NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE

No. 1673

TABLES AND CHARTS OF FLOW PARAMETERS ACROSS OBLIQUE SHOCKS

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SUMMARY

The oblique shock-wave equations have been solved for a range of Mach number in front of the shock from 1.05 to 4.0 and for a range of shock angle from a simple Mach wave to a normal shock. The results of these calculations are presented in tabular form and include values for the Mach number in front of the shock, the shock angle, the deviation of the flow across the shock, the Mach number behind the shock, the ratio of pressure behind the shock to pressure in front of the shock, the ratio of density in front of the shock to density behind the shock, and the change in entropy across the shock. Charts of several of these parameters are also presented.

INTRODUCTION

When a compression shock occurs in supersonic flow, the flow across the shock wave undergoes changes in its physical characteristics. These changes in characteristics of the flow behind the shock have been calculated in terms of similar characteristics of the flow in front of the shock from the fundamental shock-wave equations (reference 1). Calculations of values of some of the parameters most frequently used in supersonic studies have been presented in references 2 and 3. These computations, however, are limited in scope. More recently, reference 4 has been published to give a general survey of the equations, tables, and charts that are continually being used in research on supersonic flows. The material presented herein supplements and extends the information of reference 4. Because the nature of these computations is basic and the existence of such data would serve to avoid repetition of the same calculations in the future, an attempt has been made to present the results in a form that has already proved extremely useful for rapid calculations in the study of supersonic-flow problems and in supersonic design work.

SYMBOLS

M Mach number

p static pressure

ρ density

ϵ angle of the shock

δ angle of deviation of the flow behind the shock

β difference between angle of shock and deviation of the flow $(\epsilon - \delta)$

ΔS change in entropy across shock, feet^2 per second^2 per degree Fahrenheit

R gas constant for air (1715 ft^2/sec^2/°F)

γ ratio of specific heats (1.4 for air)

Subscripts

1 conditions in front of shock

2 conditions behind shock

m maximum

s sonic

SHOCK EQUATIONS

The flow conditions associated with the phenomena of shock in a supersonic stream are illustrated in figure 1. This diagram shows the angle of shock ϵ, the deviation of flow across the shock δ, and the angle of flow behind the shock with relation to the front of the shock β. The evaluation of the flow parameters following a shock are included herein for ready reference. The equations used for the present calculations were taken from reference 1 and are as follows:

The deviation of the flow across a shock wave is obtainable from the relation:

$$\frac{1}{\tan \delta} = \left(\frac{\gamma + 1}{2} \frac{M_1^2}{M_1^2 \sin^2\epsilon - 1} - 1\right) \tan \epsilon \qquad (1)$$

The value of the Mach number behind the shock is determined by

$$\frac{\tan \epsilon}{\tan \beta} = \frac{2}{\gamma + 1}\left(\frac{1}{M_2^2 \sin^2\beta} + \frac{\gamma - 1}{2}\right) \tag{2}$$

The ratio of the pressure behind the shock to the pressure in front of the shock is

$$\frac{p_2}{p_1} = \frac{2\gamma}{\gamma + 1}\left(M_1^2 \sin^2\epsilon - \frac{\gamma - 1}{2\gamma}\right) \tag{3}$$

and the ratio of density in front of the shock to density behind the shock is

$$\frac{\rho_1}{\rho_2} = \frac{2}{\gamma + 1}\left(\frac{1}{M_1^2 \sin^2\epsilon} + \frac{\gamma - 1}{2}\right) \tag{4}$$

The variation of entropy across the shock is given by the equation

$$\Delta S = \frac{R}{(\gamma - 1)}\left(\log_e \frac{p_2}{p_1} + \gamma \log_e \frac{\rho_1}{\rho_2}\right) \tag{5}$$

where

$$R = 1715 \text{ ft}^2/\text{sec}^2/^{\circ}\text{F}$$

The equation for the shock angle which gives maximum possible deviation of the flow across the shock is

$$\sin^2\epsilon_m = \frac{1}{\gamma M_1^2}\left[\frac{\gamma + 1}{4}M_1^2 - 1 + \sqrt{(\gamma + 1)\left(1 + \frac{\gamma - 1}{2}M_1^2 + \frac{\gamma + 1}{16}M_1^4\right)}\right] \tag{6}$$

The value of the angle of the shock which gives sonic velocity behind the shock is obtainable from the equation

$$\sin^2\epsilon_s = \frac{1}{\gamma M_1^2}\left[\frac{\gamma + 1}{4}M_1^2 - \frac{3 - \gamma}{4} + \sqrt{(\gamma + 1)\left(\frac{9 + \gamma}{16} - \frac{3 - \gamma}{8}M_1^2 + \frac{\gamma + 1}{16}M_1^4\right)}\right] \tag{7}$$

DISCUSSION OF TABLES AND CHARTS

The changes in Mach number, pressure, density, entropy, and the deviation of the flow across the shock wave are presented in tabular form and on the charts. Table I includes solutions of shock-wave equations for stream Mach numbers from $M_1 = 1.05$ to $M_1 = 4.0$ and for a range of angles of shock from a simple Mach wave to an angle normal to the stream (normal shock). For each angle of shock, the ratio of the pressure behind the shock to the pressure in front of the shock, the ratio of the density in front of the shock to the density behind the shock, the deviation of the flow across the shock, and the change in entropy across the shock are given. Solutions of the shock-wave equations which give Mach numbers behind the shock of less than one are included because they are useful in the study of detached shock, internal flows, and similar fields. Table II gives values of the angle of the shock and the Mach number behind the shock for the maximum possible deviation of the flow as well as values of the angle of the shock and the deviation of the flow which gives sonic velocity behind the shock $(M_2 = 1.0)$.

The data given in table I were plotted and from these curves values of the angle of the shock and the Mach number behind the shock were taken for even values of the deviation of the flow at Mach numbers in front of the shock from 1.05 to 4.0. These values (read from faired curves) are given in table III and are presented solely to aid in the preparation of large-scale figures similar to figure 2, which shows the variation of the angle of the shock with the Mach number in front of the shock for values of the deviation of the flow from zero to the maximum deviation. In figure 3 the variation of the Mach number behind the shock with the Mach number in front of the shock is shown for the same values of the deviation of the flow. Figure 4 gives the variation of the angle of shock with the pressure ratio p_2/p_1 for a range of

Mach number in front of the shock from $M_1 \cong 1.05$ to $M_1 = 4.0$. The variation of the maximum deviation of the flow across the shock with the Mach number in front of the shock is shown in figure 5.

Langley Aeronautical Laboratory
National Advisory Committee for Aeronautics
Langley Field, Va., March 31, 1948

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TABLE I

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO, AND CHANGE IN ENTROPY ACROSS SHOCK WAVES

M_1	ϵ		δ		M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^\circ F}\right)$
	(deg)	(min)	(deg)	(min)				
1.05	72	15	0	0	1.050	1.000	1.000	0
	73	0	0	16	1.037	1.010	.9932	----------
	76	0	0	25	1.014	1.044	.9695	.0010
	79	0	0	33	.991	1.073	.9511	.0454
	82	0	0	32	.973	1.095	.9375	.1284
	85	0	0	23	.961	1.110	.9283	.1739
	88	0	0	10	.954	1.118	.9234	.2035
	90	0	0	-----	.953	1.120	.9225	.2865
1.10	65	23	0	0	1.100	1.000	1.000	0
	68	0	0	40	1.063	1.047	.9678	.0494
	71	0	1	11	1.025	1.095	.9370	.2095
	74	0	1	27	.993	1.138	.9120	.3359
	77	0	1	31	.965	1.174	.8921	.8437
	80	0	1	22	.940	1.202	.8768	.9465
	83	0	1	4	.928	1.224	.8658	1.293
	86	0	0	39	.918	1.238	.8587	1.601
	90	0	0	-----	.912	1.245	.8554	1.828
1.15	60	24	0	0	1.150	1.000	1.000	0
	63	0	0	57	1.105	1.058	.9604	.0188
	66	0	1	47	1.058	1.121	.9217	.2421
	69	0	2	20	1.016	1.178	.8896	.8121
	72	0	2	37	.980	1.229	.8633	1.412
	75	0	2	39	.948	1.273	.8420	2.427
	78	0	2	27	.922	1.310	.8253	3.541
	81	0	2	2	.902	1.339	.8126	4.332
	84	0	1	27	.887	1.359	.8038	5.105
	87	0	0	45	.879	1.372	.7985	5.475
	90	0	0	0	.875	1.376	.7968	5.487
1.20	56	26	0	0	1.200	1.000	1.000	0
	59	0	1	12	1.149	1.068	.9543	.0178
	62	0	2	20	1.095	1.143	.9090	.5286
	65	0	3	9	1.045	1.213	.8712	1.317
	68	0	3	41	1.001	1.278	.8398	1.952
	71	0	3	56	.962	1.335	.8140	4.327
	74	0	3	53	.928	1.386	.7930	6.135
	77	0	3	34	.899	1.428	.7762	7.808
	80	0	3	0	.877	1.463	.7634	9.647
	83	0	2	15	.859	1.488	.7541	11.113
	86	0	1	20	.848	1.505	.7482	12.043
	90	0	0	0	.842	1.514	.7454	12.307
1.25	53	8	0	0	1.250	1.000	1.000	0
	54	0	0	31	1.230	1.026	.9815	----------
	57	0	2	4	1.166	1.116	.9249	.1531
	60	0	3	20	1.108	1.201	.8778	.9405
	63	0	4	17	1.055	1.281	.8385	2.517
	66	0	4	55	1.006	1.355	.8057	4.948
	69	0	5	15	.963	1.422	.7786	7.532
	72	0	5	15	.924	1.482	.7563	10.655
	75	0	4	57	.891	1.534	.7383	13.550
	78	0	4	22	.863	1.578	.7241	16.587
	81	0	3	31	.841	1.612	.7134	18.752
	84	0	2	28	.826	1.636	.7059	20.695
	87	0	1	16	.817	1.651	.7015	22.118
	90	0	0	-----	.813	1.656	.7000	22.229
1.30	50	17	0	0	1.300	1.000	1.000	0
	53	0	1	43	1.235	1.091	.9398	.0207
	56	0	3	20	1.169	1.189	.8841	.9998
	59	0	4	39	1.109	1.282	.8378	2.668
	62	0	5	38	1.053	1.370	.7992	5.357
	65	0	6	18	1.002	1.453	.7670	9.144
	68	0	6	38	.956	1.528	.7403	13.304
	71	0	6	37	.914	1.596	.7182	17.718
	74	0	6	16	.878	1.655	.7003	22.297
	77	0	5	36	.848	1.705	.6860	26.324
	80	0	4	28	.828	1.726	.6803	28.213
	83	0	3	26	.804	1.776	.6672	32.790
	86	0	2	2	.792	1.795	.6622	34.762
	90	0	0	0	.786	1.805	.6598	35.832
1.35	47	47	0	0	1.350	1.000	1.000	0
	50	0	1	35	1.293	1.081	.9459	.2332
	53	0	3	28	1.221	1.190	.8835	.8012
	56	0	5	2	1.155	1.295	.8319	2.943
	59	0	6	17	1.094	1.396	.7890	6.531
	62	0	7	13	1.037	1.491	.7532	11.222
	65	0	7	49	.985	1.580	.7233	16.531
	68	0	8	3	.938	1.661	.6986	22.793
	71	0	7	55	.895	1.734	.6781	28.932
	74	0	7	26	.858	1.798	.6615	34.981
	77	0	6	36	.826	1.852	.6483	40.592
	80	0	5	15	.806	1.875	.6430	43.000
	83	0	4	1	.781	1.928	.6308	48.958
1.35	86	0	2	22	0.768	1.949	0.6262	51.435
	90	0	0	0	.762	1.960	.6239	52.835
1.40	45	35	0	0	1.400	1.000	1.000	0
	47	0	1	7	1.361	1.056	.9616	.0168
	50	0	3	17	1.279	1.175	.8912	.7618
	53	0	5	8	1.211	1.292	.8333	2.773
	56	0	6	40	1.144	1.405	.7853	6.944
	59	0	7	52	1.082	1.513	.7453	12.268
	62	0	8	45	1.024	1.616	.7120	19.157
	65	0	9	16	.971	1.712	.6843	26.968
	68	0	9	25	.922	1.799	.6613	35.244
	71	0	9	12	.878	1.878	.6422	43.735
	74	0	8	35	.840	1.946	.6268	51.279
	77	0	7	35	.807	2.004	.6145	58.225
	80	0	6	2	.785	2.029	.6096	61.135
	83	0	4	36	.760	2.086	.5982	68.769
	86	0	2	43	.746	2.109	.5939	71.876
	90	0	0	0	.740	2.120	.5918	73.225
1.45	43	36	0	0	1.450	1.000	1.000	0
	44	0	0	21	1.438	1.017	.9880	.0524
	47	0	2	46	1.354	1.145	.9077	.3804
	50	0	4	54	1.275	1.273	.8421	2.590
	53	0	6	43	1.204	1.398	.7881	6.588
	56	0	8	13	1.135	1.519	.7433	12.621
	59	0	9	24	1.072	1.636	.7061	20.816
	62	0	10	13	1.021	1.746	.6751	29.965
	65	0	10	41	.959	1.848	.6492	40.298
	68	0	10	46	.909	1.942	.6277	50.600
	71	0	10	27	.864	2.026	.6100	61.012
	74	0	9	42	.826	2.100	.5956	70.594
	77	0	8	34	.790	2.162	.5841	79.032
	80	0	6	48	.767	2.188	.5795	82.727
	83	0	5	11	.740	2.250	.5690	91.785
	86	0	3	3	.727	2.274	.5650	95.562
	90	0	0	0	.720	2.286	.5630	97.685
1.50	41	49	0	0	1.500	1.000	1.000	0
	45	0	2	47	1.405	1.146	.9074	.3339
	48	0	5	5	1.322	1.283	.8373	2.643
	51	0	7	5	1.246	1.419	.7799	7.361
	54	0	8	46	1.174	1.551	.7325	14.752
	57	0	10	8	1.107	1.680	.6932	24.227
	60	0	11	9	1.045	1.802	.6605	35.484
	63	0	11	49	.986	1.917	.6332	47.745
	66	0	12	6	.932	2.024	.6105	60.597
	69	0	11	59	.882	2.121	.5916	73.519
	72	0	11	25	.837	2.208	.5761	85.625
	75	0	10	26	.797	2.282	.5636	96.758
	78	0	9	0	.764	2.345	.5538	106.52
	81	0	7	10	.737	2.394	.5463	114.27
	84	0	5	0	.717	2.430	.5411	120.18
	87	0	2	34	.705	2.451	.5381	123.69
	90	0	0	0	.701	2.458	.5370	124.97
1.55	40	11	0	0	1.550	1.000	1.000	0
	43	0	2	36	1.461	1.137	.9124	.2618
	46	0	5	5	1.375	1.284	.8370	2.758
	49	0	7	15	1.294	1.430	.7756	7.822
	52	0	9	8	1.219	1.574	.7253	16.209
	55	0	10	42	1.148	1.714	.6836	27.196
	58	0	11	55	1.081	1.849	.6490	40.282
	61	0	12	47	1.018	1.977	.6201	53.883
	64	0	13	18	.960	2.098	.5960	70.187
	67	0	13	23	.905	2.208	.5760	86.652
	70	0	13	3	.855	2.308	.5595	100.70
	73	0	12	15	.811	2.397	.5460	114.74
	76	0	10	59	.772	2.472	.5351	127.18
	79	0	9	16	.739	2.534	.5266	137.84
	82	0	7	7	.714	2.582	.5204	146.19
	85	0	4	37	.696	2.615	.5162	151.95
	88	0	1	53	.686	2.633	.5140	155.23
	90	0	0	0	.684	2.636	.5135	155.77
1.60	38	41	0	0	1.600	1.000	1.000	0
	41	0	2	16	1.524	1.119	.9230	.1492
	44	0	4	55	1.433	1.275	.8413	2.321
	47	0	7	16	1.347	1.431	.7753	8.033
	50	0	9	19	1.268	1.586	.7214	17.068
	53	0	11	4	1.193	1.738	.6770	29.336
	56	0	12	29	1.123	1.886	.6403	44.264
	59	0	13	35	1.056	2.027	.6097	51.249
	62	0	14	18	.993	2.162	.5842	79.141
	65	0	14	38	.934	2.287	.5630	97.414
	68	0	14	32	.880	2.401	.5453	115.37
	71	0	13	58	.830	2.503	.5308	132.45

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TABLE I - Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO,

AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^\circ F}\right)$
1.60	74	0	12	55	0.786	2.593	0.5190	148.21
	77	0	11	22	.748	2.669	.5095	162.13
	80	0	9	21	.722	2.701	.5058	173.06
	83	0	6	52	.692	2.776	.4971	181.56
	86	0	4	4	.676	2.805	.4938	187.21
	90	0	0	0	.668	2.820	.4922	190.04
1.65	37	18	0	0	1.650	1.000	1.000	0
	38	0	0	44	1.626	1.037	.9742	.0741
	41	0	3	40	1.526	1.200	.8778	1.074
	45	0	7	5	1.406	1.422	.7789	7.728
	48	0	9	19	1.322	1.587	.7208	16.545
	51	0	11	15	1.243	1.752	.6735	30.582
	54	0	12	53	1.169	1.912	.6343	47.195
	57	0	14	11	1.098	2.067	.6019	66.274
	60	0	15	8	1.032	2.216	.5748	86.781
	63	0	15	42	.969	2.355	.5522	108.07
	66	0	15	51	.910	2.484	.5334	129.27
	69	0	15	33	.856	2.602	.5179	149.64
	72	0	14	45	.806	2.706	.5051	168.66
	75	0	13	27	.762	2.797	.4947	185.57
	78	0	11	36	.725	2.872	.4866	200.02
	81	0	9	15	.695	2.932	.4804	211.67
	84	0	6	27	.672	2.975	.4761	220.27
	87	0	3	19	.659	3.001	.4736	225.50
	90	0	0	0	.654	3.010	.4728	227.26
1.70	36	2	0	0	1.700	1.000	1.000	0
	37	0	1	2	1.665	1.055	.9628	.1818
	40	0	4	3	1.562	1.226	.8646	1.610
	44	0	7	34	1.439	1.460	.7642	9.630
	47	0	9	53	1.350	1.637	.7058	20.803
	50	0	11	54	1.272	1.812	.6580	36.407
	53	0	13	37	1.195	1.984	.6188	55.689
	56	0	15	0	1.122	2.151	.5862	77.555
	59	0	16	4	1.052	2.311	.5591	101.14
	62	0	16	44	.987	2.462	.5365	125.46
	65	0	17	1	.925	2.602	.5177	149.93
	68	0	16	49	.867	2.732	.5021	173.35
	71	0	16	8	.815	2.848	.4892	195.27
	74	0	14	55	.768	2.949	.4787	215.00
	77	0	13	9	.726	3.034	.4704	232.17
	80	0	10	49	.698	3.070	.4670	239.48
	83	0	7	58	.666	3.155	.4594	256.95
	86	0	4	43	.649	3.189	.4564	263.86
	90	0	0	0	.641	3.205	.4550	267.45
1.75	34	51	0	0	1.750	1.000	1.000	0
	36	0	1	16	1.707	1.068	.9543	.1680
	39	0	4	21	1.602	1.248	.8537	2.002
	42	0	7	7	1.505	1.433	.7744	5.679
	45	0	9	35	1.414	1.620	.7109	19.498
	48	0	11	47	1.330	1.807	.6594	35.868
	51	0	13	41	1.249	1.991	.6172	56.587
	54	0	15	17	1.172	2.172	.5824	80.500
	57	0	16	33	1.099	2.346	.5535	106.72
	60	0	17	29	1.029	2.513	.5295	134.17
	63	0	18	0	.963	2.670	.5094	161.99
	66	0	18	6	.901	2.815	.4927	189.16
	69	0	17	43	.844	2.947	.4789	214.78
	72	0	16	48	.792	3.065	.4675	238.48
	75	0	15	19	.745	3.167	.4583	259.45
	78	0	13	14	.705	3.252	.4511	277.31
	81	0	10	34	.672	3.318	.4566	291.52
	84	0	7	23	.648	3.367	.4418	301.90
	87	0	3	48	.633	3.396	.4395	308.21
	90	0	0	0	.628	3.406	.4388	310.30
1.80	33	45	0	0	1.800	1.000	1.000	0
	35	0	1	25	1.751	1.077	.9485	.1551
	38	0	4	33	1.643	1.266	.8452	2.365
	41	0	7	24	1.544	1.460	.7642	9.580
	44	0	9	58	1.451	1.657	.6997	22.427
	47	0	12	13	1.364	1.855	.6475	40.908
	50	0	14	13	1.280	2.052	.6050	54.347
	53	0	15	54	1.201	2.244	.5699	91.046
	56	0	17	16	1.125	2.431	.5409	120.44
	59	0	18	18	1.053	2.611	.5167	151.22
	62	0	18	57	.984	2.780	.4966	182.40
	65	0	19	11	.919	2.938	.4798	212.98
	68	0	18	56	.859	3.083	.4659	242.15
	71	0	18	9	.803	3.213	.4544	269.00
	74	0	16	48	.753	3.326	.4450	293.12
	77	0	14	49	.709	3.422	.4376	313.73
	80	0	12	12	.678	3.499	.4319	330.80
	83	0	9	1	.645	3.557	.4277	343.47
	86	0	5	21	.625	3.595	.4251	351.77
	90	0	0	0	.617	3.613	.4239	356.00
1.85	32	43	0	0	1.850	1.000	1.000	0
	34	0	1	29	1.799	1.082	.9454	.0761
	37	0	4	42	1.687	1.280	.8389	3.029
	40	0	7	37	1.585	1.483	.7560	10.761
	43	0	10	14	1.490	1.691	.6902	25.168
	46	0	12	35	1.400	1.899	.6372	45.795
	49	0	14	39	1.314	2.108	.5941	71.556
	52	0	16	26	1.232	2.313	.5588	101.48
	55	0	17	54	1.153	2.513	.5295	134.09
	58	0	19	3	1.078	2.705	.5052	171.91
	61	0	19	49	1.007	2.888	.4850	203.15
	64	0	20	11	.939	3.059	.4681	237.22
	67	0	20	4	.876	3.217	.4540	269.74
	70	0	19	27	.817	3.359	.4424	300.20
	73	0	18	14	.763	3.485	.4329	327.61
	76	0	16	23	.716	3.593	.4253	351.39
	79	0	13	52	.676	3.681	.4193	371.09
	82	0	10	43	.643	3.749	.4150	386.58
	85	0	7	0	.620	3.796	.4120	397.11
	88	0	2	52	.608	3.821	.4105	402.93
	90	0	0	0	.606	3.826	.4102	405.62
1.90	31	45	0	0	1.900	1.000	1.000	0
	33	0	1	28	1.848	1.083	.9449	.1927
	36	0	4	46	1.734	1.289	.8348	2.962
	39	0	7	45	1.628	1.501	.7495	11.802
	42	0	10	26	1.530	1.719	.6822	27.594
	45	0	12	51	1.437	1.939	.6284	50.345
	48	0	15	0	1.349	2.159	.5846	78.759
	51	0	16	52	1.265	2.377	.5489	111.52
	54	0	18	27	1.184	2.590	.5194	147.61
	57	0	19	41	1.106	2.796	.4949	185.39
	60	0	20	35	1.032	2.992	.4745	223.75
	63	0	21	5	.962	3.177	.4574	261.49
	66	0	21	8	.895	3.348	.4433	297.92
	69	0	20	39	.833	3.504	.4315	331.73
	72	0	19	36	.776	3.643	.4219	362.52
	75	0	17	55	.725	3.763	.4141	389.54
	78	0	15	31	.681	3.863	.4079	412.39
	81	0	12	26	.645	3.942	.4033	430.64
	84	0	8	43	.618	3.999	.4001	443.81
	87	0	4	30	.601	4.033	.3981	452.76
	90	0	0	0	.596	4.045	.3975	454.52
1.95	30	51	0	0	1.950	1.000	1.000	0
	32	0	1	23	1.901	1.079	.9471	.1650
	35	0	4	45	1.782	1.293	.8328	3.053
	38	0	7	48	1.674	1.515	.7449	12.620
	41	0	10	34	1.573	1.743	.6758	29.754
	44	0	13	3	1.478	1.974	.6208	54.438
	47	0	15	17	1.386	2.206	.5764	85.426
	50	0	17	14	1.299	2.437	.5401	121.25
	53	0	18	54	1.216	2.663	.5103	160.67
	56	0	20	15	1.136	2.882	.4855	200.76
	59	0	21	16	1.059	3.098	.4649	251.41
	62	0	21	54	.986	3.292	.4478	285.66
	65	0	22	6	.917	3.477	.4335	325.83
	68	0	21	47	.851	3.647	.4216	363.54
	71	0	20	54	.791	3.799	.4118	397.89
	74	0	19	23	.737	3.935	.4038	430.70
	77	0	17	9	.689	4.045	.3975	454.48
	80	0	14	11	.649	4.136	.3926	475.59
	83	0	10	31	.617	4.204	.3891	491.55
	86	0	6	15	.596	4.248	.3869	501.92
	90	0	0	0	.586	4.270	.3858	507.06
2.00	30	0	0	0	2.000	1.000	1.000	0
	31	0	1	15	1.956	1.072	.9515	.0751
	34	0	4	40	1.833	1.293	.8329	2.885
	37	0	7	48	1.721	1.524	.7419	12.999
	40	0	10	36	1.617	1.762	.6709	31.470
	43	0	13	11	1.519	2.004	.6146	58.128
	46	0	15	29	1.426	2.248	.5693	91.374
	49	0	17	31	1.336	2.491	.5324	130.44
	52	0	19	16	1.250	2.731	.5022	173.24
	55	0	20	44	1.167	2.965	.4771	218.21
	58	0	21	52	1.088	3.190	.4563	264.12
	61	0	22	37	1.012	3.403	.4390	309.67
	64	0	22	58	.940	3.603	.4246	353.67
	67	0	22	49	.872	3.787	.4125	395.23
	70	0	22	7	.773	3.954	.4026	433.42
	73	0	20	47	.751	4.101	.3945	467.44
	76	0	18	44	.709	4.227	.3880	497.03
	79	0	15	55	.655	4.330	.3829	521.38
	82	0	12	21	.619	4.410	.3791	540.28
	85	0	8	5	.594	4.464	.3766	553.29
	88	0	3	19	.580	4.494	.3753	560.45
	90	0	0	0	.577	4.500	.3750	561.72

