

ENGINEERING TRIPOS PART IIB

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Friday 24 April 2009 9 to 10.30

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Module 4A11

TURBOMACHINERY II

*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.*

*Attachment: Compressible Flow Data Book (38 pages).*

STATIONERY

Single-sided script paper.

SPECIAL REQUIREMENTS

Engineering Data Book.

CUED approved calculator allowed.

**You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator**

- 1 (a) The reaction  $\Lambda$  is defined by:

$$\Lambda = \frac{\Delta h_{rotor}}{\Delta h_{stage}}$$

where  $\Delta h$  is the change in enthalpy. Discuss the importance of the reaction as a design parameter in a turbomachine stage.

[10%]

- (b) Starting from the principles of simple radial equilibrium, show that:

$$\frac{\partial h}{\partial r} = T \frac{\partial s}{\partial r} + \frac{V_\theta^2}{r}$$

[10%]

(c) A single stage axial-flow turbine, with cylindrical hub and casing, operates with air as the working fluid. The stage inlet flow is uniform with a stagnation temperature of 1400 K and zero absolute yaw angle. The absolute yaw angle is zero across the full span at stage exit. The hub to tip radius ratio ( $r_h / r_t$ ) is 0.6.

- (i) At mid-span, the stator exit absolute Mach number is 0.7, the stator exit absolute yaw angle  $\alpha_{2,mid}$  is  $74.6^\circ$  and the stage exit stagnation temperature is 1170 K. Assume that the flow in the turbine is isentropic. Using the compressible flow tables or otherwise, confirm that the mid-span reaction is approximately 50%. State any additional assumptions that you have made.

[40%]

(cont.)

- (ii) The designer chooses to employ a free vortex distribution at stator exit. State briefly why this is a common choice.

Show that the reaction varies with radius according to:

$$\Lambda = \frac{1}{2} \left[ \frac{2(T_{02} - T_{2,mid}) \sin^2 \alpha_{2,mid}}{(T_1 - T_3)} \left[ 1 - \left( \frac{r_{mid}}{r} \right)^2 \right] + 1 \right]$$

where the symbols have their usual meaning and subscripts 1, 2, 3 and mid refer to stage inlet, stator exit, stage exit and mid-height respectively. What is the reaction at the hub and at the casing?

[30%]

- (iii) Explain why the hub section is likely to have the highest profile loss.

[10%]

(TURN OVER

2 (a) A small mass flow of rate  $dm$  is injected into a mainstream flow of rate  $\dot{m}$  at an angle  $\alpha$  to the mainstream flow. The magnitude of the velocity in each flow is the same and is equal to  $V$ . The static pressure does not change. Show that the total rate of loss of kinetic energy can be expressed as:

$$\text{Rate of Loss of Kinetic Energy} \approx V^2(1 - \cos \alpha)dm$$

State carefully the assumptions made in the derivation of the above expression. Discuss the applicability of this expression in estimating the mixing loss due to the tip clearance flow in a shroudless compressor rotor with a small tip clearance gap.

[25%]

(b) The rotor of a shroudless low-speed compressor has a small tip clearance gap  $t$ , a span  $h$ , a chord  $C$ , a pitch  $s$  and an inlet rotor-relative flow angle  $\beta_1$ . Using the result in (a), show that the loss coefficient for the tip clearance loss based on the rotor-relative inlet conditions, can be expressed as:

$$\zeta = \frac{2Ct}{hs \cos \beta_1} \int_0^1 \left[ \left( \frac{V_{ss}}{V_1} \right)^3 \left( 1 - \frac{V_{ps}}{V_{ss}} \right) \sqrt{1 - \left( \frac{V_{ps}}{V_{ss}} \right)^2} \right] d\bar{C}$$

where  $\bar{C}$  is the non-dimensional distance along the chord and subscripts 1,  $ss$  and  $ps$  denote the rotor-relative conditions upstream, on the suction surface, and on the pressure surface respectively. Assume that the flow within the tip gap is isentropic. State any further assumptions made in the derivation. Comment on the dependency of the tip clearance loss on the rotor geometry and flow parameters.

[40%]

(c) A low-speed compressor rotor has a high hub to tip radius ratio, a tip clearance gap to span ratio  $t/h$  of 0.02 and a pitch to chord ratio  $s/C$  of 0.8. The relative inlet flow angle is  $30^\circ$ . Assuming a well designed, evenly loaded blade profile near the blade tip with  $V_{ss}/V_1 \leq 1.1$  on the suction surface, estimate an upper bound for the loss coefficient.

[15%]

(cont.)

(d) The compressor rotor has a loading coefficient  $\psi = \Delta h_0 / U^2$  of 0.5 at a flow coefficient  $\phi = V_x / U$  of 0.65, where  $U$  is the blade speed. Derive an expression for the isentropic efficiency of the rotor in terms of the loss coefficient for the whole rotor, the loading coefficient and the flow coefficient, and other flow properties as necessary. Assuming that the tip clearance loss is about 30% of the total loss generated in this particular rotor, estimate a lower bound for the rotor efficiency.

[20%]

(TURN OVER

3 Note that parts (a), (b) and (c) of this question are not related to each other.

(a) A low-speed axial turbine stage has a forced vortex design with uniform inlet flow conditions. The flow at the entry of the stage is axial and the stage is designed to have a volume flow rate of  $15.0 \text{ m}^3 \text{ s}^{-1}$ . The turbine has a constant casing radius of  $0.5 \text{ m}$  and a constant hub to tip radius ratio of  $0.6$ . The design tangential velocity at the casing is  $20.0 \text{ m s}^{-1}$  in the axial gap between the stator and the rotor.

- (i) Assuming that simple radial equilibrium exists, show that the spanwise distribution of the axial velocity in the axial gap between the stator and the rotor is given by:

$$V_x = \sqrt{k(C - r^2)}$$

where  $k$  is  $3200 \text{ s}^{-2}$  and  $C$  is  $0.4502 \text{ m}^2$ . Assume that the stagnation pressure is constant across the span at this location.

[30%]

- (ii) Discuss the validity of the assumption that simple radial equilibrium exists when deriving the result in (i).

[10%]

(b) Both “throughflow” and finite volume Navier-Stokes flow solvers are widely used in the design of turbomachines. By reference to the underlying assumptions and the equations solved, discuss the methods by which these techniques calculate the flowfield in a turbomachine. What are the strengths and weaknesses of each approach? When in the design process are throughflow and three-dimensional Navier-Stokes flow solvers used and what information do they give the designer?

[30%]

(cont.)

- (c) (i) A two-dimensional Navier-Stokes flow solver is used to perform blade section calculations. The flow is subsonic throughout. State, with reasoning, how many boundary conditions are needed at the inlet and at the exit of the computational domain respectively. Give examples of suitable inlet and exit boundary conditions.

[20%]

- (ii) The user finds that the program in (c)(i) can use the mass flow rate as one of the inlet boundary conditions and, if this option is chosen, the program does not require an exit boundary condition. Suggest how this is handled within the program.

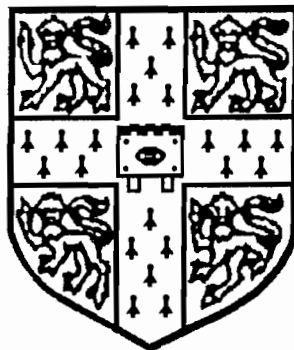
[10%]

**END OF PAPER**

# Compressible Flow Data Book

for Part II of the  
Engineering Tripos

**2006 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)

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

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

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

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

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

# 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

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

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

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

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

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

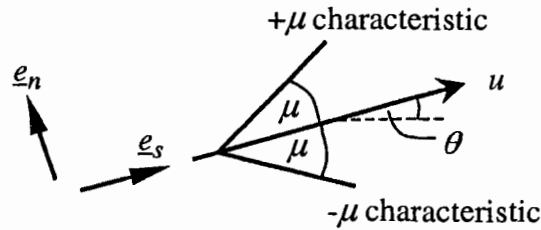
$$\frac{T_s}{T} = \frac{\gamma-1}{(\gamma+1)^2} \frac{2}{M^2} \left( 1 + \frac{\gamma-1}{2} M^2 \right) \left( \frac{2\gamma}{\gamma-1} M^2 - 1 \right)$$

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

# 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**

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

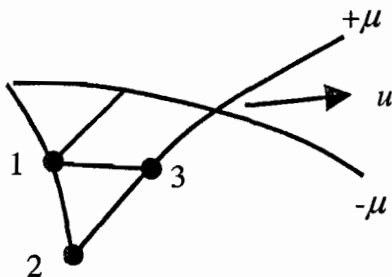
**Prandtl-Meyer function**

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

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

### Calculations

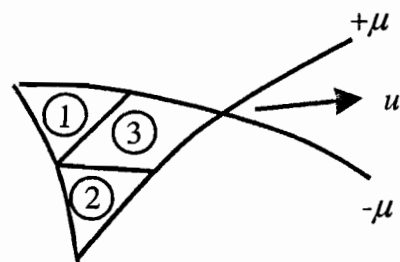
Lattice Method



$$\nu_3 - \theta_3 = \nu_2 - \theta_2 \quad \text{along } +\mu$$

$$\nu_3 + \theta_3 = \nu_1 + \theta_1 \quad \text{along } -\mu$$

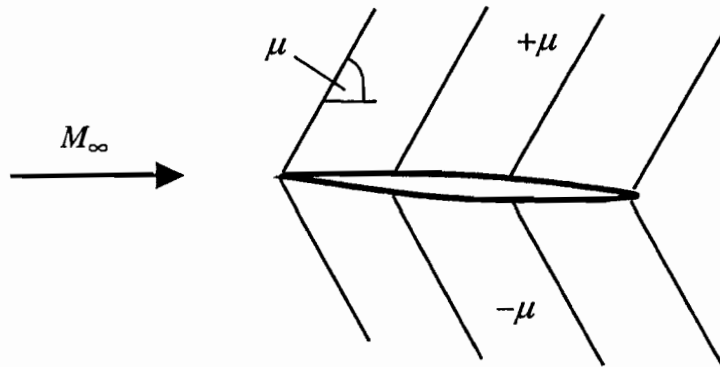
Field (or wave) method



$$\nu_3 + \theta_3 = \nu_1 + \theta_1 \quad \text{across } +\mu$$

$$\nu_3 - \theta_3 = \nu_2 - \theta_2 \quad \text{across } -\mu$$

**Linearised Method of Characteristics (thin film theory)**

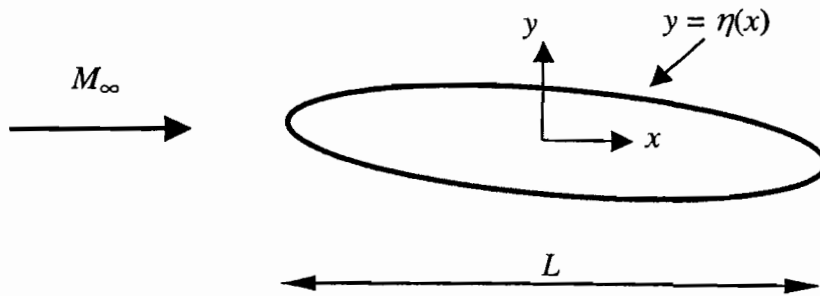


$$\mu \approx \sin^{-1}(1/M_\infty)$$

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

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

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



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)

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

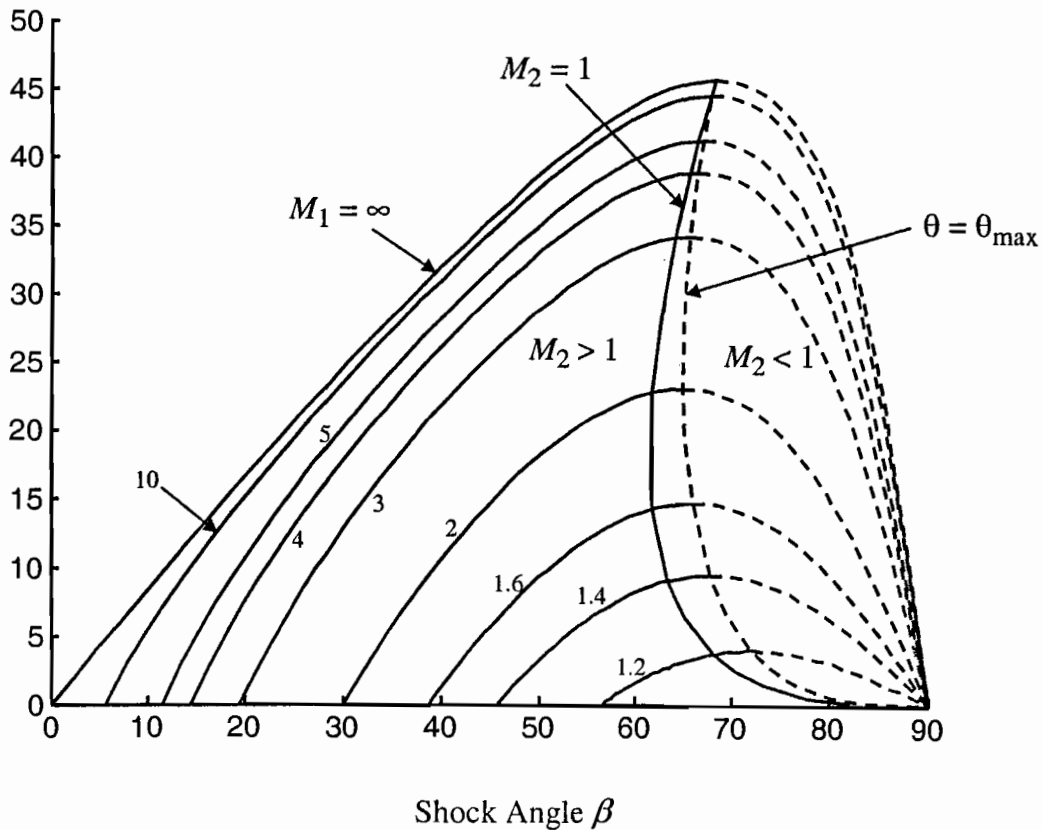
$$\frac{T_2}{T_1} = \frac{\gamma-1}{(\gamma+1)^2} \frac{2}{M_1^2 \sin^2 \beta} \left( 1 + \frac{\gamma-1}{2} M_1^2 \sin^2 \beta \right) \left( \frac{2\gamma}{\gamma-1} M_1^2 \sin^2 \beta - 1 \right)$$

