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EXPERIMENTAL PRESSURE DISTRIBUTIONS ON A BLUNT LIFTING-ENTRY BODY AT MACH 3.71

by W. Douglas Morris and Lana M. Couch

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SUMMARY

An experimental investigation has been conducted to determine the pressure distribution on a blunted 15° half-cone—wedge lifting-entry body. The tests were conducted at a Mach number of 3.71 and Reynolds numbers per foot of 2.81×10^{6} and 4.68×10^{6} (Reynolds numbers per meter of 9.22×10^{6} and 15.35×10^{6}). The angle-of-attack range was from -40° to 40°, and the angle-of-sideslip range was from -10° to 10°. A modified Newtonian method was compared with the data and, in general, found to predict the trends as well as the magnitude over the angle-of-attack and angle-of-sideslip ranges.

INTRODUCTION

Much interest has been shown in lifting-entry configurations which can be used to evaluate economically new heat shields, control systems, and other concepts which are related to manned and unmanned planetary-entry flight. One configuration being considered for this task is a blunted half-cone—wedge body.

In order to evaluate the body aerodynamics and pressure distributions on the body during the supersonic portion of the trajectory, ground tests have recently been conducted. The pressure investigation was conducted in the Langley Unitary Plan wind tunnel at a Mach number of 3.71 to determine the longitudinal and radial pressure distributions. The tests covered an angle-of-attack range of -40° to 40° and an angle-of-sideslip range of -10° to 10°. The experimental pressure distributions were compared with pressure distributions computed from modified Newtonian theory. A derivation of the modified Newtonian method used is included in an appendix.

SYMBOLS

a radius of sphere, inches (meters)

C_p pressure coefficient, local pressure minus free-stream pressure divided by free-stream dynamic pressure

$\vec{i},\vec{j},\vec{k}$	unit coordinate vectors
M	free-stream Mach number
N_{Re}	unit Reynolds number, based on free-stream conditions, per foot (per meter)
$\vec{n}$	unit vector normal to surface
p_t	free-stream stagnation pressure, pounds/foot^2 (newtons/meter^2)
R	base radius of cone, inches (meters)
s	distance measured along midline surface from orifice 1 (positive on top surface, negative on bottom surface), inches (meters)
$\vec{V}$	unit wind vector
x,y,z	rectangular Cartesian coordinates, inches (meters)
α	angle of attack, degrees
β	angle of sideslip, degrees
ϵ	wedge half-angle, degrees
η	angle between unit vector normal to surface and unit wind vector, degrees
θ_c	cone half-angle, degrees
σ	longitudinal spheric cutoff angle, degrees
ϕ	body radial cutoff angle, degrees
ϕ'	radial measurement of orifice locations taken around longitudinal axis and measured from top-surface midline, degrees

Subscripts:

av	average

b conditions at base of body

max maximum

APPARATUS AND TEST CONDITIONS

The investigation was conducted in the high Mach number test section of the Langley Unitary Plan wind tunnel, described in reference 1. This variable-pressure, continuous-flow tunnel has an asymmetrical sliding-block nozzle that permits a continuous variation in the test-section Mach number from 2.30 to 4.65. The tunnel stagnation temperature was approximately 150° F (338.9° K). Oil-flow photographs were obtained for angles of attack of 0° and 40° at a sideslip angle of 0°. Ultraviolet lighting was used on the model and the model was coated with a mixture of fluorescent dye and lubricating oil. Pressure measurements were obtained for the following test conditions:

M	N_{Re}		β, deg	α, deg (*)
	per foot	per meter		
3.71	2.81×10^6	9.22×10^6	0	0, ±2, ±5, ±10, ±15, ±20, ±25, ±30, ±35, and ±40
3.71	2.81×10^6	9.22×10^6	5	0, ±2, ±5, ±10, ±15, -20, ±30, 35, and 40
3.71	2.81×10^6	9.22×10^6	10, -5, and -10	0, ±2, ±5, ±10, ±15, -20, ±30, 35, and ±40
3.71	4.68×10^6	15.35×10^6	0	0, 10, 20, 30, 35, and 40

*The negative values of α were obtained by rolling the model 180°.

The model used in the investigation and shown in figures 1 and 2 was a lifting-entry configuration which consisted of a spherical nose segment, a flat triangular top plate with wedge sides, and conical lower surfaces. The model was constructed of 0.25-inch-thick (6.35-mm) aluminum alloy and was supported by a sting at the base. The overall length was 11.135 inches (283 mm) with a base width and height of 6.600 inches (168 mm) and 5.692 inches (145 mm), respectively.

Relative to the vertical plane of symmetry, the model was instrumented with static-pressure orifices of 0.050-inch (1.27 mm) inside diameter on one-half of the model and on the base. (See fig. 2(b) for details of orifice installation and table I for orifice locations.) The pressures were measured by electrical transducers, and each electrical output was recorded on digital self-balancing potentiometers. The tunnel free-stream static and stagnation pressures were measured on precision mercury manometers.

ACCURACY

The accuracy of the precision manometers is within 0.5 lb/ft^2 (23.94 N/m^2). Therefore, the accuracy of the pressure measurements is limited to that of the electrical transducer (0.5 percent of full-scale deflection). The maximum deviation in Mach number of the 4- by 4-foot (1.22- by 1.22-meter) test section through the range of tests is ±0.05. The accuracy of both angle of attack and angle of sideslip is $\pm 0.10^{\circ}$.

METHOD OF PREDICTIONS

A modified Newtonian expression was compared with the experimental data. The expressions for the pressure coefficients used for the various parts of the body are as follows (see appendix for derivation):

(a) For the half-cone,

$$C_p = C_{p,max}(\sin \theta_c \cos \alpha \cos \beta - \cos \theta_c \sin \beta \sin \phi - \sin \alpha \cos \beta \cos \phi \cos \theta_c)^2 \tag{1}$$

(b) For the spherical-nose segment,

$$C_p = C_{p,max}(\cos \alpha \cos \beta \cos \sigma - \sin \beta \sin \sigma \sin \phi - \sin \alpha \cos \beta \sin \sigma \cos \phi)^2 \tag{2}$$

(c) For the wedge section,

$$C_p = C_{p,max}(\cos \alpha \cos \beta \sin \epsilon - \sin \beta \cos \epsilon)^2 \tag{3}$$

(d) For the top surface,

$$C_p = C_{p,max}(\sin \alpha \cos \beta)^2 \tag{4}$$

Equations (1) and (2) were taken from reference 2. However, in the present investigation, $C_{p,max} = 1.7846$ (at $M = 3.71$) has been used. This value, obtained from reference 3, was also used to normalize the experimental data.