TABLE I - Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO,

AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^\circ F}\right)$
2.05	29	12	0	0	2.050	1.000	1.000	0
	30	0	1	0	2.013	1.059	.9598	.0336
	33	0	4	32	1.886	1.288	.8351	2.667
	36	0	7	43	1.771	1.527	.7406	13.094
	39	0	10	37	1.664	1.775	.6673	32.672
	42	0	13	14	1.563	2.029	.6095	61.108
	45	0	15	37	1.467	2.284	.5632	97.103
	48	0	17	43	1.374	2.541	.5257	138.82
	51	0	19	34	1.286	2.795	.4950	185.00
	54	0	21	7	1.200	3.042	.4696	233.68
	57	0	22	22	1.118	3.282	.4486	283.54
	60	0	23	15	1.040	3.511	.4310	333.09
	63	0	23	44	.965	3.726	.4164	381.21
	66	0	23	46	.894	3.925	.4043	426.60
	69	0	23	14	.828	4.107	.3942	468.77
	72	0	22	6	.766	4.268	.3859	506.65
	75	0	20	15	.711	4.408	.3792	539.66
	78	0	17	37	.663	4.524	.3739	567.34
	81	0	14	11	.623	4.616	.3699	589.36
	84	0	9	58	.594	4.683	.3671	605.33
	87	0	5	10	.575	4.723	.3655	614.90
	90	0	0	0	.569	4.736	.3650	618.04
2.10	28	26	0	0	2.100	1.000	1.000	0
	29	0	0	43	2.073	1.043	.9706	.0119
	32	0	4	19	1.941	1.278	.8395	2.431
	35	0	7	35	1.823	1.526	.7410	13.010
	38	0	10	32	1.712	1.784	.6652	33.503
	41	0	13	14	1.608	2.048	.6057	63.611
	44	0	15	40	1.509	2.316	.5582	101.86
	47	0	17	51	1.414	2.585	.5199	146.68
	50	0	19	47	1.323	2.852	.4887	196.12
	53	0	21	26	1.235	3.115	.4629	248.57
	56	0	22	47	1.151	3.369	.4416	302.28
	59	0	23	48	1.070	3.614	.4238	355.83
	62	0	24	26	.992	3.844	.4090	407.99
	65	0	24	37	.918	4.060	.3967	457.66
	68	0	24	16	.849	4.256	.3865	503.91
	71	0	23	20	.784	4.433	.3780	545.66
	74	0	21	41	.726	4.588	.3712	582.41
	77	0	19	16	.674	4.718	.3657	613.80
	80	0	16	0	.630	4.823	.3615	639.05
	83	0	11	54	.596	4.902	.3585	657.99
	86	0	7	6	.573	4.953	.3565	670.39
	90	0	0	0	.561	4.978	.3556	676.56
2.15	27	43	0	0	2.150	1.000	1.000	0
	28	0	0	22	2.139	1.022	.9846	.0020
	31	0	4	4	1.999	1.265	.8458	2.102
	34	0	7	23	1.876	1.520	.7432	12.711
	37	0	10	25	1.763	1.787	.6644	33.790
	40	0	13	10	1.656	2.062	.6030	65.350
	43	0	15	40	1.554	2.342	.5542	105.89
	46	0	17	56	1.456	2.624	.5151	153.61
	49	0	19	56	1.362	2.905	.4832	206.46
	52	0	21	41	1.272	3.182	.4570	262.52
	55	0	23	8	1.185	3.452	.4353	320.29
	58	0	24	16	1.101	3.712	.4173	378.01
	61	0	25	2	1.028	3.959	.4023	434.36
	64	0	25	22	.944	4.190	.3898	488.25
	67	0	25	12	.872	4.402	.3794	538.44
	70	0	24	28	.804	4.596	.3708	584.34
	73	0	23	3	.742	4.765	.3638	625.23
	76	0	20	51	.686	4.911	.3581	660.21
	79	0	17	47	.639	5.030	.3537	688.94
	82	0	13	51	.600	5.122	.3505	711.13
	85	0	9	6	.572	5.185	.3483	726.45
	88	0	3	45	.557	5.220	.3472	734.85
	90	0	0	0	.554	5.226	.3469	736.44
2.20	27	2	0	0	2.200	1.000	1.000	0
	30	0	3	43	2.059	1.245	.8553	1.720
	33	0	7	7	1.932	1.508	.7471	11.985
	36	0	10	13	1.815	1.784	.6650	33.590
	39	0	13	2	1.705	2.070	.6014	66.336
	42	0	15	36	1.600	2.362	.5512	109.03
	45	0	17	56	1.499	2.657	.5110	159.44
	48	0	20	0	1.403	2.952	.4784	215.51
	51	0	21	51	1.310	3.244	.4517	275.34
	54	0	23	24	1.220	3.529	.4297	337.15
	57	0	24	39	1.134	3.805	.4114	399.12
	60	0	25	32	1.051	4.069	.3962	459.85
	63	0	26	2	.972	4.316	.3835	518.05
	66	0	26	3	.896	4.546	.3730	572.59
	69	0	25	30	.826	4.755	.3642	622.62
2.20	72	0	24	18	0.761	4.941	0.3570	667.37
	75	0	22	20	.701	5.122	.3512	706.33
	78	0	19	31	.650	5.234	.3466	738.68
	81	0	15	47	.607	5.342	.3431	764.31
	84	0	11	9	.574	5.418	.3407	782.94
	87	0	5	47	.554	5.465	.3393	794.15
	90	0	0	0	.547	5.480	.3388	798.01
2.25	26	23	0	0	2.250	1.000	1.000	0
	29	0	3	20	2.122	1.222	.8670	1.226
	32	0	6	48	1.990	1.492	.7528	11.034
	35	0	9	58	1.869	1.776	.6670	32.873
	38	0	12	51	1.755	2.072	.6009	66.707
	41	0	15	29	1.648	2.376	.5491	111.22
	44	0	17	53	1.544	2.683	.5078	164.30
	47	0	20	2	1.445	2.992	.4744	223.75
	50	0	21	57	1.349	3.301	.4472	289.97
	53	0	23	36	1.257	3.601	.4247	352.90
	56	0	24	57	1.168	3.893	.4062	419.20
	59	0	25	58	1.083	4.173	.3907	484.09
	62	0	26	36	1.001	4.438	.3778	546.70
	65	0	26	47	.923	4.685	.3671	605.74
	68	0	26	27	.849	4.911	.3581	660.25
	71	0	25	28	.781	5.114	.3508	709.13
	74	0	23	45	.718	5.291	.3448	751.96
	77	0	21	10	.663	5.441	.3400	788.50
	80	0	17	40	.615	5.562	.3364	817.71
	83	0	13	12	.578	5.652	.3337	839.54
	86	0	7	54	.553	5.711	.3321	853.92
	90	0	0	0	.541	5.740	.3313	860.86
2.30	25	46	0	0	2.300	1.000	1.000	0
	28	0	2	53	2.186	1.194	.8814	.7943
	31	0	6	27	2.050	1.472	.7601	9.925
	34	0	9	40	1.925	1.763	.6704	31.579
	37	0	12	37	1.808	2.069	.6016	66.296
	40	0	15	18	1.697	2.383	.5479	112.53
	43	0	17	46	1.591	2.704	.5053	168.02
	46	0	20	0	1.489	3.027	.4711	229.53
	49	0	21	59	1.390	3.349	.4432	294.87
	52	0	23	43	1.295	3.666	.4203	367.61
	55	0	25	10	1.212	3.975	.4014	438.08
	58	0	26	19	1.116	4.272	.3857	507.53
	61	0	27	6	1.032	4.555	.3726	574.68
	64	0	27	26	.951	4.819	.3617	638.07
	67	0	27	17	.874	5.063	.3526	696.90
	70	0	26	32	.803	5.283	.3451	750.17
	73	0	25	3	.737	5.478	.3389	797.33
	76	0	22	45	.678	5.644	.3340	837.74
	79	0	19	29	.626	5.781	.3301	870.83
	82	0	15	14	.585	5.886	.3273	896.25
	85	0	10	3	.555	5.958	.3254	913.86
	88	0	4	9	.537	5.998	.3244	923.31
	90	0	0	0	.534	6.005	.3242	925.18
2.35	25	11	0	0	2.350	1.000	1.000	0
	27	0	2	24	2.254	1.161	.8988	.4871
	30	0	6	1	2.112	1.444	.7702	8.584
	33	0	9	19	1.983	1.745	.6754	29.851
	36	0	12	20	1.862	2.059	.6034	65.009
	39	0	15	5	1.748	2.385	.5477	112.76
	42	0	17	36	1.639	2.718	.5037	170.62
	45	0	19	54	1.534	3.055	.4684	236.22
	48	0	21	58	1.433	3.392	.4399	306.99
	51	0	23	47	1.335	3.725	.4165	380.88
	54	0	25	20	1.241	4.050	.3972	455.56
	57	0	26	35	1.151	4.365	.3812	529.42
	60	0	27	30	1.064	4.666	.3678	601.08
	63	0	28	-----	.980	4.949	.3567	669.34
	66	0	28	2	.901	5.211	.3475	752.57
	69	0	27	29	.827	5.449	.3398	790.44
	72	0	26	15	.757	5.661	.3335	841.84
	75	0	24	13	.694	5.845	.3284	886.40
	78	0	21	14	.639	5.998	.3244	923.36
	81	0	17	14	.593	6.119	.3213	952.54
	84	0	12	13	.558	6.206	.3192	973.52
	87	0	6	22	.536	6.259	.3180	986.09
	90	0	0	0	.529	5.276	.3176	990.43
2.40	24	37	0	0	2.400	1.000	1.000	0
	26	0	1	51	2.325	1.125	.9195	.1502
	29	0	5	34	2.176	1.413	.7822	7.137
	32	0	8	55	2.042	1.720	.6818	27.650
	35	0	12	0	1.919	2.044	.6064	63.094
	38	0	14	49	1.801	2.381	.5483	112.11

NACA

TABLE I - Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO, AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^\circ F}\right)$
2.40	41	0	17	23	1.688	2.726	0.5028	172.07
	44	0	19	45	1.581	3.076	.4665	240.56
	47	0	21	53	1.492	3.428	.4322	329.56
	50	0	23	47	1.376	3.777	.4132	392.62
	53	0	25	26	1.280	4.120	.3935	471.78
	56	0	26	47	1.187	4.452	.3771	550.07
	59	0	27	49	1.097	4.771	.3636	626.45
	62	0	28	29	1.011	5.072	.3522	699.18
	65	0	28	41	.929	5.353	.3428	767.25
	68	0	28	20	.852	5.610	.3349	829.37
	71	0	27	21	.780	5.841	.3285	885.40
	74	0	25	35	.713	6.043	.3232	934.25
	77	0	22	53	.654	6.213	.3190	975.29
	80	0	19	10	.604	6.350	.3158	1008.42
	83	0	14	23	.564	6.454	.3135	1033.08
	86	0	8	38	.537	6.521	.3120	1049.17
	90	0	0	0	.523	6.554	.3113	1057.03
2.45	24	5	0	0	2.450	1.000	1.000	0
	25	0	1	15	2.398	1.084	.9439	.0919
	28	0	5	3	2.243	1.377	.7965	5.580
	31	0	8	30	2.105	1.692	.6896	25.181
	34	0	11	37	1.976	2.023	.6106	60.395
	37	0	14	29	1.855	2.370	.5500	110.28
	40	0	17	8	1.740	2.727	.5027	172.27
	43	0	19	33	1.629	3.091	.4651	243.52
	46	0	21	45	1.522	3.457	.4350	321.33
	49	0	23	44	1.419	3.822	.4104	403.01
	52	0	25	28	1.320	4.182	.3902	486.38
	55	0	26	55	1.224	4.532	.3736	569.31
	58	0	28	4	1.132	4.870	.3597	650.28
	61	0	28	52	1.043	5.190	.3481	727.72
	64	0	29	14	.959	5.491	.3385	800.43
	67	0	29	6	.879	5.767	.3305	867.49
	70	0	28	20	.804	6.017	.3239	928.03
	73	0	26	50	.734	6.238	.3185	981.10
	76	0	24	26	.671	6.427	.3141	1026.47
	79	0	21	2	.616	6.582	.3107	1063.68
	82	0	16	31	.572	6.701	.3082	1092.28
	85	0	10	56	.540	6.783	.3066	1111.86
	88	0	4	31	.521	6.828	.3057	1122.61
	90	0	0	0	.518	6.836	.3055	1124.64
2.50	23	35	0	0	2.500	1.000	1.000	0
	24	0	0	39	2.477	1.040	.9726	.0099
	27	0	4	29	2.318	1.336	.8136	4.218
	30	0	8	0	2.169	1.656	.7000	22.359
	33	0	11	11	2.036	1.996	.6162	57.183
	36	0	14	7	1.911	2.353	.5526	107.72
	39	0	16	49	1.793	2.721	.5033	171.33
	42	0	19	18	1.679	3.098	.4645	245.26
	45	0	21	34	1.569	3.479	.4333	326.23
	48	0	23	37	1.463	3.860	.4081	411.85
	51	0	25	26	1.361	4.237	.3874	499.41
	54	0	26	59	1.263	4.606	.3704	586.97
	57	0	28	15	1.168	4.962	.3562	672.66
	60	0	29	11	1.077	5.302	.3444	754.91
	63	0	29	42	.990	5.622	.3346	832.63
	66	0	29	45	.907	5.919	.3264	904.33
	69	0	29	13	.829	6.189	.3197	969.50
	72	0	27	58	.756	6.429	.3141	1027.15
	75	0	25	53	.690	6.637	.3096	1076.97
	78	0	22	47	.621	6.810	.3060	1118.26
	81	0	18	34	.582	6.947	.3033	1150.70
	84	0	13	13	.545	7.045	.3015	1174.11
	87	0	6	58	.519	7.105	.3004	1188.32
	90	0	0	0	.513	7.125	.3000	1193.01
2.55	23	5	0	0	2.550	1.000	1.000	0
	26	0	3	53	2.385	1.291	.8336	2.876
	29	0	7	28	2.235	1.616	.7119	19.290
	32	0	10	44	2.098	1.964	.6230	53.132
	35	0	13	43	1.969	2.329	.5562	104.01
	38	0	16	29	1.847	2.709	.5048	169.05
	41	0	19	1	1.730	3.097	.4644	243.87
	44	0	21	21	1.618	3.494	.4323	329.59
	47	0	23	27	1.509	3.891	.4063	418.89
	50	0	25	21	1.404	4.285	.3850	510.47
	53	0	27	0	1.306	4.672	.3676	602.80
	56	0	28	22	1.206	5.048	.3531	693.13
	59	0	29	25	1.112	5.407	.3411	780.37
	62	0	30	6	1.022	5.748	.3310	862.79
	65	0	30	19	.937	6.065	.3227	939.56
	68	0	29	59	.856	6.354	.3158	1009.10
	71	0	29	0	.780	6.616	.3100	1071.77
	74	0	27	12	.710	6.843	.3054	1126.14
	77	0	24	26	.648	7.036	.3016	1171.71
2.55	80	0	20	33	0.594	7.191	.2988	1208.54
	83	0	15	29	.552	7.307	.2967	1235.73
	86	0	9	19	.523	7.383	.2954	1253.59
	90	0	0	0	.508	7.420	.2948	1262.20
2.60	22	37	0	0	2.600	1.000	1.000	0
	25	0	3	13	2.460	1.242	.8568	1.650
	28	0	6	53	2.303	1.572	.7260	15.975
	31	0	10	14	2.164	1.927	.6310	48.795
	34	0	13	17	2.029	2.299	.5609	99.355
	37	0	16	5	1.903	2.690	.5070	165.41
	40	0	18	41	1.783	3.092	.4650	243.95
	43	0	21	4	1.667	3.502	.4317	331.00
	46	0	23	15	1.556	3.914	.4049	424.05
	49	0	25	13	1.448	4.326	.3831	520.20
	52	0	26	57	1.344	4.731	.3652	616.90
	55	0	28	25	1.244	5.126	.3504	712.07
	58	0	29	35	1.148	5.505	.3381	804.08
	61	0	30	24	1.056	5.866	.3278	891.44
	64	0	30	47	.968	6.205	.3193	1000.97
	67	0	30	40	.891	6.516	.3121	1047.96
	70	0	29	55	.803	6.798	.3063	1117.32
	73	0	28	24	.733	7.046	.3015	1174.12
	76	0	25	57	.666	7.259	.2976	1224.31
	79	0	22	25	.609	7.433	.2946	1265.36
	82	0	17	40	.562	7.567	.2924	1296.76
	85	0	11	44	.527	7.660	.2909	1318.12
	88	0	4	52	.508	7.711	.2901	1329.92
	90	0	0	0	.504	7.720	.2899	1332.26
2.65	22	10	0	0	2.650	1.000	1.000	0
	24	0	2	31	2.538	1.189	.8839	---------
	27	0	6	17	2.375	1.522	.7424	12.917
	30	0	9	41	2.228	1.882	.6413	43.790
	33	0	12	48	2.091	2.264	.5667	93.992
	36	0	15	40	1.961	2.664	.5101	160.88
	39	0	18	19	1.838	3.078	.4663	241.13
	42	0	20	45	1.718	3.502	.4317	331.24
	45	0	23	0	1.604	3.930	.4040	427.82
	48	0	25	2	1.493	4.358	.3815	527.95
	51	0	26	51	1.387	4.782	.3632	629.24
	54	0	28	24	1.284	5.196	.3480	729.13
	57	0	29	41	1.186	5.596	.3354	826.05
	60	0	30	38	1.091	5.978	.3249	918.56
	63	0	31	11	1.000	6.338	.3161	1005.37
	66	0	31	15	.914	6.671	.3089	1085.28
	69	0	30	44	.832	6.974	.3028	1157.32
	72	0	29	29	.756	7.244	.2979	1221.07
	75	0	27	22	.687	7.477	.2939	1275.77
	78	0	24	11	.625	7.672	.2907	1321.10
	81	0	19	47	.573	7.826	.2883	1356.78
	84	0	14	8	.534	7.937	.2866	1382.27
	87	0	7	24	.508	8.004	.2857	1397.83
	90	0	0	0	.500	8.026	.2853	1402.90
2.70	21	44	0	0	2.700	1.000	1.000	0
	23	0	1	46	2.620	1.132	.9154	.0037
	26	0	5	37	2.448	1.468	.7615	9.908
	29	0	9	6	2.296	1.832	.6530	38.562
	32	0	12	17	2.155	2.222	.5737	87.712
	35	0	15	12	2.021	2.631	.5141	154.99
	38	0	17	54	1.893	3.057	.4683	236.84
	41	0	20	24	1.771	3.494	.4323	329.61
	44	0	22	42	1.653	3.937	.4036	429.60
	47	0	24	48	1.540	4.382	.3804	533.67
	50	0	26	42	1.431	4.824	.3615	639.51
	53	0	28	21	1.326	5.258	.3459	744.16
	56	0	29	44	1.225	5.679	.3330	846.19
	59	0	30	47	1.127	6.082	.3223	943.73
	62	0	31	30	1.034	6.464	.3133	1035.46
	65	0	31	45	.945	6.820	.3058	1120.43
	68	0	31	26	.861	7.145	.2996	1197.59
	71	0	30	28	.782	7.437	.2945	1266.21
	74	0	28	38	.709	7.692	.2904	1325.55
	77	0	25	48	.647	7.908	.2871	1375.64
	80	0	21	47	.587	8.082	.2845	1415.60
	83	0	16	29	.542	8.212	.2827	1445.41
	86	0	9	57	.511	8.297	.2815	1464.79
	90	0	0	0	.496	8.338	.2810	1474.07
2.75	21	19	0	0	2.750	1.000	1.000	0
	22	0	0	58	2.705	1.071	.9519	.0583
	25	0	4	56	2.526	1.409	.7836	6.901
	28	0	8	29	2.366	1.778	.6666	33.023
	31	0	11	39	2.217	2.175	.5818	80.901
	34	0	14	42	2.082	2.592	.5191	147.88
	37	0	17	28	1.951	3.029	.4709	231.04

NACA

TABLE I - Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO,

AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^oF}\right)$
2.75	40	0	20	1	1.826	3.479	0.4333	326.03
	43	0	22	23	1.705	3.937	.4036	429.46
	46	0	24	32	1.588	4.399	.3796	537.44
	49	0	26	30	1.477	4.859	.3601	647.59
	52	0	28	14	1.368	5.312	.3441	757.25
	55	0	29	42	1.264	5.754	.3309	864.19
	58	0	30	54	1.165	6.179	.3199	966.93
	61	0	31	44	1.069	6.583	.3107	1063.86
	64	0	32	9	.977	6.961	.3031	1152.98
	67	0	32	3	.890	7.309	.2967	1236.19
	70	0	31	19	.808	7.624	.2914	1309.77
	73	0	29	47	.732	7.902	.2872	1374.26
	76	0	27	19	.663	8.140	.2837	1428.95
	79	0	23	40	.603	8.335	.2810	1473.39
	82	0	18	44	.553	8.486	.2790	1507.35
	85	0	12	29	.517	8.589	.2777	1531.02
	88	0	5	11	.496	8.646	.2770	1543.49
	90	0	0	0	.492	8.656	.2769	1546.11
2.80	20	56	0	0	2.800	1.000	1.000	0
	21	0	0	7	2.795	1.008	.9943	.0000
	24	0	4	11	2.604	1.347	.8091	4.353
	27	0	7	50	2.439	1.719	.6824	27.389
	30	0	11	8	2.288	2.120	.5918	73.021
	33	0	14	10	2.145	2.547	.5250	139.75
	36	0	16	59	2.011	2.994	.4743	223.81
	39	0	19	36	1.882	3.456	.4350	320.95
	42	0	22	0	1.757	3.929	.4041	427.22
	45	0	24	14	1.638	4.407	.3792	539.17
	48	0	26	15	1.523	4.884	.3591	653.23
	51	0	28	4	1.412	5.358	.3426	768.04
	54	0	29	38	1.305	5.820	.3291	880.12
	57	0	30	55	1.203	6.267	.3178	988.02
	60	0	31	54	1.105	6.693	.3084	1090.41
	63	0	32	28	1.011	7.095	.3005	1185.63
	66	0	32	34	.921	7.467	.2940	1272.94
	69	0	32	4	.836	7.805	.2886	1351.78
	72	0	30	50	.757	8.107	.2842	1421.21
	75	0	28	41	.685	8.367	.2806	1480.64
	78	0	25	26	.620	8.585	.2778	1529.76
	81	0	20	53	.566	8.756	.2756	1568.17
	84	0	14	59	.524	8.880	.2741	1595.87
	87	0	7	51	.498	8.955	.2732	1612.60
	90	0	0	0	.488	8.980	.2730	1618.43
2.85	20	32	0	0	2.850	1.000	1.000	0
	23	0	3	24	2.687	1.280	.8386	2.366
	26	0	7	8	2.514	1.654	.7005	21.972
	29	0	10	31	2.358	2.061	.6031	65.049
	32	0	13	37	2.211	2.494	.5320	130.80
	35	0	16	28	2.072	2.951	.4785	215.30
	38	0	19	8	1.939	3.425	.4373	314.22
	41	0	21	36	1.811	3.912	.4050	423.51
	44	0	23	53	1.689	4.406	.3793	539.08
	47	0	25	58	1.570	4.902	.3585	657.96
	50	0	27	51	1.457	5.394	.3415	777.09
	53	0	29	31	1.348	5.878	.3275	894.04
	56	0	30	54	1.243	6.346	.3159	1007.32
	59	0	31	59	1.142	6.796	.3063	1059.43
	62	0	32	43	1.045	7.221	.2983	1215.30
	65	0	32	59	.953	7.617	.2916	1308.29
	68	0	32	42	.866	7.980	.2860	1392.15
	71	0	31	44	.784	8.305	.2814	1466.51
	74	0	29	55	.708	8.590	.2777	1531.03
	77	0	27	2	.640	8.830	.2747	1584.93
	80	0	22	55	.581	9.024	.2724	1628.01
	83	0	17	24	.534	9.169	.2708	1660.18
	86	0	10	32	.501	9.264	.2698	1681.05
	90	0	0	0	.485	9.310	.2693	1691.11
2.90	20	10	0	0	2.900	1.000	1.000	0
	21	0	1	12	2.842	1.093	.9382	.1255
	24	0	5	11	2.651	1.457	.7656	9.189
	27	0	8	45	2.483	1.856	.6474	40.835
	30	0	12	0	2.328	2.286	.5630	97.177
	33	0	14	59	2.182	2.744	.5007	175.55
	36	0	17	46	2.043	3.223	.4535	271.20
	39	0	20	21	1.910	3.719	.4169	379.65
	42	0	22	45	1.783	4.226	.3880	496.86
	45	0	24	57	1.660	4.739	.3648	618.87
	48	0	26	58	1.542	5.252	.3461	742.74
	51	0	28	47	1.428	5.759	.3307	865.63
	54	0	30	21	1.319	6.255	.3181	985.44
	57	0	31	39	1.214	6.735	.3075	1100.24
	60	0	32	38	1.114	7.192	.2988	1208.72
	63	0	33	14	1.018	7.623	.2915	1309.43