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

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

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

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



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

$M$	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{\frac{1}{2}\rho V^2}{p_0}$
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

$$\gamma=1.400$$

$M$	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$ $p_0$
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

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{m\sqrt{c_p T_0}}{A p_0}$	$\frac{m\sqrt{c_p T_0}}{A p}$	$F$	$\frac{4c_f L_{max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$v$	$M$
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



$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{m\sqrt{c_p T_0}}{A p_0}$	$\frac{m\sqrt{c_p T_0}}{A p}$	$F$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$v$	$M$
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

$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{m\sqrt{c_p T_0}}{A P_0}$	$\frac{m\sqrt{c_p T_0}}{A P}$	$F$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$V$	$M$
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

$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{m\sqrt{c_p T_0}}{A p_0}$	$\frac{m\sqrt{c_p T_0}}{A p}$	$F$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$V$	$M$
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

$$\gamma=1.400$$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m} \sqrt{c_p T_0}}{A p_0}$	$\frac{\dot{m} \sqrt{c_p T_0}}{A p}$	$F \frac{4c_f L_{\max}}{D} \frac{1}{2} \frac{\rho V^2}{p_0}$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$v$	$M$
2.010	0.5531	0.1258	0.2275	0.9454	0.7528	5.9827	1.1126	0.3080	0.3559	4.5468	5.6918	1.6956	26.66	2.010
2.020	0.5506	0.1239	0.2250	0.9480	0.7485	6.0258	1.1140	0.3109	0.3539	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	5.7396	7.0018	1.9014	33.02	2.250

$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{m\sqrt{c_p T_0}}{A p_0}$	$\frac{m\sqrt{c_p T_0}}{A p}$	$F$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_0s}{P_0}$	$\frac{P_s}{P}$	$\frac{P_0s}{P}$	$\frac{T_s}{T}$	$v$	$M$
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

$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{P}{P_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m} \sqrt{c_p T_0}}{A p_0}$	$\frac{\dot{m} \sqrt{c_p T_0}}{A p}$	$\frac{F}{\dot{m} \sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2} \frac{\rho V^2}{p_0}$	$M_s$	$\frac{P_0 s}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$V$	$M$
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

$\gamma=1.400$

$M$	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{A p_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{A p}$	$F$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\rho V^2$	$M_s$	$\frac{P_{0s}}{P_0}$	$\frac{P_s}{P}$	$\frac{P_{0s}}{P}$	$\frac{T_s}{T}$	$v$	$M$
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



$$\gamma=1.333$$

$M$	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{Ap}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
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

$$\gamma=1.333$$

$M$	$\frac{T}{T_0}$	$\frac{p}{p_0}$	$\frac{\rho}{\rho_0}$	$\frac{V}{\sqrt{c_p T_0}}$	$\frac{\dot{m}\sqrt{c_p T_0}}{A p_0}$	$\frac{\dot{m}\sqrt{c_p T_0}}{A p}$	$\frac{F}{\dot{m}\sqrt{c_p T_0}}$	$\frac{4c_f L_{\max}}{D}$	$\frac{1}{2}\frac{\rho V^2}{p_0}$
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

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
1.05	0.558	79.937	1.0803	1.0567	1.0223	0.9845	0.99995	1.40	8.000	75.893	1.9842	1.6163	1.2276	0.8184	0.96806
1.10	1.515	76.297	1.1658	1.1157	1.0449	0.9711	0.99963		2.000	87.075	2.1140	1.6865	1.2535	0.7432	0.95865
1.15	2.000	67.003	1.1408	1.0986	1.0384	1.0434	0.99977	1.45	2.000	46.004	1.1028	1.0723	1.0284	1.3808	0.99990
	2.671	73.822	1.2565	1.1767	1.0678	0.9598	0.99879	4.000	4.000	48.679	1.2169	1.1503	1.0579	1.3091	0.99923
	2.000	81.173	1.3399	1.2316	1.0880	0.9007	0.99745	6.000	6.000	51.755	1.3463	1.2357	1.0895	1.2325	0.99733
1.20	2.000	61.050	1.1197	1.0841	1.0329	1.1113	0.99985	8.000	8.000	55.517	1.5000	1.3333	1.1250	1.1460	0.99325
	3.944	71.977	1.3525	1.2397	1.0910	0.9502	0.99720	10.000	10.785	67.097	1.9147	1.4613	1.1712	1.0317	0.98440
	2.000	83.861	1.4941	1.3297	1.1237	0.8551	0.99344	8.000	8.000	72.994	2.0764	1.6664	1.2461	0.9235	0.97269
1.25	2.000	56.844	1.1110	1.0780	1.0306	1.1696	0.99988	6.000	6.000	81.733	2.2355	1.7501	1.2774	0.7485	0.94905
	4.000	61.986	1.2541	1.1752	1.0672	1.0721	0.99882	4.000	4.000	84.702	2.2653	1.7654	1.2832	0.7316	0.94659
	5.286	70.540	1.4539	1.3045	1.1146	0.9423	0.99468	2.000	2.000	87.406	2.2812	1.7736	1.2862	0.7225	0.94526
	4.000	79.385	1.5944	1.3913	1.1459	0.8525	0.98975	1.50	2.000	44.065	1.1030	1.0725	1.0284	1.4316	0.99990
	2.000	85.211	1.6435	1.4210	1.1566	0.8209	0.98763	4.000	4.000	46.543	1.2165	1.1500	1.0578	1.3615	0.99923
1.30	2.000	53.474	1.1065	1.0749	1.0294	1.2244	0.99989	6.000	6.000	49.326	1.3433	1.2337	1.0888	1.2879	0.99739
	4.000	57.423	1.2334	1.1613	1.0621	1.1398	0.99906	8.000	8.000	52.571	1.4887	1.3263	1.1224	1.2079	0.99362
	6.000	63.459	1.4113	1.2775	1.1048	1.0274	0.99585	10.000	10.000	56.679	1.6662	1.4345	1.1615	1.1144	0.98660
	6.662	69.395	1.5608	1.3709	1.1386	0.9359	0.99108	12.000	12.000	64.359	1.9668	1.6068	1.2241	0.9607	0.96925
	6.000	75.372	1.6793	1.4423	1.1643	0.8636	0.98598	12.113	12.113	66.589	2.0439	1.6489	1.2396	0.9213	0.96385
	4.000	81.649	1.7634	1.4917	1.1822	0.8118	0.98169	12.000	10.000	68.790	2.1147	1.6869	1.2537	0.8849	0.95860
	2.000	86.058	1.7957	1.5103	1.1889	0.7918	0.97990	8.000	8.000	79.712	2.3746	1.8207	1.3042	0.7484	0.94329
1.35	2.000	50.634	1.1042	1.0733	1.0287	1.2774	0.99990	6.000	6.000	82.662	2.4155	1.8410	1.3121	0.7250	0.93363
	4.000	53.965	1.2238	1.1549	1.0596	1.1994	0.99916	4.000	4.000	85.256	2.4404	1.8533	1.3168	0.7112	0.93141
	6.000	58.232	1.3702	1.2512	1.0952	1.1089	0.99682	2.000	2.000	87.668	2.4540	1.8599	1.3194	0.7035	0.93018
	8.048	66.914	1.6327	1.4145	1.1543	0.9543	0.98812	1.55	2.000	42.315	1.1036	1.0729	1.0286	1.4821	0.99990
	8.000	68.470	1.6732	1.4387	1.1630	0.9307	0.98627	4.000	4.000	44.642	1.2173	1.1505	1.0580	1.4130	0.99923
	8.000	70.023	1.7114	1.4613	1.1712	0.9085	0.98440	6.000	6.000	47.214	1.3430	1.2336	1.0887	1.3414	0.99739
	6.000	78.660	1.8774	1.5569	1.2058	0.8111	0.97506	8.000	8.000	50.131	1.4845	1.3236	1.1215	1.2651	0.99375
	4.000	83.028	1.9283	1.5854	1.2163	0.7807	0.97182	10.000	10.000	53.598	1.6491	1.4243	1.1578	1.1804	0.98738
	2.000	86.644	1.9523	1.5988	1.2211	0.7662	0.97023	12.000	12.000	58.240	1.8597	1.5469	1.2022	1.0758	0.97615
1.40	2.000	48.173	1.1030	1.0725	1.0284	1.3295	0.99990	13.403	13.403	66.171	2.1787	1.7206	1.2663	0.9198	0.95362
	4.000	51.117	1.2189	1.1516	1.0584	1.2553	0.99921	10.000	10.000	73.688	2.4151	1.8408	1.3120	0.8014	0.93367
	6.000	54.633	1.3539	1.2406	1.0913	1.1737	0.99717	8.000	8.000	77.804	2.5112	1.8877	1.3302	0.7515	0.92496
	8.000	59.367	1.5263	1.3496	1.1309	1.0744	0.99235	6.000	6.000	80.825	2.5650	1.9136	1.3404	0.7229	0.91995
	9.427	67.716	1.7912	1.5077	1.1880	0.9266	0.98016	4.000	4.000	83.385	2.5991	1.9298	1.3468	0.7045	0.91673
								2.000	2.000	85.699	2.6205	1.9399	1.3508	0.6928	0.91470
								2.000	2.000	87.879	2.6324	1.9455	1.3531	0.6862	0.91356

Oblique Shock p1

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{p_{02}}{p_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{p_{02}}{p_{01}}$	
1.60	2.000	40.724	1.1046	1.0736	1.0289	1.5323	0.99990	1.70	6.000	84.848	3.1778	2.1865	1.4534	0.6547	0.85856	
	4.000	42.931	1.2189	1.1516	1.0584	1.4638	0.99921		4.000	86.619	3.1933	2.1929	1.4562	0.6467	0.85695	
	6.000	45.344	1.3446	1.2346	1.0891	1.3934	0.99736		2.000	88.325	3.2021	2.1965	1.4578	0.6421	0.85602	
	8.000	48.030	1.4843	1.3236	1.1215	1.3195	0.99376									
	10.000	51.116	1.6430	1.4207	1.1565	1.2397	0.98766									
	12.000	54.889	1.8320	1.5311	1.1965	1.1483	0.97781		1.75	2.000	36.689	1.1087	1.0765	1.0300	1.6816	0.99989
	14.000	60.537	2.0974	1.6777	1.2502	1.0232	0.95990		4.000	38.651	1.2271	1.1571	1.0605	1.0605	1.6133	0.99913
	14.652	65.828	2.3192	1.7929	1.2936	0.9188	0.94204		6.000	40.756	1.3561	1.2421	1.0918	1.0918	1.5441	0.99713
	14.000	70.895	2.5000	1.8824	1.3281	0.8320	0.92598		8.000	43.034	1.4973	1.3317	1.1244	1.1244	1.4733	0.99334
	12.000	75.900	2.6428	1.9504	1.3550	0.7611	0.91256		10.000	45.531	1.6529	1.4266	1.1586	1.1586	1.3995	0.98721
	10.000	79.102	2.7132	1.9831	1.3682	0.7250	0.90574		12.000	48.319	1.8263	1.5279	1.1953	1.1953	1.3210	0.97814
	8.000	81.691	2.7576	2.0035	1.3764	0.7018	0.90139		14.000	51.547	1.6384	1.6384	1.2357	1.2357	1.2348	0.96524
6.000	83.967	2.7870	2.0168	1.3819	0.6862	0.89848		16.000	55.589	1.7654	1.7654	1.2831	1.2831	1.1329	0.94660	
4.000	86.061	2.8059	2.0254	1.3854	0.6761	0.89660		18.000	62.944	1.9617	1.9617	1.3595	1.3595	0.9645	0.91023	
2.000	88.054	2.8166	2.0302	1.3873	0.6703	0.89554		18.121	65.134	2.0112	2.0112	1.3795	1.3795	0.9189	0.89972	
1.65	2.000	39.267	1.1058	1.0744	1.0292	1.5823	0.99990		18.000	67.269	2.8728	2.0554	1.3977	0.8766	0.88991	
	4.000	41.377	1.2212	1.1531	1.0590	1.5140	0.99919		16.000	73.757	3.1267	2.1651	1.4441	0.7635	0.86389	
	6.000	43.665	1.3475	1.2365	1.0898	1.4444	0.99730		14.000	76.988	3.2251	2.2060	1.4620	0.7175	0.85362	
	8.000	46.181	1.4869	1.3252	1.1221	1.3720	0.99367		12.000	79.465	3.2868	2.2312	1.4731	0.6878	0.84714	
	10.000	49.007	1.6429	1.4206	1.1565	1.2952	0.98766		10.000	81.570	3.3295	2.2484	1.4808	0.6669	0.84266	
	12.000	52.312	1.8224	1.5257	1.1945	1.2104	0.97837		8.000	83.451	3.3598	2.2606	1.4862	0.6518	0.83947	
	14.000	56.541	2.0441	1.6490	1.2396	1.1090	0.96384		6.000	85.190	3.3811	2.2691	1.4901	0.6409	0.83722	
	15.855	65.547	2.4653	1.8655	1.3215	0.9184	0.92915		4.000	86.838	3.3954	2.2748	1.4926	0.6337	0.83571	
	14.000	73.864	2.7642	2.0065	1.3776	0.7782	0.90073		2.000	88.432	3.4036	2.2780	1.4941	0.6295	0.83485	
	12.000	77.411	2.8587	2.0491	1.3951	0.7317	0.89132									
	10.000	80.102	2.9157	2.0744	1.4056	0.7029	0.88557		1.80	2.000	35.538	1.1104	1.0776	1.0304	1.7312	0.99988
	8.000	82.389	2.9539	2.0911	1.4126	0.6833	0.88169		4.000	37.444	1.2306	1.1594	1.0613	1.0613	1.6624	0.99909
6.000	84.446	2.9798	2.1024	1.4174	0.6697	0.87904		6.000	39.481	1.3615	1.2455	1.0931	1.0931	1.5932	0.99701	
4.000	86.364	2.9968	2.1097	1.4205	0.6607	0.87730		8.000	41.673	1.5044	1.3360	1.1260	1.1260	1.5225	0.99310	
2.000	88.200	3.0065	2.1139	1.4222	0.6556	0.87631		10.000	44.057	1.6611	1.4315	1.1604	1.1604	1.4494	0.98683	
1.70	2.000	37.927	1.1072	1.0754	1.0295	1.6320	0.99989		12.000	46.686	1.8345	1.5326	1.1970	1.3725	0.97766	
	4.000	39.957	1.2239	1.1550	1.0597	1.5638	0.99916		14.000	49.661	2.0295	1.6411	1.2367	1.2896	0.96489	
	6.000	42.145	1.3514	1.2390	1.0907	1.4946	0.99722		16.000	53.198	2.2568	1.7611	1.2815	1.1958	0.94729	
	8.000	44.528	1.4914	1.3280	1.1231	1.4232	0.99353		18.000	57.995	2.5516	1.9072	1.3379	1.0766	0.92120	
	10.000	47.167	1.6466	1.4228	1.1573	1.3482	0.98750		19.183	64.987	2.9376	2.0839	1.4096	0.9195	0.88335	
	12.000	50.168	1.8216	1.5252	1.1943	1.2674	0.97841		18.000	71.424	3.2297	2.2079	1.4628	0.7956	0.85313	
	14.000	53.771	2.0273	1.6399	1.2362	1.1757	0.96504		16.000	75.324	3.3707	2.2650	1.4882	0.7327	0.83832	
	16.000	58.794	2.2999	1.7831	1.2898	1.0569	0.94369		14.000	78.020	3.4505	2.2965	1.5025	1.5025	0.6958	0.82990
	17.012	65.319	2.6171	1.9383	1.3502	0.9185	0.91502		12.000	80.214	3.5041	2.3174	1.5121	1.5121	0.6703	0.82423
	16.000	71.426	2.8629	2.0510	1.3959	0.8077	0.89090		10.000	82.128	3.5424	2.3322	1.5189	1.5189	0.6518	0.82018
	14.000	75.670	2.9984	2.1104	1.4208	0.7439	0.87713		8.000	83.865	3.5702	2.3428	1.5239	1.5239	0.6381	0.81725
	12.000	78.555	3.0722	2.1421	1.4342	0.7080	0.86953		6.000	85.485	3.5899	2.3503	1.5274	1.5274	0.6283	0.81516
10.000	80.906	3.1208	2.1626	1.4431	0.6838	0.86450		4.000	87.028	3.6032	2.3554	1.5298	1.5298	0.6216	0.81376	
8.000	82.965	3.1544	2.1767	1.4492	0.6667	0.86100		2.000	88.525	3.6108	2.3583	1.5311	1.5311	0.6178	0.81295	

