.4655	18.10	1.710
1.720	0.6283	0.1966	0.3129	0.8622	0.9442	4.8035	1.0704	0.2147	0.4071	0.6355	0.8474	3.2848	4.3108	1.4727	18.40	1.720
1.730	0.6256	0.1936	0.3095	0.8654	0.9374	4.8418	1.0719	0.2182	0.4056	0.6330	0.8431	3.3251	4.3547	1.4800	18.69	1.730
1.740	0.6229	0.1907	0.3062	0.8685	0.9307	4.8804	1.0734	0.2216	0.4041	0.6305	0.8389	3.3655	4.3989	1.4873	18.98	1.740
1.750	0.6202	0.1878	0.3029	0.8716	0.9239	4.9191	1.0749	0.2250	0.4026	0.6281	0.8346	3.4063	4.4433	1.4946	19.27	1.750

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
1.760	0.6175	0.1850	0.2996	0.8747	0.9172	4.9580	1.0764	0.2284	0.4011	0.6257	0.8302	3.4472	4.4880	1.5019	19.56	1.760
1.770	0.6148	0.1822	0.2964	0.8777	0.9104	4.9970	1.0779	0.2318	0.3996	0.6234	0.8259	3.4884	4.5330	1.5093	19.86	1.770
1.780	0.6121	0.1794	0.2931	0.8808	0.9037	5.0362	1.0793	0.2352	0.3980	0.6210	0.8215	3.5298	4.5782	1.5167	20.15	1.780
1.790	0.6095	0.1767	0.2900	0.8838	0.8970	5.0755	1.0808	0.2385	0.3964	0.6188	0.8171	3.5715	4.6237	1.5241	20.44	1.790
1.800	0.6068	0.1740	0.2868	0.8868	0.8902	5.1150	1.0823	0.2419	0.3947	0.6165	0.8127	3.6133	4.6695	1.5316	20.73	1.800
1.810	0.6041	0.1714	0.2837	0.8898	0.8835	5.1547	1.0838	0.2452	0.3931	0.6143	0.8082	3.6555	4.7155	1.5391	21.01	1.810
1.820	0.6015	0.1688	0.2806	0.8927	0.8768	5.1945	1.0852	0.2485	0.3914	0.6121	0.8038	3.6978	4.7618	1.5466	21.30	1.820
1.830	0.5989	0.1662	0.2776	0.8957	0.8701	5.2345	1.0867	0.2518	0.3897	0.6099	0.7993	3.7404	4.8084	1.5541	21.59	1.830
1.840	0.5963	0.1637	0.2745	0.8986	0.8634	5.2747	1.0882	0.2551	0.3879	0.6078	0.7948	3.7832	4.8552	1.5617	21.88	1.840
1.850	0.5936	0.1612	0.2715	0.9015	0.8568	5.3150	1.0896	0.2583	0.3862	0.6057	0.7902	3.8263	4.9023	1.5693	22.16	1.850
1.860	0.5910	0.1587	0.2686	0.9044	0.8501	5.3555	1.0911	0.2616	0.3844	0.6036	0.7857	3.8695	4.9497	1.5770	22.45	1.860
1.870	0.5884	0.1563	0.2656	0.9072	0.8435	5.3962	1.0926	0.2648	0.3826	0.6016	0.7811	3.9131	4.9973	1.5847	22.73	1.870
1.880	0.5859	0.1539	0.2627	0.9101	0.8368	5.4370	1.0940	0.2680	0.3808	0.5996	0.7765	3.9568	5.0452	1.5924	23.02	1.880
1.890	0.5833	0.1516	0.2598	0.9129	0.8302	5.4780	1.0955	0.2712	0.3790	0.5976	0.7720	4.0008	5.0934	1.6001	23.30	1.890
1.900	0.5807	0.1492	0.2570	0.9157	0.8237	5.5191	1.0969	0.2743	0.3771	0.5956	0.7674	4.0450	5.1418	1.6079	23.59	1.900
1.910	0.5782	0.1470	0.2542	0.9185	0.8171	5.5604	1.0984	0.2775	0.3753	0.5937	0.7627	4.0895	5.1905	1.6157	23.87	1.910
1.920	0.5756	0.1447	0.2514	0.9213	0.8106	5.6019	1.0998	0.2806	0.3734	0.5918	0.7581	4.1341	5.2394	1.6236	24.15	1.920
1.930	0.5731	0.1425	0.2486	0.9240	0.8041	5.6435	1.1012	0.2837	0.3715	0.5899	0.7535	4.1791	5.2886	1.6314	24.43	1.930
1.940	0.5705	0.1403	0.2459	0.9268	0.7976	5.6853	1.1027	0.2868	0.3696	0.5880	0.7488	4.2242	5.3381	1.6394	24.71	1.940
1.950	0.5680	0.1381	0.2432	0.9295	0.7911	5.7273	1.1041	0.2899	0.3677	0.5862	0.7442	4.2696	5.3878	1.6473	24.99	1.950
1.960	0.5655	0.1360	0.2405	0.9322	0.7846	5.7695	1.1055	0.2929	0.3657	0.5844	0.7395	4.3152	5.4378	1.6553	25.27	1.960
1.970	0.5630	0.1339	0.2378	0.9349	0.7782	5.8118	1.1069	0.2960	0.3638	0.5826	0.7349	4.3611	5.4881	1.6633	25.55	1.970
1.980	0.5605	0.1318	0.2352	0.9375	0.7718	5.8542	1.1084	0.2990	0.3618	0.5808	0.7302	4.4071	5.5386	1.6713	25.83	1.980
1.990	0.5580	0.1298	0.2326	0.9402	0.7655	5.8969	1.1098	0.3020	0.3598	0.5791	0.7255	4.4535	5.5894	1.6794	26.10	1.990
2.000	0.5556	0.1278	0.2300	0.9428	0.7591	5.9397	1.1112	0.3050	0.3579	0.5774	0.7209	4.5000	5.6404	1.6875	26.38	2.000

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
2.010	0.5531	0.1258	0.2275	0.9454	0.7528	5.9827	1.1126	0.3080	0.3559	0.5757	0.7162	4.5468	5.6918	1.6956	26.66	2.010
2.020	0.5506	0.1239	0.2250	0.9480	0.7465	6.0258	1.1140	0.3109	0.3539	0.5740	0.7115	4.5938	5.7433	1.7038	26.93	2.020