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^oF}\right)$
2.90	66	0	33	20	0.926	8.022	0.2854	1401.94
	69	0	32	52	.839	8.385	.2804	1484.81
	72	0	31	38	.758	8.708	.2762	1557.77
	75	0	29	29	.684	8.988	.2729	1620.09
	78	0	26	11	.618	9.221	.2702	1671.56
	81	0	21	34	.562	9.405	.2682	1711.92
	84	0	15	30	.519	9.538	.2668	1740.89
	87	0	8	9	.491	9.618	.2660	1758.18
	90	0	0	0	.481	9.645	.2658	1764.28
2.95	19	49	0	0	2.95	1.000	1.000	0
	20	0	0	16	2.936	1.021	.9853	.000
	23	0	4	23	2.735	1.383	.7939	5.986
	26	0	8	2	2.559	1.784	.6650	33.698
	29	0	11	21	2.399	2.220	.5741	87.349
	32	0	14	24	2.248	2.684	.5077	164.62
	35	0	16	53	2.090	3.174	.4577	260.81
	38	0	19	52	1.969	3.682	.4193	371.32
	41	0	22	19	1.838	4.203	.3892	491.51
	44	0	24	35	1.712	4.732	.3651	617.38
	47	0	26	39	1.590	5.264	.3457	745.74
	50	0	28	32	1.474	5.791	.3299	873.54
	53	0	30	12	1.360	6.309	.3168	998.57
	56	0	31	36	1.255	6.812	.3060	1118.74
	59	0	32	42	1.152	7.293	.2970	1232.49
	62	0	33	26	1.053	7.749	.2895	1338.98
	65	0	33	44	.959	8.173	.2832	1436.41
	68	0	33	28	.870	8.561	.2781	1524.82
	71	0	32	31	.786	8.910	.2738	1602.73
	74	0	30	41	.708	9.215	.2703	1670.38
	77	0	27	48	.638	9.473	.2675	1726.62
	80	0	25	54	.568	9.680	.2654	1771.85
	83	0	17	57	.529	9.836	.2639	1805.48
	86	0	10	54	.495	9.937	.2629	1827.06
	90	0	0	0	.478	9.986	.2624	1837.61
3.00	19	28	0	0	3.000	1.000	1.000	0
	20	0	0	46	2.960	1.062	.9582	.0375
	23	0	4	50	2.758	1.436	.7731	8.219
	26	0	8	27	2.581	1.851	.6485	40.430
	29	0	11	44	2.419	2.301	.5606	99.591
	32	0	14	46	2.267	2.782	.4964	182.65
	35	0	17	35	2.122	3.287	.4481	284.73
	38	0	20	12	1.983	3.813	.4109	400.94
	41	0	22	38	1.850	4.352	.3818	526.62
	44	0	24	54	1.723	4.900	.3585	657.70
	47	0	26	59	1.600	5.450	.3398	790.44
	50	0	28	52	1.483	5.995	.3244	922.61
	53	0	30	31	1.369	6.531	.3118	1051.46
	56	0	31	55	1.261	7.050	.3014	1175.15
	59	0	33	2	1.156	7.548	.2927	1292.26
	62	0	33	46	1.057	8.019	.2854	1401.11
	65	0	34	4	.961	8.458	.2794	1501.26
	68	0	33	49	.871	8.860	.2744	1591.45
	71	0	32	52	.787	9.221	.2702	1671.32
	74	0	31	3	.708	9.536	.2669	1740.34
	77	0	28	9	.637	9.802	.2642	1797.98
	80	0	23	56	.576	10.017	.2621	1844.15
	83	0	18	14	.527	10.178	.2606	1878.23
	86	0	11	4	.493	10.283	.2597	1900.44
	90	0	0	0	.475	10.333	.2593	1911.41
3.05	19	8	0	0	3.050	1.000	1.0000	0
	20	0	1	15	2.984	1.103	.9324	.0553
	23	0	5	16	2.782	1.490	.7534	11.010
	26	0	8	51	2.603	1.919	.6328	47.836
	29	0	12	7	2.440	2.384	.5478	112.68
	32	0	15	7	2.285	2.881	.4856	201.79
	35	0	17	55	2.139	3.404	.4389	309.65
	38	0	20	31	1.998	3.947	.4030	431.82
	41	0	22	57	1.863	4.505	.3748	562.70
	44	0	25	13	1.734	5.071	.3523	698.86
	47	0	27	17	1.610	5.639	.3341	836.42
	50	0	29	10	1.491	6.203	.3193	972.67
	53	0	30	50	1.376	6.756	.3071	1105.48
	56	0	32	14	1.266	7.293	.2970	1232.61
	59	0	33	21	1.161	7.808	.2886	1352.50
	62	0	34	6	1.060	8.295	.2816	1464.32
	65	0	34	24	.964	8.749	.2757	1566.64
	68	0	34	10	.873	9.164	.2709	1659.02
	71	0	33	13	.788	9.537	.2669	1740.75
	74	0	31	24	.708	9.863	.2636	1811.04
	77	0	28	29	.637	10.138	.2610	1869.52
	80	0	24	14	.575	10.360	.2590	1916.64
	83	0	18	29	.525	10.526	.2576	1951.67
	86	0	11	14	.490	10.634	.2567	1974.29
	89	0	2	54	.473	10.684	.2563	1984.65
	90	0	0	0	.472	10.686	.2562	1985.15

TABLE I - Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO,

AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^oF}\right)$
3.10	18	49	0	0	3.100	1.000	1.0000	0
	20	0	1	43	3.010	1.145	.9079	.2717
	23	0	5	41	2.806	1.545	.7346	14.353
	26	0	9	14	2.621	1.988	.6179	55.921
	29	0	12	28	2.460	2.469	.5356	126.62
	32	0	15	27	2.303	2.982	.4754	221.57
	35	0	18	14	2.155	3.522	.4302	335.62
	38	0	20	50	2.012	4.083	.3954	463.34
	41	0	23	15	1.876	4.659	.3681	599.73
	44	0	25	30	1.745	5.244	.3464	740.57
	47	0	27	35	1.619	5.830	.3288	882.83
	50	0	29	27	1.498	6.413	.3144	1023.28
	53	0	31	7	1.383	6.985	.3026	1159.52
	56	0	32	32	1.272	7.539	.2928	1290.06
	59	0	33	39	1.166	8.071	.2847	1413.16
	62	0	34	24	1.064	8.574	.2779	1527.55
	65	0	34	44	.967	9.043	.2722	1632.03
	68	0	34	29	.875	9.472	.2675	1726.51
	71	0	33	33	.789	9.857	.2637	1809.79
	74	0	31	45	.708	10.193	.2605	1881.58
	77	0	28	50	.636	10.478	.2580	1941.57
	80	0	24	33	.573	10.703	.2561	1989.35
	83	0	18	44	.523	10.879	.2547	2025.11
	86	0	11	24	.488	10.991	.2538	2048.19
	89	0	2	56	.471	11.042	.2534	2058.69
	90	0	0	0	.470	11.045	.2534	2059.38
3.15	18	31	0	0	3.150	1.000	1.0000	0
	20	0	2	9	3.034	1.188	.8845	.6698
	23	0	6	5	2.830	1.601	.7167	17.961
	26	0	9	36	2.648	2.058	.6037	64.868
	29	0	12	48	2.479	2.554	.5240	141.23
	32	0	15	46	2.321	3.084	.4657	242.24
	35	0	18	32	2.170	3.642	.4219	362.33
	38	0	21	8	2.026	4.222	.3882	495.57
	41	0	23	32	1.888	4.816	.3618	637.43
	44	0	25	47	1.755	5.420	.3407	783.40
	47	0	27	51	1.628	6.026	.3237	929.92
	50	0	29	44	1.506	6.627	.3098	1074.44
	53	0	31	24	1.390	7.218	.2983	1214.69
	56	0	32	49	1.277	7.790	.2888	1348.37
	59	0	33	56	1.170	8.340	.2810	1474.46
	62	0	34	42	1.067	8.859	.2744	1591.35
	65	0	35	2	.970	9.343	.2689	1698.35
	68	0	34	48	.877	9.786	.2644	1794.61
	71	0	33	53	.790	10.183	.2606	1879.44
	74	0	32	4	.709	10.531	.2575	1952.69
	77	0	29	8	.636	10.825	.2551	2013.81
	80	0	24	51	.572	11.061	.2533	2062.67
	83	0	18	59	.521	11.239	.2519	2098.79
	86	0	11	34	.485	11.354	.2511	2122.32
	89	0	2	59	.468	11.407	.2507	2132.92
	90	0	0	0	.467	11.410	.2506	2133.42
3.20	18	13	0	0	3.200	1.000	1.0000	0
	20	0	2	34	3.059	1.055	.8623	1.359
	23	0	6	27	2.843	1.657	.6997	22.418
	26	0	9	57	2.670	2.129	.5901	74.520
	29	0	13	8	2.500	2.641	.5129	156.77
	32	0	16	5	2.339	3.188	.4564	263.75
	35	0	18	50	2.187	3.764	.4140	389.52
	38	0	21	24	2.040	4.362	.3814	528.97
	41	0	23	47	1.900	4.975	.3557	675.74
	44	0	26	4	1.766	5.598	.3353	826.64
	47	0	28	7	1.637	6.223	.3188	977.62
	50	0	30	0	1.514	6.844	.3053	1126.41
	53	0	31	40	1.396	7.453	.2943	1270.16
	56	0	33	5	1.283	8.045	.2851	1407.01
	59	0	34	13	1.174	8.611	.2774	1535.69
	62	0	34	59	1.071	9.147	.2710	1655.19
	65	0	35	19	.972	9.647	.2657	1764.42
	68	0	35	6	.879	10.104	.2613	1862.53
	71	0	34	11	.791	10.514	.2577	1949.11
	74	0	32	23	.709	10.873	.2547	2023.80
	77	0	29	27	.635	11.176	.2524	2085.90
	80	0	25	8	.571	11.420	.2506	2135.45
	83	0	19	13	.519	11.603	.2493	2172.62
	86	0	11	43	.483	11.722	.2484	2205.80
	89	0	3	27	.465	11.777	.2481	2207.39
	90	0	0	0	.464	11.780	.2480	2207.86
3.25	17	55	0	0	3.250	1.000	1.0000	0
	20	0	2	59	3.086	1.275	.8411	2.381
	23	0	6	49	2.809	1.715	.6834	27.089
	26	0	10	17	2.692	2.201	.5772	84.619
	29	0	13	26	2.519	2.730	.5023	172.81
	32	0	16	22	2.357	3.294	.4476	286.08
3.25	35	55	19	7	2.202	3.888	0.4065	404.14
	38	0	21	41	2.054	4.504	.3748	562.45
	41	0	24	5	1.912	5.137	.3500	714.81
	44	0	26	19	1.776	5.780	.3302	870.56
	47	0	28	23	1.646	6.425	.3142	1025.95
	50	0	30	15	1.521	7.065	.3011	1178.65
	53	0	31	56	1.429	7.693	.2904	1325.99
	56	0	33	21	1.288	8.303	.2815	1466.21
	59	0	34	29	1.179	8.888	.2740	1597.61
	62	0	35	16	1.074	9.441	.2679	1719.76
	65	0	35	36	.975	9.956	.2627	1831.08
	68	0	35	23	.880	10.427	.2585	1931.61
	71	0	34	29	.792	10.851	.2549	2019.32
	74	0	32	41	.709	11.220	.2520	2095.10
	77	0	29	45	.635	11.533	.2498	2158.45
	80	0	25	25	.570	11.785	.2480	2208.96
	83	0	19	27	.517	11.974	.2467	2246.27
	86	0	11	52	.481	12.097	.2459	2270.58
	89	0	3	4	.463	12.153	.2456	2281.43
	90	0	0	0	.462	12.156	.2456	2282.42
3.30	17	35	0	0	3.300	1.000	1.0000	0
	18	0	0	32	3.268	1.047	.9680	.000
	20	0	3	22	3.110	1.320	.8208	3.555
	23	0	7	10	2.901	1.773	.6679	32.532
	26	0	10	36	2.716	2.275	.5648	95.417
	29	0	13	44	2.539	2.820	.4922	189.79
	32	0	16	39	2.374	3.401	.4392	309.14
	35	0	19	23	2.218	4.013	.3992	447.00
	38	0	21	56	2.067	4.649	.3685	607.17
	41	0	24	20	1.924	5.302	.3444	754.63
	44	0	26	34	1.787	5.964	.3252	915.30
	47	0	28	38	1.664	6.629	.3097	1074.96
	50	0	30	30	1.529	7.289	.2971	1231.29
	53	0	32	11	1.409	7.937	.2866	1382.34
	56	0	33	36	1.293	8.566	.2780	1525.56
	59	0	34	44	1.183	9.169	.2708	1660.07
	62	0	35	31	1.078	9.738	.2648	1784.22
	65	0	35	52	.977	10.270	.2598	1897.56
	68	0	35	40	.882	10.756	.2557	1999.51
	71	0	34	46	.793	11.192	.2523	2089.26
	74	0	32	58	.710	11.573	.2495	2166.48
	77	0	30	2	.634	11.896	.2473	2230.92
	80	0	25	41	.569	12.156	.2456	2282.41
	83	0	19	41	.516	12.350	.2443	2320.12
	86	0	12	1	.479	12.477	.2436	2344.95
	89	0	3	6	.461	12.535	.2432	2356.21
	90	0	0	0	.460	12.538	.2432	2356.67
3.35	17	22	0	0	3.350	1.000	1.0000	0
	20	0	3	44	3.135	1.365	.8014	5.064
	23	0	7	10	2.825	1.832	.6531	38.510
	26	0	10	54	2.735	2.349	.5531	107.19
	29	0	14	1	2.559	2.911	.4826	207.54
	32	0	16	55	2.381	3.510	.4311	333.09
	35	0	19	38	2.210	4.141	.3924	476.78
	38	0	22	11	2.081	4.796	.3626	632.66
	41	0	24	34	1.935	5.469	.3392	795.35
	44	0	26	48	1.796	6.151	.3206	960.51
	47	0	28	52	1.664	6.836	.3055	1124.67
	50	0	30	44	1.536	7.517	.2932	1285.01
	53	0	32	25	1.415	8.184	.2831	1439.07
	56	0	33	50	1.298	8.832	.2747	1585.62
	59	0	34	59	1.187	9.453	.2677	1722.56
	62	0	35	47	1.081	10.041	.2619	1849.43
	65	0	36	8	.980	10.588	.2571	1964.84
	68	0	35	56	.884	11.089	.2530	2068.30
	71	0	35	3	.794	11.539	.2497	2159.53
	74	0	33	15	.710	11.931	.2470	2237.90
	77	0	30	19	.634	12.264	.2449	2303.50
	80	0	25	56	.568	12.531	.2432	2355.54
	83	0	19	54	.514	12.732	.2420	2394.22
	86	0	12	10	.491	12.862	.2413	2419.05
	89	0	3	9	.458	12.922	.2409	2430.52
	90	0	0	0	.457	12.926	.2409	2431.31
3.40	17	6	0	0	3.400	1.000	1.0000	0
	18	0	1	20	3.361	1.121	.9216	.3557
	21	0	5	23	3.042	1.565	.7280	15.651
	24	0	8	59	2.881	2.065	.6024	65.946
	27	0	12	15	2.696	2.613	.5164	151.75
	30	0	15	17	2.521	3.205	.4550	267.45
	33	0	18	6	2.354	3.834	.4097	405.84
	36	0	20	45	2.196	4.493	.3753	560.16
	39	0	23	14	2.044	5.175	.3487	724.10
	42	0	25	34	1.899	5.872	.3277	892.88
	45	0	27	44	1.761	6.577	.3108	1062.65

NACA

TABLE I.- Continued

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO,

AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Continued

M_1	ε (deg)	ε (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{°F}\right)$
3.40	48	0	29	44	1.628	7.282	.2972	1229.91
	51	0	31	33	1.502	7.979	.2860	1391.92
	54	0	33	9	1.381	8.661	.2768	1547.13
	57	0	34	29	1.262	9.320	.2692	1694.75
	60	0	35	32	1.155	9.949	.2628	1829.58
	63	0	36	12	1.050	10.540	.2575	1954.93
	66	0	36	23	.950	11.089	.2530	2068.30
	69	0	35	59	.855	11.588	.2494	2169.44
	72	0	34	50	.766	12.032	.2464	2258.45
	75	0	32	4	.684	12.417	.2439	2333.35
	78	0	29	18	.610	12.731	.2420	2395.19
	81	0	24	22	.547	12.990	.2406	2443.70
	84	0	17	41	.498	13.173	.2396	2478.08
	87	0	9	22	.466	13.283	.2390	2498.82
	90	0	0	0	.455	13.320	.2388	2505.96
3.45	16	51	0	0	3.450	1.000	1.0000	0
	18	0	1	42	3.346	1.159	.8999	.4693
	21	0	5	43	3.113	1.617	.7118	19.243
	24	0	9	17	2.907	2.131	.5899	74.797
	27	0	12	32	2.717	2.695	.5064	166.63
	30	0	15	32	2.539	3.305	.4467	288.56
	33	0	18	21	2.371	3.952	.4027	432.93
	36	0	20	59	2.210	4.631	.3693	593.00
	39	0	23	27	2.056	5.333	.3435	762.36
	42	0	25	47	1.910	6.051	.3230	936.17
	45	0	27	57	1.770	6.777	.3067	1111.59
	48	0	29	57	1.636	7.502	.2934	1281.49
	51	0	31	46	1.504	8.220	.2826	1447.34
	54	0	33	22	1.387	8.922	.2736	1605.36
	57	0	34	43	1.270	9.601	.2662	1754.71
	60	0	35	45	1.159	10.248	.2600	1893.51
	63	0	36	26	1.053	10.858	.2549	2020.94
	66	0	36	38	.952	11.422	.2506	2136.31
	69	0	36	14	.856	11.936	.2470	2239.14
	72	0	35	5	.767	12.394	.2441	2328.84
	75	0	32	57	.684	12.790	.2417	2405.02
	78	0	29	33	.610	13.119	.2398	2467.98
	81	0	24	36	.546	13.380	.2384	2497.27
	84	0	17	53	.496	13.568	.2375	2542.10
	87	0	9	29	.464	13.619	.2369	2573.13
	90	0	0	0	.453	13.720	.2367	2580.25
3.50	16	36	0	0	3.500	1.000	1.0000	0
	17	0	0	36	3.462	1.055	.9625	----------
	20	0	4	46	3.209	1.505	.7482	11.778
	23	0	8	26	2.997	2.015	.6122	59.476
	26	0	11	45	2.800	2.580	.5206	145.61
	29	0	14	49	2.617	3.193	.4561	264.53
	32	0	17	40	2.443	3.847	.4089	418.39
	35	0	20	21	2.277	4.535	.3734	570.04
	38	0	22	52	2.131	5.251	.3461	742.39
	41	0	25	14	1.970	5.985	.3247	920.04
	44	0	27	27	1.819	6.730	.3076	1099.16
	47	0	29	30	1.688	7.478	.2938	1275.69
	50	0	31	23	1.557	8.220	.2826	1447.18
	53	0	33	7	1.433	8.949	.2733	1611.78
	56	0	34	30	1.313	9.656	.2656	1766.51
	59	0	35	40	1.200	10.334	.2592	1911.35
	62	0	36	28	1.091	10.975	.2539	2042.66
	65	0	36	51	.987	11.573	.2495	2152.46
	68	0	36	41	.889	12.120	.2458	2275.07
	71	0	35	49	.797	12.610	.2428	2370.67
	74	0	34	2	.711	13.039	.2403	2452.74
	77	0	31	5	.633	13.402	.2383	2521.04
	80	0	26	40	.565	13.695	.2368	2575.43
	83	0	20	31	.510	13.913	.2357	2615.70
	86	0	12	31	.472	14.056	.2350	2641.81
	89	0	3	15	.453	14.121	.2347	2653.77
	90	0	0	0	.451	14.125	.2347	2654.47
3.55	16	22	0	0	3.550	1.000	1.0000	0
	17	0	0	58	3.489	1.090	.9402	.1433
	20	0	5	5	3.238	1.553	.7319	14.698
	23	0	8	43	3.021	2.078	.5998	67.626
	26	0	12	1	2.822	2.659	.5107	159.87
	29	0	15	3	2.635	3.289	.4480	285.05
	32	0	17	54	2.460	3.962	.4021	435.15
	35	0	20	34	2.292	4.671	.3676	602.31
	38	0	23	5	2.132	5.407	.3411	780.18
	41	0	25	26	1.979	6.162	.3203	962.95
	44	0	27	39	1.834	6.928	.3037	1146.00
	47	0	29	42	1.696	7.698	.2903	1326.89
	50	0	31	35	1.564	8.462	.2793	1502.04
	53	0	33	16	1.439	9.212	.2703	1669.53
	56	0	34	42	1.318	9.939	.2629	1827.35
	59	0	35	52	1.203	10.637	.2567	1974.95

M_1	ε (deg)	ε (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{°F}\right)$
3.55	62	0	36	41	1.094	11.296	0.2515	2110.35
	65	0	37	5	.990	11.911	.2472	2233.82
	68	0	36	55	.891	12.473	.2436	2343.96
	71	0	36	3	.798	12.978	.2406	2441.09
	74	0	34	17	.712	13.420	.2382	2524.31
	77	0	31	20	.633	13.793	.2363	2588.67
	80	0	26	54	.564	14.093	.2348	2638.79
	83	0	20	42	.509	14.318	.2338	2689.23
	86	0	12	42	.469	14.465	.2331	2715.95
	89	0	3	18	.450	14.532	.2328	2727.85
	90	0	0	0	.449	14.536	.2328	2728.51
3.60	16	8	0	0	3.600	1.000	1.0000	0
	17	0	1	19	3.465	1.126	.9189	.0356
	20	0	5	23	3.263	1.602	.7163	18.007
	23	0	8	59	3.044	2.142	.5878	76.282
	26	0	12	16	2.843	2.739	.5013	174.56
	29	0	15	17	2.654	3.387	.4402	306.06
	32	0	18	7	2.476	4.079	.3956	462.38
	35	0	20	46	2.305	4.808	.3621	635.32
	38	0	23	17	2.144	5.565	.3363	818.37
	41	0	25	38	1.990	6.341	.3161	1006.11
	44	0	27	51	1.844	7.130	.2999	1193.84
	47	0	29	54	1.704	7.921	.2869	1378.49
	50	0	31	47	1.571	8.706	.2762	1557.16
	53	0	33	28	1.444	9.478	.2674	1727.56
	56	0	34	54	1.323	10.226	.2602	1888.50
	59	0	36	4	1.207	10.943	.2542	2038.24
	62	0	36	54	1.097	11.621	.2489	2169.45
	65	0	37	17	.992	12.253	.2449	2301.30
	68	0	37	8	.893	12.832	.2415	2413.29
	71	0	36	17	.799	13.351	.2386	2511.45
	74	0	34	31	.712	13.805	.2363	2595.91
	77	0	31	34	.633	14.189	.2344	2665.81
	80	0	27	7	.564	14.498	.2330	2721.83
	83	0	20	54	.507	14.729	.2319	2762.93
	86	0	12	49	.468	14.880	.2313	2789.74
	89	0	3	19	.449	14.949	.2310	2801.83
	90	0	0	0	.447	14.953	.2310	2802.74
3.65	15	54	0	0	3.650	1.000	1.0000	0
	18	0	3	3	3.453	1.318	.8217	3.597
	21	0	6	55	3.213	1.830	.6537	38.249
	24	0	10	22	2.998	2.405	.5448	116.07
	27	0	13	32	2.799	3.037	.4702	232.78
	30	0	16	28	2.611	3.719	.4169	379.76
	33	0	19	14	2.434	4.444	.3775	548.35
	36	0	21	49	2.264	5.203	.3477	731.01
	39	0	24	16	2.103	5.989	.3246	921.31
	42	0	26	35	1.951	6.792	.3064	1114.11
	45	0	28	44	1.805	7.605	.2918	1305.54
	48	0	30	44	1.666	8.417	.2799	1492.14
	51	0	32	33	1.534	9.221	.2702	1671.50
	54	0	34	9	1.408	10.006	.2622	1841.85
	57	0	35	31	1.288	10.766	.2556	2001.93
	60	0	36	35	1.173	11.491	.2501	2150.14
	63	0	37	17	1.064	12.173	.2455	2285.79
	66	0	37	31	.960	12.805	.2416	2408.32
	69	0	37	9	.862	13.380	.2384	2516.99
	72	0	36	2	.770	13.892	.2358	2612.02
	75	0	33	54	.685	14.335	.2337	2692.72
	78	0	30	30	.608	14.705	.2320	2758.78
	81	0	25	28	.542	14.996	.2308	2810.27
	84	0	18	34	.491	15.206	.2299	2847.39
	87	0	9	52	.457	15.334	.2294	2869.56
	90	0	0	0	.446	15.376	.2292	2876.98
3.70	15	41	0	0	3.700	1.000	1.0000	0
	18	0	3	21	3.479	1.359	.8041	5.102
	21	0	7	11	3.237	1.885	.6406	44.156
	24	0	10	37	3.021	2.476	.5346	127.94
	27	0	13	45	2.818	3.125	.4620	250.85
	30	0	16	41	2.629	3.826	.4102	404.07
	33	0	19	25	2.448	4.571	.3719	578.54
	36	0	22	1	2.278	5.352	.3429	766.95
	39	0	24	7	2.114	6.159	.3204	962.36
	42	0	26	45	1.960	6.984	.3026	1159.67
	45	0	28	55	1.813	7.819	.2884	1355.26
	48	0	30	54	1.673	8.654	.2769	1545.54
	51	0	32	43	1.540	9.480	.2675	1728.47
	54	0	34	20	1.413	10.287	.2597	1901.59
	57	0	35	42	1.292	11.067	.2532	2064.01
	60	0	36	46	1.177	11.812	.2478	2214.25
	63	0	37	28	1.067	12.513	.2433	2352.02
	66	0	37	43	.962	13.163	.2396	2476.39
	69	0	37	22	.863	13.754	.2365	2586.61
	72	0	36	15	.771	14.280	.2340	2682.84

TABLE I - Concluded

VALUES OF DEVIATION OF FLOW, MACH NUMBER, PRESSURE RATIO, DENSITY RATIO, AND CHANGE IN ENTROPY ACROSS SHOCK WAVES - Concluded