RESULTS AND DISCUSSION

Oil-flow photographs of the model are presented in figure 3; schlieren photographs, in figure 4; and the effects of angle-of-attack and angle-of-sideslip variations on the pressure distribution, in figures 5 to 11. The data presented have been compared with a modified Newtonian method and, in general, found to agree in trend and magnitude with the predicted values. The data shown in the figures are considered typical, and a complete list of the data obtained throughout the range of test variables is presented in tables II and III.

Oil-Flow Studies

Typical oil-flow photographs are presented in figure 3 for the model at angles of attack of 0^{o} and 40^{o} at an angle of sideslip of 0^{o}. The light areas indicate the presence of oil, and the dark regions indicate the lack of oil. The flow field over the surface of the flat top at $\alpha = 0^{o}$, as indicated in figure 3(a), is apparently similar to that obtained over the leeward surface of a delta wing. (See ref. 4.) The coiled-vortex sheets, induced at the juncture of the spherical segments and wedge sides with the flat top, are formed as a result of flow separation from the model surface. This separation occurs along the entire length of the top of the cylindrical edge and is evidenced by the ridge of accumulated oil along this edge. In the vicinity of the spherical segment, the ridge of oil along the edge is seen as a narrow white band. However, farther aft, this ridge of oil shows up in the photograph as a dark band, which is actually a shadow cast by the ridge. The ridge of oil along the entire length of the cylindrical edge could easily be seen during the wind-tunnel test. Also in figure 3(a), the opposite cylindrical edge shows an accumulation of oil along its entire length. The vortex sheets reattach on each side of the longitudinal midline on the flat top. (See sketch in fig. 3(a).) The vortex sheets are indicated in the photograph by the darker areas. Inboard of the vortex attachment line, the flow appears to have a spanwise velocity component directed toward and merging with the flow along the top midline (center line of top flat plate). Although the results of reference 4 indicated velocity components parallel to the center line within this region, the present model is considerably more complex and deviations from the results of reference 4 might be expected. The magnitude of this spanwise velocity component cannot be ascertained because of the angle from which the photographs were obtained. Outboard of the coiled vortex sheet there is a spanwise velocity component directed toward the leading edge. This result is in agreement with reference 4. A second flow separation occurs as this spanwise flow approaches the leading edge; however, it is not clearly visible in the photographs, but could be seen during the test. Along the center line there is a dark streak that appears to be due to the accumulation of oil at the front of the pressure orifices, thereby preventing the oil behind the orifices from being replenished.

Schlieren Photographs

Schlieren photographs of the model at angles of attack of 0^{o}, 15^{o}, and 40^{o} at an angle of sideslip of 0^{o} are shown in figure 4. Throughout the angle-of-attack range, a shock wave originates directly behind the spherical segments at each end of the conical-nose region (fig. 4(a)). Both shock waves are apparently due to a localized separation and reattachment in this region. In figure 4(b), the regions of large density gradients, above the boundary layer on the flat surface of the model, that occur throughout the range of angles of attack are believed to be associated with vortex formations, as discussed previously in the oil-flow description. At angles of attack of $\pm 40^{\circ}$ (see fig. 4(c) for $\alpha = 40^{\circ}$), the model nose is in close proximity to the tunnel-wall boundary layer; and, as a result, these data could have been influenced by the boundary layer.

Pressure Distributions

The pressure distributions along the midline of the body surface in the vertical plane of symmetry are shown in figure 5(a) for negative angles of attack and in figure 5(b) for positive angles of attack. (The model in these tests was at an angle of sideslip of 0°.) For the negative angle-of-attack range (fig. 5(a)), the stagnation point remains on the spherical segment adjacent to the flat top. However, with an increasing positive angle of attack (fig. 5(b)), the stagnation point shifts from the spherical segment to the conical nose and is located on the spherical segment adjacent to the half-cone at $\alpha \approx 30^{\circ}$ and 40°.

The longitudinal pressure distributions on the conical nose and wedge sides of the model at angles of sideslip of 0° and -10° are shown in figure 6. Figure 6(a) presents the pressure data for an angle of attack of 0°; figure 6(b) presents the data for an angle of attack of 30°. The values of the pressure coefficients are presented only for $x/R < 1.0$ since the magnitudes remain approximately constant for $x/R \geqq 1.0$. A comparison of the two parts of figure 6 indicates that the effect of varying the angle of attack on the pressure is negligible for a constant value of sideslip and z/R location.

The pressure distributions on the conical portions of the body are presented in figures 7 and 8 for angles of attack of 0° and 30° and for angles of sideslip of 0° and -10°. The distribution on the orifice ray 45° from the midline of the nose is shown in figure 7; the distribution on the orifice ray 45° from the midline of the half-cone is shown in figure 8.

The cross-sectional pressure-coefficient distribution at selected body stations is shown in figure 9 for angles of attack of -30°, 0°, and 30° for a sideslip angle of 0°; the variation with sideslip angles of 0° and -10° at an angle of attack of 0° is indicated in figure 10.

Figure 11 presents the average value of base-pressure coefficients for various angles of attack and sideslip. The values represent the average of the base-orifice readings. For comparison, the value of the empirical relation is as follows:

$$\frac{C_{p,b}}{C_{p,max}} = \frac{-1/M^2}{C_{p,max}}$$

This expression has previously been used to approximate the base pressure for blunt bodies. (See ref. 5.)