2.030	0.5482	0.1220	0.2225	0.9506	0.7403	6.0692	1.1154	0.3138	0.3518	0.5723	0.7069	4.6411	5.7952	1.7120	27.20	2.030
2.040	0.5458	0.1201	0.2200	0.9531	0.7340	6.1126	1.1167	0.3168	0.3498	0.5707	0.7022	4.6885	5.8473	1.7203	27.48	2.040
2.050	0.5433	0.1182	0.2176	0.9557	0.7279	6.1563	1.1181	0.3197	0.3478	0.5691	0.6975	4.7363	5.8996	1.7285	27.75	2.050
2.060	0.5409	0.1164	0.2152	0.9582	0.7217	6.2001	1.1195	0.3225	0.3458	0.5675	0.6928	4.7842	5.9523	1.7369	28.02	2.060
2.070	0.5385	0.1146	0.2128	0.9607	0.7156	6.2441	1.1209	0.3254	0.3437	0.5659	0.6882	4.8324	6.0051	1.7452	28.29	2.070
2.080	0.5361	0.1128	0.2104	0.9632	0.7095	6.2883	1.1222	0.3282	0.3417	0.5643	0.6835	4.8808	6.0583	1.7536	28.56	2.080
2.090	0.5337	0.1111	0.2081	0.9657	0.7034	6.3326	1.1236	0.3310	0.3396	0.5628	0.6789	4.9295	6.1117	1.7620	28.83	2.090
2.100	0.5313	0.1094	0.2058	0.9681	0.6974	6.3772	1.1250	0.3339	0.3376	0.5613	0.6742	4.9783	6.1654	1.7705	29.10	2.100
2.110	0.5290	0.1077	0.2035	0.9706	0.6914	6.4218	1.1263	0.3366	0.3355	0.5598	0.6696	5.0275	6.2193	1.7789	29.36	2.110
2.120	0.5266	0.1060	0.2013	0.9730	0.6854	6.4667	1.1276	0.3394	0.3334	0.5583	0.6649	5.0768	6.2735	1.7875	29.63	2.120
2.130	0.5243	0.1043	0.1990	0.9754	0.6795	6.5117	1.1290	0.3422	0.3314	0.5568	0.6603	5.1264	6.3280	1.7960	29.90	2.130
2.140	0.5219	0.1027	0.1968	0.9778	0.6736	6.5569	1.1303	0.3449	0.3293	0.5554	0.6557	5.1762	6.3827	1.8046	30.16	2.140
2.150	0.5196	0.1011	0.1946	0.9802	0.6677	6.6023	1.1317	0.3476	0.3272	0.5540	0.6511	5.2263	6.4377	1.8132	30.43	2.150
2.160	0.5173	0.0996	0.1925	0.9825	0.6619	6.6478	1.1330	0.3503	0.3252	0.5525	0.6464	5.2765	6.4929	1.8219	30.69	2.160
2.170	0.5150	0.0980	0.1903	0.9849	0.6561	6.6936	1.1343	0.3530	0.3231	0.5511	0.6419	5.3271	6.5484	1.8306	30.95	2.170
2.180	0.5127	0.0965	0.1882	0.9872	0.6503	6.7395	1.1356	0.3556	0.3210	0.5498	0.6373	5.3778	6.6042	1.8393	31.21	2.180
2.190	0.5104	0.0950	0.1861	0.9895	0.6446	6.7855	1.1369	0.3583	0.3189	0.5484	0.6327	5.4288	6.6602	1.8481	31.47	2.190
2.200	0.5081	0.0935	0.1841	0.9918	0.6389	6.8318	1.1382	0.3609	0.3169	0.5471	0.6281	5.4800	6.7165	1.8569	31.73	2.200
2.210	0.5059	0.0921	0.1820	0.9941	0.6333	6.8782	1.1395	0.3635	0.3148	0.5457	0.6236	5.5315	6.7730	1.8657	31.99	2.210
2.220	0.5036	0.0906	0.1800	0.9964	0.6277	6.9248	1.1408	0.3661	0.3127	0.5444	0.6191	5.5831	6.8298	1.8746	32.25	2.220
2.230	0.5014	0.0892	0.1780	0.9986	0.6221	6.9715	1.1421	0.3687	0.3106	0.5431	0.6145	5.6351	6.8869	1.8835	32.51	2.230
2.240	0.4991	0.0878	0.1760	1.0009	0.6165	7.0185	1.1434	0.3712	0.3085	0.5418	0.6100	5.6872	6.9442	1.8924	32.76	2.240
2.250	0.4969	0.0865	0.1740	1.0031	0.6110	7.0656	1.1446	0.3738	0.3065	0.5406	0.6055	5.7396	7.0018	1.9014	33.02	2.250

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
2.260	0.4947	0.0851	0.1721	1.0053	0.6056	7.1129	1.1459	0.3763	0.3044	0.5393	0.6011	5.7922	7.0597	1.9104	33.27	2.260
2.270	0.4925	0.0838	0.1702	1.0075	0.6002	7.1603	1.1472	0.3788	0.3023	0.5381	0.5966	5.8451	7.1178	1.9194	33.53	2.270
2.280	0.4903	0.0825	0.1683	1.0097	0.5948	7.2080	1.1484	0.3813	0.3003	0.5368	0.5921	5.8981	7.1762	1.9285	33.78	2.280
2.290	0.4881	0.0812	0.1664	1.0118	0.5894	7.2558	1.1497	0.3838	0.2982	0.5356	0.5877	5.9515	7.2348	1.9376	34.03	2.290
2.300	0.4859	0.0800	0.1646	1.0140	0.5841	7.3038	1.1509	0.3862	0.2961	0.5344	0.5833	6.0050	7.2937	1.9468	34.28	2.300
2.310	0.4837	0.0787	0.1628	1.0161	0.5788	7.3520	1.1521	0.3887	0.2941	0.5332	0.5789	6.0588	7.3528	1.9560	34.53	2.310
2.320	0.4816	0.0775	0.1609	1.0182	0.5736	7.4003	1.1534	0.3911	0.2920	0.5321	0.5745	6.1128	7.4122	1.9652	34.78	2.320
2.330	0.4794	0.0763	0.1592	1.0204	0.5684	7.4488	1.1546	0.3935	0.2900	0.5309	0.5702	6.1671	7.4719	1.9745	35.03	2.330