M_1	ϵ (deg)	ϵ (min)	δ (deg)	δ (min)	M_2	$\frac{p_2}{p_1}$	$\frac{\rho_1}{\rho_2}$	ΔS $\left(\frac{ft^2/sec^2}{^\circ F}\right)$
3.70	75	0	34	7	0.685	14.735	0.2319	2764.36
	78	0	30	43	.608	15.115	.2303	2831.36
	81	0	25	40	.542	15.414	.2291	2883.64
	84	0	18	44	.490	15.630	.2282	2920.32
	87	0	9	58	.456	15.761	.2277	2943.39
	90	0	0	0	.444	15.805	.2275	2950.81
3.75	15	28	0	0	3.750	1.000	1.0000	0
	18	0	3	39	3.506	1.400	.7873	6.776
	21	0	7	27	3.263	1.940	.6281	50.411
	24	0	10	51	3.043	2.548	.5249	140.21
	27	0	13	58	2.838	3.215	.4542	269.45
	30	0	16	53	2.646	3.935	.4037	428.93
	33	0	19	37	2.464	4.700	.3664	609.50
	36	0	22	12	2.291	5.502	.3382	803.26
	39	0	24	38	2.126	6.331	.3163	1003.82
	42	0	26	56	1.970	7.179	.2990	1205.69
	45	0	29	5	1.821	8.037	.2852	1391.39
	48	0	31	5	1.680	8.894	.2740	1599.23
	51	0	32	54	1.546	9.742	.2648	1785.17
	54	0	34	30	1.418	10.571	.2572	1961.46
	57	0	35	52	1.296	11.373	.2509	2126.34
	60	0	37	6	1.186	12.138	.2457	2278.71
	63	0	37	40	1.070	12.858	.2413	2418.46
	66	0	37	54	.964	13.526	.2377	2544.18
	69	0	37	34	.865	14.133	.2347	2656.08
	72	0	36	27	.772	14.673	.2322	2753.23
	75	0	34	20	.685	15.141	.2302	2835.86
	78	0	30	55	.608	15.531	.2286	2903.55
	81	0	25	51	.541	15.838	.2274	2956.35
	84	0	18	53	.488	16.060	.2266	2994.16
	87	0	10	3	.455	16.195	.2261	3016.89
	90	0	0	0	.442	16.240	.2259	3024.28
3.80	15	15	0	0	3.800	1.000	1.0000	0
	17	0	2	34	3.624	1.273	.8418	2.328
	20	0	6	30	3.368	1.804	.6600	35.512
	23	0	9	59	3.137	2.405	.5447	116.10
	26	0	13	10	2.925	3.071	.4670	239.51
	29	0	16	8	2.727	3.793	.4122	396.33
	32	0	18	54	2.538	4.564	.3722	576.93
	35	0	21	32	2.361	5.376	.3421	772.71
	38	0	24	1	2.192	6.219	.3189	976.54
	41	0	26	21	2.031	7.085	.3007	1183.35
	44	0	28	33	1.879	7.963	.2863	1384.22
	47	0	30	36	1.734	8.844	.2746	1588.04
	50	0	32	28	1.596	9.720	.2650	1780.24
	53	0	34	10	1.465	10.579	.2571	1962.64
	56	0	35	37	1.340	11.401	.2506	2129.67
	59	0	36	48	1.222	12.212	.2452	2292.69
	62	0	37	39	1.136	12.967	.2407	2438.95
	65	0	38	4	1.001	13.672	.2369	2571.26
	68	0	37	57	.899	14.316	.2338	2689.05
	71	0	37	7	.803	14.895	.2312	2792.42
	74	0	35	22	.714	15.400	.2291	2880.82
	77	0	32	26	.632	15.828	.2274	2954.38
	80	0	27	56	.561	16.172	.2262	3013.13
	83	0	21	36	.503	16.430	.2252	3056.29
	86	0	13	17	.462	16.598	.2247	3084.18
	89	0	3	27	.442	16.675	.2244	3096.82
	90	0	0	0	.441	16.680	.2244	3097.73
3.85	15	3	0	0	3.850	1.000	1.0000	0
	17	0	2	51	3.655	1.312	.8243	3.462
	20	0	6	45	3.392	1.856	.6472	40.898
	23	0	10	12	3.159	2.474	.5349	127.38
	26	0	13	23	2.946	3.157	.4592	243.39
	29	0	16	19	2.734	3.898	.4059	420.41
	32	0	19	5	2.553	4.690	.3669	606.90
	35	0	21	42	2.373	5.523	.3375	808.22
	38	0	24	11	2.203	6.388	.3150	1017.35
	41	0	26	31	2.041	7.277	.2973	1228.64
	44	0	28	42	1.886	8.178	.2832	1423.73
	47	0	30	45	1.741	9.083	.2718	1640.95
	50	0	32	38	1.602	9.981	.2625	1836.43
	53	0	34	19	1.470	10.864	.2548	2021.90
	56	0	35	47	1.345	11.719	.2485	2195.86
	59	0	36	58	1.225	12.758	.2432	2431.05
	62	0	37	49	1.112	13.315	.2388	2504.68
	65	0	38	15	1.003	14.038	.2351	2638.48
	68	0	38	8	.901	14.700	.2321	2757.79
	71	0	37	19	.804	15.294	.2295	2862.02
	74	0	35	34	.714	15.813	.2275	2942.33
	77	0	32	38	.632	16.252	.2259	3025.35
	80	0	28	8	.561	16.605	.2246	3085.16
	83	0	21	46	.501	16.870	.2237	3128.90
	86	0	13	24	.461	17.043	.2232	3157.50
3.85	89	0	3	29	0.440	17.122	0.2229	3170.36
	90	0	0	0	.439	17.126	.2229	3171.00
3.90	14	51	0	0	3.900	1.000	1.0000	0
	17	0	3	8	3.679	1.350	.8076	4.523
	20	0	6	59	3.418	1.907	.6350	40.704
	23	0	10	25	3.181	2.542	.5255	139.05
	26	0	13	34	2.964	3.244	.4518	275.36
	29	0	16	30	2.761	4.004	.3998	444.78
	32	0	19	16	2.570	4.817	.3618	639.36
	35	0	21	52	2.386	5.671	.3332	844.31
	38	0	24	20	2.214	6.560	.3112	1058.43
	41	0	26	40	2.050	7.471	.2940	1274.21
	44	0	28	52	1.895	8.396	.2802	1487.37
	47	0	30	54	1.747	9.325	.2691	1694.37
	50	0	32	47	1.608	10.247	.2600	1897.88
	53	0	34	28	1.475	11.152	.2526	2081.24
	56	0	35	56	1.348	12.030	.2464	2257.39
	59	0	37	8	1.228	12.872	.2412	2420.62
	62	0	37	59	1.114	13.668	.2369	2570.33
	65	0	38	25	1.005	14.409	.2334	2705.87
	68	0	38	18	.902	15.088	.2304	2826.46
	71	0	37	30	.805	15.698	.2279	2932.18
	74	0	35	45	.715	16.230	.2260	3008.81
	77	0	32	49	.632	16.681	.2244	3097.97
	80	0	28	19	.560	17.044	.2232	3157.53
	83	0	21	55	.501	17.316	.2223	3201.68
	86	0	13	30	.459	17.492	.2217	3230.39
	89	0	3	30	.439	17.573	.2215	3243.46
	90	0	0	0	.438	17.578	.2215	3244.11
3.95	14	40	0	0	3.950	1.000	1.0000	0
	17	0	3	24	3.707	1.389	.7914	5.742
	20	0	7	13	3.441	1.963	.6232	52.900
	23	0	10	38	3.205	2.613	.5165	151.47
	26	0	13	46	2.985	3.332	.4446	294.11
	29	0	16	41	2.778	4.112	.3939	469.90
	32	0	19	26	2.584	4.945	.3568	668.50
	35	0	22	2	2.399	5.822	.3290	880.96
	38	0	24	29	2.224	6.733	.3076	1099.96
	41	0	26	49	2.059	7.669	.2908	1320.30
	44	0	29	0	1.902	8.618	.2773	1537.36
	47	0	31	3	1.754	9.570	.2665	1747.86
	50	0	32	56	1.614	10.516	.2577	1949.57
	53	0	34	37	1.480	11.444	.2504	2140.49
	56	0	36	5	1.353	12.345	.2444	2319.36
	59	0	37	17	1.187	13.208	.2394	2484.70
	62	0	38	8	1.116	14.025	.2352	2636.29
	65	0	38	35	1.007	14.786	.2317	2773.19
	68	0	38	28	.903	15.483	.2288	2895.03
	71	0	37	40	.806	16.108	.2264	2992.18
	74	0	35	57	.715	16.654	.2245	3093.50
	77	0	33	0	.632	17.116	.2229	3169.55
	80	0	28	29	.560	17.489	.2217	3229.18
	83	0	22	4	.500	17.767	.2209	3274.19
	86	0	13	36	.458	17.949	.2203	3302.83
	89	0	3	32	.438	18.032	.2201	3316.12
	90	0	0	0	.436	18.036	.2201	3316.92
4.00	14	29	0	0	4.000	1.000	1.0000	0
	17	0	3	39	3.733	1.429	.7759	7.820
	20	0	7	27	3.467	2.017	.6119	59.660
	23	0	10	50	3.226	2.683	.5078	164.23
	26	0	13	57	3.004	3.421	.4377	313.26
	29	0	16	51	2.795	4.221	.3882	495.42
	32	0	19	35	2.598	5.075	.3521	699.85
	35	0	22	11	2.412	5.975	.3250	917.71
	38	0	24	38	2.235	6.909	.3041	1141.61
	41	0	26	58	2.069	7.868	.2877	1366.26
	44	0	29	9	1.911	8.841	.2746	1587.36
	47	0	31	14	1.768	9.818	.2640	1801.39
	50	0	33	4	1.619	10.788	.2554	2006.14
	53	0	34	46	1.485	11.740	.2479	2190.53
	56	0	36	14	1.357	12.664	.2424	2380.55
	59	0	37	26	1.235	13.549	.2375	2548.28
	62	0	38	18	1.119	14.386	.2335	2701.78
	65	0	38	44	1.009	15.167	.2301	2840.29
	68	0	38	39	.905	15.881	.2272	2963.41
	71	0	37	51	.807	16.522	.2249	3071.60
	74	0	36	7	.716	17.082	.2230	3163.69
	77	0	33	21	.632	17.556	.2215	3240.53
	80	0	28	40	.559	17.938	.2204	3301.04
	83	0	22	13	.499	18.224	.2195	3346.19
	86	0	13	42	.457	18.410	.2190	3365.66
	89	0	3	34	.436	18.495	.2188	3378.91
	90	0	0	0	.435	18.500	.2187	3389.42

TABLE II

ANGLE OF SHOCK AND M_{2m} FOR MAXIMUM DEVIATION OF THE FLOW AND ANGLE OF SHOCK AND δ, WHICH GIVE SONIC VELOCITY BEHIND THE SHOCK

M_1	ϵ_m		ϵ_s		δ_m		δ_s		M_{2m}
	(deg)	(min)	(deg)	(min)	(deg)	(min)	(deg)	(min)	
1.0	90		90		0		0		1.000
1.1	76	18	73	14	1	31	1	24	.9710
1.2	71	59	68	5	3	57	3	42	.9500
1.3	69	24	65	7	6	40	6	19	.9357
1.4	67	42	63	20	9	26	9	1	.9268
1.5	66	36	62	15	12	6	11	41	.9212
1.6	65	50	61	39	14	39	14	15	.9187
1.7	65	19	61	22	17	0	16	38	.9185
1.8	64	59	61	17	19	11	18	50	.9196
1.9	64	47	61	21	21	10	20	52	.9216
2.0	64	40	61	29	22	59	22	43	.9243
2.1	64	37	61	41	24	37	24	23	.9274
2.2	64	37	61	54	26	6	25	54	.9306
2.3	64	41	62	9	27	28	27	17	.9331
2.4	64	42	62	24	28	42	28	32	.9374
2.5	64	48	62	39	29	48	29	40	.9397
2.6	64	52	62	53	30	49	30	42	.9426
2.7	64	57	63	7	31	45	31	39	.9464
2.8	65	3	63	21	32	35	32	30	.9489
2.9	65	9	63	33	33	21	33	17	.9514
3.0	65	15	63	46	34	4	34	1	.9537
3.1	65	20	63	58	34	44	34	40	.9565
3.2	65	25	64	8	35	20	35	17	.9589
3.3	65	31	64	18	35	53	35	51	.9606
3.4	65	36	64	28	36	24	36	22	.9627
3.5	65	41	64	37	36	52	36	50	.9645
3.6	65	46	64	45	37	18	37	17	.9660
3.7	65	51	64	54	37	43	37	41	.9674
3.8	65	56	65	2	38	5	38	4	.9685
3.9	65	59	65	9	38	27	38	25	.9708
4.0	66	3	65	15	38	47	38	45	.9721

NACA

TABLE III

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK

M_1	δ		ϵ		M_2
	(deg)	(min)	(deg)	(min)	
1.05	0	0	72	15	1.050
	0	30	78	0	1.000
1.10	0	0	65	23	1.100
	0	30	67	20	1.074
	1	0	69	54	1.041
	1	30	74	40	.982
1.15	0	0	60	24	1.150
	0	30	61	42	1.127
	1	0	63	11	1.104
	1	30	64	54	1.075
	2	0	66	58	1.044
	2	30	70	38	.998
1.20	0	0	56	26	1.200
	0	30	57	27	1.180
	1	0	58	54	1.158
	1	30	59	45	1.135
	2	0	61	3	1.110
	2	30	62	32	1.083
	3	0	64	25	1.053
	3	30	66	56	1.019
1.25	0	0	53	8	1.250
	0	30	53	58	1.232
	1	0	54	54	1.212
	1	30	55	51	1.192
	2	0	56	52	1.171
	2	30	57	58	1.149
	3	0	59	10	1.126
	3	30	60	29	1.100
	4	0	62	5	1.072
	4	30	63	59	1.040
	5	0	66	32	.998
1.30	0	0	50	17	1.300
	0	30	51	2	1.282
	1	0	51	50	1.264
	1	30	52	39	1.245
	2	0	53	30	1.225
	2	30	54	24	1.206
	3	0	55	11	1.186
	3	30	56	20	1.165
	4	0	57	26	1.142
	4	30	58	36	1.117
	5	0	59	58	1.091
	5	30	61	32	1.062
	6	0	63	39	1.028
	6	30	66	28	.980
1.35	0	0	47	47	1.350
	0	30	48	29	1.332
	1	0	49	10	1.315
	1	30	49	55	1.297
	2	0	50	41	1.278
	2	30	51	18	1.259
	3	0	52	16	1.240
	3	30	53	6	1.219
	4	0	53	59	1.199
	4	30	54	56	1.177
	5	0	55	57	1.156
	5	30	57	3	1.131
	6	0	58	17	1.106
	6	30	59	37	1.080
	7	0	61	14	1.050
	7	30	63	15	1.017
	8	0	66	58	.952
1.40	0	0	45	35	1.400
	0	30	46	10	1.382
	1	0	46	49	1.365
	1	30	47	28	1.347
	2	0	48	9	1.330
	2	30	48	52	1.311
	3	0	49	35	1.293
	3	30	50	19	1.275
	4	0	51	6	1.256
	4	30	51	55	1.236
1.40	5	0	52	46	1.216
	5	30	53	39	1.195
	6	0	54	38	1.174
	6	30	55	40	1.151
	7	0	56	46	1.127
	7	30	57	58	1.102
	8	0	59	22	1.074
	8	30	61	6	1.042
	9	0	63	14	1.004
1.45	0	0	43	36	1.450
	0	30	44	11	1.433
	1	0	44	48	1.416
	1	30	45	24	1.397
	2	0	46	2	1.380
	2	30	46	40	1.362
	3	0	47	10	1.344
	3	30	48	1	1.326
	4	0	48	42	1.307
	4	30	49	24	1.290
	5	0	50	7	1.271
	5	30	50	55	1.252
	6	0	51	45	1.232
	6	30	52	36	1.211
	7	0	53	30	1.190
	7	30	54	28	1.168
	8	0	55	30	1.146
	8	30	56	38	1.120
	9	0	57	54	1.095
	9	30	59	19	1.067
	10	0	61	5	1.036
	10	30	63	38	.987
1.50	0	0	41	49	1.500
	0	30	42	22	1.487
	1	0	42	55	1.466
	1	30	43	30	1.449
	2	0	44	5	1.431
	2	30	44	42	1.414
	3	0	45	19	1.396
	3	30	45	55	1.380
	4	0	46	34	1.362
	4	30	47	14	1.344
	5	0	47	54	1.326
	5	30	48	37	1.309
	6	0	49	22	1.290
	6	30	50	6	1.271
	7	0	50	54	1.251
	7	30	51	44	1.230
	8	0	52	34	1.209
	8	30	53	30	1.187
	9	0	54	26	1.164
	9	30	55	30	1.139
	10	0	56	42	1.113
	10	30	57	58	1.086
	11	0	59	29	1.055
	11	30	61	25	1.016
	12	0	64	24	.956
1.55	0	0	40	11	1.550
	0	30	40	41	1.532
	1	0	41	14	1.515
	1	30	41	47	1.497
	2	0	42	10	1.480
	2	30	42	54	1.463
	3	0	43	29	1.446
	3	30	44	4	1.428
	4	0	44	41	1.412
	4	30	45	18	1.395
	5	0	45	55	1.376
	5	30	46	34	1.360
	6	0	47	14	1.341
	6	30	47	55	1.324
	7	0	48	40	1.306
	7	30	49	24	1.286
	8	0	50	10	1.267
	8	30	50	59	1.246
	9	0	51	50	1.225
	9	30	52	41	1.204

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	δ (min)	ε (deg)	ε (min)	M_2
1.55	10	0	53	17	1.181
	10	30	54	36	1.156
	11	0	55	38	1.131
	11	30	56	52	1.105
	12	0	58	14	1.075
	12	30	59	49	1.040
	13	0	62	0	1.000
1.60	0	0	38	41	1.600
	0	30	39	14	1.582
	1	0	39	47	1.565
	1	30	40	19	1.548
	2	0	40	53	1.531
	2	30	41	27	1.515
	3	0	42	1	1.497
	3	30	42	34	1.480
	4	0	43	10	1.462
	4	30	43	45	1.445
	5	0	44	19	1.427
	5	30	44	55	1.410
	6	0	45	32	1.391
	6	30	46	10	1.374
	7	0	46	47	1.356
	7	30	47	26	1.338
	8	0	48	7	1.320
	8	30	48	50	1.300
	9	0	49	32	1.281
	9	30	50	14	1.261
	10	0	51	6	1.240
	10	30	51	58	1.218
	11	0	52	53	1.196
	11	30	53	53	1.174
	12	0	54	56	1.148
	12	30	56	1	1.122
	13	0	57	14	1.093
	13	30	58	44	1.062
	14	0	60	37	1.024
	14	30	63	20	.965
1.65	0	0	37	18	1.650
	0	30	37	47	1.632
	1	0	38	16	1.615
	1	30	38	45	1.598
	2	0	39	15	1.581
	2	30	39	46	1.564
	3	0	40	16	1.552
	3	30	40	49	1.530
	4	0	41	22	1.514
	4	30	41	56	1.496
	5	0	42	31	1.479
	5	30	43	5	1.461
	6	0	43	41	1.444
	6	30	44	17	1.425
	7	0	44	55	1.408
	7	30	45	32	1.389
	8	0	46	11	1.370
	8	30	46	52	1.351
	9	0	47	33	1.332
	9	30	48	15	1.313
	10	0	49	1	1.294
	10	30	49	47	1.274
	11	0	50	36	1.252
	11	30	51	26	1.232
	12	0	52	21	1.210
	12	30	53	16	1.187
	13	0	54	16	1.163
	13	30	55	22	1.136
	14	0	56	33	1.108
	14	30	57	54	1.077
	15	0	59	30	1.043
	15	30	61	44	.997
1.70	0	0	36	2	1.700
	0	30	36	30	1.684
	1	0	36	58	1.667
	1	30	37	28	1.649
	2	0	37	56	1.632
	2	30	38	26	1.615
	3	0	38	55	1.597
1.70	3	30	39	26	1.580
	4	0	39	58	1.563
	4	30	40	30	1.546
	5	0	41	2	1.528
	5	30	41	35	1.511
	6	0	42	9	1.494
	6	30	42	43	1.476
	7	0	43	18	1.458
	7	30	43	54	1.440
	8	0	44	30	1.421
	8	30	45	10	1.403
	9	0	45	49	1.379
	9	30	46	29	1.365
	10	0	47	10	1.346
	10	30	47	53	1.327
	11	0	48	37	1.307
	11	30	49	22	1.287
	12	0	50	9	1.267
	12	30	51	0	1.245
	13	0	51	53	1.223
	13	30	52	47	1.200
	14	0	53	48	1.175
	14	30	54	52	1.149
	15	0	56	0	1.121
	15	30	57	18	1.091
	16	0	58	42	1.057
	16	30	60	40	1.014
	17	0	64	40	.930
1.75	0	0	34	51	1.750
	0	30	35	18	1.732
	1	0	35	47	1.716
	1	30	36	15	1.698
	2	0	36	44	1.681
	2	30	37	13	1.664
	3	0	37	42	1.647
	3	30	38	11	1.630
	4	0	38	42	1.612
	4	30	39	11	1.595
	5	0	39	42	1.578
	5	30	40	14	1.561
	6	0	40	47	1.544
	6	30	41	20	1.526
	7	0	41	54	1.509
	7	30	42	28	1.490
	8	0	43	2	1.471
	8	30	43	38	1.452
	9	0	44	14	1.435
	9	30	44	32	1.416
	10	0	45	29	1.397
	10	30	46	10	1.379
	11	0	46	50	1.360
	11	30	47	32	1.341
	12	0	48	18	1.322
	12	30	49	4	1.300
	13	0	49	51	1.280
	13	30	50	39	1.257
	14	0	51	32	1.234
	14	30	52	28	1.211
	15	0	53	26	1.186
	15	30	54	28	1.160
	16	0	55	38	1.131
	16	30	56	54	1.101
	17	0	58	22	1.067
	17	30	60	8	1.027
	18	0	63	6	.963
1.80	0	0	33	45	1.800
	0	30	34	13	1.785
	1	0	34	39	1.767
	1	30	35	6	1.750
	2	0	35	34	1.727
	2	30	36	2	1.714
	3	0	36	30	1.696
	3	30	36	58	1.678
	4	0	37	48	1.661
	4	30	37	59	1.644
	5	0	38	9	1.626
	5	30	39	0	1.609
	6	0	39	30	1.592

NACA

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	δ (min)	ε (deg)	ε (min)	M_2
1.80	6	30	40	2	1.575
	7	0	40	34	1.557
	7	30	41	8	1.540
	8	0	41	42	1.523
	8	30	42	16	1.505
	9	0	42	50	1.487
	9	30	43	26	1.468
	10	0	44	2	1.450
	10	30	44	42	1.431
	11	0	45	22	1.411
	11	30	46	1	1.392
	12	0	46	41	1.372
	12	30	47	24	1.352
	13	0	48	9	1.332
	13	30	48	54	1.311
	14	0	49	39	1.289
	14	30	50	28	1.267
	15	0	51	20	1.243
	15	30	52	14	1.219
	16	0	53	10	1.195
	16	30	54	15	1.170
	17	0	55	22	1.142
	17	30	56	36	1.112
	18	0	58	0	1.077
	18	30	59	42	1.035
	19	0	62	18	.972
1.85	0	0	32	43	1.850
	0	30	33	9	1.832
	1	0	33	35	1.816
	1	30	34	2	1.797
	2	0	34	29	1.780
	2	30	34	56	1.764
	3	0	35	23	1.746
	3	30	35	50	1.729
	4	0	36	19	1.711
	4	30	36	47	1.694
	5	0	37	17	1.676
	5	30	37	47	1.659
	6	0	38	18	1.641
	6	30	38	49	1.624
	7	0	39	20	1.607
	7	30	40	12	1.590
	8	0	40	25	1.571
	8	30	40	58	1.553
	9	0	41	34	1.535
	9	30	42	9	1.516
	10	0	42	43	1.498
	10	30	43	19	1.480
	11	0	43	56	1.460
	11	30	44	33	1.441
	12	0	45	12	1.423
	12	30	45	53	1.403
	13	0	46	14	1.384
	13	30	47	18	1.364
	14	0	48	2	1.344
	14	30	48	46	1.322
	15	0	49	33	1.300
	15	30	50	22	1.277
	16	0	51	13	1.254
	16	30	52	8	1.230
	17	0	53	6	1.204
	17	30	54	6	1.177
	18	0	55	14	1.147
	18	30	56	26	1.117
	19	0	57	48	1.083
	19	30	59	28	1.042
	20	0	62	14	.983
1.90	0	0	31	45	1.900
	0	30	32	9	1.884
	1	0	32	35	1.866
	1	30	33	1	1.847
	2	0	33	28	1.830
	2	30	33	54	1.813
	3	0	34	22	1.795
	3	30	34	48	1.777
	4	0	35	16	1.760
	4	30	35	44	1.743

M_1	δ (deg)	δ (min)	ε (deg)	ε (min)	M_2
1.90	5	0	36	13	1.725
	5	30	36	42	1.707
	6	0	37	13	1.690
	6	30	37	43	1.672
	7	0	38	14	1.654
	7	30	38	45	1.636
	8	0	39	17	1.618
	8	30	39	49	1.600
	9	0	40	21	1.582
	9	30	40	54	1.565
	10	0	41	29	1.547
	10	30	42	4	1.528
	11	0	42	40	1.510
	11	30	43	16	1.490
	12	0	43	52	1.471
	12	30	44	30	1.452
	13	0	45	10	1.433
	13	30	45	51	1.413
	14	0	46	33	1.392
	14	30	47	16	1.371
	15	0	48	0	1.349
	15	30	48	44	1.327
	16	0	49	32	1.305
	16	30	50	20	1.272
	17	0	51	12	1.259
	17	30	52	4	1.234
	18	0	53	2	1.209
	18	30	54	5	1.182
	19	0	55	14	1.152
	19	30	56	29	1.120
	20	0	57	52	1.084
	20	30	59	36	1.043
	21	0	62	6	.981
1.95	0	0	30	51	1.950
	0	30	31	16	1.932
	1	0	31	42	1.915
	1	30	32	7	1.897
	2	0	32	33	1.879
	2	30	32	59	1.862
	3	0	33	25	1.844
	3	30	33	51	1.826
	4	0	34	19	1.809
	4	30	34	46	1.791
	5	0	35	14	1.773
	5	30	35	42	1.756
	6	0	36	11	1.738
	6	30	36	41	1.720
	7	0	37	10	1.703
	7	30	37	42	1.685
	8	0	38	12	1.666
	8	30	38	44	1.647
	9	0	39	15	1.629
	9	30	39	48	1.611
	10	0	40	20	1.593
	10	30	40	54	1.575
	11	0	41	29	1.556
	11	30	42	5	1.537
	12	0	42	40	1.519
	12	30	43	16	1.500
	13	0	43	55	1.480
	13	30	44	34	1.459
	14	0	45	14	1.439
	14	30	45	55	1.418
	15	0	46	36	1.397
	15	30	47	20	1.376
	16	0	48	4	1.355
	16	30	48	50	1.333
	17	0	49	37	1.310
	17	30	50	26	1.286
	18	0	51	19	1.261
	18	30	52	14	1.236
	19	0	53	10	1.210
	19	30	54	15	1.182
	20	0	55	22	1.152
	20	30	56	38	1.121
	21	0	58	6	1.084
	21	30	59	46	1.038
	22	0	62	10	.963