CONCLUDING REMARKS

An experimental investigation has been conducted to determine the pressure distribution on a blunted 15° half-cone—wedge lifting-entry body. The tests were conducted at a Mach number of 3.71 and Reynolds numbers per foot of 2.81×10^6 and 4.68×10^6 (Reynolds numbers per meter of 9.22×10^6 and 15.35×10^6). The angle-of-attack range was from -40° to 40°, and the angle-of-sideslip range was from -10° to 10°. A modified Newtonian method was compared with the data. For most of the pressure measurements, the method predicted not only the trend but also the magnitude of the data over the body for the ranges of angles of attack and sideslip.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., November 22, 1967,
124-08-03-18-23.

APPENDIX

MODIFIED NEWTONIAN PRESSURE COEFFICIENTS FOR SEGMENTS OF THE HALF-CONE—WEDGE BODY

In order to calculate the pressure coefficient on each segment, the composite body was divided as shown in figure 1. The derivation for the pressure coefficients on the conical and spherical surfaces may be found detailed in reference 2.

The expression for the modified Newtonian pressure coefficient is

$$C_p = C_{p,max} \cos^2\eta$$

where η is defined as the angle between the unit vector normal to the surface and the unit wind vector. If the body surface is described by

$$f = g(x,y,z)$$

then the unit vector normal to the surface is defined by

$$\vec{n} = \frac{\nabla f}{|\nabla f|} = \frac{\frac{\partial f}{\partial x}\vec{i} + \frac{\partial f}{\partial y}\vec{j} + \frac{\partial f}{\partial z}\vec{k}}{\sqrt{\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 + \left(\frac{\partial f}{\partial z}\right)^2}}$$

The unit wind vector in terms of the body axis is defined as follows:

$$\vec{V} = -\cos\alpha\cos\beta\vec{i} - \sin\beta\vec{j} - \sin\alpha\cos\beta\vec{k}$$

Taking the dot product of the unit normal and wind vectors gives, by definition,

$$\vec{n}\cdot\vec{V} = |\vec{n}|\,|\vec{V}|\cos\eta = \cos\eta$$

In the following derivations, $\vec{V}$ is defined as above.

Half-Cone

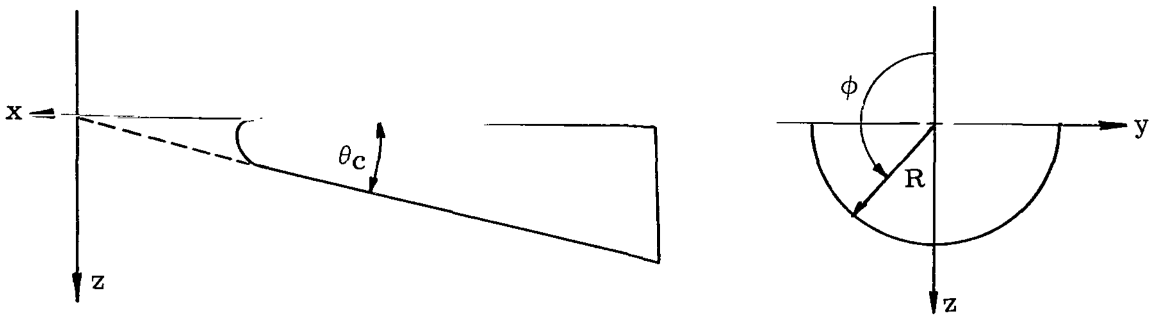

Figure A1.- Coordinate system of half-cone.

The surface equation for the half-cone is as follows (see fig. A1):

$$f(x,y,z) = -x^2\tan^2\theta_c + y^2 + z^2$$

where

$$x = x$$

$$y = -R \sin \phi$$

$$z = -R \cos \phi$$

The unit vector normal to the surface is

$$\vec{n} = \cos \theta_c\left(\tan \theta_c \vec{i} - \sin \phi \vec{j} - \cos \phi \vec{k}\right)$$

Therefore, by definition,

$$\vec{n} \cdot \vec{V} = \cos \eta$$

$$= -(\sin \theta_c \cos \alpha \cos \beta - \cos \theta_c \sin \beta \sin \phi - \sin \alpha \cos \beta \cos \phi \cos \theta_c)$$

and the modified Newtonian pressure coefficient for the half-cone is

$$C_p = C_{p,max}(\sin \theta_c \cos \alpha \cos \beta - \cos \theta_c \sin \beta \sin \phi - \sin \alpha \cos \beta \cos \phi \cos \theta_c)^2$$

Spherical-Nose Segment

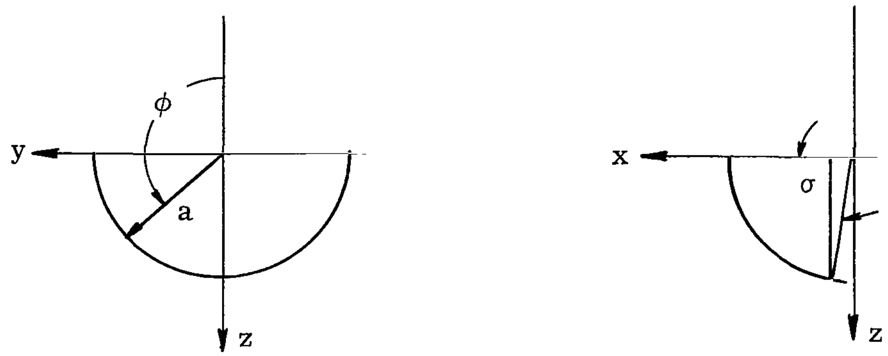

Figure A2.- Coordinate system of spherical-nose segment.