2.340	0.4773	0.0751	0.1574	1.0224	0.5632	7.4975	1.1558	0.3959	0.2879	0.5297	0.5658	6.2215	7.5319	1.9838	35.28	2.340
2.350	0.4752	0.0740	0.1556	1.0245	0.5581	7.5464	1.1570	0.3983	0.2859	0.5286	0.5615	6.2763	7.5920	1.9931	35.53	2.350
2.360	0.4731	0.0728	0.1539	1.0266	0.5530	7.5955	1.1582	0.4006	0.2839	0.5275	0.5572	6.3312	7.6525	2.0025	35.77	2.360
2.370	0.4709	0.0717	0.1522	1.0286	0.5480	7.6447	1.1595	0.4030	0.2818	0.5264	0.5529	6.3864	7.7132	2.0119	36.02	2.370
2.380	0.4688	0.0706	0.1505	1.0307	0.5430	7.6941	1.1606	0.4053	0.2798	0.5253	0.5486	6.4418	7.7742	2.0213	36.26	2.380
2.390	0.4668	0.0695	0.1488	1.0327	0.5380	7.7437	1.1618	0.4076	0.2778	0.5242	0.5444	6.4975	7.8354	2.0308	36.50	2.390
2.400	0.4647	0.0684	0.1472	1.0347	0.5331	7.7935	1.1630	0.4099	0.2758	0.5231	0.5401	6.5533	7.8969	2.0403	36.75	2.400
2.410	0.4626	0.0673	0.1456	1.0367	0.5282	7.8434	1.1642	0.4122	0.2738	0.5221	0.5359	6.6095	7.9587	2.0499	36.99	2.410
2.420	0.4606	0.0663	0.1439	1.0387	0.5233	7.8935	1.1654	0.4144	0.2718	0.5210	0.5317	6.6658	8.0207	2.0595	37.23	2.420
2.430	0.4585	0.0653	0.1424	1.0407	0.5185	7.9438	1.1665	0.4167	0.2698	0.5200	0.5276	6.7224	8.0830	2.0691	37.47	2.430
2.440	0.4565	0.0643	0.1408	1.0426	0.5137	7.9943	1.1677	0.4189	0.2678	0.5189	0.5234	6.7792	8.1455	2.0788	37.71	2.440
2.450	0.4544	0.0633	0.1392	1.0446	0.5090	8.0450	1.1689	0.4211	0.2658	0.5179	0.5193	6.8363	8.2083	2.0885	37.95	2.450
2.460	0.4524	0.0623	0.1377	1.0465	0.5043	8.0958	1.1700	0.4233	0.2639	0.5169	0.5152	6.8935	8.2713	2.0982	38.18	2.460
2.470	0.4504	0.0613	0.1362	1.0484	0.4996	8.1468	1.1712	0.4255	0.2619	0.5159	0.5111	6.9511	8.3346	2.1080	38.42	2.470
2.480	0.4484	0.0604	0.1346	1.0503	0.4950	8.1980	1.1723	0.4277	0.2599	0.5149	0.5071	7.0088	8.3982	2.1178	38.66	2.480
2.490	0.4464	0.0594	0.1332	1.0522	0.4904	8.2494	1.1734	0.4298	0.2580	0.5140	0.5030	7.0668	8.4620	2.1276	38.89	2.490
2.500	0.4444	0.0585	0.1317	1.0541	0.4858	8.3010	1.1746	0.4320	0.2561	0.5130	0.4990	7.1250	8.5261	2.1375	39.12	2.500

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
2.510	0.4425	0.0576	0.1302	1.0560	0.4813	8.3527	1.1757	0.4341	0.2541	0.5120	0.4950	7.1835	8.5905	2.1474	39.36	2.510
2.520	0.4405	0.0567	0.1288	1.0578	0.4768	8.4046	1.1768	0.4362	0.2522	0.5111	0.4911	7.2421	8.6551	2.1574	39.59	2.520
2.530	0.4386	0.0559	0.1274	1.0597	0.4724	8.4567	1.1779	0.4383	0.2503	0.5102	0.4871	7.3011	8.7200	2.1674	39.82	2.530
2.540	0.4366	0.0550	0.1260	1.0615	0.4680	8.5090	1.1790	0.4404	0.2484	0.5092	0.4832	7.3602	8.7851	2.1774	40.05	2.540
2.550	0.4347	0.0542	0.1246	1.0633	0.4636	8.5615	1.1801	0.4425	0.2465	0.5083	0.4793	7.4196	8.8505	2.1875	40.28	2.550
2.560	0.4328	0.0533	0.1232	1.0651	0.4593	8.6141	1.1812	0.4445	0.2446	0.5074	0.4754	7.4792	8.9161	2.1976	40.51	2.560
2.570	0.4309	0.0525	0.1218	1.0669	0.4550	8.6670	1.1823	0.4466	0.2427	0.5065	0.4715	7.5391	8.9820	2.2077	40.74	2.570
2.580	0.4289	0.0517	0.1205	1.0687	0.4507	8.7200	1.1834	0.4486	0.2409	0.5056	0.4677	7.5991	9.0482	2.2179	40.96	2.580
2.590	0.4271	0.0509	0.1192	1.0705	0.4465	8.7732	1.1844	0.4506	0.2390	0.5047	0.4639	7.6595	9.1146	2.2281	41.19	2.590
2.600	0.4252	0.0501	0.1179	1.0722	0.4423	8.8265	1.1855	0.4526	0.2371	0.5039	0.4601	7.7200	9.1813	2.2383	41.41	2.600
2.610	0.4233	0.0493	0.1166	1.0740	0.4382	8.8801	1.1866	0.4546	0.2353	0.5030	0.4564	7.7808	9.2483	2.2486	41.64	2.610
2.620	0.4214	0.0486	0.1153	1.0757	0.4341	8.9338	1.1876	0.4565	0.2335	0.5022	0.4526	7.8418	9.3155	2.2590	41.86	2.620
2.630	0.4196	0.0478	0.1140	1.0774	0.4300	8.9877	1.1887	0.4585	0.2317	0.5013	0.4489	7.9031	9.3829	2.2693	42.09	2.630
2.640	0.4177	0.0471	0.1128	1.0791	0.4260	9.0418	1.1897	0.4604	0.2298	0.5005	0.4452	7.9645	9.4506	2.2797	42.31	2.640
2.650	0.4159	0.0464	0.1115	1.0808	0.4220	9.0961	1.1908	0.4624	0.2280	0.4996	0.4416	8.0263	9.5186	2.2902	42.53	2.650