NACA

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
2.00	0	30	0	2.000
	1	30	50	1.964
	2	31	40	1.927
	3	32	30	1.892
	4	33	23	1.856
	5	34	19	1.821
	6	35	16	1.785
	7	36	13	1.749
	8	37	14	1.713
	9	38	16	1.676
	10	39	19	1.639
	11	40	25	1.602
	12	41	33	1.565
	13	42	44	1.526
	14	44	1	1.486
	15	45	20	1.447
	16	46	42	1.405
	17	48	10	1.360
	18	49	42	1.313
	19	51	9	1.264
	20	53	20	1.211
	21	55	32	1.151
	22	58	24	1.077
2.05	0	29	12	2.050
	1	30	0	2.014
	2	30	50	1.978
	3	31	40	1.943
	4	32	32	1.907
	5	33	23	1.871
	6	34	22	1.834
	7	35	18	1.797
	8	36	16	1.760
	9	37	18	1.723
	10	38	22	1.685
	11	39	26	1.648
	12	40	32	1.609
	13	41	42	1.570
	14	42	54	1.531
	15	44	11	1.491
	16	45	30	1.450
	17	46	56	1.406
	18	48	26	1.361
	19	50	2	1.314
	20	51	46	1.263
	21	53	42	1.209
	22	56	2	1.145
	23	59	6	1.065
2.10	0	28	26	2.100
	1	29	13	2.064
	2	30	2	2.027
	3	30	52	1.991
	4	31	44	1.955
	5	32	37	1.918
	6	33	41	1.882
	7	34	28	1.846
	8	35	25	1.809
	9	36	24	1.771
	10	37	26	1.732
	11	38	30	1.695
	12	39	36	1.656
	13	40	42	1.617
	14	41	54	1.577
	15	43	10	1.537
	16	44	28	1.495
	17	45	49	1.451

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
2.10	18	47	13	1.407
	19	48	44	1.361
	20	50	22	1.312
	21	52	7	1.260
	22	54	9	1.202
	23	56	34	1.136
	24	59	48	1.051
2.15	0	27	43	2.150
	1	28	30	2.112
	2	29	19	2.075
	3	30	7	2.039
	4	30	57	2.002
	5	31	48	1.964
	6	32	42	1.927
	7	33	37	1.890
	8	34	34	1.852
	9	35	33	1.814
	10	36	34	1.776
	11	37	38	1.739
	12	38	43	1.700
	13	39	49	1.662
	14	40	58	1.620
	15	42	10	1.579
	16	43	25	1.537
	17	44	43	1.495
	18	46	5	1.451
	19	47	33	1.406
	20	49	8	1.358
	21	50	48	1.307
	22	52	36	1.252
	23	54	42	1.192
	24	57	14	1.122
	25	60	52	1.033
2.20	0	27	2	2.200
	1	27	48	2.161
	2	28	35	2.123
	3	29	24	2.086
	4	30	14	2.049
	5	31	5	2.011
	6	31	58	1.973
	7	32	52	1.935
	8	33	50	1.897
	9	34	49	1.860
	10	35	48	1.822
	11	36	50	1.784
	12	37	52	1.745
	13	38	58	1.705
	14	40	4	1.664
	15	41	14	1.623
	16	42	28	1.582
	17	43	44	1.539
	18	45	4	1.494
	19	46	28	1.449
	20	47	58	1.403
	21	49	32	1.354
	22	51	14	1.301
	23	53	8	1.246
	24	55	18	1.184
	25	58	2	1.107
	26	62	56	.982
2.25	0	26	23	2.250
	1	27	6	2.212
	2	27	54	2.173
	3	28	42	2.135

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
2.25	4	29	32	2.096
	5	30	24	2.059
	6	31	16	2.021
	7	32	10	1.982
	8	33	5	1.944
	9	34	2	1.905
	10	35	2	1.866
	11	36	1	1.827
	12	37	4	1.788
	13	38	8	1.747
	14	39	14	1.706
	15	40	24	1.666
	16	41	36	1.624
	17	42	50	1.581
	18	44	8	1.538
	19	45	29	1.495
	20	46	56	1.447
	21	48	27	1.399
	22	50	4	1.347
	23	51	50	1.292
	24	53	49	1.233
	25	56	8	1.164
	26	59	8	1.080
2.30	0	25	46	2.300
	1	26	30	2.260
	2	27	16	2.222
	3	28	4	2.183
	4	28	54	2.144
	5	29	44	2.105
	6	30	35	2.067
	7	31	30	2.028
	8	32	25	1.989
	9	33	21	1.949
	10	34	19	1.910
	11	35	20	1.870
	12	36	22	1.831
	13	37	25	1.791
	14	38	30	1.750
	15	39	38	1.708
	16	40	48	1.667
	17	42	0	1.625
	18	43	16	1.581
	19	44	36	1.535
	20	46	0	1.489
	21	47	26	1.441
	22	49	2	1.390
	23	50	38	1.336
	24	52	30	1.280
	25	54	29	1.217
	26	57	2	1.142
	27	60	38	1.046
2.35	0	25	11	2.350
	1	25	55	2.311
	2	26	42	2.272
	3	27	28	2.234
	4	28	18	2.195
	5	29	8	2.155
	6	29	58	2.116
	7	30	51	2.076
	8	31	46	2.037
	9	32	42	1.997
	10	33	38	1.957
	11	34	38	1.917
	12	35	39	1.876
	13	36	42	1.834

NACA

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	ε (deg)	ε (min)	M_2
2.35	14	37	46	1.793
	15	38	54	1.751
	16	40	2	1.709
	17	41	15	1.666
	18	42	28	1.622
	19	43	45	1.576
	20	45	6	1.530
	21	46	31	1.483
	22	48	2	1.432
	23	49	38	1.380
	24	51	23	1.324
	25	53	16	1.264
	26	55	30	1.196
	27	58	14	1.116
	28	63	0	.980
2.40	0	24	37	2.400
	1	25	21	2.360
	2	26	7	2.320
	3	26	54	2.280
	4	27	42	2.241
	5	28	32	2.201
	6	29	22	2.160
	7	30	14	2.120
	8	31	8	2.080
	9	32	4	2.041
	10	33	0	2.000
	11	33	58	1.959
	12	34	59	1.917
	13	36	0	1.876
	14	37	6	1.835
	15	38	13	1.792
	16	39	22	1.748
	17	40	32	1.704
	18	41	46	1.660
	19	43	2	1.615
	20	44	20	1.570
	21	45	43	1.522
	22	47	10	1.472
	23	48	44	1.421
	24	50	23	1.367
	25	52	10	1.309
	26	54	9	1.243
	27	56	32	1.169
	28	59	45	1.077
2.45	0	24	5	2.450
	1	24	50	2.408
	2	25	34	2.367
	3	26	21	2.326
	4	27	9	2.286
	5	27	57	2.246
	6	28	48	2.205
	7	29	40	2.163
	8	30	33	2.122
	9	31	27	2.081
	10	32	23	2.041
	11	33	22	2.000
	12	34	22	1.958
	13	35	24	1.917
	14	36	28	1.876
	15	37	34	1.834
	16	38	42	1.790
	17	39	50	1.746
	18	41	2	1.701
	19	42	16	1.655
	20	43	36	1.608

M_1	δ (deg)	ε (deg)	ε (min)	M_2
2.45	21	44	57	1.560
	22	46	21	1.510
	23	47	50	1.459
	24	49	25	1.405
	25	51	7	1.349
	26	53	1	1.287
	27	55	12	1.219
	28	57	52	1.140
	29	61	51	1.023
2.50	0	23	35	2.500
	1	24	19	2.459
	2	25	5	2.418
	3	25	52	2.376
	4	26	38	2.335
	5	27	26	2.294
	6	28	17	2.252
	7	29	8	2.210
	8	30	1	2.169
	9	30	56	2.126
	10	31	52	2.085
	11	32	49	2.038
	12	33	47	2.000
	13	34	48	1.957
	14	35	52	1.916
	15	36	56	1.871
	16	38	5	1.827
	17	39	14	1.783
	18	40	24	1.739
	19	41	37	1.692
	20	42	54	1.645
	21	44	14	1.598
	22	45	35	1.548
	23	47	2	1.496
	24	48	38	1.443
	25	50	18	1.387
	26	52	5	1.327
	27	54	0	1.263
	28	56	20	1.189
	29	59	17	1.100
2.60	0	22	37	2.600
	1	23	20	2.556
	2	24	6	2.512
	3	24	50	2.470
	4	25	37	2.426
	5	26	26	2.384
	6	27	15	2.341
	7	28	6	2.299
	8	28	58	2.257
	9	29	52	2.214
	10	30	47	2.173
	11	31	45	2.129
	12	32	43	2.084
	13	33	43	2.039
	14	34	45	1.995
	15	35	48	1.950
	16	36	54	1.906
	17	38	2	1.860
	18	39	11	1.813
	19	40	23	1.767
	20	41	38	1.719
	21	42	55	1.671
	22	44	14	1.621
	23	45	38	1.569
	24	47	6	1.516
	25	48	38	1.459

M_1	δ (deg)	ε (deg)	ε (min)	M_2
2.60	26	50	17	1.401
	27	52	6	1.340
	28	54	4	1.272
	29	56	22	1.197
	30	59	22	1.105
2.70	0	21	44	2.700
	1	22	26	2.652
	2	23	10	2.608
	3	23	56	2.564
	4	24	43	2.519
	5	25	30	2.474
	6	26	19	2.430
	7	27	10	2.386
	8	28	2	2.343
	9	28	55	2.300
	10	29	50	2.256
	11	30	45	2.211
	12	31	42	2.166
	13	32	42	2.121
	14	33	44	2.075
	15	34	47	2.029
	16	35	52	1.982
	17	36	58	1.935
	18	38	6	1.887
	19	39	17	1.839
	20	40	30	1.790
	21	41	45	1.740
	22	43	3	1.690
	23	44	23	1.638
	24	45	48	1.584
	25	47	19	1.530
	26	48	52	1.472
	27	50	32	1.412
	28	52	20	1.345
	29	54	19	1.280
	30	56	36	1.202
	31	59	38	1.198
2.80	0	20	56	2.800
	1	21	38	2.753
	2	22	22	2.707
	3	23	6	2.661
	4	23	52	2.615
	5	24	38	2.569
	6	25	26	2.523
	7	26	16	2.476
	8	27	9	2.431
	9	28	2	2.386
	10	28	56	2.339
	11	29	52	2.293
	12	30	50	2.247
	13	31	48	2.200
	14	32	48	2.153
	15	33	50	2.106
	16	34	54	2.057
	17	36	0	2.010
	18	37	8	1.961
	19	38	17	1.912
	20	39	30	1.863
	21	40	44	1.811
	22	42	0	1.757
	23	43	20	1.704
	24	44	42	1.649
	25	46	9	1.594
	26	47	37	1.539
	27	49	12	1.480

NACA

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
2.80	28	50	54	1.418
	29	52	42	1.350
	30	54	48	1.279
	31	57	9	1.198
	32	60	25	1.093
2.90	0	20	10	2.900
	1	20	52	2.852
	2	21	35	2.804
	3	22	19	2.755
	4	23	4	2.709
	5	23	50	2.660
	6	24	38	2.612
	7	25	28	2.564
	8	26	19	2.517
	9	27	13	2.470
	10	28	7	2.422
	11	29	3	2.375
	12	30	0	2.326
	13	30	57	2.279
	14	31	58	2.231
	15	33	0	2.182
	16	34	2	2.132
	17	35	6	2.083
	18	36	13	2.031
	19	37	22	1.980
	20	38	33	1.929
	21	39	46	1.875
	22	41	1	1.822
	23	42	18	1.768
	24	43	40	1.713
	25	45	4	1.656
	26	46	30	1.599
	27	48	2	1.541
	28	49	39	1.481
	29	51	24	1.415
	30	53	16	1.346
	31	55	22	1.270
	32	57	56	1.177
3.00	0	19	28	3.000
	1	20	10	2.949
	2	20	53	2.900
	3	21	37	2.849
	4	22	22	2.800
	5	23	8	2.750
	6	23	56	2.700
	7	24	45	2.651
	8	25	35	2.602
	9	26	27	2.553
	10	27	21	2.503
	11	28	17	2.454
	12	29	13	2.404
	13	30	12	2.355
	14	31	12	2.304
	15	32	13	2.254
	16	33	14	2.203
	17	34	19	2.151
	18	35	25	2.100
	19	36	32	2.046
	20	37	43	1.993
	21	38	56	1.939
	22	40	9	1.884
	23	41	25	1.828
	24	42	44	1.773
	25	44	7	1.716

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
3.00	26	45	32	1.659
	27	47	0	1.600
	28	48	34	1.539
	29	50	14	1.475
	30	52	0	1.407
	31	53	57	1.335
	32	56	7	1.254
3.05	0	19	8	3.050
	1	19	50	3.000
	2	20	33	2.949
	3	21	18	2.898
	4	22	2	2.847
	5	22	48	2.796
	6	23	36	2.746
	7	24	26	2.695
	8	25	16	2.643
	9	26	8	2.594
	10	27	1	2.545
	11	27	57	2.495
	12	28	53	2.443
	13	29	52	2.392
	14	30	50	2.341
	15	31	50	2.290
	16	32	55	2.239
	17	34	0	2.186
	18	35	6	2.133
	19	36	14	2.080
	20	37	23	2.027
	21	38	35	1.971
	22	39	50	1.916
	23	41	5	1.860
	24	42	21	1.803
	25	43	42	1.747
	26	45	8	1.689
	27	46	34	1.629
	28	48	7	1.568
	29	49	45	1.504
	30	51	28	1.436
	31	53	20	1.365
	32	56	10	1.284
	33	58	0	1.195
	34	61	32	1.073
3.10	0	18	49	3.100
	1	19	29	3.046
	2	20	13	2.995
	3	20	58	2.944
	4	21	43	2.892
	5	22	28	2.840
	6	23	16	2.787
	7	24	7	2.736
	8	24	58	2.686
	9	25	48	2.635
	10	26	41	2.585
	11	27	37	2.533
	12	28	34	2.483
	13	29	32	2.431
	14	30	31	2.379
	15	31	31	2.327
	16	32	33	2.274
	17	33	36	2.220
	18	34	43	2.166
	19	35	51	2.112
	20	37	1	2.058
	21	38	12	2.002

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
3.10	22	39	28	1.946
	23	40	43	1.890
	24	42	0	1.832
	25	43	20	1.775
	26	44	44	1.715
	27	46	8	1.654
	28	47	40	1.593
	29	49	16	1.528
	30	50	58	1.462
	31	52	46	1.391
	32	54	50	1.316
	33	57	10	1.230
	34	60	12	1.124
3.15	0	18	31	3.150
	1	19	12	3.096
	2	19	54	3.044
	3	20	38	2.992
	4	21	22	2.940
	5	22	7	2.887
	6	22	56	2.836
	7	23	47	2.784
	8	24	37	2.731
	9	25	29	2.679
	10	26	22	2.627
	11	27	18	2.575
	12	28	16	2.522
	13	29	14	2.469
	14	30	12	2.416
	15	31	12	2.363
	16	32	15	2.310
	17	33	19	2.255
	18	34	24	2.200
	19	35	30	2.145
	20	36	39	2.088
	21	37	50	2.032
	22	39	2	1.975
	23	40	18	1.918
	24	41	35	1.860
	25	42	54	1.802
	26	44	16	1.742
	27	45	41	1.680
	28	47	13	1.618
	29	48	46	1.555
	30	50	27	1.489
	31	52	15	1.419
	32	54	13	1.343
	33	56	28	1.260
	34	59	11	1.160
	35	64	36	.990
3.20	0	18	13	3.200
	1	18	54	3.146
	2	19	36	3.092
	3	20	20	3.040
	4	21	4	2.987
	5	21	50	2.933
	6	22	38	2.879
	7	23	28	2.826
	8	24	19	2.773
	9	25	10	2.720
	10	26	2	2.667
	11	26	58	2.614
	12	27	56	2.561
	13	28	54	2.507
	14	29	52	2.452

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
3.20	15	30	52	2.398
	16	31	54	2.344
	17	33	0	2.288
	18	34	5	2.232
	19	35	10	2.176
	20	36	18	2.120
	21	37	32	2.062
	22	38	44	2.005
	23	39	58	1.946
	24	41	16	1.887
	25	42	34	1.829
	26	43	57	1.770
	27	45	22	1.709
	28	46	50	1.646
	29	48	22	1.583
	30	50	0	1.516
	31	51	45	1.445
	32	53	40	1.370
	33	55	50	1.289
	34	58	24	1.196
	35	62	6	1.067
3.25	0	17	55	3.250
	1	18	36	3.195
	2	19	18	3.140
	3	20	1	3.086
	4	20	46	3.031
	5	21	30	2.977
	6	22	20	2.923
	7	23	10	2.868
	8	24	1	2.815
	9	24	52	2.760
	10	25	44	2.706
	11	26	40	2.651
	12	27	36	2.597
	13	28	34	2.543
	14	29	34	2.489
	15	30	35	2.433
	16	31	38	2.378
	17	32	41	2.322
	18	33	46	2.265
	19	34	53	2.210
	20	36	1	2.152
	21	37	12	2.094
	22	38	24	2.035
	23	39	38	1.975
	24	40	54	1.916
	25	42	10	1.856
	26	43	31	1.795
	27	44	55	1.734
	28	46	25	1.671
	29	47	57	1.607
	30	49	33	1.540
	31	51	18	1.469
	32	53	8	1.398
	33	55	14	1.318
	34	57	38	1.228
	35	60	50	1.116
3.30	0	17	35	3.300
	1	18	18	3.244
	2	19	2	3.189
	3	19	46	3.132
	4	20	30	3.077
	5	21	15	3.022
	6	22	4	2.966

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
3.30	7	22	52	2.910
	8	23	42	2.856
	9	24	33	2.801
	10	25	26	2.748
	11	26	23	2.692
	12	37	19	2.636
	13	28	16	2.580
	14	29	16	2.524
	15	30	18	2.467
	16	31	20	2.410
	17	32	22	2.355
	18	33	28	2.297
	19	34	35	2.239
	20	35	43	2.182
	21	36	53	2.123
	22	38	6	2.064
	23	39	21	2.005
	24	40	36	1.945
	25	41	54	1.884
	26	43	13	1.823
	27	44	34	1.760
	28	46	0	1.697
	29	47	34	1.631
	30	49	10	1.565
	31	50	50	1.496
	32	52	40	1.423
	33	54	42	1.344
	34	57	1	1.256
	35	59	54	1.152
3.35	0	17	22	3.350
	1	18	3	3.294
	2	18	45	3.237
	3	19	28	3.181
	4	20	13	3.125
	5	21	0	3.068
	6	21	49	3.013
	7	22	37	2.955
	8	23	26	2.899
	9	24	18	2.842
	10	25	10	2.786
	11	26	6	2.729
	12	27	4	2.672
	13	28	2	2.615
	14	29	0	2.558
	15	30	0	2.500
	16	31	3	2.442
	17	32	6	2.385
	18	33	12	2.327
	19	34	19	2.269
	20	35	25	2.211
	21	36	34	2.152
	22	37	46	2.092
	23	39	2	2.032
	24	40	18	1.970
	25	41	35	1.910
	26	42	54	1.846
	27	44	18	1.783
	28	45	44	1.719
	29	47	14	1.655
	30	48	46	1.587
	31	50	28	1.520
	32	52	14	1.445
	33	54	10	1.369
	34	56	24	1.283
	35	59	4	1.186

M_1	δ (deg)	ϵ (deg)	ϵ (min)	M_2
3.35	36	63	24	1.033
3.40	0	17	6	3.400
	1	17	49	3.341
	2	18	32	3.284
	3	19	14	3.226
	4	19	58	3.169
	5	20	44	3.111
	6	21	32	3.054
	7	22	21	2.996
	8	23	10	2.937
	9	24	2	2.881
	10	24	55	2.824
	11	25	50	2.766
	12	26	45	2.708
	13	27	44	2.651
	14	28	44	2.595
	15	29	44	2.536
	16	30	46	2.477
	17	31	50	2.420
	18	32	54	2.360
	19	34	2	2.301
	20	35	10	2.241
	21	36	19	2.180
	22	37	30	2.120
	23	38	44	2.058
	24	40	0	1.997
	25	41	16	1.935
	26	42	35	1.873
	27	43	58	1.809
	28	45	24	1.744
	29	46	54	1.677
	30	48	25	1.610
	31	50	4	1.540
	32	51	50	1.468
	33	53	42	1.392
	34	55	53	1.310
	35	58	24	1.214
	36	61	54	1.090
3.45	0	16	51	3.450
	1	17	32	3.391
	2	18	13	3.333
	3	18	56	3.275
	4	19	41	3.216
	5	20	26	3.156
	6	21	14	3.097
	7	22	4	3.040
	8	22	54	2.981
	9	23	46	2.922
	10	24	39	2.864
	11	25	34	2.805
	12	26	30	2.747
	13	27	27	2.687
	14	28	26	2.630
	15	29	28	2.570
	16	30	30	2.512
	17	31	34	2.452
	18	32	37	2.391
	19	33	45	2.331
	20	34	51	2.270
	21	36	0	2.208
	22	37	14	2.147
	23	38	27	2.085
	24	39	43	2.022
	25	41	0	1.958

NACA

TABLE III - Continued

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Continued

M_1	δ (deg)	ϵ		M_2
		(deg)	(min)	
3.45	26	42	18	1.895
	27	43	38	1.831
	28	45	5	1.766
	29	46	34	1.700
	30	48	6	1.631
	31	49	42	1.562
	32	51	26	1.491
	33	53	17	1.416
	34	55	22	1.334
	35	57	45	1.242
	36	61	0	1.127
3.50	0	16	36	3.500
	1	17	16	3.440
	2	17	58	3.381
	3	18	40	3.321
	4	19	24	3.262
	5	20	10	3.203
	6	21	0	3.141
	7	21	48	3.082
	8	22	38	3.023
	9	23	29	2.963
	10	24	24	2.904
	11	25	18	2.844
	12	26	14	2.785
	13	27	10	2.724
	14	28	10	2.662
	15	29	11	2.602
	16	30	14	2.543
	17	31	17	2.483
	18	32	22	2.422
	19	33	28	2.361
	20	34	35	2.299
	21	35	45	2.237
	22	36	57	2.174
	23	38	10	2.111
	24	39	24	2.048
	25	40	42	1.983
	26	42	2	1.918
	27	43	24	1.852
	28	44	47	1.787
	29	46	14	1.720
	30	47	46	1.652
	31	49	21	1.584
	32	51	4	1.513
	33	52	53	1.437
	34	54	55	1.356
	35	57	14	1.266
	36	60	12	1.158
3.55	0	16	22	3.550
	1	17	2	3.488
	2	17	44	3.426
	3	18	26	3.365
	4	19	10	3.304
	5	19	56	3.244
	6	20	46	3.184
	7	21	34	3.125
	8	22	25	3.065
	9	23	15	3.005
	10	24	10	2.943
	11	25	4	2.882
	12	26	0	2.821
	13	26	56	2.760
	14	27	54	2.699
	15	28	56	2.637

M_1	δ (deg)	ϵ		M_2
		(deg)	(min)	
3.55	16	29	59	2.576
	17	31	3	2.516
	18	32	6	2.455
	19	33	12	2.392
	20	34	20	2.330
	21	35	30	2.266
	22	36	42	2.203
	23	37	55	2.139
	24	39	10	2.075
	25	40	26	2.009
	26	41	44	1.943
	27	43	8	1.877
	28	44	32	1.812
	29	45	57	1.745
	30	47	28	1.675
	31	49	2	1.606
	32	50	44	1.535
	33	52	30	1.459
	34	54	29	1.380
	35	56	42	1.291
	36	59	26	1.187
	37	64	10	1.019
3.60	0	16	8	3.600
	1	16	47	3.538
	2	17	29	3.474
	3	18	12	3.412
	4	18	56	3.350
	5	19	41	3.288
	6	20	30	3.226
	7	21	19	3.166
	8	22	10	3.104
	9	23	0	3.044
	10	23	54	2.981
	11	24	48	2.919
	12	25	44	2.857
	13	26	42	2.795
	14	27	41	2.731
	15	28	41	2.670
	16	29	45	2.608
	17	30	47	2.546
	18	31	52	2.483
	19	32	58	2.419
	20	34	6	2.357
	21	35	15	2.292
	22	36	27	2.227
	23	37	39	2.163
	24	38	53	2.097
	25	40	10	2.032
	26	41	28	1.966
	27	42	49	1.900
	28	44	13	1.834
	29	45	39	1.766
	30	47	8	1.699
	31	48	43	1.628
	32	50	24	1.556
	33	52	9	1.481
	34	54	7	1.402
	35	56	14	1.315
	36	58	49	1.215
	37	62	39	1.075
3.65	0	15	54	3.650
	1	16	34	3.587
	2	17	16	3.523
	3	17	58	3.460

M_1	δ (deg)	ϵ		M_2
		(deg)	(min)	
3.65	4	18	41	3.396
	5	19	28	3.333
	6	20	15	3.270
	7	21	4	3.207
	8	21	55	3.145
	9	22	46	3.082
	10	23	40	3.020
	11	24	34	2.957
	12	25	30	2.894
	13	26	28	2.831
	14	27	28	2.766
	15	28	28	2.703
	16	29	30	2.640
	17	30	34	2.577
	18	31	38	2.513
	19	32	46	2.448
	20	33	53	2.383
	21	35	2	2.317
	22	36	14	2.252
	23	37	26	2.187
	24	38	40	2.121
	25	39	56	2.055
	26	41	14	1.987
	27	42	34	1.922
	28	43	57	1.855
	29	45	24	1.786
	30	46	54	1.718
	31	48	26	1.648
	32	50	4	1.575
	33	51	49	1.500
	34	53	44	1.422
	35	55	46	1.337
	36	58	16	1.241
	37	60	50	1.117
3.70	0	15	41	3.700
	1	16	20	3.635
	2	17	2	3.569
	3	17	44	3.503
	4	18	28	3.438
	5	19	15	3.376
	6	20	2	3.312
	7	20	50	3.250
	8	21	41	3.186
	9	22	33	3.124
	10	23	26	3.060
	11	24	21	2.996
	12	25	17	2.932
	13	26	14	2.868
	14	27	14	2.802
	15	28	15	2.737
	16	29	16	2.672
	17	30	20	2.606
	18	31	26	2.540
	19	32	32	2.475
	20	33	40	2.410
	21	34	49	2.342
	22	36	0	2.277
	23	37	13	2.211
	24	38	28	2.145
	25	39	42	2.077
	26	41	2	2.010
	27	42	22	1.943
	28	43	45	1.875
	29	45	10	1.806
	30	46	38	1.737