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{p_{02}}{p_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{p_{02}}{p_{01}}$
1.85	2.000	34.466	1.1121	1.0788	1.0309	1.7805	0.99988	1.95	2.000	32.528	1.1160	1.0815	1.0319	1.8790	0.99987
	4.000	36.323	1.2343	1.1619	1.0623	1.7114	0.99905		4.000	34.304	1.2424	1.1674	1.0643	1.8085	0.99896
	6.000	38.302	1.3672	1.2492	1.0945	1.6418	0.99689		6.000	36.191	1.3801	1.2575	1.0975	1.7380	0.99660
	8.000	40.424	1.5123	1.3409	1.1278	1.5711	0.99284		8.000	38.204	1.5302	1.3521	1.1318	1.6666	0.99221
	10.000	42.717	1.6709	1.4373	1.1625	1.4983	0.98638		10.000	40.360	1.6938	1.4509	1.1674	1.5938	0.98528
	12.000	45.223	1.8453	1.5388	1.1992	1.4224	0.97701		12.000	42.688	1.8726	1.5542	1.2049	1.5185	0.97535
	14.000	48.014	2.0395	1.6465	1.2387	1.3415	0.96417		14.000	45.230	2.0693	1.6625	1.2446	1.4366	0.96200
	16.000	51.232	2.2607	1.7631	1.2822	1.2524	0.94697		16.000	48.059	2.2879	1.7770	1.2875	1.3553	0.94470
	18.000	55.227	2.5275	1.8956	1.3333	1.1476	0.92345		18.000	51.320	2.5368	1.9001	1.3351	1.2622	0.92258
	20.000	62.099	2.9519	2.0902	1.4123	0.9818	0.88189		20.000	55.381	2.8378	2.0397	1.3913	1.1520	0.89342
	20.198	64.872	3.1062	2.1565	1.4404	0.9205	0.86601		22.000	62.860	3.3464	2.2553	1.4838	0.9655	0.84087
	20.000	67.544	3.2437	2.2136	1.4653	0.8648	0.85167		22.092	64.716	3.4603	2.3003	1.5043	0.9229	0.82885
	18.000	73.440	3.5019	2.3165	1.5117	0.7560	0.82446		22.000	66.523	3.5655	2.3410	1.5231	0.8829	0.81774
	16.000	76.511	3.6090	2.3576	1.5308	0.7085	0.81314		20.000	72.926	3.8872	2.4601	1.5801	0.7555	0.76384
	14.000	78.861	3.6772	2.3833	1.5429	0.6773	0.80593		18.000	75.964	4.0086	2.5030	1.6015	0.7045	0.77114
	12.000	80.844	3.7252	2.4011	1.5514	0.6548	0.80088		16.000	78.253	4.0857	2.5297	1.6151	0.6710	0.76313
	10.000	82.606	3.7601	2.4140	1.5576	0.6381	0.79719		14.000	80.165	4.1401	2.5484	1.6246	0.6467	0.75750
	8.000	84.222	3.7858	2.4234	1.5622	0.6257	0.79449		12.000	81.849	4.1804	2.5620	1.6317	0.6283	0.75335
	6.000	85.740	3.8042	2.4301	1.5655	0.6166	0.79255		10.000	83.381	4.2106	2.5722	1.6370	0.6142	0.75024
	4.000	87.193	3.8167	2.4346	1.5677	0.6105	0.79124		8.000	84.808	4.2333	2.5798	1.6409	0.6036	0.74791
	2.000	88.606	3.8239	2.4373	1.5689	0.6069	0.79048		6.000	86.163	4.2497	2.5853	1.6438	0.5957	0.74623
									4.000	87.467	4.2609	2.5890	1.6458	0.5904	0.74508
									2.000	88.741	4.2674	2.5912	1.6469	0.5872	0.74441
1.90	2.000	33.466	1.1140	1.0801	1.0314	1.8298	0.99987	2.00	2.000	31.647	1.1180	1.0829	1.0324	1.9280	0.99986
	4.000	35.279	1.2382	1.1646	1.0633	1.7600	0.99901		4.000	33.390	1.2468	1.1702	1.0654	1.8568	0.99891
	6.000	37.209	1.3735	1.2533	1.0959	1.6901	0.99675		6.000	35.241	1.3871	1.2620	1.0991	1.7856	0.99644
	8.000	39.272	1.5209	1.3463	1.1297	1.6191	0.99254		8.000	37.210	1.5400	1.3581	1.1339	1.7138	0.99186
	10.000	41.490	1.6818	1.4438	1.1649	1.5464	0.98586		10.000	39.314	1.7066	1.4584	1.1702	1.6405	0.98464
	12.000	43.898	1.8582	1.5460	1.2019	1.4709	0.97624		12.000	41.575	1.8884	1.5631	1.2081	1.5651	0.97437
	14.000	46.550	2.0530	1.6538	1.2414	1.3913	0.96319		14.000	44.029	2.0876	1.6724	1.2483	1.4866	0.96064
	16.000	49.544	2.2718	1.7688	1.2844	1.3052	0.94605		16.000	46.731	2.3076	1.7870	1.2913	1.4034	0.94304
	18.000	53.095	2.5263	1.8951	1.3331	1.2077	0.92356		18.000	49.785	2.5546	1.9086	1.3384	1.3131	0.92092
	20.000	57.900	2.8557	2.0477	1.3946	1.0835	0.89162		20.000	53.423	2.8429	2.0420	1.3922	1.2102	0.89291
	21.167	64.783	3.2805	2.2286	1.4720	0.9216	0.84781		22.000	58.457	3.2228	2.2051	1.4616	1.0760	0.85385
	18.000	74.861	3.7578	2.4131	1.5572	0.7274	0.79744		22.974	64.669	3.6458	2.3715	1.5373	0.9243	0.80926
	16.000	77.463	3.8466	2.4455	1.5729	0.6884	0.78810		22.000	70.332	3.9714	2.4899	1.5950	0.8017	0.77503
	14.000	79.565	3.9068	2.4671	1.5836	0.6611	0.78178		20.000	74.270	4.1570	2.5541	1.6276	0.7278	0.75576
	12.000	81.383	3.9504	2.4826	1.5913	0.6409	0.77721		18.000	76.862	4.2589	2.5883	1.6454	0.6854	0.74529
	10.000	83.020	3.9828	2.4940	1.5970	0.6257	0.77383		16.000	78.921	4.3277	2.6110	1.6574	0.6558	0.73827
	8.000	84.534	4.0068	2.5024	1.6012	0.6142	0.77133		14.000	80.684	4.3777	2.6274	1.6662	0.6337	0.73319
	6.000	85.965	4.0241	2.5084	1.6042	0.6058	0.76953		12.000	82.257	4.4153	2.6396	1.6727	0.6168	0.72939
	4.000	87.338	4.0359	2.5125	1.6063	0.6001	0.76830		10.000	83.700	4.4438	2.6487	1.6777	0.6037	0.72652
	2.000	88.677	4.0428	2.5149	1.6075	0.5967	0.76759		8.000	85.052	4.4653	2.6556	1.6815	0.5937	0.72436
									6.000	86.339	4.4810	2.6606	1.6842	0.5864	0.72278
									4.000	87.582	4.4917	2.6640	1.6861	0.5813	0.72171
									2.000	88.798	4.4979	2.6660	1.6871	0.5783	0.72108

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	
2.05	2.000	30.816	1.1200	1.0843	1.0330	1.9771	0.99985	2.10	4.000	87.778	4.9706	2.8097	1.7691	0.5648	0.67494	
	4.000	32.532	1.2512	1.1732	1.0665	1.9050	0.99885		2.000	88.894	4.9764	2.8113	1.7701	0.5622	0.67438	
	6.000	34.350	1.3943	1.2666	1.1008	1.8330	0.99627									
	8.000	36.281	1.5502	1.3644	1.1362	1.7605	0.99148	2.15	2.000	29.293	1.1243	1.0872	1.0341	2.0749	0.99984	
	10.000	38.341	1.7201	1.4664	1.1730	1.6868	0.98396		4.000	30.960	1.2606	1.1794	1.0688	2.0008	0.99874	
	12.000	40.547	1.9053	1.5726	1.2116	1.6111	0.97330		6.000	32.725	1.4094	1.2763	1.1043	1.9271	0.99590	
	14.000	42.928	2.1076	1.6831	1.2522	1.5326	0.95914		8.000	34.596	1.5719	1.3777	1.1410	1.8529	0.99065	
	16.000	45.528	2.3300	1.7983	1.2956	1.4500	0.94112		10.000	36.584	1.7490	1.4833	1.1791	1.7778	0.98246	
	18.000	48.428	2.5774	1.9195	1.3427	1.3614	0.91878		12.000	38.702	1.9417	1.5929	1.2190	1.7011	0.97093	
	20.000	51.785	2.8600	2.0497	1.3953	1.2630	0.89120		14.000	40.971	2.1518	1.7065	1.2610	1.6221	0.95574	
2.10	2.000	23.814	3.8367	2.4419	1.5712	0.9257	0.78913	16.000	16.000	43.422	2.3813	1.8241	1.3055	1.5397	0.93666	
	22.000	22.000	4.2777	2.5946	1.6487	0.7626	0.74336	18.000	18.000	46.104	2.6337	1.9461	1.3533	1.4527	0.91343	
	24.000	20.000	4.4215	2.6416	1.6738	0.7056	0.72876	20.000	20.000	49.106	2.9150	2.0740	1.4055	1.3588	0.88564	
	26.000	18.000	4.5107	2.6700	1.6894	0.6698	0.71981	22.000	22.000	52.618	3.2384	2.2115	1.4644	1.2534	0.85222	
	28.000	16.000	4.5734	2.6898	1.7003	0.6422	0.71356	24.000	24.000	57.217	3.6452	2.3712	1.5372	1.1223	0.80932	
	30.000	14.000	4.6199	2.7043	1.7084	0.6219	0.70894	25.376	25.376	64.616	4.2352	2.5804	1.6413	0.9289	0.74772	
	32.000	12.000	4.6553	2.7152	1.7145	0.6062	0.70545	24.000	24.000	71.164	4.6641	2.7180	1.7160	0.7794	0.70458	
	34.000	10.000	4.6824	2.7236	1.7192	0.5939	0.70278	22.000	22.000	74.564	4.8442	2.7725	1.7472	0.7122	0.68703	
	36.000	8.000	4.7029	2.7299	1.7228	0.5846	0.70077	20.000	20.000	76.920	4.9500	2.8037	1.7656	0.6709	0.67689	
	38.000	6.000	4.7179	2.7344	1.7254	0.5776	0.69930	18.000	18.000	78.817	5.0234	2.8249	1.7782	0.6413	0.66994	
2.10	4.000	87.685	4.7283	2.7376	1.7272	0.5728	0.69829	16.000	16.000	80.444	5.0776	2.8405	1.7876	0.6188	0.66484	
	2.000	88.849	4.7343	2.7394	1.7282	0.5700	0.69770	14.000	14.000	81.896	5.1191	2.8523	1.7947	0.6012	0.66097	
								12.000	12.000	83.224	5.1512	2.8613	1.8003	0.5874	0.65798	
								10.000	10.000	84.464	5.1761	2.8683	1.8046	0.5765	0.65568	
								8.000	8.000	85.639	5.1951	2.8736	1.8078	0.5680	0.65392	
								6.000	6.000	86.767	5.2091	2.8775	1.8103	0.5617	0.65263	
								4.000	4.000	87.862	5.2187	2.8802	1.8119	0.5574	0.65174	
								2.000	2.000	88.936	5.2244	2.8818	1.8129	0.5548	0.65122	
2.20	2.000	30.033	1.1222	1.0858	1.0335	2.0260	0.99984	2.20	2.000	28.592	1.1266	1.0888	1.0347	2.1237	0.99983	
	4.000	31.723	1.2558	1.1763	1.0676	1.9530	0.99880		4.000	30.238	1.2654	1.1826	1.0700	2.0485	0.99867	
	6.000	33.513	1.4017	1.2714	1.1025	1.8801	0.99609		6.000	31.981	1.4173	1.2813	1.1061	1.9738	0.99569	
	8.000	35.412	1.5608	1.3709	1.1386	1.8069	0.99108		8.000	33.827	1.5832	1.3845	1.1435	1.8987	0.99020	
	10.000	37.433	1.7342	1.4746	1.1760	1.7325	0.98324		10.000	35.785	1.7641	1.4921	1.1823	1.8228	0.98165	
	12.000	39.592	1.9230	1.5825	1.2152	1.6564	0.97216		12.000	37.869	1.9611	1.6036	1.2229	1.7454	0.96964	
	14.000	41.912	2.1290	1.6944	1.2565	1.5777	0.95750		14.000	40.095	2.1756	1.7190	1.2656	1.6657	0.95387	
	16.000	44.430	2.3547	1.8107	1.3004	1.4954	0.93899		16.000	42.489	2.4095	1.8380	1.3109	1.5631	0.93417	
	18.000	47.210	2.6041	1.9322	1.3478	1.4078	0.91626		18.000	45.092	2.6658	1.9611	1.3593	1.4963	0.91035	
	20.000	50.365	2.8848	2.0607	1.3999	1.3122	0.88870		20.000	47.975	2.9494	2.0891	1.4118	1.4035	0.88215	
2.40	24.000	54.169	3.2152	2.2019	1.4602	1.2019	0.85466		22.000	51.277	3.2704	2.2245	1.4701	1.3013	0.84887	
	24.000	59.767	3.6739	2.3820	1.5424	1.0493	0.80628		24.000	55.356	3.6552	2.3750	1.5390	1.1805	0.80826	
	24.614	64.621	4.0332	2.5116	1.6058	0.9273	0.76858		26.000	62.695	4.2918	2.5992	1.6512	0.9795	0.74193	
	24.000	69.104	4.3238	2.6098	1.6568	0.8245	0.73867		26.000	64.620	4.4426	2.6484	1.6775	0.9305	0.72663	
	22.000	73.521	4.5644	2.6870	1.6987	0.7345	0.71445		26.000	66.480	4.5807	2.6921	1.7015	0.8849	0.71283	
	20.000	76.189	4.6852	2.7244	1.7197	0.6870	0.70251		24.000	72.560	4.9728	2.8103	1.7695	0.7490	0.67473	
	18.000	78.257	4.7652	2.7488	1.7336	0.6543	0.69468		22.000	75.420	5.1222	2.8531	1.7953	0.6936	0.66068	
	16.000	80.001	4.8232	2.7662	1.7436	0.6299	0.68906									
	14.000	81.539	4.8669	2.7792	1.7512	0.6111	0.68484									
	12.000	82.938	4.9006	2.7892	1.7570	0.5964	0.68162									
10.000	84.237	4.9264	2.7968	1.7615	0.5849	0.67914										
8.000	85.463	4.9461	2.8025	1.7649	0.5760	0.67726										
6.000	86.638	4.9606	2.8068	1.7674	0.5694	0.67588										

# Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
2.20	20.000	77.549	5.2175	2.8799	1.8117	0.6568	0.65185	2.30	16.000	40.816	2.4701	1.8678	1.3224	1.6676	0.92872
	18.000	79.308	5.2856	2.8987	1.8234	0.6296	0.64562		18.000	43.299	2.7360	1.9936	1.3724	1.5804	0.90351
	16.000	80.839	5.3369	2.9127	1.8323	0.6086	0.64096		20.000	46.007	3.0276	2.1230	1.4261	1.4885	0.87413
	14.000	82.216	5.3764	2.9235	1.8391	0.5921	0.63739		22.000	49.026	3.3514	2.2573	1.4847	1.3894	0.84035
	12.000	83.483	5.4073	2.9318	1.8444	0.5789	0.63462		24.000	52.536	3.7216	2.3998	1.5508	1.2788	0.80125
	10.000	84.670	5.4313	2.9382	1.8485	0.5686	0.63247		26.000	57.077	4.1819	2.5625	1.6319	1.1425	0.75319
	8.000	85.798	5.4497	2.9431	1.8517	0.5605	0.63083		27.454	64.653	4.8739	2.7813	1.7524	0.9338	0.68417
	6.000	86.883	5.4633	2.9468	1.8540	0.5545	0.62962		28.000	71.264	5.3682	2.9212	1.8377	0.7743	0.63813
	4.000	87.938	5.4727	2.9493	1.8556	0.5503	0.62879		30.000	74.512	5.6649	2.9736	1.8714	0.7060	0.62065
	2.000	88.973	5.4782	2.9507	1.8565	0.5479	0.62830		32.000	76.770	5.6817	3.0039	1.8915	0.6635	0.61049
2.25	2.000	27.926	1.1288	1.0903	1.0353	2.1725	0.99982		18.000	80.133	5.8238	3.0399	1.9158	0.6092	0.59838
	4.000	29.555	1.2703	1.1859	1.0712	2.0962	0.99861		16.000	81.509	5.8705	3.0515	1.9238	0.5906	0.59445
	6.000	31.277	1.4254	1.2864	1.1080	2.0203	0.99548		14.000	82.764	5.9071	3.0606	1.9301	0.5757	0.59139
	8.000	33.102	1.5949	1.3916	1.1461	1.9443	0.98973		12.000	83.928	5.9360	3.0677	1.9350	0.5638	0.58899
	10.000	35.034	1.7798	1.5011	1.1856	1.8674	0.98079		10.000	85.026	5.9586	3.0732	1.9389	0.5543	0.58712
	12.000	37.088	1.9812	1.6147	1.2270	1.7891	0.96827		8.000	86.074	5.9761	3.0775	1.9419	0.5469	0.58568
	14.000	39.277	2.2004	1.7319	1.2705	1.7088	0.95189		6.000	87.085	5.9980	3.0807	1.9441	0.5413	0.58461
	16.000	41.623	2.4392	1.8527	1.3166	1.6257	0.93152		4.000	88.070	5.9990	3.0828	1.9456	0.5374	0.58387
	18.000	44.161	2.7000	1.9770	1.3657	1.5388	0.90703		2.000	89.039	6.0033	3.0841	1.9465	0.5352	0.58344
	20.000	46.948	2.9871	2.1055	1.4187	1.4466	0.87829								
2.30	2.000	50.091	3.3085	2.2400	1.4770	1.3464	0.84486	2.35	2.000	26.692	1.1334	1.0935	1.0365	2.2698	0.99980
	4.000	53.837	3.6830	2.3854	1.5440	1.2318	0.80532		4.000	28.289	1.2804	1.1926	1.0736	2.1911	0.99846
	6.000	59.122	4.1839	2.5632	1.6323	1.0792	0.75298		6.000	29.979	1.4420	1.2970	1.1118	2.1129	0.99502
	8.000	64.633	4.6556	2.7153	1.7145	0.9321	0.70542		8.000	31.765	1.6189	1.4062	1.1513	2.0346	0.98872
	10.000	69.627	5.0238	2.8250	1.7783	0.8115	0.66991		10.000	33.657	1.8124	1.5199	1.1924	1.9557	0.97895
	12.000	73.624	5.2977	2.8946	1.8209	0.7254	0.64698		12.000	35.662	2.0322	1.6376	1.2354	1.8755	0.96534
	14.000	76.145	5.4009	2.9301	1.8433	0.6775	0.63519		14.000	37.790	2.2526	1.7589	1.2807	1.7934	0.94765
	16.000	78.098	5.4884	2.9534	1.8583	0.6441	0.62739		16.000	40.060	2.5021	1.8833	1.3285	1.7089	0.92580
	18.000	79.744	5.5523	2.9703	1.8693	0.6189	0.62175		18.000	42.497	2.7736	2.0108	1.3794	1.6212	0.89981
	20.000	81.192	5.6011	2.9830	1.8776	0.5993	0.61749		20.000	45.140	3.0705	2.1413	1.4339	1.5291	0.86971
2.30	2.000	27.294	1.1311	1.0919	1.0359	2.2212	0.99981		22.000	48.059	3.3981	2.2759	1.4931	1.4308	0.83542
	4.000	28.906	1.2753	1.1892	1.0724	2.1437	0.99854		24.000	51.393	3.7677	2.4168	1.5590	1.3227	0.79639
	6.000	30.611	1.4336	1.2916	1.1099	2.0667	0.99526		26.000	55.500	4.2092	2.5717	1.6367	1.1954	0.75038
	8.000	32.415	1.6068	1.3988	1.1487	1.9896	0.98923		28.000	62.973	4.9459	2.8024	1.7648	0.9810	0.67729
	10.000	34.326	1.7959	1.5104	1.1890	1.9117	0.98062		30.000	72.454	5.0977	2.8462	1.7911	0.9354	0.66296
	12.000	36.354	2.0019	1.6260	1.2311	1.8325	0.96684		32.000	84.122	5.2377	2.8855	1.8152	0.8927	0.65000
	14.000	38.510	2.2261	1.7452	1.2755	1.7514	0.95688		34.000	98.070	5.6907	3.0662	1.8930	0.8277	0.60972
									36.000	114.171	5.8587	3.0486	1.9218	0.7889	0.59544
									38.000	133.717	5.9657	3.0750	1.9401	0.7510	0.58653
									40.000	158.014	6.0423	3.0936	1.9532	0.7224	0.58024



**Oblique Shock Tables ( $\gamma = 1.4$ )**

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
2.35	6.000	87.174	6.2606	3.1453	1.9904	0.5353	0.56272	2.45	26.000	53.045	4.3053	2.6037	1.6535	1.2861	0.74055
	4.000	88.129	6.2694	3.1474	1.9919	0.5315	0.56203		28.000	57.780	4.8455	2.7729	1.7475	1.1385	0.68691
	2.000	89.068	6.2745	3.1486	1.9928	0.5293	0.56162		29.253	64.744	5.5614	2.9727	1.8708	0.9386	0.62095
2.40	2.000	26.120	1.1358	1.0951	1.0371	2.3184	0.99979		28.000	70.828	6.0810	3.1029	1.9598	0.7837	0.57709
	4.000	27.702	1.2856	1.1960	1.0749	2.2383	0.99839		26.000	74.185	6.3161	3.1582	1.9999	0.7082	0.55836
	6.000	29.377	1.4505	1.3023	1.1138	2.1589	0.99478		24.000	76.446	6.4516	3.1891	2.0230	0.6623	0.54787
	8.000	31.149	1.6314	1.4137	1.1540	2.0794	0.98818		22.000	78.236	6.5451	3.2101	2.0389	0.6294	0.54076
	10.000	33.023	1.8292	1.5295	1.1959	1.9994	0.97797		20.000	79.752	6.6146	3.2254	2.0508	0.6042	0.53555
	12.000	35.007	2.0450	1.6495	1.2398	1.9181	0.96377		18.000	81.089	6.6682	3.2372	2.0599	0.5842	0.53157
	14.000	37.112	2.2798	1.7729	1.2860	1.8350	0.94538		16.000	82.299	6.7105	3.2464	2.0671	0.5681	0.52845
	16.000	39.351	2.5351	1.8993	1.3348	1.7497	0.92274		14.000	83.416	6.7442	3.2536	2.0728	0.5550	0.52599
	18.000	41.748	2.8128	2.0285	1.3866	1.6613	0.89592		12.000	84.462	6.7710	3.2594	2.0774	0.5444	0.52403
	20.000	44.336	3.1155	2.1604	1.4421	1.5689	0.86505		10.000	85.455	6.7923	3.2640	2.0810	0.5359	0.52249
	22.000	47.174	3.4480	2.2955	1.5021	1.4709	0.83015		8.000	86.408	6.8088	3.2675	2.0838	0.5292	0.52129
	24.000	50.371	3.8196	2.4357	1.5682	1.3644	0.79093		6.000	87.331	6.8211	3.2701	2.0859	0.5242	0.52041
	26.000	54.184	4.2521	2.5861	1.6442	1.2426	0.74598		4.000	88.232	6.8296	3.2719	2.0873	0.5207	0.51979
28.000	59.656	4.8382	2.7707	1.7462	1.0779	0.68761		2.000	89.119	6.8346	3.2730	2.0882	0.5186	0.51943	
28.681	64.710	5.3269	2.9100	1.8305	0.9370	0.64187									
28.000	69.291	5.7130	3.0119	1.8968	0.8201	0.60781		2.50	2.000	25.050	1.1405	1.0984	1.0384	2.4155	0.99977
26.000	73.400	6.0048	3.0845	1.9468	0.7260	0.58331		4.000	26.609	26.609	1.2961	1.2029	1.0775	2.3326	0.99822
24.000	75.889	6.1539	3.1203	1.9722	0.6751	0.57121		6.000	28.259	28.259	1.4679	1.3133	1.1177	2.2505	0.99427
22.000	77.803	6.2534	3.1436	1.9892	0.6397	0.56329		8.000	30.005	30.005	1.6568	1.4289	1.1595	2.1685	0.98703
20.000	79.402	6.3260	3.1605	2.0016	0.6129	0.55758		10.000	33.802	33.802	1.8639	1.5493	1.2031	2.0859	0.97589
18.000	80.800	6.3816	3.1732	2.0111	0.5919	0.55326		12.000	35.866	35.866	2.0900	1.6710	1.2488	2.0022	0.96046
16.000	82.059	6.4251	3.1831	2.0185	0.5751	0.54990		14.000	38.057	38.057	2.3042	1.8015	1.2969	1.9169	0.94057
14.000	83.217	6.4596	3.1909	2.0244	0.5615	0.54726		16.000	40.389	40.389	2.6042	1.9322	1.3478	1.8295	0.91625
12.000	84.299	6.4870	3.1971	2.0290	0.5505	0.54517		18.000	44.890	44.890	2.8949	2.0652	1.4018	1.7394	0.88767
10.000	85.324	6.5087	3.2019	2.0327	0.54352	0.54352		20.000	48.800	48.800	3.2109	2.2002	1.4594	1.6458	0.85510
8.000	86.306	6.5254	3.2057	2.0356	0.5348	0.54225		22.000	45.602	45.602	3.5558	2.3373	1.5213	1.5475	0.81877
6.000	87.255	6.5379	3.2085	2.0377	0.5296	0.54131		24.000	48.600	48.600	3.9361	2.4775	1.5887	1.4426	0.77871
4.000	88.182	6.5466	3.2104	2.0392	0.5260	0.54065		26.000	52.036	52.036	4.3657	2.6235	1.6641	1.3268	0.73441
2.000	89.094	6.5517	3.2115	2.0400	0.5238	0.54027		28.000	56.335	56.335	4.8844	2.7844	1.7542	1.1888	0.68317
2.45	2.000	25.572	1.1381	1.0968	1.0377	2.3670	0.99978		29.797	64.782	5.8014	3.0342	1.9120	0.9402	0.60027
	4.000	27.143	1.2908	1.1994	1.0762	2.2855	0.99831		26.000	71.949	6.4249	3.1831	2.0185	0.7573	0.54992
	6.000	28.805	1.4591	1.3078	1.1157	2.2048	0.99453		24.000	74.856	6.6273	3.2282	2.0529	0.6928	0.53460
	8.000	30.563	1.6440	1.4212	1.1567	2.1241	0.98761		22.000	76.939	6.7526	3.2555	2.0742	0.6509	0.52537
	10.000	32.422	1.8463	1.5393	1.1994	2.0428	0.97695		20.000	78.625	6.8414	3.2744	2.0893	0.6201	0.51894
	12.000	34.388	2.0672	1.6615	1.2442	1.9603	0.96215		18.000	80.070	6.9602	3.2885	2.1007	0.5962	0.51417
	14.000	36.472	2.3078	1.7871	1.2914	1.8762	0.94302		16.000	81.353	7.0682	3.2994	2.1095	0.5770	0.51048
	16.000	38.685	2.5692	1.9156	1.3412	1.7898	0.91955		14.000	83.598	7.0343	3.3148	2.1165	0.5616	0.50759
	18.000	41.047	2.8532	2.0466	1.3941	1.7006	0.89187		12.000	84.612	7.0607	3.3202	2.1221	0.5489	0.50528
	20.000	43.588	3.1623	2.1800	1.4506	1.6077	0.86018		10.000	85.576	7.0816	3.3245	2.1266	0.5387	0.50345
22.000	46.358	3.5007	2.3160	1.5115	1.5097	0.82459		8.000	86.502	7.0979	3.3278	2.1301	0.5304	0.50200	
24.000	49.445	3.8759	2.4560	1.5781	1.4042	0.78502		6.000	87.400	7.1100	3.3303	2.1350	0.5208	0.50088	
								4.000	88.277	7.1184	3.3320	2.1364	0.5157	0.49947	
								2.000	89.142	7.1234	3.3330	2.1372	0.5137	0.49913	



# Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
2.65	4.000	88.396	8.0198	3.5035	2.2891	0.5021	0.44194	2.75	24.000	45.225	4.2794	2.5951	1.6490	1.6181	0.74319
	2.000	89.200	8.0247	3.5044	2.2899	0.5003	0.44165		26.000	48.206	47.7404	4.7375	2.7404	1.7288	1.5056
2.70	2.000	23.173	1.1503	1.1051	1.0409	2.6090	0.99972	30.000	55.674	55.674	5.8507	3.0466	1.9204	1.2416	0.59611
	4.000	24.696	1.3179	1.2172	1.0827	2.5201	0.99786	32.000	62.549	62.549	6.7812	3.2616	2.0791	1.0209	0.52329
	6.000	26.311	1.5042	1.3360	1.1260	2.4321	0.99311	32.000	65.002	65.002	7.0807	3.3243	2.1300	0.9476	0.50207
	8.000	28.019	1.7102	1.4605	1.1709	2.3444	0.98446	32.000	67.323	67.323	7.3448	3.3773	2.1748	0.8812	0.48420
	10.000	29.824	1.9369	1.5902	1.2180	2.2561	0.97125	30.000	72.678	72.678	7.8741	3.4773	2.2644	0.7401	0.45066
	12.000	31.728	2.1855	1.7241	1.2676	2.1669	0.95309	28.000	75.285	75.285	8.0870	3.5154	2.3004	0.6789	0.43799
	14.000	33.739	2.4569	1.8614	1.3199	2.0763	0.92991	26.000	77.202	77.202	8.2233	3.5393	2.3235	0.6378	0.43010
	16.000	35.862	2.7523	2.0010	1.3754	1.9838	0.90191	24.000	78.766	78.766	8.3214	3.5561	2.3400	0.6071	0.42454
	18.000	38.109	3.0727	2.1423	1.4343	1.9890	0.86948	22.000	80.110	80.110	8.3960	3.5688	2.3526	0.5829	0.42037
	20.000	40.496	3.4200	2.2845	1.4970	1.8890	0.83311	20.000	81.303	81.303	8.4545	3.5786	2.3625	0.5634	0.41714
	22.000	43.049	3.7964	2.4273	1.5641	1.7915	0.80311	18.000	82.386	82.386	8.5014	3.5864	2.3704	0.5474	0.41457
	24.000	45.809	4.2059	2.5706	1.6362	1.6905	0.79337	16.000	83.387	83.387	8.5392	3.5927	2.3768	0.5343	0.41251
	26.000	48.852	4.6560	2.7155	1.7146	1.5848	0.75072	14.000	84.324	84.324	8.5699	3.5978	2.3820	0.5234	0.41085
	28.000	52.334	5.1626	2.8645	1.8022	1.4723	0.70538	12.000	85.212	85.212	8.5948	3.6019	2.3862	0.5145	0.40951
	30.000	56.687	5.7730	3.0271	1.9071	1.3488	0.65692	10.000	86.062	86.062	8.6146	3.6051	2.3895	0.5072	0.40845
31.741	64.956	6.8143	3.2687	2.0847	1.2018	0.60268	8.000	86.882	86.882	8.6301	3.6077	2.3922	0.5015	0.40762	
30.000	71.913	7.5186	3.4110	2.2042	0.9462	0.52090	6.000	87.680	87.680	8.6418	3.6096	2.3941	0.4972	0.40700	
28.000	74.790	7.7529	3.4551	2.2439	0.7587	0.47286	4.000	88.462	88.462	8.6499	3.6109	2.3955	0.4942	0.40656	
26.000	76.828	7.8967	3.4814	2.2682	0.6468	0.44930	2.000	89.234	89.234	8.6547	3.6117	2.3963	0.4924	0.40631	
24.000	78.466	7.9983	3.4997	2.2854	0.6145	0.44321									
22.000	79.862	8.0748	3.5133	2.2984	0.43870	0.5893	2.80	22.344	22.344	1.1553	1.1085	1.0422	2.7056	0.99969	
20.000	81.095	8.1345	3.5238	2.3085	0.43522	0.5893	4.000	23.854	23.854	1.3292	1.2246	1.0854	2.6133	0.99766	
18.000	82.210	8.1821	3.5321	2.3165	0.43247	0.5891	6.000	25.455	25.455	1.5230	1.3476	1.1302	2.5222	0.99246	
16.000	83.238	8.2204	3.5388	2.3230	0.43027	0.5527	8.000	27.150	27.150	1.7379	1.4768	1.1768	2.4313	0.98304	
14.000	84.199	8.2515	3.5441	2.3282	0.42850	0.5391	10.000	28.940	28.940	1.9751	1.6113	1.2257	2.3399	0.96869	
12.000	85.109	8.2765	3.5484	2.3324	0.42708	0.5188	12.000	30.830	30.830	2.2357	1.7502	1.2774	2.2476	0.94903	
10.000	85.978	8.2965	3.5518	2.3358	0.42595	0.5114	14.000	32.822	32.822	2.5205	1.8923	1.3320	2.1540	0.92409	
8.000	86.816	8.3121	3.5545	2.3385	0.42506	0.5056	16.000	34.923	34.923	2.8309	2.0367	1.3900	2.0585	0.89411	
6.000	87.631	8.3238	3.5565	2.3404	0.42441	0.5012	18.000	37.141	37.141	3.1677	2.1822	1.4516	1.9610	0.85962	
4.000	88.430	8.3319	3.5579	2.3418	0.42395	0.4981	20.000	39.490	39.490	3.5324	2.3283	1.5172	1.8610	0.82123	
2.000	89.218	8.3367	3.5587	2.3426	0.42368	0.4962	22.000	41.990	41.990	3.9271	2.4743	1.5872	1.7578	0.77965	
2.75	2.000	22.750	1.1528	1.1068	1.0415	2.6573	0.99971	24.000	44.676	44.676	4.3550	2.6200	1.6622	1.6506	0.73549
	4.000	24.267	1.3236	1.2209	1.0841	2.5667	0.99776	26.000	47.604	47.604	4.8219	2.7658	1.7434	1.5379	0.68919
	6.000	25.873	1.5135	1.3417	1.1280	2.4772	0.99279	28.000	50.887	50.887	5.3398	2.9135	1.8328	1.4163	0.64070
	8.000	27.572	1.7239	1.4686	1.1738	2.3879	0.98377	30.000	54.786	54.786	5.9387	3.0683	1.9355	1.2783	0.58877
	10.000	29.375	1.9558	1.6007	1.2219	2.2982	0.96999	32.000	60.433	60.433	6.7529	3.2555	2.0743	1.0909	0.52555
	12.000	31.269	2.2104	1.7371	1.2724	2.2074	0.95109	32.587	65.050	65.050	7.3524	3.3788	2.1761	0.9490	0.48369
	14.000	33.269	2.4885	1.8768	1.3259	2.1153	0.92704	32.000	69.211	69.211	7.8278	3.4689	2.2566	0.8307	0.45348
	16.000	35.381	2.7912	2.0188	1.3826	2.0213	0.89806	30.000	73.328	73.328	8.2272	3.5399	2.3241	0.7243	0.42988
	18.000	37.612	3.1197	2.1622	1.4429	1.8265	0.86461	28.000	75.728	75.728	8.4241	3.5735	2.3574	0.6684	0.41882
	20.000	39.980	3.4757	2.3063	1.5070	1.8265	0.82724	26.000	77.543	77.543	8.5544	3.5952	2.3794	0.6296	0.41169
	22.000	42.504	3.8610	2.4506	1.5755	1.8265	0.78659	24.000	79.042	79.042	8.6495	3.6108	2.3954	0.6002	0.40659
						1.7245	0.78659	22.000	80.339	80.339	8.7224	3.6227	2.4077	0.5769	0.40273
						1.5755	0.78659	20.000	81.496	81.496	8.7800	3.6319	2.4174	0.5580	0.39971

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	
2.80	18.000	82.550	8.8262	3.6393	2.4252	0.5425	0.39731	2.90	6.000	24.666	1.5421	1.3594	1.1344	2.6117	0.99178	
	16.000	83.525	8.8637	3.6453	2.4316	0.5297	0.39538		8.000	26.350	1.7663	1.4933	1.1828	2.5175	0.98153	
	14.000	84.440	8.8942	3.6501	2.4367	0.5191	0.39382		10.000	28.129	2.0143	1.6328	1.2336	2.4229	0.96597	
	12.000	85.308	8.9188	3.6540	2.4409	0.5103	0.39256		12.000	30.007	2.2873	1.7767	1.2874	2.3273	0.94475	
	10.000	86.140	8.9385	3.6571	2.4442	0.5033	0.39156		14.000	31.985	2.5863	1.9238	1.3444	2.2304	0.91794	
	8.000	86.943	8.9540	3.6595	2.4468	0.4977	0.39078		16.000	34.069	3.0629	2.0729	1.4050	2.1318	0.88591	
	6.000	87.725	8.9656	3.6613	2.4487	0.4935	0.39019		18.000	36.264	3.6496	2.2229	1.4694	2.0313	0.84930	
	4.000	88.492	8.9737	3.6626	2.4501	0.4905	0.38978		20.000	38.584	4.0638	2.3729	1.5380	1.9285	0.80886	
	2.000	89.248	8.9784	3.6633	2.4509	0.4887	0.38954		22.000	41.044	4.5119	2.5222	1.6112	1.8229	0.76540	
									24.000	43.672	4.9884	2.6704	1.6896	1.7138	0.71969	
2.85	2.000	21.954	1.1579	1.1103	1.0429	2.7537	0.99968		26.000	46.515	4.9884	2.8177	1.7739	1.5999	0.67230	
	4.000	23.457	1.3349	1.2283	1.0868	2.6598	0.99755		28.000	49.655	5.5328	2.9652	1.8659	1.4788	0.62347	
	6.000	25.052	1.5325	1.3535	1.1323	2.5670	0.99213		30.000	53.274	6.1364	3.1161	1.9692	1.3453	0.57262	
	8.000	26.742	1.7520	1.4850	1.1798	2.4744	0.98230		32.000	57.931	6.8791	3.2824	2.0957	1.1827	0.51624	
	10.000	28.526	1.9946	1.6220	1.2297	2.3815	0.96735		33.363	65.145	7.9116	3.4841	2.2708	0.9516	0.44840	
	12.000	30.410	2.2613	1.7634	1.2824	2.2876	0.94692		32.000	71.287	8.6350	3.6085	2.3930	0.7771	0.40736	
	14.000	32.394	2.5532	1.9080	1.3382	2.1923	0.92105		30.000	74.392	8.9447	3.6565	2.4435	0.6985	0.39175	
	16.000	34.486	2.8712	2.0547	1.3974	2.0953	0.89006		28.000	76.490	9.1095	3.6836	2.4730	0.6500	0.38301	
	18.000	36.692	3.2165	2.2025	1.4604	1.9964	0.85451		26.000	78.142	9.2307	3.7020	2.4934	0.6149	0.37709	
	20.000	39.025	3.5904	2.3505	1.5275	1.8950	0.81511		24.000	79.533	9.3212	3.7156	2.5087	0.5878	0.37275	
2.90	2.000	41.505	3.9948	2.4982	1.5991	1.7906	0.77258		22.000	80.750	9.3915	3.7260	2.5205	0.5660	0.36942	
	4.000	44.160	4.4325	2.6451	1.6757	1.6825	0.72766		20.000	81.843	9.4475	3.7343	2.5300	0.5482	0.36680	
	6.000	47.042	4.9089	2.7916	1.7585	1.5692	0.68081		18.000	82.845	9.4928	3.7409	2.5376	0.5335	0.36469	
	8.000	50.247	5.4345	2.9391	1.8490	1.4481	0.63219		16.000	83.775	9.5296	3.7462	2.5438	0.5212	0.36299	
	10.000	53.992	6.0344	3.0917	1.9518	1.3127	0.58089		14.000	84.651	9.5597	3.7506	2.5489	0.5111	0.36161	
	12.000	59.037	6.8013	3.2659	2.0825	1.8285	0.52183		12.000	85.484	9.5842	3.7541	2.5530	0.5027	0.36049	
	14.000	65.097	7.6294	3.4320	2.2230	2.0825	0.46580		10.000	86.283	9.6038	3.7570	2.5563	0.4959	0.35960	
	16.000	70.389	8.2421	3.5425	2.3266	2.3266	0.42903		8.000	87.055	9.6191	3.7592	2.5588	0.4906	0.35890	
	18.000	73.893	8.5802	3.5995	2.3837	2.3837	0.40130		6.000	87.808	9.6306	3.7608	2.5608	0.4865	0.35838	
	20.000	76.127	8.7648	3.6295	2.4149	2.4149	0.38588		4.000	88.546	9.6387	3.7620	2.5621	0.4836	0.35802	
2.95	2.000	77.855	8.8902	3.6495	2.4360	0.6220	0.40050		2.000	89.275	9.6434	3.7626	2.5629	0.4819	0.35780	
	4.000	79.297	8.9827	3.6640	2.4516	0.5938	0.38933									
	6.000	80.552	9.0543	3.6751	2.4637	0.5713	0.38574	2.95	2.000	21.216	1.1630	1.1138	1.0442	2.8500	0.99965	
	8.000	81.676	9.1110	3.6838	2.4733	0.5530	0.38294		4.000	22.708	1.3464	1.2357	1.0895	2.7526	0.99732	
	10.000	82.702	9.1567	3.6908	2.4810	0.5379	0.38069		6.000	24.294	1.5518	1.3654	1.1366	2.6563	0.99142	
	12.000	83.655	9.1938	3.6964	2.4872	0.5253	0.37888		8.000	25.974	1.7807	1.5017	1.1858	2.5604	0.98074	
	14.000	84.549	9.2241	3.7010	2.4923	0.5150	0.37741		10.000	27.749	2.0343	1.6437	1.2377	2.4640	0.96454	
	16.000	85.399	9.2486	3.7047	2.4964	0.5064	0.37623		12.000	29.621	2.3137	1.7901	1.2925	2.3668	0.94252	
	18.000	86.213	9.2683	3.7077	2.4998	0.4995	0.37528		14.000	31.593	2.6199	1.9396	1.3507	2.2682	0.91475	
	20.000	87.001	9.2836	3.7100	2.5023	0.4940	0.37454		16.000	33.670	2.9540	2.0911	1.4126	2.1679	0.88168	
2.90	2.000	87.768	9.2952	3.7117	2.5043	0.4899	0.37399		18.000	35.856	3.3169	2.2434	1.4785	2.0658	0.84398	
	4.000	88.520	9.3033	3.7129	2.5057	0.4870	0.37360		20.000	38.164	3.7098	2.3954	1.5487	1.9615	0.80249	
	6.000	89.262	9.3080	3.7136	2.5065	0.4853	0.37338		22.000	40.607	4.1344	2.5464	1.6236	1.8546	0.75809	
	8.000								24.000	43.211	4.5930	2.6959	1.7037	1.7444	0.71160	
	10.000								26.000	46.018	5.0902	2.8441	1.7898	1.6297	0.66366	
	12.000								28.000	49.102	5.6343	2.9916	1.8833	1.5085	0.61460	
	14.000								30.000	52.618	6.2438	3.1414	1.9876	1.3762	0.56404	
	16.000															
	18.000															
	20.000															