2.660	0.4141	0.0457	0.1103	1.0825	0.4180	9.1506	1.1918	0.4643	0.2262	0.4988	0.4379	8.0882	9.5869	2.3006	42.75	2.660
2.670	0.4122	0.0450	0.1091	1.0842	0.4141	9.2052	1.1928	0.4662	0.2245	0.4980	0.4343	8.1504	9.6554	2.3111	42.97	2.670
2.680	0.4104	0.0443	0.1079	1.0859	0.4102	9.2601	1.1939	0.4681	0.2227	0.4972	0.4307	8.2128	9.7241	2.3217	43.19	2.680
2.690	0.4086	0.0436	0.1067	1.0875	0.4063	9.3151	1.1949	0.4700	0.2209	0.4964	0.4271	8.2755	9.7931	2.3323	43.40	2.690
2.700	0.4068	0.0430	0.1056	1.0892	0.4025	9.3703	1.1959	0.4718	0.2192	0.4956	0.4236	8.3383	9.8624	2.3429	43.62	2.700
2.710	0.4051	0.0423	0.1044	1.0908	0.3987	9.4257	1.1969	0.4737	0.2174	0.4949	0.4201	8.4015	9.9319	2.3536	43.84	2.710
2.720	0.4033	0.0417	0.1033	1.0924	0.3949	9.4812	1.1979	0.4755	0.2157	0.4941	0.4166	8.4648	10.0017	2.3642	44.05	2.720
2.730	0.4015	0.0410	0.1022	1.0941	0.3912	9.5370	1.1989	0.4773	0.2140	0.4933	0.4131	8.5284	10.0718	2.3750	44.27	2.730
2.740	0.3998	0.0404	0.1010	1.0957	0.3875	9.5929	1.1999	0.4791	0.2123	0.4926	0.4097	8.5922	10.1421	2.3858	44.48	2.740
2.750	0.3980	0.0398	0.0999	1.0973	0.3838	9.6490	1.2009	0.4809	0.2106	0.4918	0.4062	8.6563	10.2127	2.3966	44.69	2.750

$$\gamma=1.400$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$	M_s	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	ν	M
2.760	0.3963	0.0392	0.0989	1.0988	0.3802	9.7053	1.2019	0.4827	0.2089	0.4911	0.4028	8.7205	10.2835	2.4074	44.91	2.760
2.770	0.3945	0.0386	0.0978	1.1004	0.3766	9.7618	1.2029	0.4845	0.2072	0.4903	0.3994	8.7851	10.3546	2.4183	45.12	2.770
2.780	0.3928	0.0380	0.0967	1.1020	0.3730	9.8185	1.2038	0.4863	0.2055	0.4896	0.3961	8.8498	10.4259	2.4292	45.33	2.780
2.790	0.3911	0.0374	0.0957	1.1035	0.3695	9.8753	1.2048	0.4880	0.2039	0.4889	0.3928	8.9148	10.4975	2.4402	45.54	2.790
2.800	0.3894	0.0368	0.0946	1.1051	0.3660	9.9324	1.2058	0.4898	0.2022	0.4882	0.3895	8.9800	10.5694	2.4512	45.75	2.800
2.810	0.3877	0.0363	0.0936	1.1066	0.3625	9.9896	1.2067	0.4915	0.2006	0.4875	0.3862	9.0455	10.6415	2.4622	45.95	2.810
2.820	0.3860	0.0357	0.0926	1.1081	0.3591	10.0470	1.2077	0.4932	0.1990	0.4868	0.3829	9.1111	10.7139	2.4733	46.16	2.820
2.830	0.3844	0.0352	0.0916	1.1096	0.3557	10.1046	1.2086	0.4949	0.1973	0.4861	0.3797	9.1771	10.7865	2.4844	46.37	2.830
2.840	0.3827	0.0347	0.0906	1.1111	0.3523	10.1624	1.2095	0.4966	0.1957	0.4854	0.3765	9.2432	10.8594	2.4955	46.57	2.840
2.850	0.3810	0.0341	0.0896	1.1126	0.3490	10.2204	1.2105	0.4983	0.1941	0.4847	0.3733	9.3096	10.9326	2.5067	46.78	2.850
2.860	0.3794	0.0336	0.0886	1.1141	0.3457	10.2785	1.2114	0.5000	0.1926	0.4840	0.3701	9.3762	11.0060	2.5179	46.98	2.860
2.870	0.3777	0.0331	0.0877	1.1156	0.3424	10.3368	1.2123	0.5016	0.1910	0.4833	0.3670	9.4431	11.0797	2.5292	47.19	2.870
2.880	0.3761	0.0326	0.0867	1.1171	0.3392	10.3954	1.2132	0.5033	0.1894	0.4827	0.3639	9.5101	11.1536	2.5405	47.39	2.880
2.890	0.3745	0.0321	0.0858	1.1185	0.3359	10.4541	1.2142	0.5049	0.1879	0.4820	0.3608	9.5775	11.2278	2.5518	47.59	2.890
2.900	0.3729	0.0317	0.0849	1.1199	0.3328	10.5130	1.2151	0.5065	0.1863	0.4814	0.3577	9.6450	11.3022	2.5632	47.79	2.900
2.910	0.3712	0.0312	0.0840	1.1214	0.3296	10.5720	1.2160	0.5081	0.1848	0.4807	0.3547	9.7128	11.3770	2.5746	47.99	2.910
2.920	0.3696	0.0307	0.0831	1.1228	0.3265	10.6313	1.2169	0.5097	0.1833	0.4801	0.3517	9.7808	11.4519	2.5861	48.19	2.920
2.930	0.3681	0.0302	0.0822	1.1242	0.3234	10.6908	1.2178	0.5113	0.1818	0.4795	0.3487	9.8491	11.5271	2.5976	48.39	2.930
2.940	0.3665	0.0298	0.0813	1.1256	0.3203	10.7504	1.2187	0.5129	0.1803	0.4788	0.3457	9.9175	11.6026	2.6091	48.59	2.940
2.950	0.3649	0.0293	0.0804	1.1270	0.3173	10.8102	1.2195	0.5145	0.1788	0.4782	0.3428	9.9863	11.6784	2.6206	48.78	2.950