The surface equation for the spherical-nose segment is as follows (see fig. A2):

$$f(x,y,z) = -x^2 - y^2 - z^2 + a^2$$

where

$$x = a \cos \sigma$$

$$y = -a \sin \sigma \sin \phi$$

$$z = -a \sin \sigma \cos \phi$$

The unit vector normal to the surface is

$$\vec{n} = \frac{-\left(x\vec{i} + y\vec{j} + z\vec{k}\right)}{\sqrt{x^2 + y^2 + z^2}}$$

and taking the dot product of $\vec{n}$ and $\vec{V}$ gives

$$\vec{n} \cdot \vec{V} = \frac{x \cos \alpha \cos \beta + y \sin \beta + z \sin \alpha \cos \beta}{\sqrt{x^2 + y^2 + z^2}}$$

Therefore, the modified Newtonian pressure coefficient for the spherical-nose segment is

$$C_p = C_{p,max}(\cos \alpha \cos \beta \cos \sigma - \sin \beta \sin \sigma \sin \phi - \sin \alpha \cos \beta \sin \sigma \cos \phi)^2$$

Wedge Section

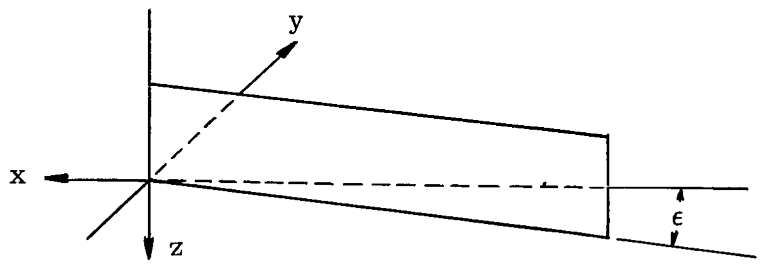

Figure A3.- Coordinate system of wedge section.

The surface equation for the wedge section is as follows (see fig. A3):

$$f(x,y,z) = -x \tan \epsilon + y$$

and the unit vector normal to the surface is

$$\vec{n} = -\sin \epsilon \, \vec{i} + \cos \epsilon \, \vec{j}$$

Taking the dot product of the unit vector normal to the surface and the wind vector yields

$$\vec{n} \cdot \vec{V} = \cos \alpha \cos \beta \sin \epsilon - \sin \beta \cos \epsilon$$

Therefore, the theoretical pressure coefficient is

$$C_p = C_{p,max}(\cos \alpha \cos \beta \sin \epsilon - \sin \beta \cos \epsilon)^2$$

Flat Top Surface

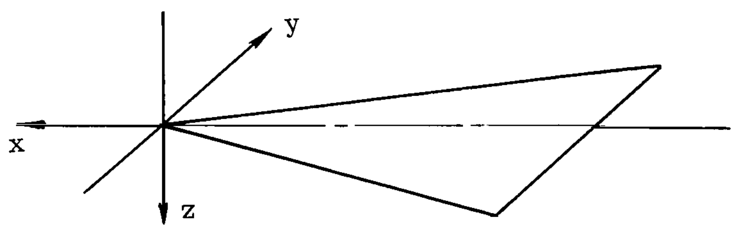

Figure A4.- Coordinate system of flat top surface.

The surface equation for the top surface is as follows (see fig. A4):

$$f(x,y,z) = z$$

The unit normal vector is $\vec{n} = \vec{k}$. The dot product of the unit vector normal to the surface and the wind vector yields

$$\vec{n} \cdot \vec{V} = -\sin \alpha \cos \beta$$

Therefore, the modified Newtonian pressure coefficient for the flat top surface is

$$C_p = C_{p,max}(\sin \alpha \cos \beta)^2$$

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

4. Murray, William M., Jr.; and Stallings, Robert L., Jr.: Heat-Transfer and Pressure Distributions on 60° and 70° Swept Delta Wings Having Turbulent Boundary Layers. NASA TN D-3644, 1966.

5. Stallings, Robert L., Jr.: Experimentally Determined Local Flow Properties and Drag Coefficients for a Family of Blunt Bodies at Mach Numbers From 2.49 to 4.63. NASA TR R-274, 1967.

TABLE I.- PRESSURE-ORIFICE LOCATIONS

Orifice	Location	s/R	z/R	x/R	ϕ', deg (*)
1		0.000	0.120	0.092	
2		-.082	.210	.140	180
3		-.200	.300	.190	180
4	Midline - nose	-.320	.400	.250	180
5		-.450	.520	.320	180
6		-.610	.650	.390	180
7		-.800	.850	.490	180
8		-.890	.920	.560	180
9		-.990	.970	.650	180
10	Midline - lower surface	-1.710	1.150	1.350	180
11		-2.500	1.360	2.100	180
12		-3.280	1.560	2.860	180
13		.098	.037	.130	---
14		.200	.000	.220	0
15		.350	.000	.380	0
16	Midline - upper surface	.690	.000	.710	0
17		1.320	.000	1.350	0
18		2.080	.000	2.100	0
19		2.840	.000	2.860	0
20			.000	.710	38
21	Top surface		.000	1.350	66
22			.000	2.100	75
23			.000	2.860	79
24	Spherical segment		.064	.153	---
25			.037	.220	45
26			.037	.380	53
27	Cylindrical edge		.037	.710	68
28			.037	1.350	78
29			.037	2.100	82
30			.037	2.860	84
31	Conical nose		.120	.120	90
32			.120	.220	90
33			.120	.380	90
34	Wedge side		.120	.560	90
35			.120	.710	90
36			.120	.920	90
37	Conical nose		.207	.147	90
38			.210	.277	---
39			.210	.380	115
40	Wedge side		.210	.560	112
41			.210	.710	108
42			.210	.920	104
43	Conical nose		.260	.200	---
44			.300	.380	137
45	Wedge side		.300	.560	129
46			.300	.710	125
47			.300	.920	119
48	Conical nose		.370	.270	---
49			.370	1.350	119
50			.370	2.100	111
51			.370	2.860	106
52	Wedge side		.400	.440	---
53			.400	.560	143
54			.400	.710	139
55			.400	.920	132
56	Conical nose		.480	.345	---
57			.520	.530	---
58	Wedge side		.520	.710	148
59			.520	.920	142
60	Conical nose		.610	.420	---
61			.720	.710	158
62			.720	.920	153
63	Wedge side		.720	1.350	144
64			.720	2.100	134
65			.720	2.860	126
66	Conical nose		.820	.560	168
67	Spherical segment		.870	.500	---
68			.900	.610	---
69	Conical lower surface		1.030	1.350	160
70			1.170	2.100	156
71			1.310	2.860	153
72			.191	3.466	---
73			.227	3.466	---
74			.370	3.466	---
75			.720	3.466	---
76	Base		1.108	3.466	---
77			1.270	3.466	---
78			1.500	3.466	---
79			1.270	3.466	---
80			.720	3.466	---
81			.227	3.466	---

*Orifice 1 lies on longitudinal axis; values of ϕ' marked with dashes were not measured.