Oblique Shock  $p_9$

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
2.95	32.000	56.997	6.9741	3.3023	2.1119	1.2199	0.50950	3.00	14.000	84.837	10.2483	3.8459	2.6647	0.5038	0.33180
	33.726	65.193	8.1990	3.5350	2.3194	0.9528	0.43150		12.000	85.638	10.2726	3.8491	2.6688	0.4958	0.33081
	32.000	72.020	9.0188	3.6696	2.4577	0.7585	0.38752		10.000	86.408	10.2921	3.8517	2.6721	0.4892	0.33001
	30.000	74.838	9.2917	3.7112	2.5037	0.6877	0.37416		8.000	87.154	10.3074	3.8537	2.6747	0.4841	0.32939
	28.000	76.821	9.4585	3.7359	2.5318	0.6420	0.36628		6.000	87.881	10.3190	3.8553	2.6766	0.4801	0.32892
	26.000	78.407	9.5762	3.7530	2.5516	0.6084	0.36086		4.000	88.594	10.3270	3.8563	2.6779	0.4774	0.32860
	24.000	79.752	9.6649	3.7657	2.5666	0.5821	0.35684		2.000	89.299	10.3318	3.8569	2.6787	0.4757	0.32841
	22.000	80.935	9.7342	3.7755	2.5782	0.5610	0.35374								
	20.000	82.000	9.7896	3.7834	2.5875	0.5437	0.35128								
	18.000	82.978	9.8345	3.7896	2.5951	0.5293	0.34931	3.05	2.000	20.530	1.1681	1.1173	1.0455	2.9462	0.99962
	16.000	83.889	9.8712	3.7947	2.6013	0.5173	0.34771		4.000	22.014	1.3581	1.2433	1.0923	2.8450	0.99708
	14.000	84.747	9.9012	3.7989	2.6063	0.5074	0.34641		6.000	23.591	1.5716	1.3774	1.1409	2.7451	0.99066
	12.000	85.563	9.9255	3.8023	2.6104	0.4992	0.34536		8.000	25.263	1.8100	1.5186	1.1919	2.6457	0.97909
	10.000	86.348	9.9450	3.8050	2.6137	0.4925	0.34452		10.000	27.031	2.0749	1.6656	1.2458	2.5458	0.96158
	8.000	87.106	9.9604	3.8071	2.6163	0.4872	0.34386		12.000	28.895	2.3674	1.8171	1.3029	2.4450	0.93788
	6.000	87.845	9.9719	3.8087	2.6182	0.4832	0.34336		14.000	30.859	2.6886	1.9717	1.3636	2.3429	0.90814
	4.000	88.571	9.9799	3.8098	2.6196	0.4804	0.34302		16.000	32.923	3.0394	2.1281	1.4282	2.2392	0.87292
	2.000	89.288	9.9847	3.8104	2.6204	0.4788	0.34282		18.000	35.095	3.4208	2.2848	1.4972	2.1338	0.83303
									20.000	37.382	3.8338	2.4408	1.5707	2.0263	0.78944
									22.000	39.797	4.2796	2.5952	1.6490	1.9166	0.74317
3.00	2.000	20.867	1.1656	1.1155	1.0449	2.8981	0.99963		24.000	42.361	4.7607	2.7474	1.7328	1.8039	0.69513
	4.000	22.355	1.3522	1.2395	1.0909	2.7988	0.99721		26.000	45.110	5.2806	2.8973	1.8226	1.6874	0.64608
	6.000	23.936	1.5616	1.3714	1.1387	2.7008	0.99105		28.000	48.102	5.8462	3.0455	1.9196	1.5654	0.59649
	8.000	25.611	1.7953	1.5101	1.1888	2.6031	0.97993		30.000	51.455	6.4722	3.1938	2.0265	1.4345	0.54630
	10.000	27.383	2.0545	1.6546	1.2417	2.5050	0.96308		32.000	55.456	7.1967	3.3478	2.1497	1.2858	0.49412
	12.000	29.251	2.3404	1.8036	1.2977	2.4060	0.94022		34.000	61.505	8.2161	3.5380	2.3222	1.0765	0.43052
	14.000	31.218	2.6540	1.9556	1.3571	2.3056	0.91148		36.000	65.288	8.7895	3.6335	2.4190	0.9552	0.39922
	16.000	33.288	2.9964	2.1095	1.4204	2.2037	0.87734		38.000	68.742	9.2596	3.7064	2.4983	0.8514	0.37570
	18.000	35.467	3.3685	2.2641	1.4878	2.1000	0.83855		40.000	73.184	9.7779	3.7817	2.5856	0.7291	0.35180
	20.000	37.764	3.7713	2.4181	1.5596	1.9941	0.79602		42.000	75.604	10.0154	3.8146	2.6255	0.6689	0.34151
	22.000	40.192	4.2064	2.5708	1.6362	1.8858	0.75068		44.000	77.406	10.1703	3.8355	2.6516	0.6276	0.33501
	24.000	42.775	4.6761	2.7216	1.7181	1.7744	0.70340		46.000	78.880	10.2825	3.8505	2.6705	0.5965	0.33040
	26.000	45.552	5.1844	2.8706	1.8060	1.6589	0.65491		48.000	80.145	10.3683	3.8617	2.6849	0.5719	0.32694
	28.000	48.586	5.7388	3.0184	1.9012	1.5374	0.60560		50.000	81.287	10.4361	3.8705	2.6963	0.5518	0.32423
	30.000	52.014	6.3559	3.1673	2.0067	1.4059	0.55526		52.000	82.284	10.4906	3.8776	2.7055	0.5353	0.32208
	32.000	56.182	7.0810	3.3244	2.1300	1.2541	0.50205		54.000	83.221	10.5350	3.8833	2.7129	0.5215	0.32034
	34.000	63.673	8.2682	3.5470	2.3310	1.0029	0.42755		56.000	84.095	10.5714	3.8879	2.7190	0.5100	0.31892
	36.000	65.241	8.4917	3.5848	2.3688	0.9540	0.41510		58.000	84.921	10.6012	3.8917	2.7240	0.5005	0.31777
	38.000	66.749	8.6971	3.6186	2.4035	0.9083	0.40406		60.000	85.709	10.6255	3.8948	2.7281	0.4926	0.31683
	40.000	72.642	9.3988	3.7271	2.5217	0.7428	0.36908		62.000	86.466	10.6450	3.8973	2.7314	0.4861	0.31608
	42.000	75.239	9.6517	3.7638	2.5643	0.6779	0.35743		64.000	87.199	10.6603	3.8992	2.7340	0.4810	0.31549
	44.000	77.126	9.8121	3.7865	2.5913	0.6345	0.35029		66.000	87.914	10.6719	3.9007	2.7359	0.4772	0.31505
	46.000	78.652	9.9268	3.8024	2.6106	0.6022	0.34530		68.000	88.617	10.6799	3.9017	2.7373	0.4744	0.31474
	48.000	79.956	10.0139	3.8144	2.6253	0.5768	0.34157		70.000	89.310	10.6847	3.9023	2.7381	0.4728	0.31456
	50.000	81.106	10.0824	3.8237	2.6368	0.5563	0.33868								
	52.000	82.147	10.1373	3.8311	2.6460	0.5394	0.33638								
	54.000	83.103	10.1819	3.8371	2.6536	0.5253	0.33453	3.10	2.000	20.205	1.1707	1.1190	1.0462	2.9942	0.99960
	56.000	83.996	10.2184	3.8420	2.6597	0.5136	0.33302		4.000	21.684	1.3640	1.2471	1.0937	2.8911	0.99696



# Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
3.20	22.00	81.694	11.5307	4.0035	2.8802	0.5398	0.28438	3.30	2.00	19.009	1.1812	1.1262	1.0489	3.1858	0.99953
	20.00	82.649	11.5844	4.0096	2.8992	0.5243	0.28260		4.00	20.475	1.3880	1.2626	1.0993	3.0748	0.99642
	18.00	83.533	11.6285	4.0146	2.8966	0.5113	0.28115		6.00	22.039	1.6222	1.4082	1.1520	2.9653	0.98858
	16.00	84.363	11.6647	4.0187	2.9026	0.5004	0.27996		8.00	23.699	1.8859	1.5617	1.2076	2.8563	0.97453
	14.00	85.147	11.6945	4.0220	2.9076	0.4913	0.27899		10.00	25.457	2.1807	1.7216	1.2666	2.7468	0.95347
	12.00	85.897	11.7188	4.0247	2.9117	0.4837	0.27820		12.00	27.310	2.5078	1.8861	1.3296	2.6364	0.92526
	10.00	86.619	11.7385	4.0269	2.9150	0.4776	0.27757		14.00	29.261	2.8688	2.0536	1.3970	2.5248	0.89031
	8.00	87.320	11.7539	4.0286	2.9176	0.4727	0.27707		16.00	31.308	3.2640	2.2219	1.4690	2.4118	0.84954
	6.00	88.003	11.7655	4.0298	2.9196	0.4690	0.27669		18.00	33.456	3.6947	2.3898	1.5460	2.2974	0.80409
	4.00	88.675	11.7736	4.0308	2.9209	0.4664	0.27643		20.00	35.710	4.1617	2.5557	1.6284	2.1813	0.75527
	2.00	89.340	11.7784	4.0313	2.9217	0.4649	0.27628		22.00	38.077	4.6655	2.7184	1.7163	2.0636	0.70444
									24.00	40.573	5.2081	2.8773	1.8101	1.9439	0.65272
									26.00	43.222	5.7918	3.0318	1.9103	1.8215	0.60108
									28.00	46.062	6.4212	3.1822	2.0178	1.6955	0.55020
									30.00	49.163	7.1057	3.3294	2.1342	1.5638	0.50034
									32.00	52.667	7.8658	3.4758	2.2630	1.4218	0.45116
									34.00	56.963	8.7622	3.6291	2.4144	1.2575	0.40064
									35.882	65.518	10.3564	3.8602	2.6929	0.32741	
									34.000	72.501	11.3896	3.9873	2.8565	0.28914	
									32.000	89.402	12.1408	4.0706	2.9825	0.25702	
									30.000	77.029	11.8983	4.0445	2.9418	0.6336	
									28.000	78.535	12.0364	4.0595	2.9650	0.5993	
									26.000	79.812	12.1408	4.0706	2.9825	0.5725	
									24.000	80.932	12.2227	4.0793	2.9963	0.5507	
									22.000	81.938	12.2884	4.0862	3.0073	0.5328	
									20.000	82.859	12.3420	4.0918	3.0163	0.5178	
									18.000	83.714	12.3860	4.0964	3.0236	0.5052	
									16.000	84.517	12.4223	4.1001	3.0297	0.4946	
									14.000	85.278	12.4523	4.1032	3.0348	0.4858	
									12.000	86.007	12.4767	4.1057	3.0389	0.4785	
									10.000	86.708	12.4964	4.1077	3.0422	0.4725	
									8.000	87.390	12.5120	4.1093	3.0448	0.4677	
									6.000	88.056	12.5237	4.1105	3.0467	0.4641	
									4.000	88.710	12.5319	4.1114	3.0481	0.4616	
									2.000	89.357	12.5367	4.1119	3.0489	0.4601	
															0.25332
															0.25504
															0.25448
															0.25403
															0.25369
															0.25346
															0.25332
															0.99951
															0.99628
															0.98812
															0.97354
															0.95172
															0.92257
															0.88654
															0.84462
															0.79804
															0.74822
															0.69650





### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
3.45	16.000	84.720	13.6020	4.2145	3.2275	0.4869	0.22521	3.55	2.000	17.715	1.1947	1.1353	1.0523	3.4246	0.99943
	14.000	85.451	13.6322	4.2172	3.2325	0.4784	0.22448		4.000	19.170	1.4187	1.2822	1.1065	3.3029	0.99566
	12.000	86.151	13.6570	4.2195	3.2367	0.4714	0.22388		6.000	20.726	1.6748	1.4396	1.1634	3.1829	0.98619
	10.000	86.826	13.6770	4.2213	3.2400	0.4656	0.22340		8.000	22.383	1.9653	1.6059	1.2238	3.0633	0.96935
	8.000	87.482	13.6928	4.2227	3.2427	0.4610	0.22302		10.000	24.138	2.2920	1.7791	1.2883	2.9433	0.94435
	6.000	88.125	13.7047	4.2238	3.2447	0.4575	0.22273		12.000	25.989	2.6566	1.9569	1.3576	2.8224	0.91123
	4.000	88.756	13.7130	4.2245	3.2461	0.4551	0.22253		14.000	27.936	3.0603	2.1370	1.4321	2.7003	0.87077
	2.000	89.379	13.7180	4.2250	3.2469	0.4536	0.22241		16.000	29.977	3.5040	2.3174	1.5121	2.5771	0.82424
									18.000	32.115	3.9877	2.4961	1.5980	2.4526	0.77322
3.50	2.000	17.958	1.1920	1.1335	1.0516	3.3769	0.99945		20.000	34.352	4.5148	2.6714	1.6901	2.3271	0.71939
	4.000	19.415	1.4125	1.2783	1.1050	3.2574	0.99582		22.000	36.692	5.0827	2.8419	1.7885	2.2005	0.66437
	6.000	20.972	1.6642	1.4333	1.1611	3.1396	0.98669		24.000	39.149	5.6937	3.0069	1.8935	2.0727	0.60946
	8.000	22.629	1.9491	1.5970	1.2205	3.0222	0.97044		26.000	41.738	6.3495	3.1659	2.0056	1.9434	0.55575
	10.000	24.384	2.2693	1.7675	1.2839	2.9044	0.94626		28.000	44.488	7.0535	3.1870	2.1254	1.8117	0.50395
	12.000	26.236	2.6262	1.9426	1.3519	2.7856	0.91415		30.000	47.447	7.8120	3.1660	2.2539	1.6762	0.45445
	14.000	28.182	3.0211	2.1202	1.4249	2.6657	0.87481		32.000	50.705	8.6392	3.0922	2.3937	1.5342	0.40714
	16.000	30.225	3.4549	2.2982	1.5033	2.5445	0.82942		34.000	54.463	9.5691	2.9204	2.5504	1.3790	0.36118
	18.000	32.363	3.9283	2.4747	1.5874	2.4222	0.77952		36.000	59.399	10.7262	2.7450	2.7450	1.1885	0.31299
	20.000	34.602	4.4421	2.6482	1.6774	2.2986	0.72668		38.000	65.729	12.0520	2.4612	2.9676	0.9651	0.26768
	22.000	36.947	4.9969	2.8173	1.7737	2.1739	0.67245		40.000	74.353	13.4667	2.2021	3.2048	0.7018	0.22854
	24.000	39.410	5.5936	2.9811	1.8764	2.0478	0.61813		42.000	76.427	13.7265	2.0227	3.2483	0.6473	0.22221
	26.000	42.009	6.2345	3.1392	1.9860	1.9199	0.56478		44.000	78.025	13.9033	1.9215	3.2779	0.6083	0.21803
	28.000	44.774	6.9227	3.2916	2.1032	1.7894	0.51313		46.000	79.351	14.0342	1.8250	3.2998	0.5782	0.21501
	30.000	47.755	7.6654	3.4388	2.2291	1.6549	0.46353		48.000	80.497	14.1355	1.7268	3.3168	0.5541	0.21271
	32.000	51.053	8.4777	3.5825	2.3664	1.5131	0.41586		50.000	81.517	14.2163	1.6267	3.3303	0.5343	0.21090
	34.000	54.888	9.3968	3.7268	2.5214	1.3570	0.36917		52.000	82.442	14.2819	1.5243	3.3413	0.5178	0.20944
	36.000	60.090	10.5715	3.8879	2.7191	1.1594	0.31891		54.000	83.294	14.3358	1.4289	3.3503	0.5039	0.20826
	36.867	65.689	11.7027	4.0229	2.9090	0.9643	0.27872		56.000	84.090	14.3804	1.3378	3.3578	0.4922	0.20729
	36.000	70.545	12.5396	4.1121	3.0494	0.8105	0.25324		58.000	84.839	14.4173	1.2528	3.3640	0.4823	0.20649
	34.000	74.048	13.0455	4.1623	3.1342	0.7098	0.23934		60.000	85.552	14.4478	1.1744	3.3691	0.4740	0.20583
	32.000	76.207	13.3126	4.1877	3.1790	0.6529	0.23241		62.000	86.235	14.4729	1.1015	3.3733	0.4671	0.20529
	30.000	77.851	13.4920	4.2044	3.2090	0.6128	0.22791		64.000	86.895	14.4931	1.0334	3.3767	0.4615	0.20485
	28.000	79.207	13.6238	4.2165	3.2311	0.5820	0.22468		66.000	87.537	14.5091	0.9704	3.3794	0.4570	0.20451
	26.000	80.375	13.7255	4.2256	3.2481	0.5574	0.22223		68.000	88.165	14.5212	0.9114	3.3814	0.4535	0.20425
	24.000	81.413	13.8064	4.2329	3.2617	0.5373	0.22031		70.000	88.782	14.5296	0.8564	3.3828	0.4511	0.20407
	22.000	82.352	13.8719	4.2387	3.2727	0.5205	0.21877		72.000	89.392	14.5346	0.8049	3.3836	0.4497	0.20397
	20.000	83.216	13.9256	4.2435	3.2817	0.5065	0.21751								
	18.000	84.022	13.9700	4.2474	3.2891	0.4946	0.21649								
	16.000	84.781	14.0067	4.2506	3.2952	0.4846	0.21564	3.60	2.000	17.479	1.1973	1.1371	1.0530	3.4722	0.99940
	14.000	85.503	14.0371	4.2532	3.3003	0.4762	0.21494		4.000	18.932	1.4250	1.2862	1.1079	3.3482	0.99549
	12.000	86.194	14.0620	4.2554	3.3045	0.4692	0.21438		6.000	20.488	1.6857	1.4461	1.1657	3.2260	0.98567
	10.000	86.862	14.0822	4.2578	3.3079	0.4635	0.21392		8.000	22.144	1.9816	1.6149	1.2271	3.1043	0.96824
	8.000	87.510	14.0980	4.2585	3.3105	0.4590	0.21356		10.000	23.899	2.3149	1.7907	1.2927	2.9821	0.94241
	6.000	88.145	14.1100	4.2596	3.3125	0.4555	0.21329		12.000	25.751	2.6873	1.9711	1.3633	2.8590	0.90827
	4.000	88.769	14.1184	4.2603	3.3139	0.4531	0.21310		14.000	27.698	3.0999	2.1538	1.4393	2.7347	0.86667
	2.000	89.386	14.1234	4.2607	3.3148	0.4516	0.21298		16.000	29.740	3.5540	2.3366	1.5210	2.6092	0.81895
									18.000	31.876	4.0498	2.5174	1.6088	2.4827	0.76685



**Oblique Shock Tables ( $\gamma = 1.4$ )**

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
3.70	20.00	83.507	15.6008	4.3797	3.5621	0.4969	0.18289	3.75	2.000	89.416	16.2379	4.4261	3.6687	0.4428	0.17169
	18.00	84.274	15.6460	4.3831	3.5696	0.4856	0.18206								
	16.00	84.998	15.6836	4.3859	3.5759	0.4760	0.18138	3.80	2.000	16.600	1.2083	1.1445	1.0558	3.6624	0.99931
	14.00	85.687	15.7147	4.3882	3.5811	0.4680	0.18082	4.000	4.000	18.048	1.4503	1.3022	1.1137	3.5291	0.99479
	12.00	86.348	15.7402	4.3901	3.5854	0.4613	0.18035	6.000	6.000	19.602	1.7294	1.4718	1.1750	3.3978	0.98349
	10.00	86.988	15.7609	4.3916	3.5889	0.4558	0.17998	8.000	8.000	21.258	2.0480	1.6511	1.2404	3.2669	0.96355
	8.000	87.610	15.7772	4.3928	3.5916	0.4515	0.17969	10.000	10.000	23.016	2.4088	1.8377	1.3108	3.1354	0.93423
	6.000	88.219	15.7896	4.3937	3.5937	0.4481	0.17947	12.000	12.000	24.872	2.8134	2.0288	1.3867	3.0031	0.89586
	4.000	88.817	15.7982	4.3944	3.5951	0.4458	0.17932	14.000	14.000	26.821	3.2631	2.2216	1.4688	2.8697	0.84963
	2.000	89.411	15.8033	4.3947	3.5960	0.4444	0.17922	16.000	16.000	28.864	3.7592	2.4137	1.5575	2.7353	0.79728
3.75	2.000	16.810	1.2055	1.1426	1.0551	3.6149	0.99933								
	4.000	18.260	1.4440	1.2982	1.1123	3.4840	0.99497	20.000	20.000	33.229	4.8923	2.7867	1.7556	2.6001	0.74088
	6.000	19.814	1.7184	1.4654	1.1727	3.3550	0.98405	22.000	22.000	35.556	5.5299	2.9644	1.8654	2.4644	0.68241
	8.000	21.470	2.0312	1.6420	1.2370	3.2264	0.96476	24.000	24.000	37.989	6.2157	3.1348	1.9828	2.3283	0.62373
	10.000	23.227	2.3849	1.8258	1.3062	3.0974	0.93634	26.000	26.000	40.542	6.9510	3.2975	2.1080	2.0548	0.51113
	12.000	25.081	2.7813	2.0142	1.3808	2.9674	0.89905	28.000	28.000	43.234	7.7378	3.4523	2.2414	1.9166	0.45902
	14.000	27.030	3.2217	2.2046	1.4614	2.8363	0.85397	30.000	30.000	46.105	8.5816	3.5997	2.3840	1.7761	0.41022
	16.000	29.072	3.7069	2.3942	1.5482	2.7042	0.80280	32.000	32.000	49.218	9.4923	3.7408	2.5375	1.6313	0.36471
	18.000	31.207	4.2379	2.5813	1.6417	2.5712	2.5712	34.000	34.000	52.702	10.4420	3.8780	2.7060	1.4778	0.32194
	20.000	33.438	4.8148	2.7637	1.7422	2.4376	2.4376	36.000	36.000	56.894	11.6543	4.0175	2.9009	1.3044	0.28030
22.000	35.767	5.4382	2.9401	1.8497	1.8497	2.3034	0.63185	38.092	38.092	65.921	13.8756	4.2390	3.2733	0.9690	0.21868
	38.204	6.1086	3.1095	1.9645	1.9645	2.1688	0.57486	38.000	38.000	67.568	14.2269	4.2696	3.3321	0.9133	0.21066
	40.762	6.8272	3.2714	2.0869	2.0869	2.0333	0.51996	36.000	36.000	73.114	15.2586	4.3536	3.5048	0.7394	0.18932
	43.464	7.5969	3.4259	2.2175	2.2175	1.8964	0.46786	34.000	34.000	75.572	15.6341	4.3822	3.5676	0.6701	0.18228
	46.350	8.4228	3.5733	2.3572	2.3572	1.7570	0.41888	32.000	32.000	77.342	15.8710	4.3997	3.6073	0.6238	0.17802
	49.486	9.3159	3.7148	2.5078	2.5078	1.6129	0.37300	30.000	30.000	78.762	16.0402	4.4120	3.6356	0.5892	0.17506
	53.014	10.3013	3.8529	2.6736	2.6736	1.4594	0.32964	28.000	28.000	79.967	16.1687	4.4212	3.6571	0.5619	0.17286
	57.310	11.4538	3.9947	2.8672	2.8672	1.2839	0.28696	26.000	26.000	81.022	16.2697	4.4284	3.6740	0.5397	0.17116
	65.884	13.5007	4.2052	3.2105	3.2105	0.9683	0.22770	24.000	24.000	81.969	16.3512	4.4341	3.6876	0.5213	0.16980
	77.180	14.8041	4.3176	3.4287	3.4287	0.7481	0.19834	22.000	22.000	82.833	16.4178	4.4387	3.6988	0.5058	0.16870
30.000	83.631	15.1917	4.3484	3.4936	3.4936	0.6755	0.19061	20.000	20.000	83.634	16.4729	4.4426	3.7080	0.4927	0.16780
	79.856	15.4318	4.3669	3.5338	3.5338	0.6280	0.18602	18.000	18.000	84.383	16.5186	4.4457	3.7156	0.4816	0.16706
	80.927	15.6021	4.3798	3.5623	3.5623	0.5926	0.18286	16.000	16.000	85.092	16.5567	4.4484	3.7220	0.4723	0.16644
	81.887	15.7307	4.3894	3.5838	3.5838	0.5649	0.18053	14.000	14.000	85.767	16.5882	4.4505	3.7273	0.4644	0.16594
	82.762	15.8316	4.3968	3.6007	3.6007	0.5423	0.17872	12.000	12.000	86.415	16.6141	4.4523	3.7316	0.4578	0.16552
	82.762	15.9128	4.4028	3.6143	3.6143	0.5237	0.17728	10.000	10.000	87.043	16.6352	4.4537	3.7351	0.4524	0.16518
	83.572	15.9792	4.4076	3.6294	3.6294	0.5080	0.17612	8.000	8.000	87.653	16.6518	4.4549	3.7379	0.4481	0.16492
	84.330	16.0399	4.4115	3.6345	3.6345	0.4948	0.17517	6.000	6.000	88.251	16.6643	4.4557	3.7400	0.4448	0.16472
	85.045	16.0794	4.4148	3.6422	3.6422	0.4836	0.17439	4.000	4.000	88.839	16.6731	4.4563	3.7414	0.4426	0.16458
	85.727	16.1172	4.4175	3.6485	3.6485	0.4741	0.17374	2.000	2.000	89.421	16.6783	4.4567	3.7423	0.4412	0.16450
12.000	86.382	16.1485	4.4198	3.6537	3.6537	0.4662	0.17321								
	16.1743	16.1743	4.4216	3.6580	3.6580	0.4595	0.17277								
	16.1951	16.1951	4.4231	3.6615	3.6615	0.4541	0.17242	3.85	2.000	16.395	1.2110	1.1463	1.0564	3.7099	0.99928
	16.2116	16.2116	4.4242	3.6643	3.6643	0.4498	0.17214	4.000	4.000	17.843	1.4568	1.3063	1.1152	3.5741	0.99460
	16.2240	16.2240	4.4251	3.6663	3.6663	0.4465	0.17193	6.000	6.000	19.396	1.7405	1.4783	1.1773	3.4404	0.98291
	16.2327	16.2327	4.4257	3.6678	3.6678	0.4441	0.17178	8.000	8.000	21.053	2.0650	1.6603	1.2438	3.3071	0.96231