TABLE III - Concluded

VALUES OF MACH NUMBER, DEVIATION OF FLOW, ANGLE OF SHOCK,

AND MACH NUMBER BEHIND THE SHOCK - Concluded

M_1	δ	ϵ		M_2
	(deg)	(deg)	(min)	
3.70	31	48	10	1.665
	32	49	46	1.594
	33	51	30	1.518
	34	53	21	1.440
	35	55	22	1.357
	36	57	46	1.263
	37	60	50	1.148
3.80	0	15	15	3.800
	1	15	55	3.734
	2	16	36	3.665
	3	17	18	3.597
	4	18	2	3.532
	5	18	49	3.467
	6	19	36	3.402
	7	20	25	3.336
	8	21	16	3.270
	9	22	8	3.204
	10	23	1	3.137
	11	23	57	3.069
	12	24	53	3.002
	13	25	50	2.935
	14	26	19	2.866
	15	27	50	2.800
	16	28	50	2.733
	17	29	56	2.665
	18	31	2	2.598
	19	32	7	2.531
	20	33	15	2.462
	21	34	23	2.395
	22	35	34	2.328
	23	36	46	2.260
	24	38	0	2.193
	25	39	16	2.124
	26	40	34	2.055
	27	41	54	1.986
	28	43	16	1.916
	29	44	41	1.846
	30	46	8	1.776
	31	47	38	1.706
	32	49	13	1.631
	33	50	54	1.557
	34	52	41	1.480
	35	54	42	1.397
	36	56	57	1.306
	37	59	40	1.200
	38	64	14	1.026
3.90	0	14	51	3.900
	1	15	30	3.828
	2	16	12	3.757
	3	16	54	3.687
	4	17	37	3.618
	5	18	22	3.551
	6	19	10	3.482
	7	20	0	3.413
	8	20	51	3.345
	9	21	43	3.276
	10	22	36	3.207
	11	23	32	3.139
	12	24	29	3.070
	13	25	26	3.002
	14	26	24	2.932
3.90	15	27	25	2.864
	16	28	26	2.796
	17	29	30	2.727
	18	30	34	2.657
	19	31	40	2.587
	20	32	48	2.517
	21	33	57	2.446
	22	35	8	2.377
	23	36	21	2.308
	24	37	36	2.237
	25	38	50	2.166
	26	40	8	2.095
	27	41	28	2.025
	28	42	50	1.955
	29	44	13	1.885
	30	45	40	1.812
	31	47	10	1.741
	32	48	43	1.666
	33	50	22	1.591
	34	52	6	1.513
	35	54	2	1.431
	36	56	9	1.343
	37	58	38	1.240
	38	62	8	1.114
4.0	0	14	29	4.000
	1	15	10	3.927
	2	15	50	3.854
	3	16	33	3.783
	4	17	17	3.711
	5	18	2	3.639
	6	18	50	3.568
	7	19	39	3.497
	8	20	30	3.426
	9	21	20	3.355
	10	22	13	3.285
	11	23	9	3.213
	12	24	6	3.141
	13	25	3	3.070
	14	26	2	2.999
	15	27	4	2.926
	16	28	6	2.856
	17	29	9	2.780
	18	30	14	2.713
	19	31	18	2.641
	20	32	26	2.570
	21	33	37	2.497
	22	34	46	2.424
	23	35	58	2.354
	24	37	12	2.282
	25	38	28	2.210
	26	39	46	2.137
	27	41	5	2.065
	28	42	26	1.992
	29	43	48	1.922
	30	45	14	1.850
	31	46	42	1.777
	32	48	14	1.700
	33	49	55	1.625
	34	51	38	1.548
	35	53	27	1.465
	36	55	30	1.380
	37	57	52	1.281
	38	60	50	1.165

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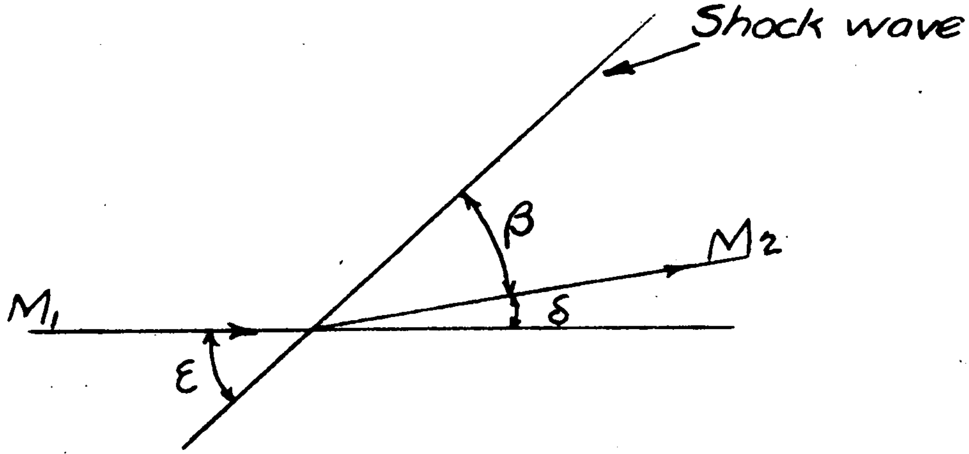


Figure 1.- Diagram showing the angle of the shock, deviation of the flow, and the angle of the flow behind the shock.

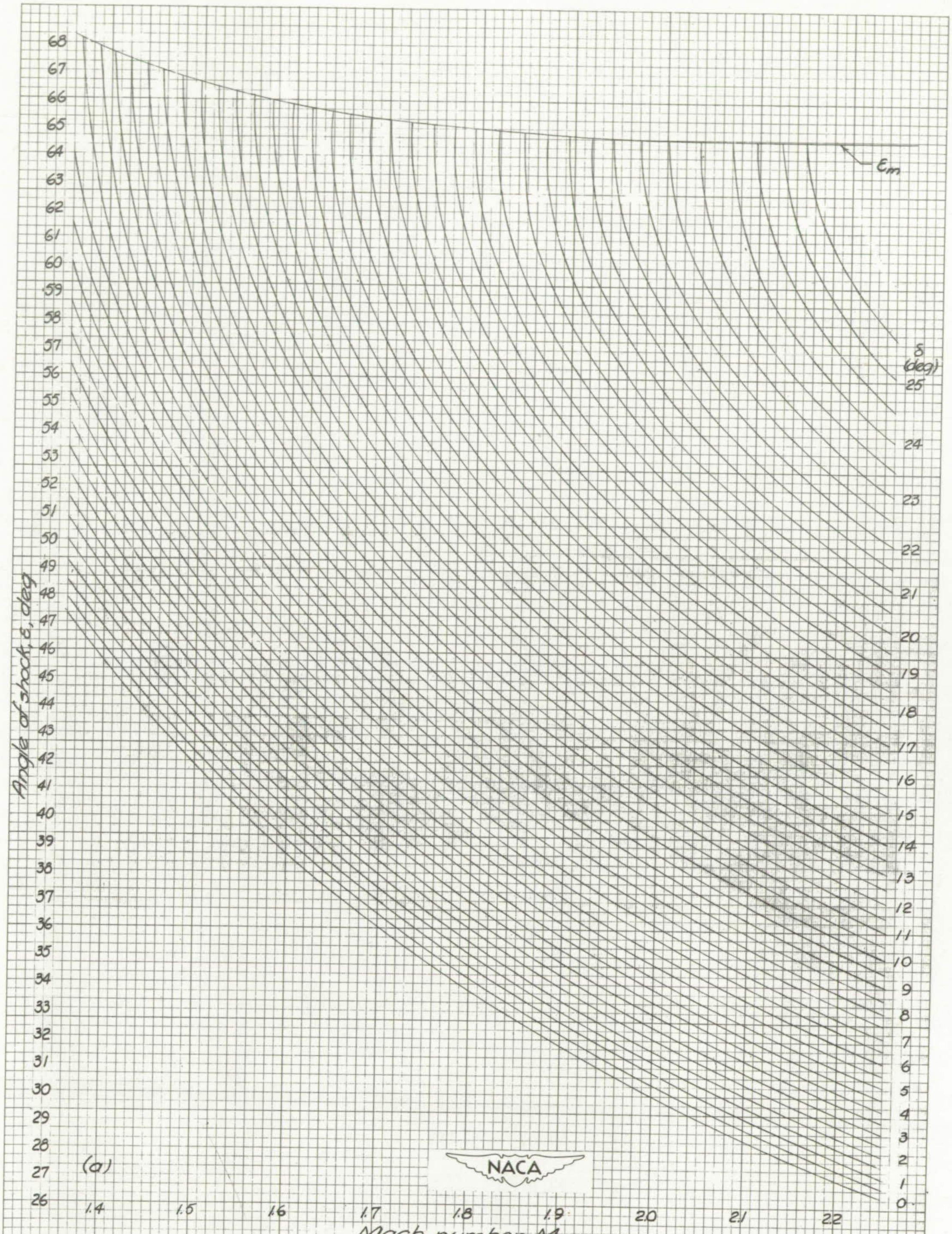


Figure 2.- Variation of angle of shock with Mach number in front of the shock for various deviations of the flow.

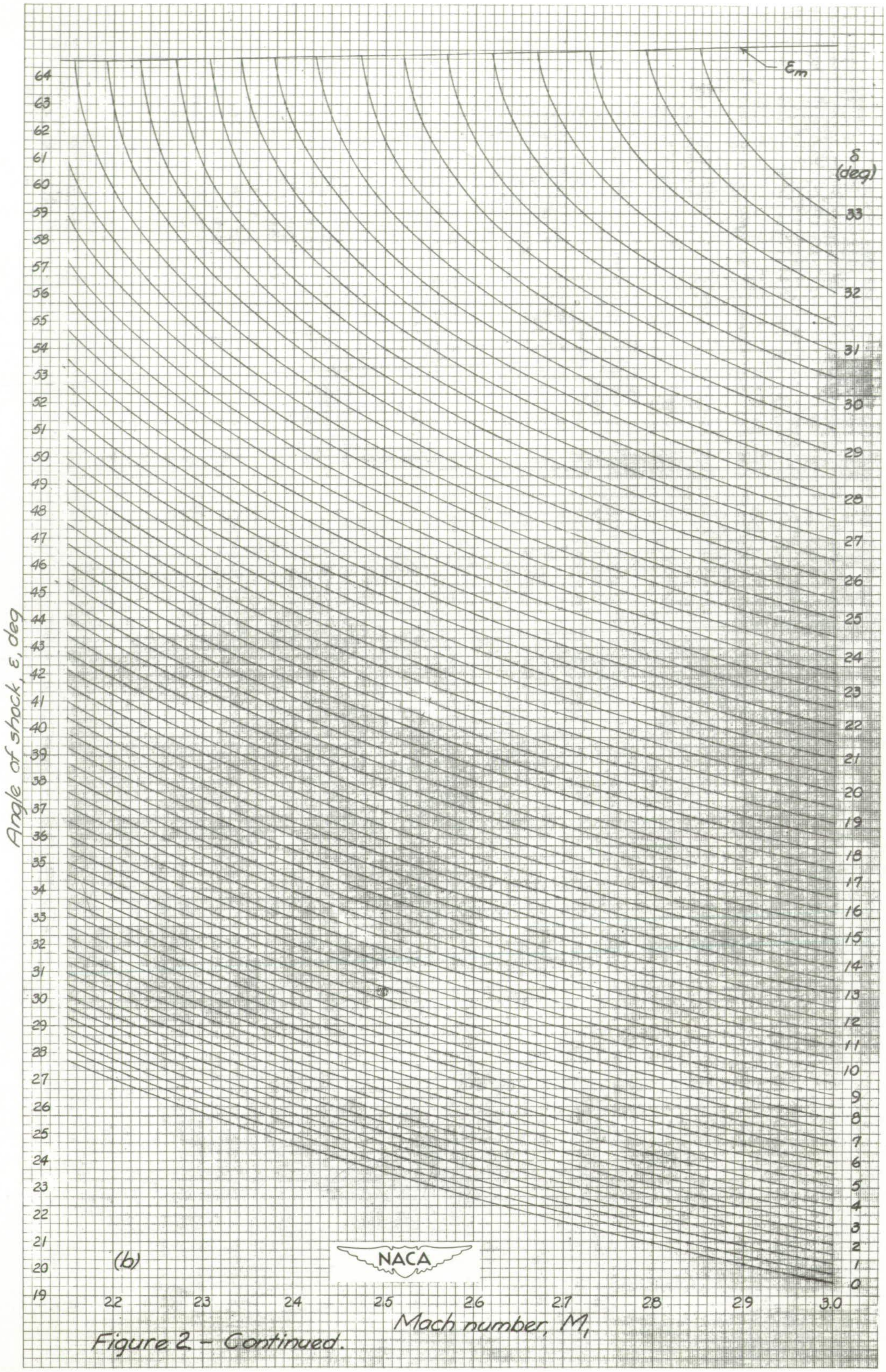


Figure 2 - Continued.

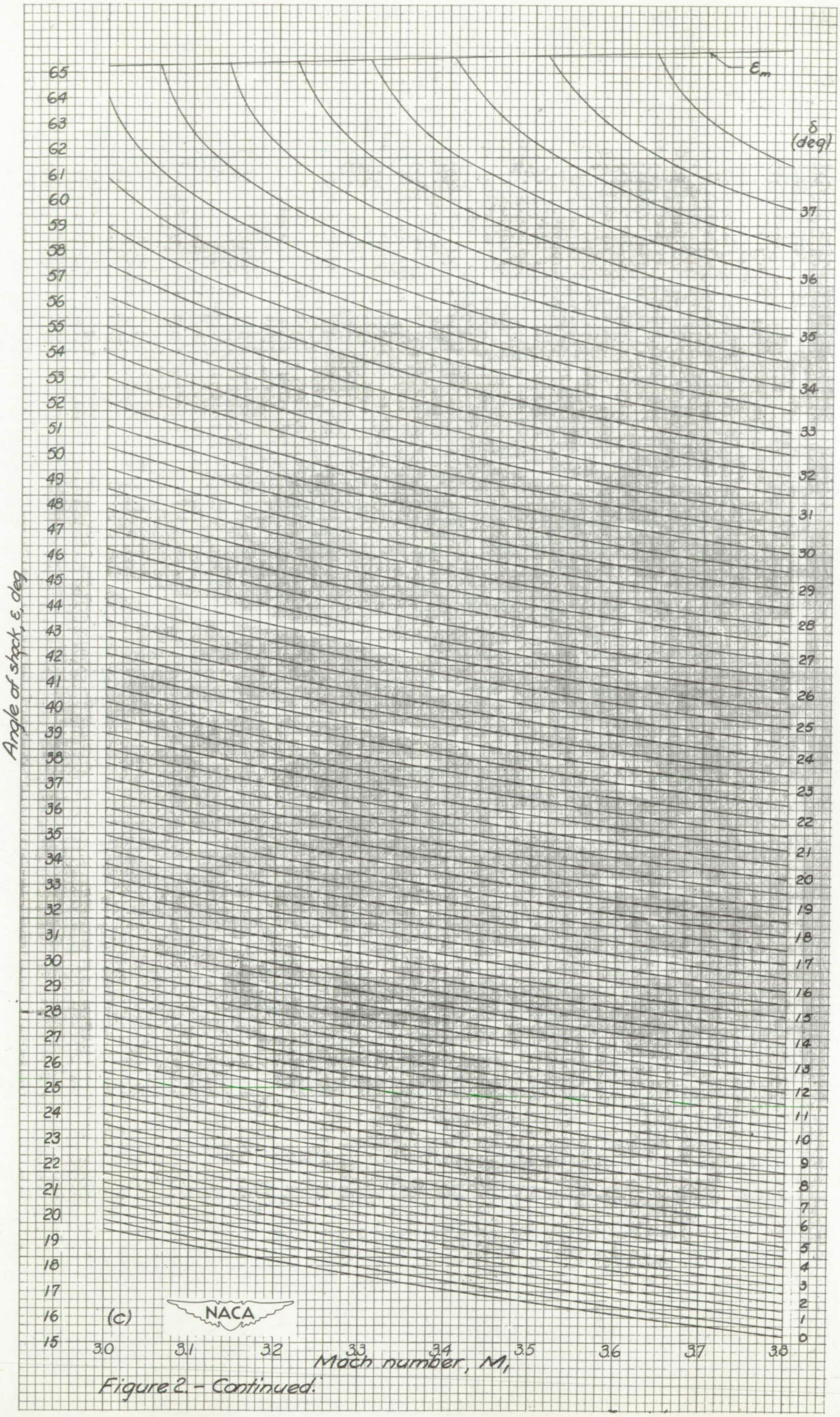


Figure 2. - Continued.

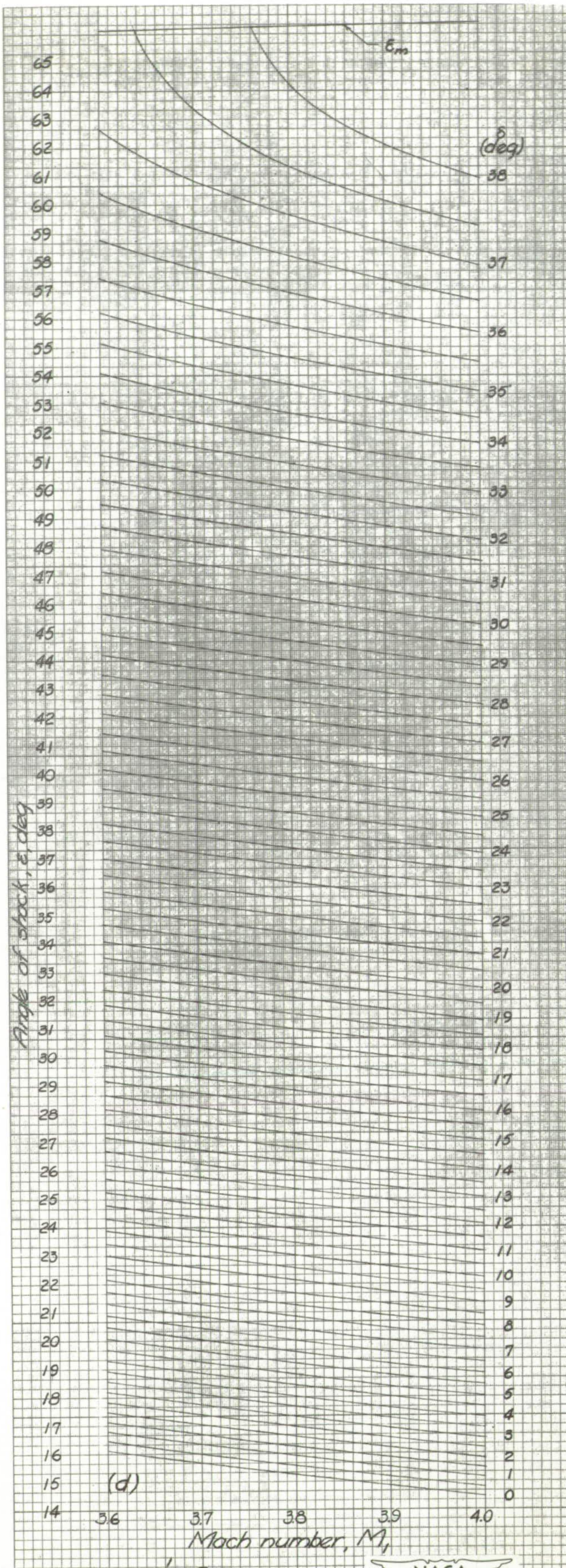


Figure 2.– Concluded.

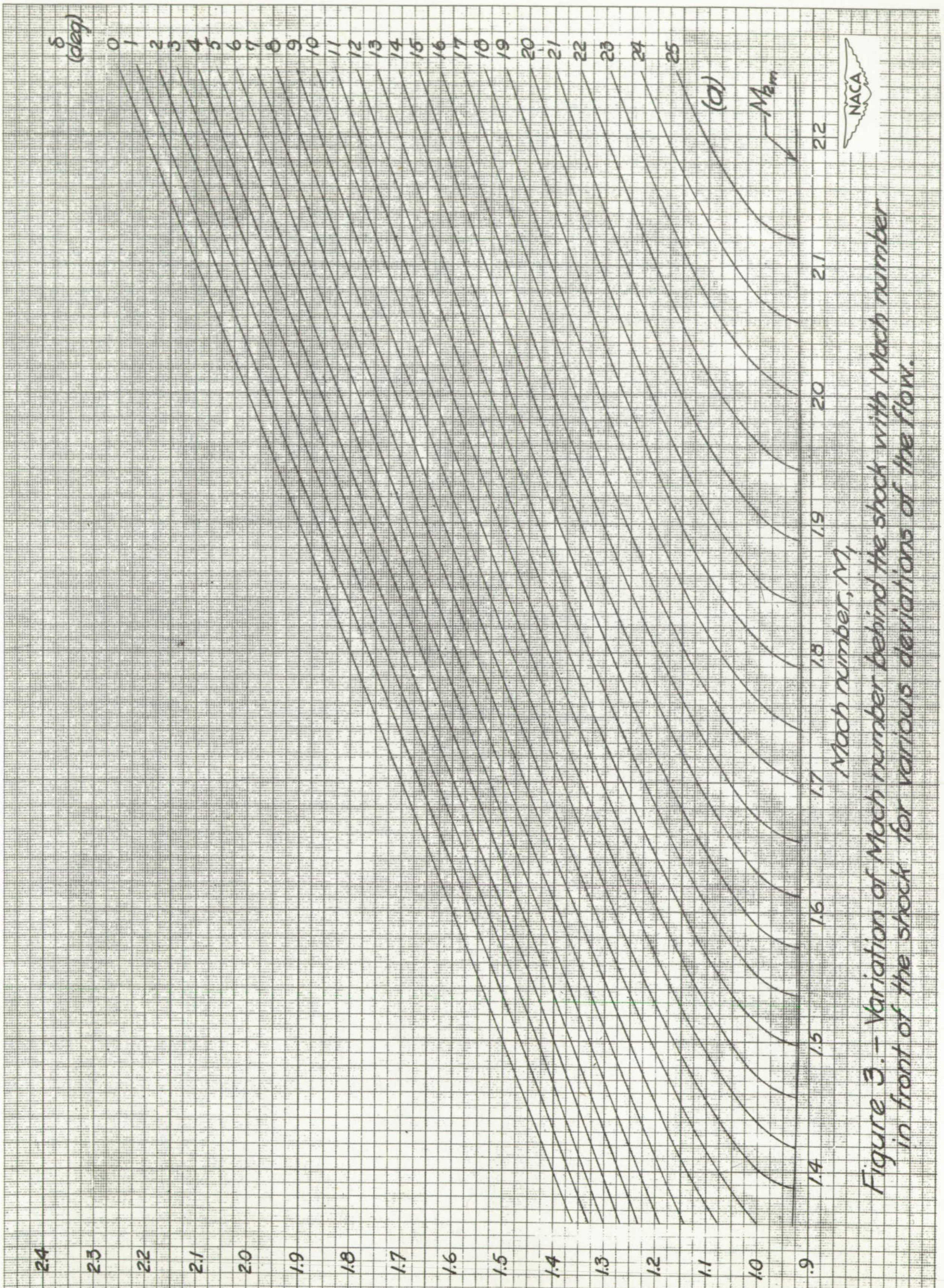


Figure 3.- Variation of Mach number behind the shock with Mach number in front of the shock for various deviations of the flow.

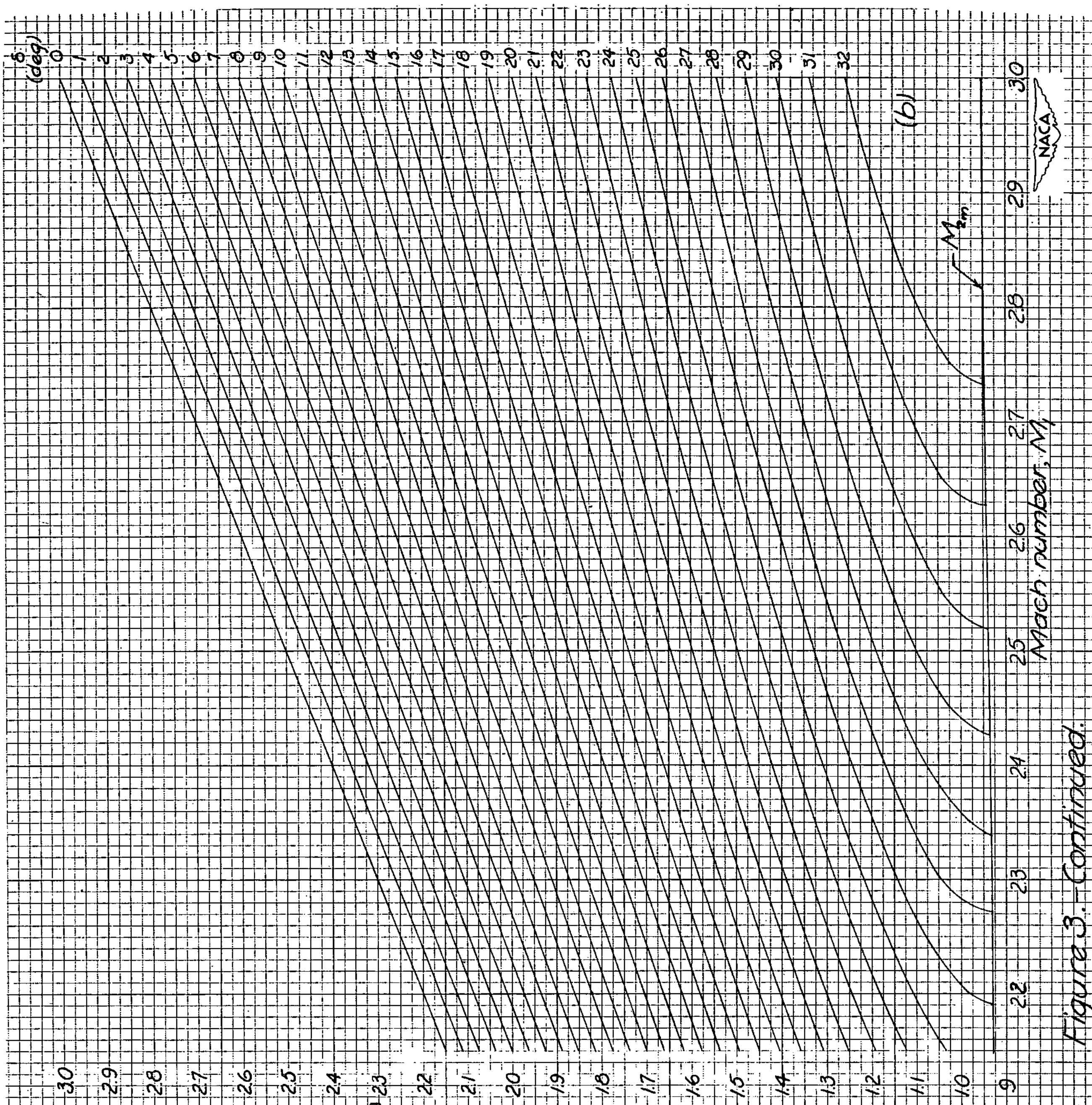


Figure 3.- Continued.