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$

(a) $\alpha = -40^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4510.0 psf = 215.9 kN/m^2	p_t = 4511.1 psf = 216.0 kN/m^2	p_t = 4512.3 psf = 216.0 kN/m^2		p_t = 4513.9 psf = 216.1 kN/m^2
1	0.57706	0.59960	0.61027		0.60351
2	.14300	.14911	.15337		.15747
3	.13029	.13430	.13433		.13421
4	.11970	.12161	.12376		.12364
5	.11970	.12161	.12376		.12576
6	.12182	.12584	.12799		.12787
7	.09853	.10258	.10472		.10039
8	-.02004	-.01797	-.01797		-.01799
9	-.04545	-.04335	-.04547		-.04547
10	-.04757	-.04547	-.02854		-.04547
11	-.04122	-.03912	-.03912		-.04125
12	-.03487	-.03278	-.03489		-.03913
13	1.00054	1.03740	1.05025		1.04955
14	.50931	.52557	.53624		.55066
15	.53472	.54672	.55105		.53164
16	.53895	.55095	.55528		.54220
17	.53683	.54672	.55105		.53586
18	.53895	.54038	.54682		.53164
19	.53683	.53615	.54258		.53586
20	.56648	.56576	.54893		.50838
21	.58130	.56576	.53412		.46610
22	.58553	.55941	.52355		.43862
23	.58765	.55095	.51297		.42171
24	.64906	.55095	.44105		.26950
25	.58342	.49596	.40509		.26316
26	.56012	.48327	.40086		.25471
27	.54318	.46636	.38394		.23568
28	.50931	.42617	.34163		.19552
29	.47331	.38599	.29933		.15956
30	.45637	.36484	.27817		.13633
31	.46908	.38810	.30990		.19129
32	.24040	.17872	.12376		.05388
33	.21075	.14483	.08780		.01583
34	.20652	.14065	.07934		.00526
35	.20863	.14065	.08357		.00737
36	.20652	.13642	.07934		.00315
37	.19170	.15122	.11107		.05177
38	.20017	.14276	.09203		.03063
39	.20440	.14276	.08991		.02429
40	.21499	.14276	.08145		.01372
41	.21922	.14276	.07934		-.00108
42	.24218	.16391	.10895		.03908
43	.18296	.13642	.09837		.04120
44	.19565	.13430	.08991		.03063
45	.20622	.13642	.08357		.01583
46	.21468	.14276	.08357		.00737
47	.22314	.14699	.08357		.00315
48	.18507	.13642	.09414		.03274
49	.22949	.14911	.08780		.00526
50	.24641	.15757	.08780		-.00103
51	.25275	.15545	.08357		-.00742
52	.19988	.13430	.08568		.02429
53	.20199	.13430	.08568		.02429
54	.21045	.13642	.08357		.01372
55	.21680	.14276	.08568		.00737
56	.19353	.13853	.09414		.02640
57	.19988	.13430	.08568		.02429
58	.20411	.13430	.08357		.02217
59	.21468	.13853	.08357		.01160
60	.19988	.14065	.09626		.02429
61	.19565	.12373	.07511		.01583
62	.20199	.12584	.07299		.01583
63	.21045	.13642	.08145		.00949
64	.22737	.14911	.08780		.00526
65	.23160	.15545	.09414		.01160
66	.16181	.11527	.07299		.00737
67	.03067	.00952	-.00528		-.03068
68	-.00951	-.02009	-.02854		-.04125
69	-.02643	-.03489	-.03912		-.04125
70	-.02643	-.03701	-.04124		-.04336
71	-.02643	-.03701	-.04124		-.04336
72	-.03701	-.03701	-.03912		-.03913
73	-.03912	-.03912	-.03912		-.03702
74	-.03912	-.03912	-.03912		-.03913
75	-.04124	-.03912	-.03912		-.03913
76	.03913	.03702	.03915		.03908
77	-.03066	-.03278	-.03277		-.03490
78	.11105	.11104	.11318		.11307
79	-.02643	-.02855	-.02854		-.03068
80	-.03701	-.03701	-.03701		-.03702
81	-.03912	-.03912	-.03701		-.03913

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(b) $\alpha = -35^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0° (p_t = 4513.0 psf = 216.1 kN/m²)	5°	10°
1			0.67996		
2			.19987		
3			.18083		
4			.17237		
5			.17872		
6			.18718		
7			.15968		
8			-.00528		
9			-.04124		
10			-.01163		
11			-.03278		
12			-.03489		
13			1.00990		
14			.41771		
15			.43251		
16			.45155		
17			.44943		
18			.44520		
19			.43674		
20			.44732		
21			.44097		
22			.43040		
23			.42194		
24			.41982		
25			.34157		
26			.33523		
27			.33523		
28			.30562		
29			.26966		
30			.25063		
31			.33523		
32			.12161		
33			.08566		
34			.07720		
35			.08143		
36			.07931		
37			.13430		
38			.09200		
39			.09200		
40			.08566		
41			.08143		
42			.10911		
43			.11546		
44			.09217		
45			.08582		
46			.08582		
47			.08582		
48			.10911		
49			.09217		
50			.09429		
51			.09429		
52			.08794		
53			.08794		
54			.08370		
55			.08582		
56			.10911		
57			.09005		
58			.08582		
59			.08370		
60			.11546		
61			.08159		
62			.07312		
63			.08370		
64			.09217		
65			.09641		
66			.09217		
67			-.00099		
68			-.02852		
69			-.03699		
70			-.04334		
71			-.04334		
72			-.04334		
73			-.04334		
74			-.04334		
75			-.04334		
76			.03712		
77			-.03699		
78			.11123		
79			-.03275		
80			-.04122		
81			-.04122		