Oblique Shock p16

# Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{p_2}{p_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
3.85	10.000	22.812	2.4328	1.8495	1.3153	3.1734	0.93209	3.90	24.000	37.584	6.4345	3.1853	2.0201	2.2371	0.54918
	12.000	24.668	2.8456	2.0432	1.3927	3.0386	0.89264		26.000	40.126	7.2035	3.3492	2.1508	2.0968	0.49366
	14.000	26.619	3.3050	2.2386	1.4764	2.9028	0.84523		28.000	42.802	8.0258	3.5046	2.2901	1.9558	0.44158
	16.000	28.664	3.8121	2.4330	1.5668	2.7661	0.79172		30.000	45.646	8.9059	3.6519	2.4387	1.8131	0.39322
	18.000	30.799	4.3670	2.6239	1.6643	2.6287	0.73428		32.000	48.716	9.8536	3.7923	2.5983	1.6668	0.34848
	20.000	33.028	4.9706	2.8097	1.7691	2.4909	0.67493		34.000	52.126	10.8901	3.9278	2.7726	1.5130	0.30686
	22.000	35.353	5.6230	2.9887	1.8814	2.3529	0.61558		36.000	56.149	12.0723	4.0633	2.9710	1.3425	0.26706
	24.000	37.783	6.3245	3.1601	2.0013	2.2146	0.55770		38.000	62.087	13.6897	4.2224	3.2421	1.1106	0.22309
	26.000	40.330	7.0764	3.3234	2.1293	2.0760	0.50236		38.445	64.901	14.6407	4.3043	3.4014	0.9704	0.20173
	28.000	43.014	7.8808	3.4785	2.2656	1.9364	0.45026		38.000	69.501	15.4023	4.3647	3.5289	0.8527	0.18658
	30.000	45.871	8.7425	3.6259	2.4111	1.7948	0.40167		36.000	73.678	16.1768	4.4218	3.6584	0.7240	0.17273
	32.000	48.961	9.6715	3.7666	2.5677	1.6493	0.35654		34.000	75.956	16.9334	4.4468	3.7181	0.6660	0.16682
	34.000	52.407	10.6904	3.9030	2.7390	1.4957	0.31434		32.000	77.640	17.6653	4.4738	3.7569	0.6160	0.16313
	36.000	56.508	11.8605	4.0404	2.9355	1.3239	0.27366		30.000	79.006	18.3330	4.4823	3.7849	0.5828	0.16052
	38.000	62.939	13.5472	4.2095	3.2183	1.0767	0.22655		28.000	80.172	19.0613	4.4890	3.8064	0.5563	0.15857
	38.272	65.956	14.2556	4.2721	3.3369	0.9697	0.21003		26.000	81.199	19.71629	4.4890	3.8234	0.5347	0.15705
	38.000	68.733	15.1716	4.3214	3.4366	0.8764	0.19738		24.000	82.121	20.2449	4.4943	3.8371	0.5168	0.15583
	36.000	73.407	16.0813	4.3683	3.5814	0.7314	0.18079		22.000	82.966	21.3122	4.4986	3.8483	0.5016	0.15485
	34.000	75.770	16.9813	4.4150	3.6425	0.6649	0.17436		20.000	83.749	22.4143	4.5022	3.8576	0.4888	0.15404
	32.000	77.495	16.3155	4.4316	3.6816	0.6198	0.17039		18.000	84.483	23.5113	4.5114	3.8654	0.4780	0.15337
30.000	78.888	16.4839	4.4433	3.7098	0.5859	0.16762		16.000	85.177	24.5929	4.5076	3.8718	0.4688	0.15281	
28.000	80.072	16.6122	4.4522	3.7313	0.5591	0.16555		14.000	85.840	25.6600	4.5097	3.8772	0.4610	0.15235	
26.000	81.112	16.7135	4.4591	3.7482	0.5372	0.16394		12.000	86.477	26.7113	4.5114	3.8816	0.4545	0.15198	
24.000	82.047	16.7952	4.4646	3.7619	0.5190	0.16266		10.000	87.093	27.5327	4.5127	3.8852	0.4492	0.15167	
22.000	82.901	16.8622	4.4691	3.7731	0.5037	0.16162		8.000	87.693	28.1992	4.5138	3.8880	0.4450	0.15143	
20.000	83.692	16.9175	4.4728	3.7823	0.4907	0.16076		6.000	88.280	28.8280	4.5146	3.8901	0.4418	0.15125	
18.000	84.434	16.9636	4.4758	3.7900	0.4798	0.16006		4.000	88.858	29.4151	4.5151	3.8916	0.4395	0.15113	
16.000	85.136	17.0019	4.4784	3.7964	0.4705	0.15947		2.000	89.430	30.0386	4.5155	3.8925	0.4382	0.15105	
14.000	85.804	17.0337	4.4805	3.8017	0.4627	0.15899									
12.000	86.447	17.0598	4.4822	3.8061	0.4561	0.15859									
10.000	87.068	17.0810	4.4836	3.8097	0.4508	0.15827		3.95	2.000	16.001	1.2166	1.1500	1.0578	3.8047	0.99923
8.000	87.674	17.0978	4.4847	3.8125	0.4465	0.15802		4.000	17.447	17.447	1.4697	1.3144	1.1182	3.6641	0.99421
6.000	88.266	17.1104	4.4855	3.8146	0.4433	0.15783		6.000	19.001	19.001	1.7630	1.4915	1.1821	3.5255	0.98171
4.000	88.849	17.1193	4.4861	3.8161	0.4410	0.15770		8.000	20.660	20.660	2.0992	1.6786	1.2506	3.3874	0.95977
2.000	89.426	17.1245	4.4865	3.8169	0.4397	0.15762		10.000	22.422	22.422	2.4815	1.8734	1.3246	3.2486	0.92768
								12.000	24.280	24.280	2.9112	2.0724	1.4048	3.1090	0.88602
								14.000	26.234	26.234	3.3902	2.2727	1.4917	2.9684	0.83626
								16.000	28.281	28.281	3.9194	2.4716	1.5858	2.8270	0.78046
								18.000	30.417	30.417	4.4992	2.6664	1.6874	2.6851	0.72095
								20.000	32.646	32.646	5.1304	2.8554	1.7967	2.5430	0.65992
								22.000	34.969	34.969	5.8125	3.0370	1.9139	2.4010	0.59933
								24.000	37.393	37.393	6.5462	3.2103	2.0391	2.2591	0.54068
								26.000	39.929	39.929	7.3323	3.3748	2.1727	2.1172	0.48503
								28.000	42.598	42.598	8.1726	3.5304	2.3149	1.9748	0.43302
								30.000	45.431	45.431	9.0717	3.6778	2.4666	1.8310	0.38488
								32.000	48.483	48.483	10.0386	3.8178	2.6294	1.6838	0.34053
								34.000	51.859	51.859	11.0931	3.9524	2.8067	1.5299	0.29949
								36.000	55.812	55.812	12.2888	4.0863	3.0073	1.3604	0.26054
3.90	2.000	16.196	1.2138	1.1482	1.0571	3.7573	0.99926								
4.000	4.000	17.642	1.4633	1.3104	1.1167	3.6191	0.99441								
6.000	8.000	19.196	1.7517	1.4849	1.1797	3.4830	0.98232								
8.000	20.854	20.854	2.0821	1.6694	1.2472	3.3473	0.96106								
10.000	22.614	22.614	2.4570	1.8614	1.3200	3.2111	0.92990								
12.000	24.472	24.472	2.8783	2.0578	1.3987	3.0739	0.88935								
14.000	26.424	26.424	3.3474	2.2557	1.4840	2.9357	0.84077								
16.000	28.469	28.469	3.8655	2.4523	1.5763	2.7967	0.78611								
18.000	30.605	30.605	4.4329	2.6452	1.6758	2.6570	0.72761								
20.000	32.834	32.834	5.0501	2.8326	1.7828	2.5171	0.66743								
22.000	35.157	35.157	5.7171	3.0129	1.8975	2.3771	0.60746								

### Oblique Shock Tables ( $\gamma = 1.4$ )

$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$	$M_1$	$\theta$	$\beta$	$\frac{P_2}{P_1}$	$\frac{\rho_2}{\rho_1}$	$\frac{T_2}{T_1}$	$M_2$	$\frac{P_{02}}{P_{01}}$
3.95	38.000	61.406	13.8667	4.2383	3.2718	1.1389	0.21889	4.00	28.000	80.359	17.9765	4.5402	3.9594	0.5513	0.14555
	38.612	66.026	15.0309	4.3358	3.4667	0.9711	0.19376		26.000	81.359	18.0787	4.5464	3.9765	0.5302	0.14419
	38.000	70.101	15.9275	4.4038	3.6167	0.8345	0.17703		24.000	82.261	18.1615	4.5514	3.9903	0.5126	0.14310
	36.000	73.928	16.6412	4.4541	3.7361	0.7172	0.16509		22.000	83.087	18.2296	4.5555	4.0017	0.4978	0.14221
	34.000	76.131	16.9904	4.4776	3.7945	0.6554	0.15965		20.000	83.854	18.2861	4.5588	4.0111	0.4852	0.14148
	32.000	77.777	17.2203	4.4927	3.8330	0.6125	0.15620		18.000	84.574	18.3331	4.5616	4.0190	0.4746	0.14087
	30.000	79.120	17.3877	4.5035	3.8609	0.5798	0.15375		16.000	85.256	18.3723	4.5639	4.0255	0.4655	0.14037
	28.000	80.268	17.5161	4.5117	3.8824	0.5537	0.15191		14.000	85.907	18.4049	4.5659	4.0310	0.4579	0.13996
	26.000	81.281	17.6179	4.5181	3.8994	0.5324	0.15047		12.000	86.533	18.4317	4.5674	4.0355	0.4515	0.13962
	24.000	82.192	17.7003	4.5232	3.9132	0.5147	0.14932		10.000	87.139	18.4535	4.5687	4.0391	0.4463	0.13934
	22.000	83.028	17.7680	4.5274	3.9245	0.4997	0.14838		8.000	87.730	18.4707	4.5697	4.0420	0.4421	0.13912
	20.000	83.803	17.8241	4.5309	3.9339	0.4870	0.14761		6.000	88.307	18.4837	4.5705	4.0442	0.4390	0.13896
	18.000	84.529	17.8708	4.5338	3.9417	0.4762	0.14698		4.000	88.876	18.4928	4.5710	4.0457	0.4367	0.13885
	16.000	85.218	17.9097	4.5362	3.9482	0.4671	0.14645		2.000	89.439	18.4982	4.5713	4.0466	0.4354	0.13878
	14.000	85.874	17.9420	4.5381	3.9536	0.4594	0.14601								
	12.000	86.505	17.9686	4.5398	3.9581	0.4530	0.14566								
	10.000	87.116	17.9902	4.5411	3.9617	0.4477	0.14537								
	8.000	87.711	18.0072	4.5421	3.9645	0.4435	0.14514								
	6.000	88.294	18.0201	4.5429	3.9667	0.4404	0.14497								
	4.000	88.868	18.0291	4.5434	3.9682	0.4381	0.14485								
	2.000	89.435	18.0345	4.5438	3.9691	0.4368	0.14478								
4.00	2.000	15.813	1.2194	1.1519	1.0586	3.8521	0.99920								
	4.000	17.258	1.4763	1.3185	1.1196	3.7089	0.99401								
	6.000	18.812	1.7743	1.4980	1.1844	3.5679	0.98110								
	8.000	20.471	2.1166	1.6879	1.2540	3.4273	0.95845								
	10.000	22.234	2.5061	1.8853	1.3293	3.2860	0.92542								
	12.000	24.095	2.9445	2.0870	1.4109	3.1439	0.88264								
	14.000	26.050	3.4334	2.2898	1.4994	3.0009	0.83170								
	16.000	28.098	3.9741	2.4909	1.5954	2.8570	0.77474								
	18.000	30.236	4.5667	2.6877	1.6991	2.7128	0.71422								
	20.000	32.464	5.2116	2.8782	1.8107	2.5686	0.65240								
	22.000	34.786	5.9090	3.0611	1.9304	2.4246	0.59123								
	24.000	37.208	6.6592	3.2352	2.0583	2.2809	0.53224								
	26.000	39.740	7.4625	3.4002	2.1947	2.1374	0.47648								
	28.000	42.402	8.3215	3.5561	2.3401	1.9935	0.42453								
	30.000	45.224	9.2397	3.7034	2.4949	1.8485	0.37666								
	32.000	48.258	10.2259	3.8430	2.6609	1.7006	0.33272								
	34.000	51.605	11.2995	3.9768	2.8413	1.5463	0.29223								
	36.000	55.495	12.5100	4.1091	3.0444	1.3776	0.25409								
	38.000	60.827	14.0647	4.2556	3.3049	1.1637	0.21432								
	38.774	66.059	15.4261	4.3665	3.5329	0.9717	0.18613								
	38.000	70.601	16.4407	4.4403	3.7026	0.8196	0.16833								
	36.000	74.161	17.1095	4.4855	3.8144	0.7109	0.15785								
	34.000	76.297	17.4525	4.5076	3.8718	0.6511	0.15282								
	32.000	77.908	17.6808	4.5220	3.9099	0.6090	0.14959								
	30.000	79.227	17.8479	4.5324	3.9379	0.5769	0.14729								