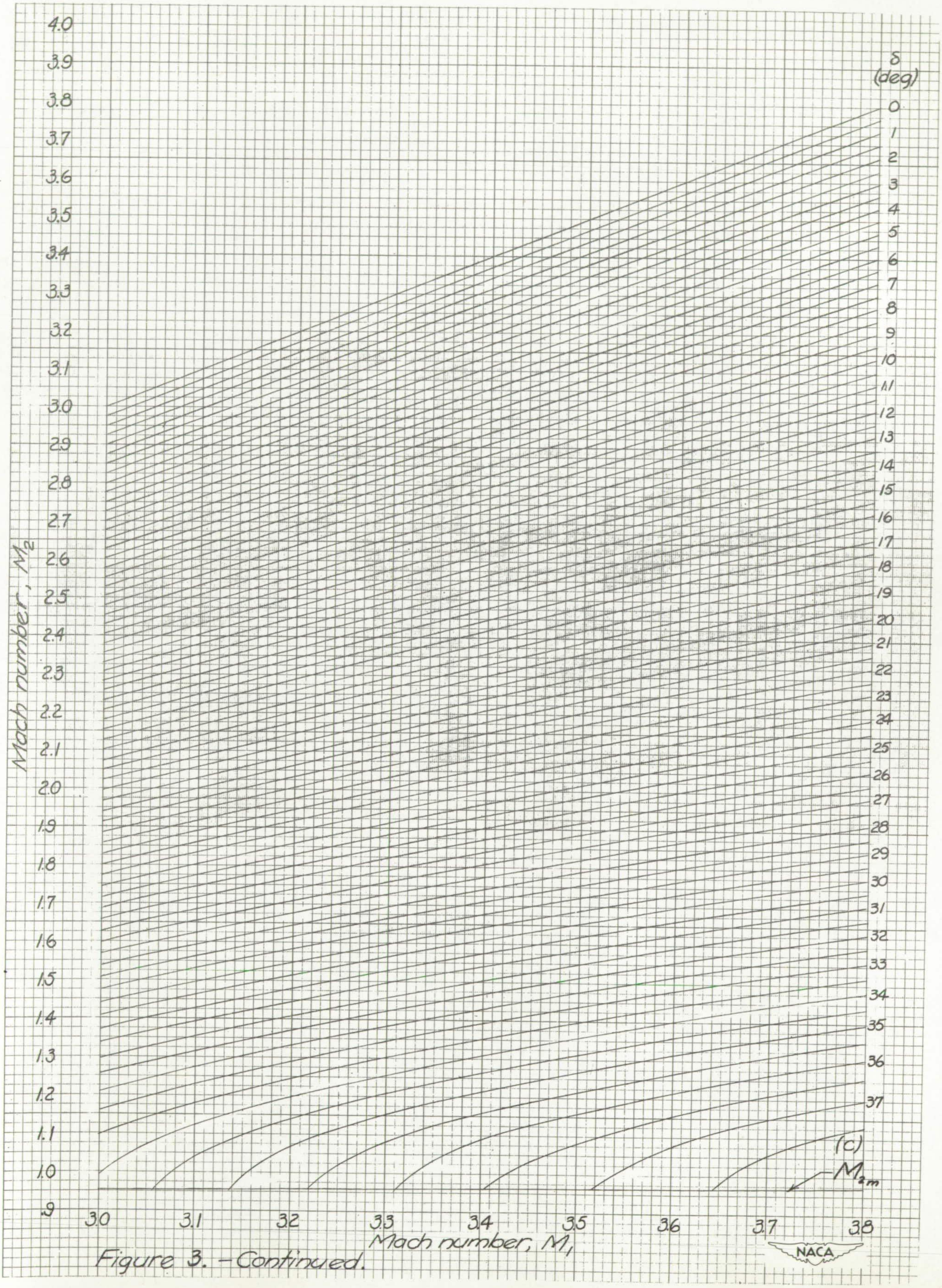


Figure 3. – Continued.

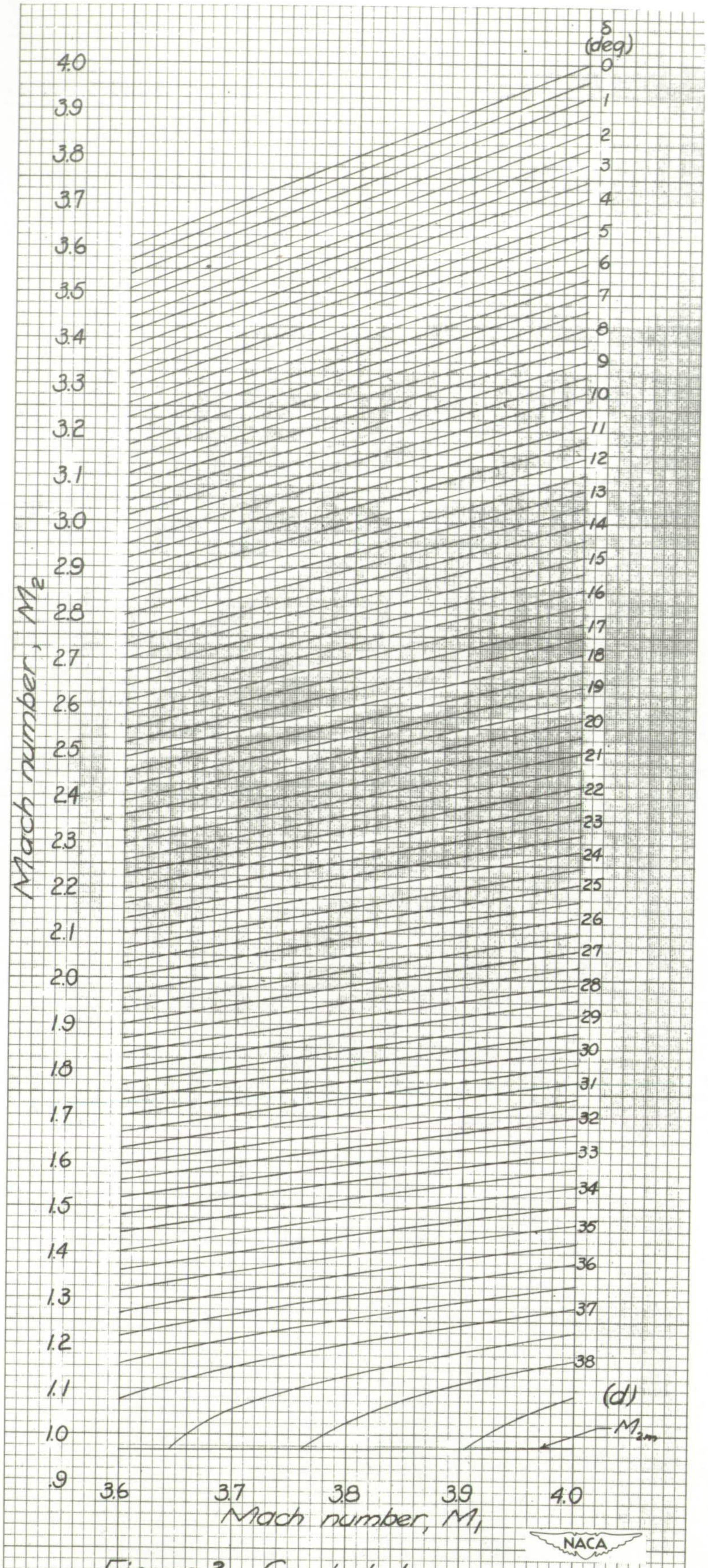


Figure 3.- Concluded.

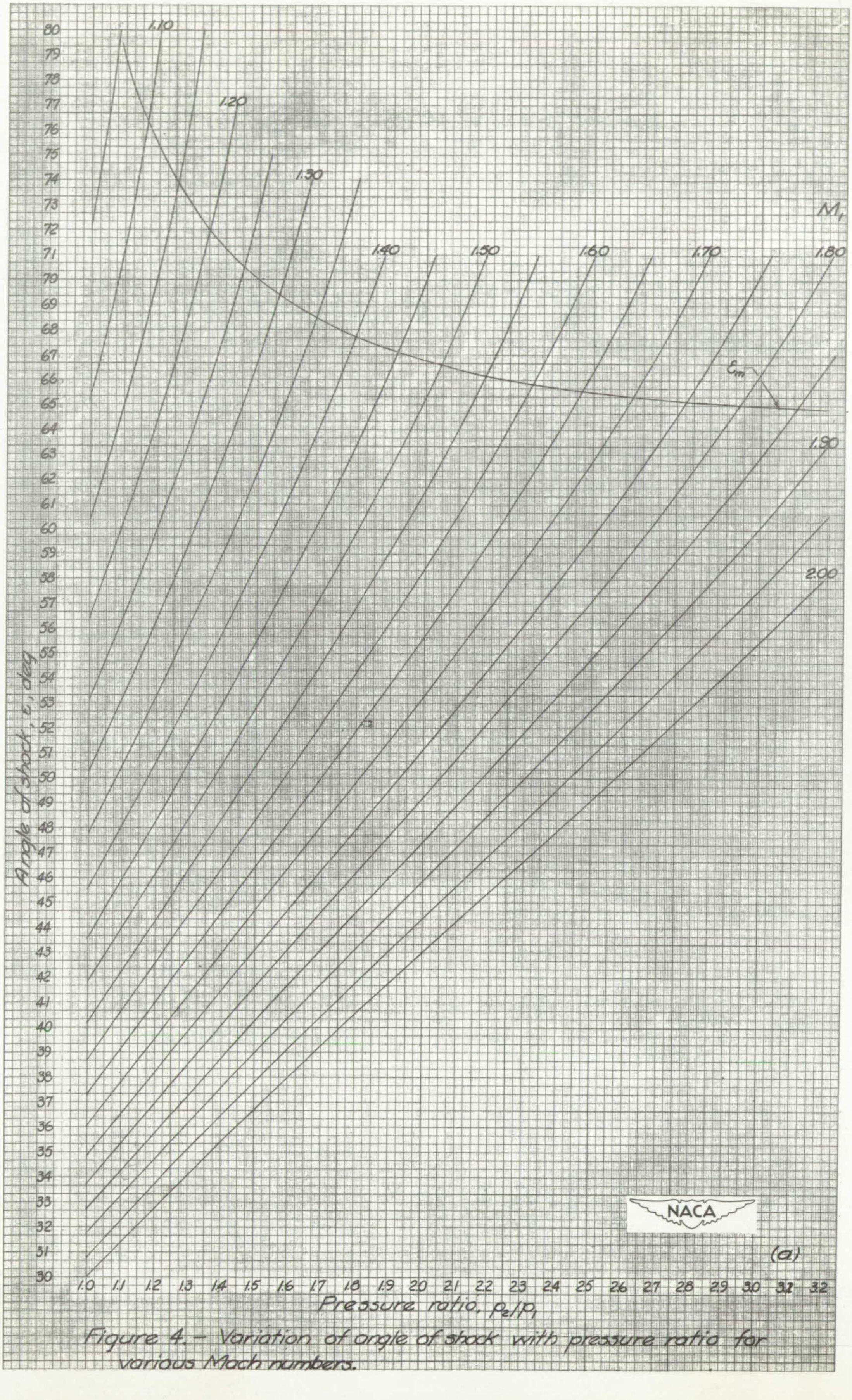


Figure 4.– Variation of angle of shock with pressure ratio for various Mach numbers.

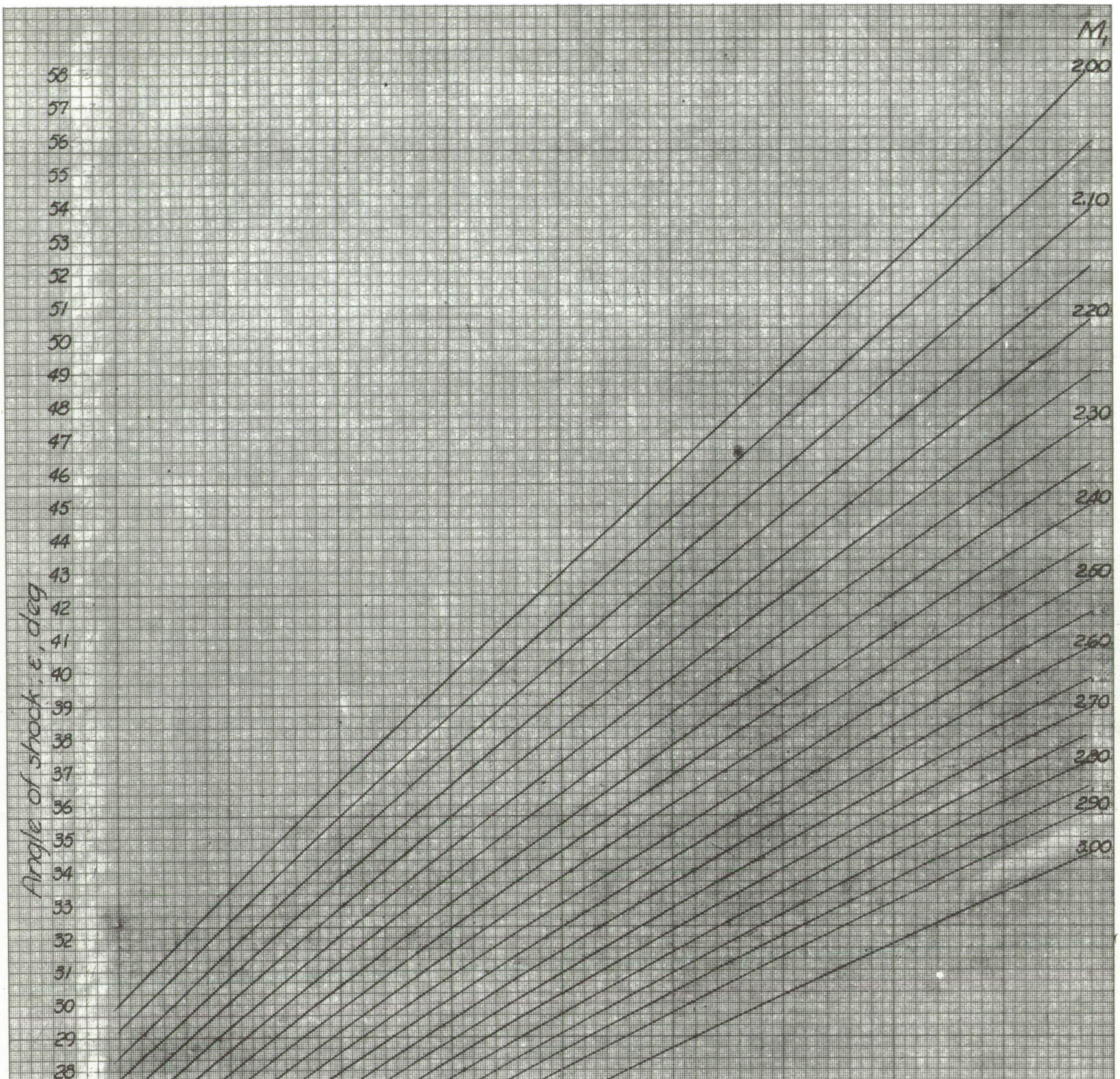


Figure 4.- Continued.

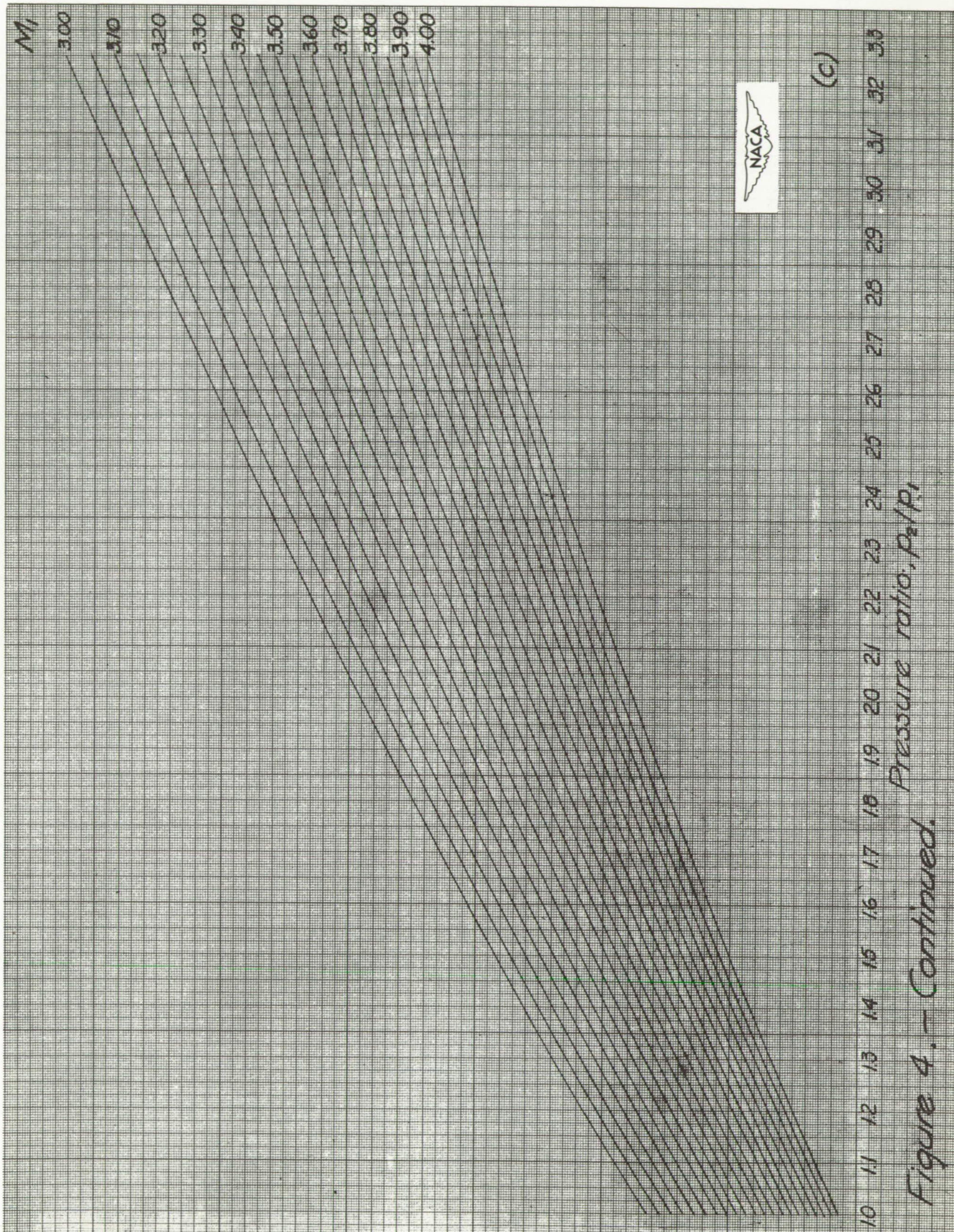


Figure 4. – Continued.

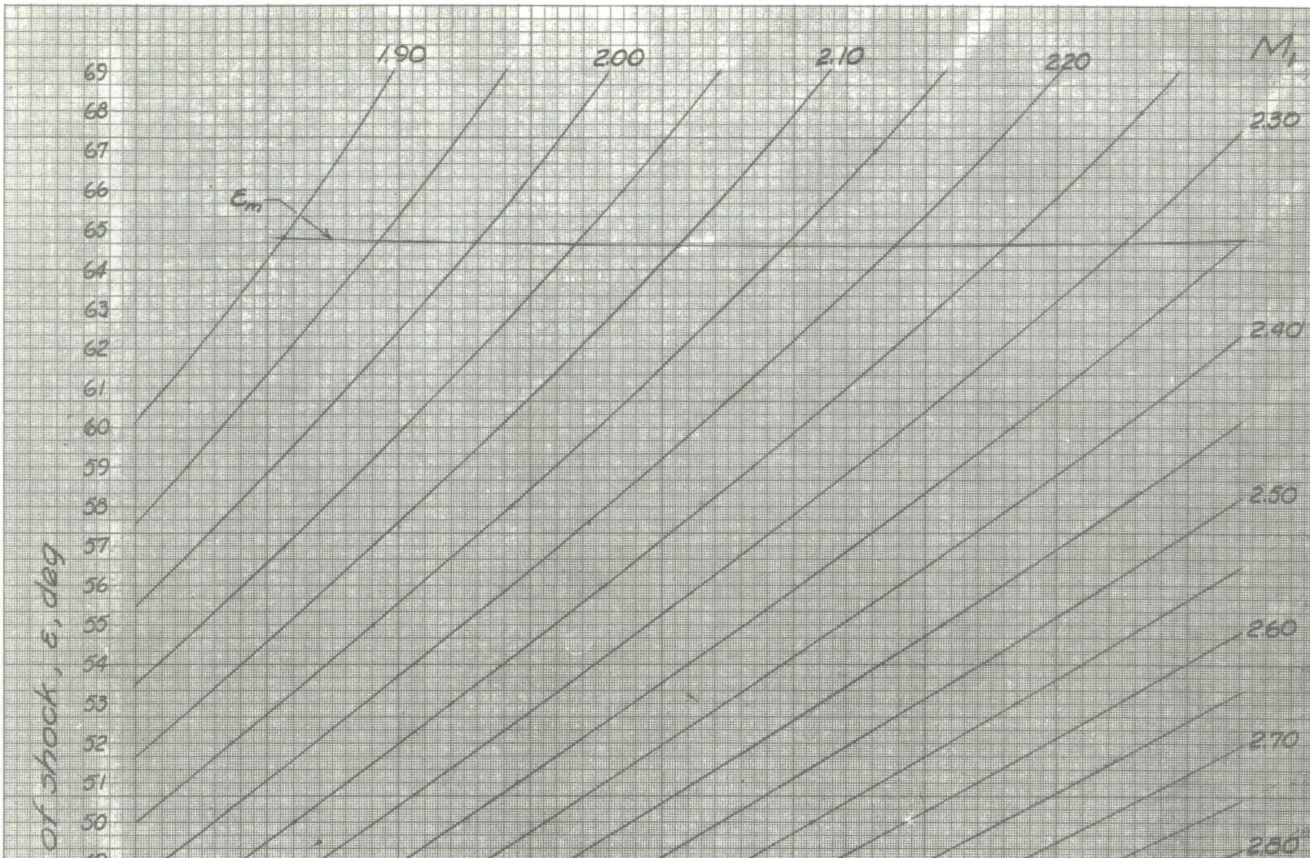


Figure 4.- Continued.

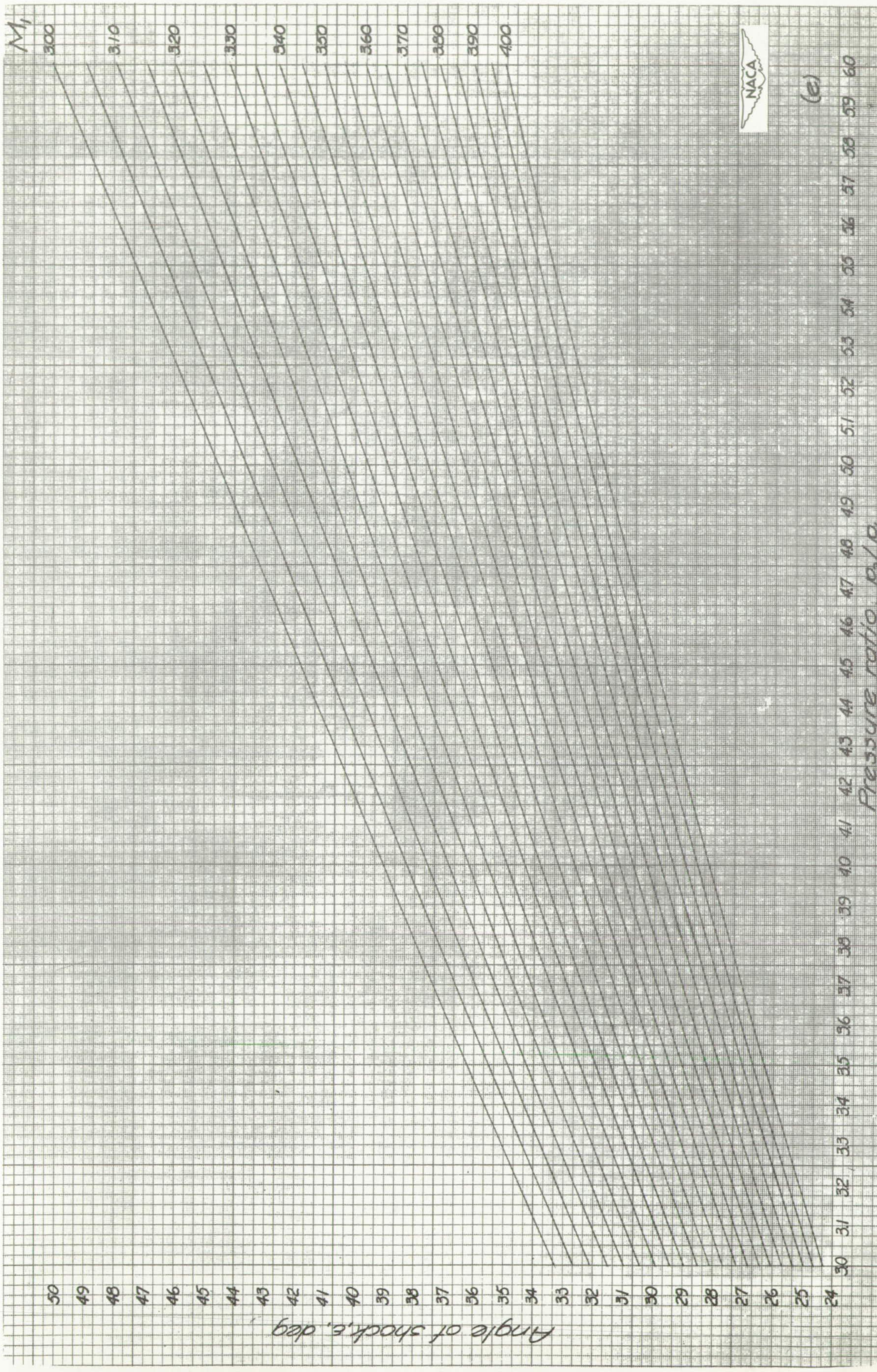


Figure 4.- Continued.