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(c) $\alpha = -30^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0°	5°	10°
	p_t = 4509.0 psf = 215.9 kN/m²	p_t = 4510.7 psf = 216.0 kN/m²	p_t = 4514.3 psf = 216.1 kN/m²	p_t = 4513.2 psf = 216.1 kN/m²	p_t = 4512.6 psf = 216.1 kN/m²
1	0.72247	0.74777	0.76438	0.76727	0.75801
2	.25071	.25914	.26536	.26778	.27169
3	.24225	.24856	.25056	.24873	.25055
4	.24436	.24645	.25056	.24873	.25055
5	.25494	.25914	.26536	.26355	.26323
6	.26340	.26971	.27593	.27201	.26958
7	.21897	.22741	.23153	.22757	.22306
8	.00742	.00953	.01162	.00745	.00950
9	-.03912	-.03912	-.03913	-.04123	-.03913
10	-.04123	-.03912	-.02856	-.04334	-.04124
11	-.04123	-.04124	-.02644	-.04334	-.03913
12	-.04123	-.04124	-.02433	-.04334	-.03913
13	.91921	.95507	.97372	.98104	.97368
14	.30571	.31414	.32034	.32916	.33935
15	.31840	.32260	.32034	.31858	.31821
16	.33744	.34375	.34571	.34186	.33935
17	.33956	.34163	.34571	.33974	.33935
18	.33533	.33952	.33937	.33551	.33512
19	.33744	.33529	.33514	.33339	.33724
20	.36071	.35644	.34783	.33551	.31821
21	.37764	.36490	.34571	.32281	.29706
22	.38822	.36702	.33725	.31011	.28015
23	.39879	.36913	.33514	.29953	.26958
24	.60611	.50874	.40492	.31858	.24632
25	.43053	.35856	.28862	.22757	.17866
26	.41995	.34375	.27170	.21064	.16174
27	.41995	.35433	.28651	.21910	.15963
28	.40726	.33740	.26325	.19794	.14060
29	.39668	.31414	.23576	.16831	.11311
30	.39033	.30144	.22307	.15137	.09619
31	.55323	.46009	.37531	.29953	.23575
32	.23378	.17241	.12157	.07941	.05179
33	.22109	.14914	.09197	.04767	.01796
34	.22532	.14491	.08140	.03285	.00316
35	.22955	.14491	.08140	.03073	.00105
36	.23590	.14491	.07928	.02862	-.00318
37	.26552	.21260	.16598	.12598	.09197
38	.21474	.14914	.09831	.05825	.03065
39	.21897	.15126	.09831	.05825	.03276
40	.23167	.15760	.09620	.05613	.02642
41	.23801	.15760	.09409	.04343	.00950
42	.26128	.15549	.11966	.07066	.03910
43	.25282	.19568	.14718	.10867	.07505
44	.21897	.14703	.09849	.06010	.03065
45	.22532	.14914	.09426	.05799	.03065
46	.22955	.15126	.09426	.05377	.02219
47	.23801	.15972	.09426	.04954	.01162
48	.26340	.19779	.14294	.10234	.06659
49	.24225	.16606	.10061	.05165	.01162
50	.25917	.17664	.10484	.04954	.00316
51	.27186	.18299	.10696	.04532	-.00318
52	.22744	.15337	.09637	.05377	.02219
53	.22744	.15337	.09637	.05799	.02853
54	.22744	.15337	.09426	.05588	.02853
55	.23167	.15337	.09426	.05165	.02219
56	.28032	.20414	.14294	.09811	.05813
57	.23378	.15549	.09849	.05377	.01796
58	.22744	.15337	.09637	.05377	.02642
59	.22744	.15337	.09426	.05377	.02430
60	.29090	.21895	.15564	.10656	.06448
61	.22532	.15126	.09002	.04321	.00739
62	.21686	.14491	.08579	.04743	.01585
63	.21686	.14491	.08367	.04321	.01585
64	.22744	.15972	.09849	.05165	.01796
65	.23167	.16183	.10061	.05377	.01585
66	.23378	.17241	.11966	.07700	.04122
67	.05185	.02857	.00958	-.00536	-.02010
68	-.00104	-.01374	-.02641	-.03071	-.03701
69	-.01373	-.02220	-.02852	-.03282	-.03490
70	-.02008	-.03277	-.03911	-.03704	-.03701
71	-.01796	-.03277	-.04122	-.03704	-.03913
72	-.03912	-.03912	-.04122	-.03915	-.03913
73	-.04123	-.04124	-.04334	-.03915	-.04124
74	-.04123	-.04124	-.04334	-.04126	-.04124
75	-.04335	-.04124	-.04334	-.04126	-.04124
76	.03704	.03703	.03710	.03898	.03910
77	-.03489	-.03489	-.03699	-.03282	-.03279
78	.10897	.11107	.11119	.11290	.11311
79	-.03489	-.03489	-.03487	-.03282	-.03279
80	-.04123	-.04124	-.04122	-.03915	-.03913
81	-.04123	-.04124	-.04334	-.04126	-.04124

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(d) $\alpha = -25^{\circ}$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0°, p_t = 4501.6 psf = 215.5 kN/m²	5°	10°
1			0.83450		
2			.34258		
3			.33410		
4			.34258		
5			.35742		
6			.36167		
7			.30018		
8			.03090		
9			-.03271		
10			-.02423		
11			-.01787		
12			-.00939		
13			.92143		
14			.24293		
15			.22808		
16			.24929		
17			.24929		
18			.24717		
19			.24717		
20			.25141		
21			.25777		
22			.25353		
23			.25565		
24			.38499		
25			.23869		
26			.21324		
27			.22808		
28			.21960		
29			.20264		
30			.19416		
31			.40831		
32			.11995		
33			.09450		
34			.08814		
35			.08602		
36			.08390		
37			.20264		
38			.10087		
39			.10087		
40			.10087		
41			.10087		
42			.12652		
43			.18383		
44			.10104		
45			.10104		
46			.10104		
47			.09892		
48			.18383		
49			.10529		
50			.10953		
51			.11590		
52			.09892		
53			.09892		
54			.09892		
55			.09892		
56			.18383		
57			.10104		
58			.09892		
59			.09892		
60			.19869		
61			.09468		
62			.08831		
63			.08406		
64			.09468		
65			.10104		
66			.15199		
67			.02038		
68			-.01995		
69			-.02632		
70			-.03269		
71			-.03481		
72			-.04118		
73			-.04330		
74			-.04330		
75			-.04330		
76			.03736		
77			-.03481		
78			.11166		
79			-.03481		
80			-.04330		
81			-.04330		