2.960	0.3633	0.0289	0.0796	1.1284	0.3143	10.8702	1.2204	0.5160	0.1773	0.4776	0.3398	10.0552	11.7544	2.6322	48.98	2.960
2.970	0.3618	0.0285	0.0787	1.1298	0.3113	10.9304	1.2213	0.5176	0.1758	0.4770	0.3369	10.1244	11.8306	2.6439	49.18	2.970
2.980	0.3602	0.0281	0.0779	1.1312	0.3083	10.9908	1.2222	0.5191	0.1744	0.4764	0.3340	10.1938	11.9072	2.6555	49.37	2.980
2.990	0.3587	0.0276	0.0770	1.1325	0.3054	11.0514	1.2230	0.5206	0.1729	0.4758	0.3312	10.2635	11.9839	2.6673	49.56	2.990
3.000	0.3571	0.0272	0.0762	1.1339	0.3025	11.1122	1.2239	0.5222	0.1715	0.4752	0.3283	10.3333	12.0610	2.6790	49.76	3.000

GAS FLOW TABLES ($\gamma=1.333$): SUBSONIC FLOW

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$ p_0
0.010	1.0000	0.9999	1.0000	0.0058	0.0231	0.0231	43.2958	7493.200	0.0001
0.020	0.9999	0.9997	0.9998	0.0115	0.0462	0.0462	21.6560	1868.007	0.0003
0.030	0.9999	0.9994	0.9996	0.0173	0.0693	0.0693	14.4464	826.7890	0.0006
0.040	0.9997	0.9989	0.9992	0.0231	0.0923	0.0924	10.8442	462.6179	0.0011
0.050	0.9996	0.9983	0.9988	0.0288	0.1153	0.1155	8.6851	294.2161	0.0017
0.060	0.9994	0.9976	0.9982	0.0346	0.1383	0.1386	7.2475	202.8455	0.0024
0.070	0.9992	0.9967	0.9976	0.0404	0.1612	0.1618	6.2222	147.8292	0.0033
0.080	0.9989	0.9957	0.9968	0.0461	0.1841	0.1849	5.4546	112.1800	0.0042
0.090	0.9987	0.9946	0.9960	0.0519	0.2069	0.2080	4.8587	87.7848	0.0054
0.100	0.9983	0.9934	0.9950	0.0577	0.2297	0.2312	4.3831	70.3719	0.0066
0.110	0.9980	0.9920	0.9940	0.0634	0.2523	0.2544	3.9949	57.5186	0.0080
0.120	0.9976	0.9905	0.9928	0.0692	0.2749	0.2775	3.6724	47.7680	0.0095
0.130	0.9972	0.9888	0.9916	0.0749	0.2974	0.3007	3.4003	40.2012	0.0111
0.140	0.9967	0.9870	0.9903	0.0807	0.3197	0.3239	3.1678	34.2155	0.0129
0.150	0.9963	0.9851	0.9888	0.0864	0.3420	0.3471	2.9670	29.4027	0.0148
0.160	0.9958	0.9831	0.9873	0.0921	0.3641	0.3704	2.7920	25.4777	0.0168
0.170	0.9952	0.9810	0.9857	0.0979	0.3861	0.3936	2.6383	22.2372	0.0189
0.180	0.9946	0.9787	0.9840	0.1036	0.4080	0.4169	2.5022	19.5326	0.0211
0.190	0.9940	0.9763	0.9822	0.1093	0.4298	0.4402	2.3809	17.2536	0.0235
0.200	0.9934	0.9738	0.9803	0.1150	0.4514	0.4635	2.2724	15.3166	0.0260
0.210	0.9927	0.9711	0.9783	0.1207	0.4728	0.4869	2.1747	13.6578	0.0285
0.220	0.9920	0.9684	0.9762	0.1264	0.4941	0.5102	2.0863	12.2273	0.0312
0.230	0.9913	0.9655	0.9740	0.1321	0.5152	0.5336	2.0061	10.9859	0.0340
0.240	0.9905	0.9625	0.9717	0.1378	0.5362	0.5570	1.9330	9.9026	0.0370
0.250	0.9897	0.9594	0.9694	0.1435	0.5569	0.5805	1.8662	8.9522	0.0400
0.260	0.9889	0.9562	0.9669	0.1492	0.5775	0.6040	1.8049	8.1146	0.0431
0.270	0.9880	0.9529	0.9644	0.1549	0.5979	0.6275	1.7486	7.3731	0.0463
0.280	0.9871	0.9494	0.9618	0.1605	0.6181	0.6510	1.6966	6.7140	0.0496
0.290	0.9862	0.9459	0.9591	0.1662	0.6380	0.6746	1.6486	6.1261	0.0530
0.300	0.9852	0.9422	0.9563	0.1718	0.6578	0.6982	1.6042	5.5998	0.0565
0.310	0.9843	0.9384	0.9534	0.1775	0.6774	0.7218	1.5629	5.1272	0.0601
0.320	0.9832	0.9346	0.9505	0.1831	0.6967	0.7455	1.5245	4.7016	0.0638
0.330	0.9822	0.9306	0.9475	0.1887	0.7158	0.7692	1.4888	4.3173	0.0675
0.340	0.9811	0.9265	0.9444	0.1943	0.7347	0.7929	1.4555	3.9693	0.0714
0.350	0.9800	0.9224	0.9412	0.1999	0.7533	0.8167	1.4244	3.6535	0.0753
0.360	0.9789	0.9181	0.9379	0.2055	0.7717	0.8405	1.3953	3.3663	0.0793
0.370	0.9777	0.9137	0.9346	0.2111	0.7898	0.8644	1.3680	3.1046	0.0834
0.380	0.9765	0.9093	0.9311	0.2167	0.8077	0.8883	1.3425	2.8655	0.0875
0.390	0.9753	0.9047	0.9276	0.2223	0.8253	0.9122	1.3185	2.6469	0.0917
0.400	0.9741	0.9001	0.9241	0.2278	0.8427	0.9362	1.2959	2.4466	0.0960
0.410	0.9728	0.8954	0.9204	0.2334	0.8598	0.9603	1.2747	2.2627	0.1003
0.420	0.9715	0.8906	0.9167	0.2389	0.8766	0.9843	1.2548	2.0937	0.1047
0.430	0.9701	0.8857	0.9130	0.2444	0.8932	1.0085	1.2360	1.9382	0.1091