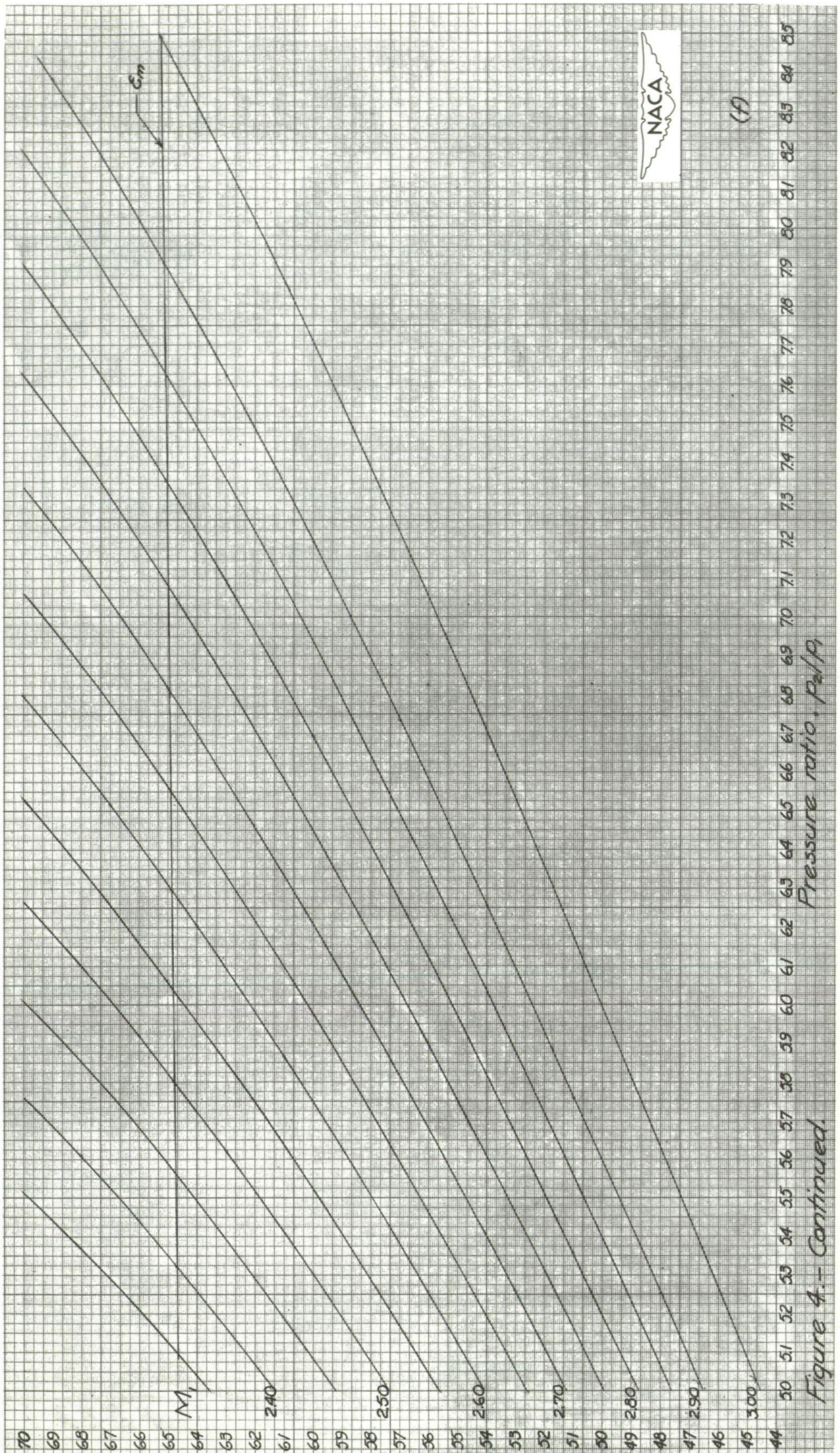


Figure 4.- Continued.

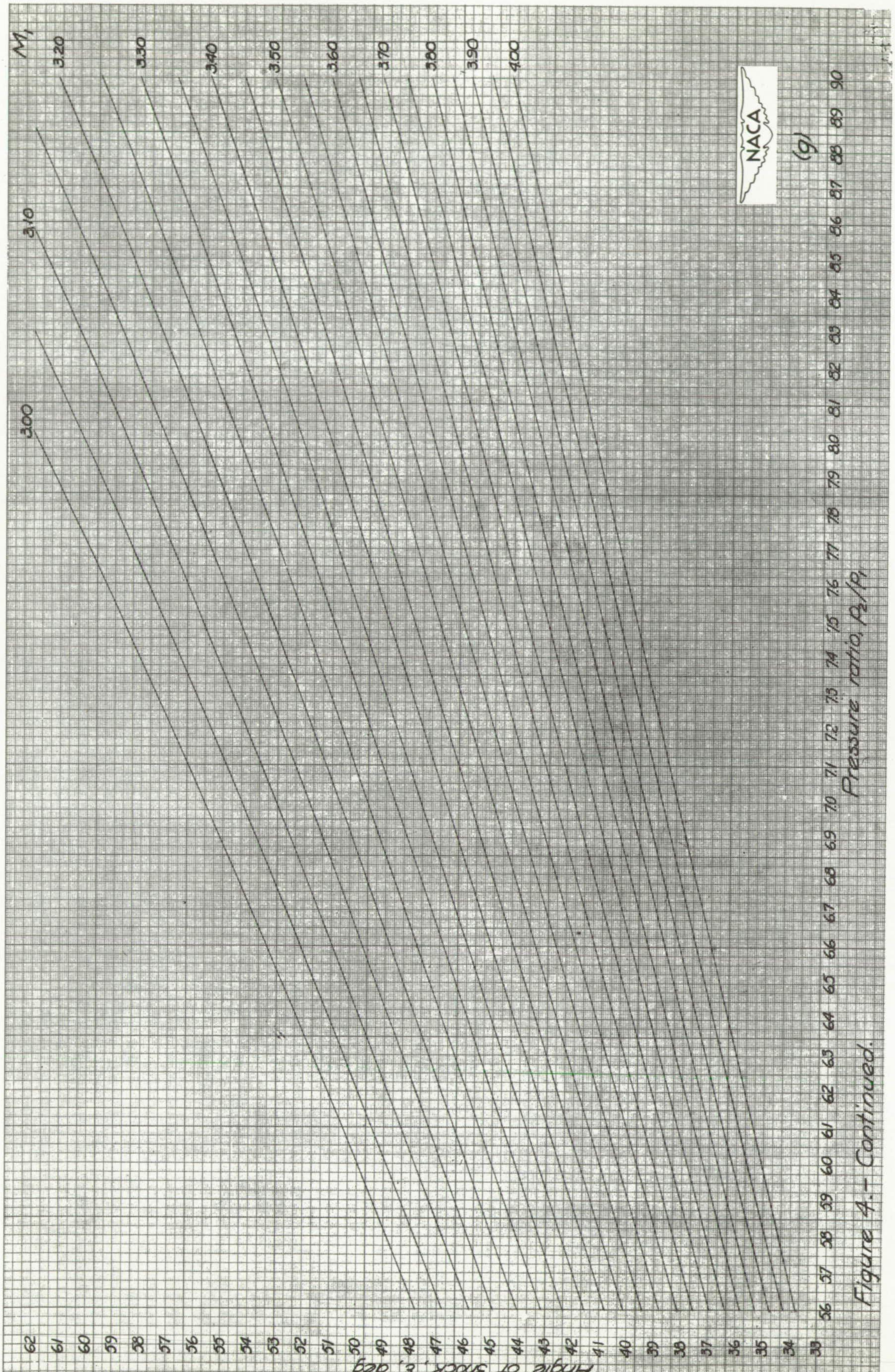


Figure 4.- Continued.

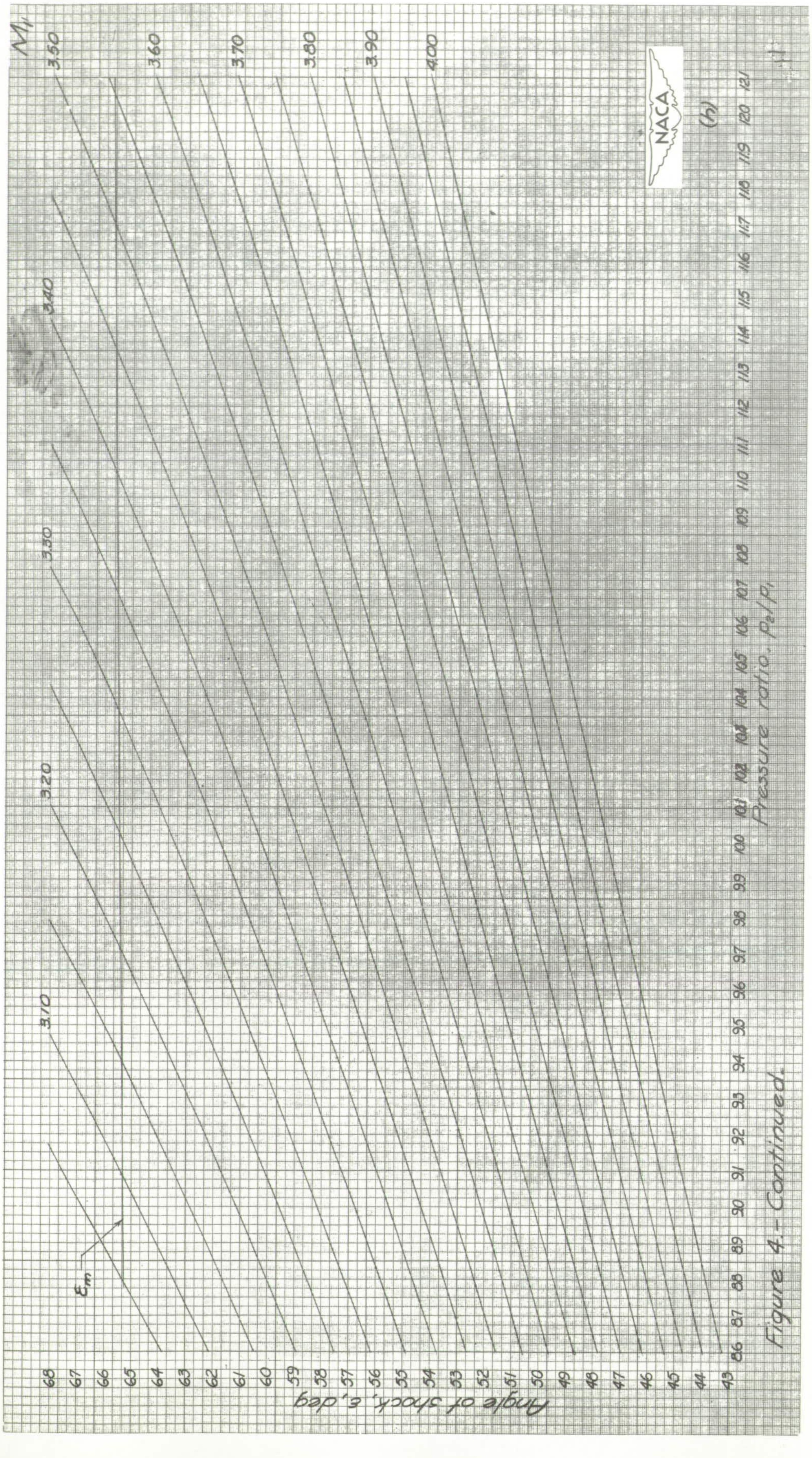
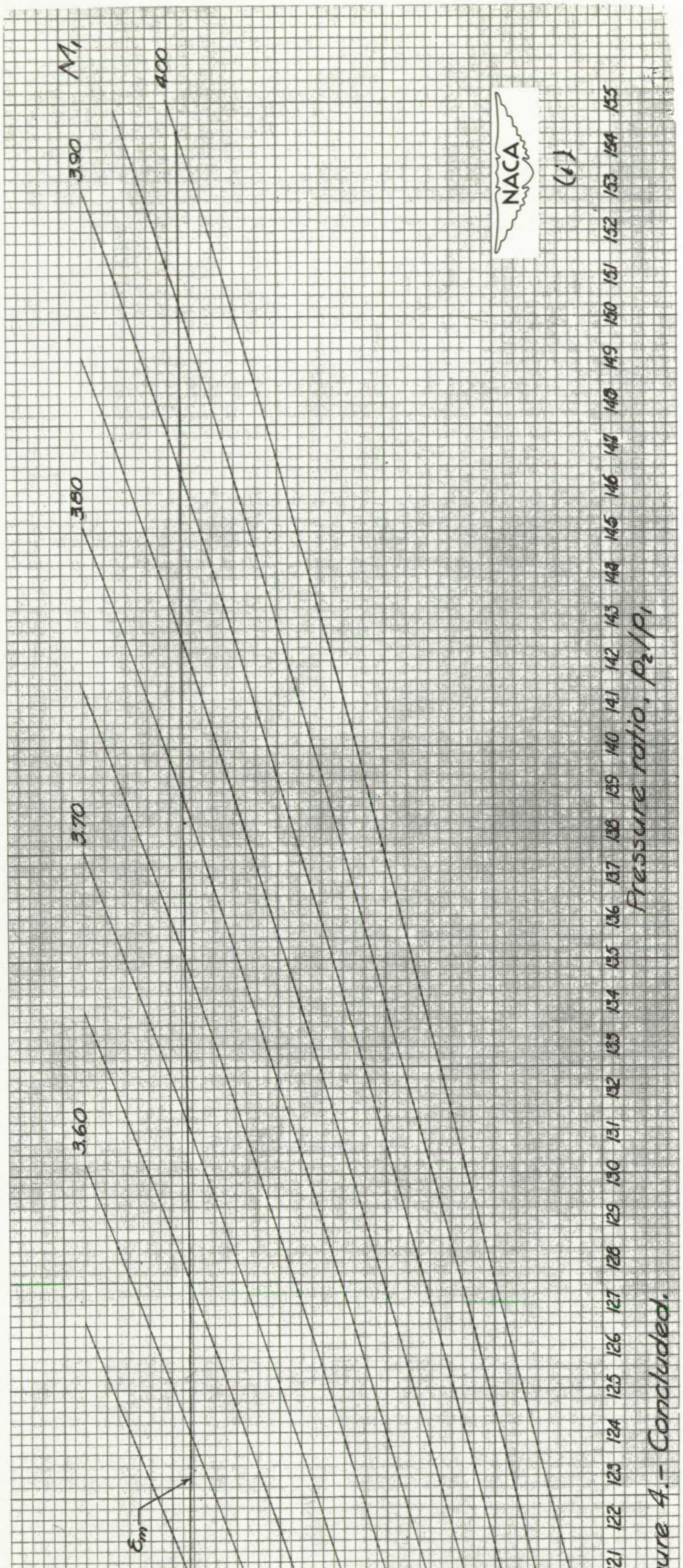


Figure 4.- Continued.



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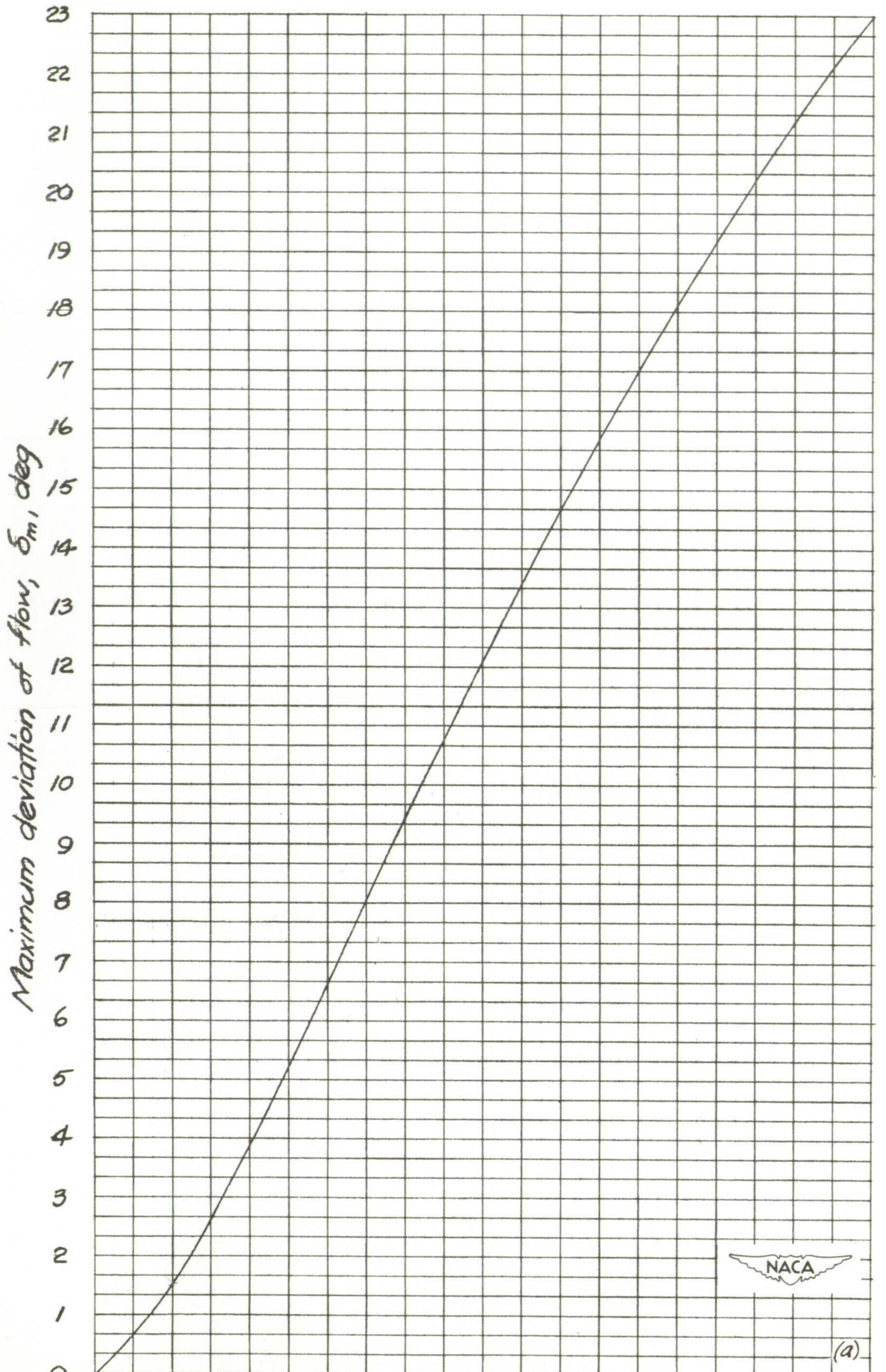

Figure 5.- Variation of maximum deviation of flow across the shock with Mach number in front of shock.

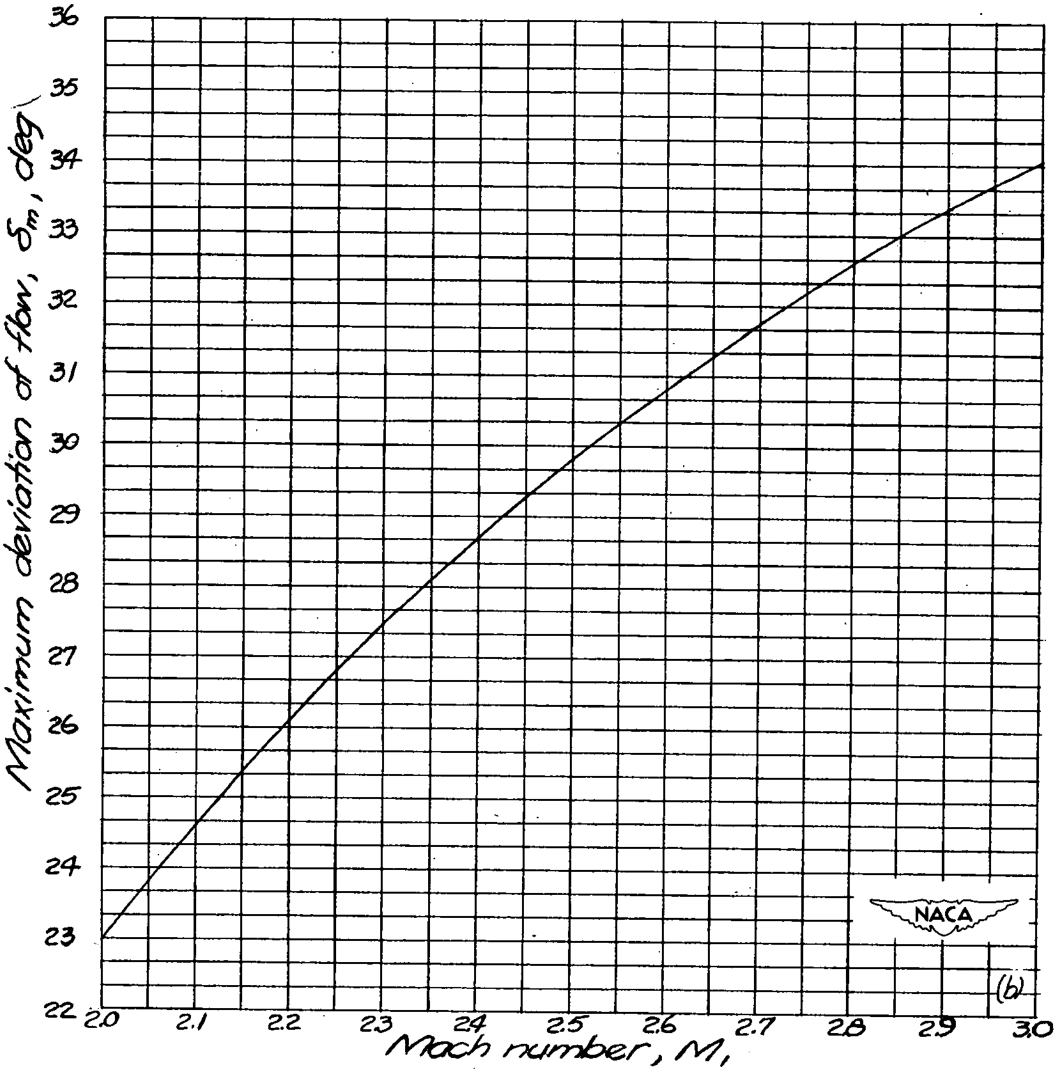

Figure 5.- Continued.

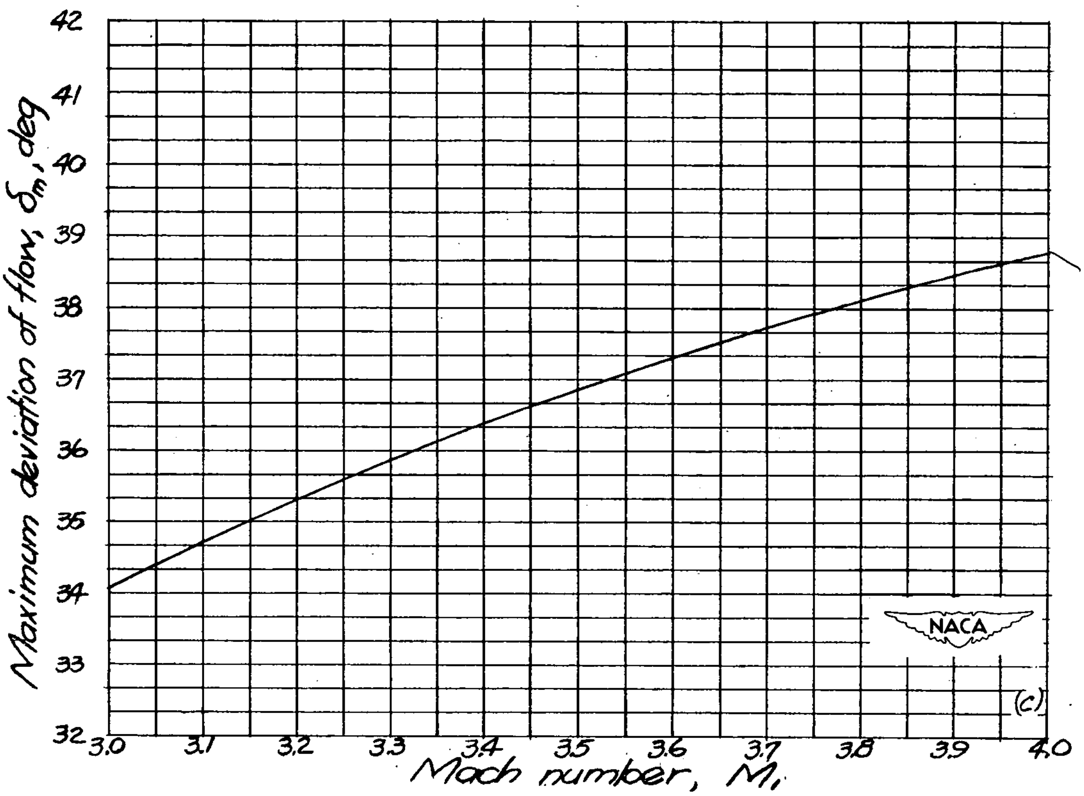

Figure 5.- Concluded.

Abstract

Shock-wave equations have been evaluated for a range of Mach number in front of the shock from 1.05 to 4.0. Mach number behind the shock, pressure ratio, deviation of flow, and angle of shock are presented on charts. Values are also included for density ratio and change in entropy.

Flow, Supersonic 1.1.2.3
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Tables and Charts of Flow Parameters across Oblique Shocks.

By Mary M. Neice

NACA TN No. 1673

August 1948

(Abstract on Reverse Side)