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), M = 3.71, AND $C_{p,max}$ = 1.7846 - Continued

(e) $\alpha = -20^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4512.4 psf = 216.1 kN/m^2	p_t = 4510.8 psf = 216.0 kN/m^2	p_t = 4513.3 psf = 216.1 kN/m^2	p_t = 4510.3 psf = 216.0 kN/m^2	p_t = 4510.8 psf = 216.0 kN/m^2
1	0.84038	0.87044	0.88935	0.89064	0.87897
2	.40486	.41778	.42617	.42895	.42839
3	.41543	.42142	.43040	.42683	.41992
4	.41965	.43047	.43886	.43318	.42627
5	.42600	.43893	.44732	.44377	.43685
6	.42811	.43893	.44943	.44166	.43262
7	.36046	.36912	.38176	.37177	.36492
8	.05390	.05184	.05817	.05197	.05607
9	-.02433	-.02643	-.02432	-.02851	-.02431
10	-.02433	-.01797	-.01586	-.02004	-.02431
11	-.03067	-.02008	-.00317	-.02427	-.03066
12	-.03279	-.02220	-.00105	-.02427	-.03277
13	.79810	.82814	.84916	.85040	.84724
14	.16595	.17241	.17872	.18116	.18934
15	.15538	.15548	.15757	.15151	.15761
16	.16172	.16394	.16603	.15998	.16396
17	.17229	.17241	.17237	.17057	.17242
18	.17229	.17452	.17237	.17057	.17242
19	.17441	.17452	.17237	.17269	.17454
20	.17652	.17452	.17026	.15786	.14915
21	.19555	.19356	.18083	.16422	.15127
22	.20400	.19990	.18506	.16210	.14492
23	.20823	.20413	.18506	.15998	.14069
24	.54439	.44950	.35638	.27646	.21261
25	.29703	.24221	.19352	.14727	.11107
26	.27377	.21260	.16180	.11762	.08569
27	.29280	.22952	.17237	.11974	.07934
28	.29069	.23586	.17872	.12186	.07511
29	.28434	.23375	.17026	.11127	.06454
30	.27800	.22952	.16603	.10068	.05396
31	.61628	.52565	.43463	.34635	.27396
32	.22515	.16394	.11527	.07738	.04973
33	.22726	.15337	.09835	.05197	.02857
34	.24206	.15971	.09623	.04985	.02223
35	.24840	.16394	.09835	.04773	.01800
36	.25686	.17241	.09835	.04350	.00953
37	.36469	.29932	.24005	.18751	.14281
38	.22726	.15971	.10469	.06256	.03069
39	.22726	.15760	.10258	.06256	.03704
40	.23995	.16394	.10258	.06256	.03704
41	.24417	.16394	.10258	.05621	.02646
42	.26743	.18933	.12817	.08570	.05197
43	.35411	.28451	.22345	.17032	.12609
44	.23783	.16183	.10488	.06031	.02655
45	.23783	.15971	.10064	.06031	.02867
46	.23995	.16183	.10064	.05819	.02867
47	.24206	.16394	.10064	.05608	.02655
48	.36891	.29298	.22768	.17032	.11973
49	.24840	.16817	.10488	.05819	.02443
50	.25052	.17452	.10699	.05819	.01808
51	.26109	.18510	.11335	.06242	.01385
52	.24417	.16183	.10064	.05185	.01385
53	.24206	.16183	.10064	.05608	.02020
54	.24417	.16183	.10064	.05608	.02443
55	.24206	.16183	.10064	.05608	.02443
56	.37103	.29298	.22345	.16397	.11338
57	.25052	.16817	.10064	.04762	.00961
58	.24629	.16606	.10064	.05185	.01596
59	.24417	.16394	.09852	.05185	.02020
60	.37948	.30355	.23827	.17878	.12397
61	.24417	.16394	.09429	.04127	.00326
62	.23360	.15548	.09429	.04550	.00749
63	.22092	.15125	.08794	.04550	.01173
64	.20400	.14068	.08159	.03915	.00961
65	.21035	.15125	.09641	.05185	.02020
66	.30337	.23798	.18322	.13435	.09009
67	.08561	.05607	.03500	.01800	-.00098
68	.02218	.00530	-.00946	-.01796	-.02851
69	.00738	-.00739	-.01793	-.02219	-.02427
70	.00527	-.01162	-.02428	-.02219	-.02216
71	.00315	-.01374	-.02852	-.02431	-.02004
72	-.04124	-.04124	-.04122	-.04123	-.04122
73	-.04336	-.04335	-.04334	-.04335	-.04333
74	-.04336	-.04335	-.04334	-.04335	-.04333
75	-.04336	-.04335	-.04545	-.04547	-.04545
76	.03698	.03703	.03500	.03704	.03714
77	-.03490	-.03489	-.03487	-.03489	-.03486
78	.10886	.11106	.11123	.11108	.11126
79	-.03702	-.03701	-.03698	-.03700	-.03698
80	-.04336	-.04335	-.04334	-.04335	-.04333
81	-.04336	-.04335	-.04334	-.04335	-.04333