0.440	0.9688	0.8807	0.9091	0.2499	0.9095	1.0326	1.2183	1.7949	0.1136
0.450	0.9674	0.8757	0.9052	0.2554	0.9255	1.0569	1.2016	1.6627	0.1182
0.460	0.9660	0.8706	0.9012	0.2609	0.9412	1.0811	1.1858	1.5405	0.1228
0.470	0.9645	0.8654	0.8972	0.2664	0.9567	1.1055	1.1710	1.4276	0.1274
0.480	0.9631	0.8601	0.8931	0.2718	0.9718	1.1299	1.1569	1.3231	0.1321
0.490	0.9616	0.8548	0.8890	0.2773	0.9867	1.1543	1.1436	1.2263	0.1368
0.500	0.9600	0.8494	0.8847	0.2827	1.0012	1.1788	1.1310	1.1365	0.1415

$$\gamma=1.333$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$ p_0
0.510	0.9585	0.8439	0.8805	0.2881	1.0155	1.2033	1.1192	1.0532	0.1463
0.520	0.9569	0.8384	0.8761	0.2935	1.0295	1.2279	1.1079	0.9759	0.1511
0.530	0.9553	0.8328	0.8717	0.2989	1.0431	1.2526	1.0973	0.9041	0.1559
0.540	0.9537	0.8271	0.8673	0.3043	1.0565	1.2773	1.0872	0.8373	0.1608
0.550	0.9520	0.8214	0.8628	0.3097	1.0696	1.3021	1.0777	0.7752	0.1656
0.560	0.9504	0.8157	0.8583	0.3150	1.0823	1.3269	1.0687	0.7174	0.1705
0.570	0.9487	0.8099	0.8537	0.3204	1.0948	1.3518	1.0601	0.6636	0.1754
0.580	0.9470	0.8040	0.8490	0.3257	1.1069	1.3768	1.0520	0.6136	0.1803
0.590	0.9452	0.7981	0.8443	0.3310	1.1188	1.4018	1.0444	0.5669	0.1852
0.600	0.9434	0.7921	0.8396	0.3363	1.1303	1.4269	1.0371	0.5235	0.1901
0.610	0.9417	0.7861	0.8348	0.3416	1.1415	1.4521	1.0303	0.4830	0.1950
0.620	0.9398	0.7801	0.8300	0.3469	1.1524	1.4773	1.0238	0.4452	0.1999
0.630	0.9380	0.7740	0.8252	0.3521	1.1630	1.5026	1.0176	0.4101	0.2048
0.640	0.9362	0.7679	0.8203	0.3573	1.1733	1.5280	1.0118	0.3773	0.2096
0.650	0.9343	0.7618	0.8153	0.3626	1.1833	1.5534	1.0063	0.3467	0.2145
0.660	0.9324	0.7556	0.8104	0.3678	1.1930	1.5789	1.0011	0.3183	0.2194
0.670	0.9305	0.7494	0.8054	0.3729	1.2023	1.6045	0.9962	0.2918	0.2242
0.680	0.9285	0.7431	0.8003	0.3781	1.2114	1.6301	0.9916	0.2671	0.2290
0.690	0.9266	0.7368	0.7953	0.3833	1.2201	1.6559	0.9872	0.2441	0.2338
0.700	0.9246	0.7306	0.7902	0.3884	1.2285	1.6817	0.9831	0.2227	0.2386
0.710	0.9226	0.7242	0.7850	0.3935	1.2367	1.7075	0.9792	0.2028	0.2433
0.720	0.9205	0.7179	0.7799	0.3986	1.2445	1.7335	0.9755	0.1843	0.2480
0.730	0.9185	0.7116	0.7747	0.4037	1.2520	1.7595	0.9721	0.1671	0.2527
0.740	0.9164	0.7052	0.7695	0.4088	1.2592	1.7856	0.9688	0.1512	0.2574
0.750	0.9144	0.6988	0.7643	0.4139	1.2661	1.8118	0.9658	0.1364	0.2620
0.760	0.9123	0.6924	0.7590	0.4189	1.2727	1.8381	0.9629	0.1227	0.2666
0.770	0.9102	0.6860	0.7537	0.4239	1.2790	1.8644	0.9603	0.1100	0.2711
0.780	0.9080	0.6796	0.7484	0.4289	1.2850	1.8908	0.9578	0.0983	0.2756
0.790	0.9059	0.6732	0.7431	0.4339	1.2907	1.9174	0.9554	0.0875	0.2800
0.800	0.9037	0.6668	0.7378	0.4389	1.2961	1.9440	0.9533	0.0776	0.2844
0.810	0.9015	0.6603	0.7325	0.4438	1.3013	1.9706	0.9513	0.0685	0.2888
0.820	0.8993	0.6539	0.7271	0.4487	1.3061	1.9974	0.9494	0.0601	0.2930
0.830	0.8971	0.6475	0.7217	0.4536	1.3107	2.0243	0.9477	0.0524	0.2973
0.840	0.8949	0.6411	0.7164	0.4585	1.3149	2.0512	0.9461	0.0454	0.3015
0.850	0.8926	0.6346	0.7110	0.4634	1.3189	2.0782	0.9446	0.0391	0.3056
0.860	0.8904	0.6282	0.7056	0.4683	1.3226	2.1053	0.9433	0.0333	0.3097
0.870	0.8881	0.6218	0.7002	0.4731	1.3260	2.1326	0.9420	0.0281	0.3137
0.880	0.8858	0.6154	0.6948	0.4779	1.3292	2.1599	0.9409	0.0235	0.3176
0.890	0.8835	0.6090	0.6893	0.4827	1.3321	2.1873	0.9399	0.0193	0.3215
0.900	0.8812	0.6026	0.6839	0.4875	1.3347	2.2147	0.9390	0.0156	0.3253
0.910	0.8788	0.5963	0.6785	0.4923	1.3370	2.2423	0.9383	0.0124	0.3291
0.920	0.8765	0.5899	0.6731	0.4970	1.3391	2.2700	0.9376	0.0096	0.3328
0.930	0.8741	0.5836	0.6676	0.5018	1.3410	2.2978	0.9370	0.0072	0.3364
0.940	0.8717	0.5773	0.6622	0.5065	1.3425	2.3256	0.9365	0.0052	0.3400
0.950	0.8694	0.5710	0.6568	0.5111	1.3439	2.3536	0.9360	0.0035	0.3435
0.960	0.8670	0.5647	0.6514	0.5158	1.3449	2.3817	0.9357	0.0022	0.3469
0.970	0.8646	0.5585	0.6459	0.5205	1.3458	2.4098	0.9354	0.0012	0.3502
0.980	0.8621	0.5522	0.6405	0.5251	1.3464	2.4381	0.9353	0.0005	0.3535
0.990	0.8597	0.5460	0.6351	0.5297	1.3467	2.4664	0.9351	0.0001	0.3567
1.000	0.8573	0.5398	0.6297	0.5343	1.3468	2.4949	0.9351	0.0000	0.3598

GAS FLOW TABLES ($\gamma=1.333$): SUPERSONIC FLOW

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
1.010	0.8548	0.5337	0.6243	0.5389	1.3467	2.5234	0.9351	0.0001	0.3628
1.020	0.8524	0.5276	0.6189	0.5434	1.3464	2.5521	0.9352	0.0005	0.3658
1.030	0.8499	0.5215	0.6136	0.5479	1.3458	2.5809	0.9354	0.0011	0.3687
1.040	0.8474	0.5154	0.6082	0.5525	1.3450	2.6097	0.9356	0.0019	0.3715
1.050	0.8449	0.5093	0.6028	0.5569	1.3440	2.6387	0.9359	0.0029	0.3743
1.060	0.8424	0.5033	0.5975	0.5614	1.3428	2.6678	0.9363	0.0042	0.3769
1.070	0.8399	0.4974	0.5922	0.5659	1.3414	2.6970	0.9367	0.0056	0.3795
1.080	0.8374	0.4914	0.5869	0.5703	1.3397	2.7263	0.9371	0.0071	0.3820
1.090	0.8349	0.4855	0.5816	0.5747	1.3379	2.7557	0.9376	0.0089	0.3845
1.100	0.8323	0.4796	0.5763	0.5791	1.3359	2.7852	0.9381	0.0108	0.3868
1.110	0.8298	0.4738	0.5710	0.5835	1.3337	2.8148	0.9387	0.0128	0.3891
1.120	0.8272	0.4680	0.5658	0.5878	1.3313	2.8446	0.9394	0.0150	0.3913
1.130	0.8247	0.4622	0.5605	0.5922	1.3287	2.8744	0.9401	0.0173	0.3934
1.140	0.8221	0.4565	0.5553	0.5965	1.3259	2.9043	0.9408	0.0197	0.3954
1.150	0.8195	0.4508	0.5501	0.6008	1.3229	2.9344	0.9415	0.0223	0.3974
1.160	0.8170	0.4452	0.5449	0.6050	1.3198	2.9646	0.9424	0.0250	0.3993
1.170	0.8144	0.4396	0.5398	0.6093	1.3165	2.9949	0.9432	0.0277	0.4011
1.180	0.8118	0.4340	0.5347	0.6135	1.3131	3.0253	0.9441	0.0306	0.4028
1.190	0.8092	0.4285	0.5295	0.6177	1.3094	3.0558	0.9450	0.0335	0.4044
1.200	0.8066	0.4230	0.5245	0.6219	1.3057	3.0864	0.9459	0.0366	0.4060
1.210	0.8040	0.4176	0.5194	0.6261	1.3017	3.1172	0.9469	0.0397	0.4075
1.220	0.8014	0.4122	0.5143	0.6302	1.2976	3.1481	0.9479	0.0429	0.4089
1.230	0.7988	0.4068	0.5093	0.6344	1.2934	3.1791	0.9489	0.0462	0.4102
1.240	0.7962	0.4015	0.5043	0.6385	1.2890	3.2102	0.9500	0.0495	0.4115
1.250	0.7936	0.3963	0.4994	0.6426	1.2845	3.2414	0.9511	0.0529	0.4127
1.260	0.7909	0.3911	0.4944	0.6466	1.2798	3.2727	0.9522	0.0564	0.4138
1.270	0.7883	0.3859	0.4895	0.6507	1.2751	3.3042	0.9533	0.0599	0.4148
1.280	0.7857	0.3808	0.4846	0.6547	1.2701	3.3358	0.9545	0.0634	0.4158
1.290	0.7830	0.3757	0.4798	0.6587	1.2651	3.3675	0.9557	0.0670	0.4167
1.300	0.7804	0.3706	0.4749	0.6627	1.2599	3.3993	0.9569	0.0707	0.4175
1.310	0.7778	0.3657	0.4701	0.6667	1.2547	3.4313	0.9581	0.0744	0.4182
1.320	0.7751	0.3607	0.4654	0.6706	1.2493	3.4633	0.9594	0.0781	0.4189
1.330	0.7725	0.3558	0.4606	0.6746	1.2438	3.4955	0.9606	0.0819	0.4195
1.340	0.7698	0.3510	0.4559	0.6785	1.2382	3.5279	0.9619	0.0857	0.4200
1.350	0.7672	0.3462	0.4512	0.6824	1.2325	3.5603	0.9632	0.0895	0.4205
1.360	0.7646	0.3414	0.4465	0.6862	1.2266	3.5929	0.9645	0.0934	0.4209
1.370	0.7619	0.3367	0.4419	0.6901	1.2207	3.6256	0.9659	0.0973	0.4212
1.380	0.7593	0.3320	0.4373	0.6939	1.2147	3.6584	0.9672	0.1012	0.4215
1.390	0.7566	0.3274	0.4328	0.6977	1.2086	3.6914	0.9686	0.1051	0.4216
1.400	0.7540	0.3229	0.4282	0.7015	1.2025	3.7245	0.9700	0.1091	0.4218
1.410	0.7513	0.3183	0.4237	0.7053	1.1962	3.7577	0.9714	0.1130	0.4218
1.420	0.7487	0.3139	0.4192	0.7090	1.1899	3.7910	0.9728	0.1170	0.4218
1.430	0.7460	0.3094	0.4148	0.7127	1.1835	3.8245	0.9742	0.1210	0.4217
1.440	0.7434	0.3051	0.4104	0.7164	1.1770	3.8581	0.9756	0.1250	0.4216
1.450	0.7407	0.3007	0.4060	0.7201	1.1704	3.8918	0.9771	0.1290	0.4214
1.460	0.7381	0.2965	0.4017	0.7238	1.1638	3.9257	0.9785	0.1331	0.4212
1.470	0.7354	0.2922	0.3974	0.7275	1.1571	3.9597	0.9800	0.1371	0.4209
1.480	0.7328	0.2880	0.3931	0.7311	1.1504	3.9938	0.9815	0.1411	0.4205
1.490	0.7301	0.2839	0.3888	0.7347	1.1435	4.0281	0.9829	0.1452	0.4201
1.500	0.7275	0.2798	0.3846	0.7383	1.1367	4.0625	0.9844	0.1492	0.4196

$$\gamma=1.333$$

M	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
1.510	0.7248	0.2758	0.3804	0.7419	1.1298	4.0970	0.9859	0.1532	0.4191
1.520	0.7222	0.2718	0.3763	0.7454	1.1228	4.1317	0.9874	0.1573	0.4185
1.530	0.7195	0.2678	0.3722	0.7489	1.1158	4.1665	0.9889	0.1613	0.4178
1.540	0.7169	0.2639	0.3681	0.7524	1.1087	4.2014	0.9905	0.1654	0.4171
1.550	0.7143	0.2600	0.3641	0.7559	1.1016	4.2365	0.9920	0.1694	0.4164
1.560	0.7116	0.2562	0.3600	0.7594	1.0945	4.2717	0.9935	0.1734	0.4156
1.570	0.7090	0.2524	0.3561	0.7629	1.0873	4.3070	0.9950	0.1775	0.4147
1.580	0.7064	0.2487	0.3521	0.7663	1.0801	4.3425	0.9966	0.1815	0.4138
1.590	0.7038	0.2450	0.3482	0.7697	1.0729	4.3782	0.9981	0.1855	0.4129
1.600	0.7011	0.2414	0.3443	0.7731	1.0656	4.4139	0.9997	0.1895	0.4119
1.610	0.6985	0.2378	0.3405	0.7765	1.0583	4.4498	1.0012	0.1935	0.4109
1.620	0.6959	0.2343	0.3367	0.7799	1.0510	4.4859	1.0028	0.1975	0.4098
1.630	0.6933	0.2308	0.3329	0.7832	1.0436	4.5220	1.0043	0.2015	0.4087
1.640	0.6907	0.2273	0.3291	0.7865	1.0363	4.5584	1.0059	0.2055	0.4075
1.650	0.6881	0.2239	0.3254	0.7898	1.0289	4.5948	1.0075	0.2094	0.4063
1.660	0.6855	0.2206	0.3217	0.7931	1.0215	4.6314	1.0090	0.2134	0.4051
1.670	0.6829	0.2172	0.3181	0.7964	1.0141	4.6682	1.0106	0.2173	0.4038
1.680	0.6803	0.2139	0.3145	0.7996	1.0066	4.7051	1.0122	0.2213	0.4025
1.690	0.6777	0.2107	0.3109	0.8028	0.9992	4.7421	1.0137	0.2252	0.4011
1.700	0.6751	0.2075	0.3074	0.8061	0.9918	4.7793	1.0153	0.2291	0.3997
1.710	0.6726	0.2044	0.3039	0.8093	0.9843	4.8166	1.0169	0.2330	0.3983
1.720	0.6700	0.2012	0.3004	0.8124	0.9769	4.8541	1.0184	0.2369	0.3968
1.730	0.6674	0.1982	0.2969	0.8156	0.9694	4.8917	1.0200	0.2407	0.3953
1.740	0.6649	0.1951	0.2935	0.8187	0.9620	4.9294	1.0216	0.2446	0.3938
1.750	0.6623	0.1922	0.2901	0.8218	0.9545	4.9673	1.0232	0.2484	0.3922
1.760	0.6597	0.1892	0.2868	0.8249	0.9471	5.0054	1.0247	0.2522	0.3906
1.770	0.6572	0.1863	0.2835	0.8280	0.9396	5.0435	1.0263	0.2560	0.3890
1.780	0.6546	0.1834	0.2802	0.8311	0.9322	5.0819	1.0279	0.2598	0.3874
1.790	0.6521	0.1806	0.2770	0.8341	0.9248	5.1204	1.0294	0.2636	0.3857
1.800	0.6496	0.1778	0.2737	0.8372	0.9173	5.1590	1.0310	0.2673	0.3840
1.810	0.6471	0.1751	0.2706	0.8402	0.9099	5.1978	1.0326	0.2711	0.3822
1.820	0.6445	0.1723	0.2674	0.8432	0.9025	5.2367	1.0341	0.2748	0.3805
1.830	0.6420	0.1697	0.2643	0.8461	0.8951	5.2758	1.0357	0.2785	0.3787
1.840	0.6395	0.1670	0.2612	0.8491	0.8878	5.3150	1.0373	0.2822	0.3769
1.850	0.6370	0.1644	0.2581	0.8521	0.8804	5.3544	1.0388	0.2858	0.3751
1.860	0.6345	0.1619	0.2551	0.8550	0.8731	5.3939	1.0404	0.2895	0.3732
1.870	0.6320	0.1593	0.2521	0.8579	0.8658	5.4336	1.0419	0.2931	0.3714
1.880	0.6295	0.1568	0.2491	0.8608	0.8585	5.4734	1.0435	0.2967	0.3695
1.890	0.6271	0.1544	0.2462	0.8636	0.8512	5.5134	1.0450	0.3003	0.3676
1.900	0.6246	0.1520	0.2433	0.8665	0.8439	5.5535	1.0466	0.3039	0.3656
1.910	0.6221	0.1496	0.2404	0.8693	0.8367	5.5938	1.0481	0.3074	0.3637
1.920	0.6197	0.1472	0.2376	0.8722	0.8295	5.6342	1.0497	0.3110	0.3617
1.930	0.6172	0.1449	0.2348	0.8750	0.8223	5.6748	1.0512	0.3145	0.3598
1.940	0.6148	0.1426	0.2320	0.8778	0.8152	5.7155	1.0527	0.3180	0.3578
1.950	0.6123	0.1404	0.2292	0.8805	0.8081	5.7564	1.0543	0.3215	0.3558
1.960	0.6099	0.1382	0.2265	0.8833	0.8010	5.7974	1.0558	0.3249	0.3537
1.970	0.6075	0.1360	0.2238	0.8860	0.7939	5.8386	1.0573	0.3284	0.3517
1.980	0.6051	0.1338	0.2212	0.8888	0.7869	5.8800	1.0588	0.3318	0.3497
1.990	0.6026	0.1317	0.2185	0.8915	0.7799	5.9215	1.0603	0.3352	0.3476
2.000	0.6002	0.1296	0.2159	0.8942	0.7729	5.9631	1.0619	0.3386	0.3455