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(f) $\alpha = -15^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4509.8 psf = 215.9 kN/m^2	p_t = 4510.9 psf = 216.0 kN/m^2	p_t = 4512.5 psf = 216.1 kN/m^2	p_t = 4512.7 psf = 216.1 kN/m^2	p_t = 4513.9 psf = 216.1 kN/m^2
1	0.88962	0.91689	0.94226	0.93778	0.92694
2	.50670	.51714	.53194	.53179	.52952
3	.52151	.52983	.54040	.53391	.52529
4	.51940	.52983	.54675	.53602	.52529
5	.52151	.53195	.54675	.54025	.52741
6	.51728	.52772	.54675	.53179	.52318
7	.44112	.45147	.46426	.45355	.44708
8	.08782	.08990	.09624	.09409	.09405
9	-.00950	-.01163	-.00951	-.00952	-.00954
10	-.00527	-.00105	.00106	.00105	-.00531
11	-.01373	.00106	.00741	.00105	-.01377
12	-.02008	.00106	.00741	.00105	-.02011
13	.72461	.74980	.77306	.77285	.76628
14	.11532	.11951	.12374	.12792	.13210
15	.10051	.10047	.10047	.09832	.09827
16	.09628	.09836	.09836	.09620	.09616
17	.10051	.10259	.10259	.10255	.10039
18	.10474	.10259	.10047	.10255	.10462
19	.10897	.10682	.10259	.10677	.10673
20	.10474	.10470	.10047	.09409	.08559
21	.11320	.11739	.11105	.10043	.08559
22	.11320	.12162	.11316	.10043	.08559
23	.11320	.12162	.11528	.10255	.08348
24	.50247	.41350	.32890	.25479	.19340
25	.24225	.19565	.15335	.11523	.08136
26	.21264	.16181	.12162	.08563	.06022
27	.22745	.17238	.12374	.08351	.04965
28	.22745	.18296	.13431	.08774	.04754
29	.21264	.17661	.13431	.08774	.03908
30	.19783	.17027	.13008	.08351	.03486
31	.64210	.55098	.45791	.36686	.29064
32	.22321	.16392	.11739	.07717	.04965
33	.22745	.15758	.10259	.06448	.03486
34	.24014	.16181	.10047	.05814	.02851
35	.24437	.16604	.10259	.05814	.02640
36	.24860	.17238	.10470	.05603	.02217
37	.42419	.35216	.28871	.22730	.17649
38	.23591	.16604	.11316	.06871	.03486
39	.22956	.15969	.10682	.06660	.03697
40	.24014	.16392	.10259	.06448	.03486
41	.24225	.16604	.10259	.05603	.03063
42	.26129	.18903	.12817	.08774	.05824
43	.41362	.33903	.27004	.21039	.15559
44	.24225	.17001	.10700	.06025	.02649
45	.24225	.16368	.10276	.05814	.02649
46	.24225	.16579	.10065	.05814	.02649
47	.24437	.16579	.10065	.05603	.02649
48	.42419	.34748	.27428	.21039	.15136
49	.24860	.17424	.10488	.05814	.02861
50	.24437	.17213	.10488	.05814	.02438
51	.24014	.17001	.10488	.05814	.02438
52	.24649	.16790	.10065	.04757	.01380
53	.24649	.17001	.10276	.05603	.01803
54	.24437	.16790	.10065	.05603	.02226
55	.24649	.16790	.10065	.05391	.02226
56	.41362	.33903	.26581	.20404	.14501
57	.25495	.17213	.10065	.04757	.01380
58	.25283	.17213	.10488	.05391	.01591
59	.24860	.16790	.10065	.05391	.01803
60	.42419	.35171	.27851	.21673	.15771
61	.24860	.16579	.09430	.04757	.01380
62	.23168	.15945	.09430	.04757	.00956
63	.21475	.14889	.08794	.04545	.01168
64	.19571	.13832	.08371	.04122	.01168
65	.19148	.13410	.07947	.04122	.01380
66	.34380	.27988	.21922	.16598	.11538
67	.11320	.08128	.05618	.03277	.01168
68	.04127	.02212	.00536	-.00741	-.01795
69	.02858	.01156	-.00311	-.00741	-.01372
70	.02647	.00311	-.00734	-.00741	-.00737
71	.02858	.00522	-.01158	-.00530	-.00313
72	-.04123	-.03914	-.04334	-.04124	-.04123
73	-.04335	-.04126	-.04334	-.04547	-.04334
74	-.04546	-.04337	-.04545	-.04547	-.04334
75	-.04546	-.04337	-.04545	-.04547	-.04546
76	.03704	.03903	.03501	.03700	.03496
77	-.03489	-.03281	-.03698	-.03490	-.03488
78	.10897	.11086	.10912	.11100	.11115
79	-.03700	-.03492	-.03698	-.03701	-.03700
80	-.04335	-.04126	-.04334	-.04547	-.04334
81	-.04546	-.04337	-.04334	-.04547	-.04334

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(g) $\alpha = -10^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4509.2 psf = 215.9 kN/m^2	p_t = 4511.0 psf = 216.0 kN/m^2	p_t = 4509.7 psf = 215.9 kN/m^2	p_t = 4512.2 psf = 216.0 kN/m^2	p_t = 4513.9 psf = 216.1 kN/m^2
1	0.91514	0.94655	0.96207	0.96652	0.95245
2	.59564	.62293	.62976	.62990	.62686
3	.61469	.62927	.63187	.62779	.61629
4	.60411	.62293	.62976	.62355	.60994
5	.60199	.62081	.63399	.62355	.60994
6	.59988	.61658	.63187	.61720	.60360
7	.51947	.53197	.54932	.53463	.52115
8	.13227	.13432	.13869	.13450	.13212
9	.00955	.00953	.00534	.00536	.00950
10	.01590	.02010	.02439	.02017	.01373
11	.00743	.01587	.02016	.01594	.00738
12	.00320	.01587	.02016	.01382	.00315
13	.63796	.66523	.67844	.68283	.67760
14	.07303	.07510	.07942	.08157	.08772
15	.05821	.05606	.05826	.05617	.05813
16	.05187	.05183	.05191	.04981	.05178
17	.05187	.05183	.05402	.05193	.05178
18	.05398	.05395	.05191	.05193	.05390
19	.05821	.05606	.05402	.05617	.05813
20	.04975	.05183	.05191	.04981	.04755
21	.04129	.04972	.05402	.05193	.04544
22	.03071	.04972	.05614	.05193	.04544
23	.01801	.04337	.05826	.05405	.04544
24	.45177	.36911	.29321	.22765	.17441
25	.19151	.15124	.11541	.08369	.05813
26	.16189	.11952	.08577	.05828	.04121
27	.16612	.12163	.08154	.05405	.03487
28	.16401	.12375	.08789	.05828	.03275
29	.15131	.11740	.08789	.06252	.03064
30	.12804	.10259	.08366	.06252	.03064
31	.65066	.56370	.46677	.38008	.30126
32	.22748	.16605	.11752	.07734	.05178
33	.22114	.15336	.10059	.06252	.03698
34	.22748	.15336	.09636	.05617	.03064
35	.22960	.15547	.09424	.05405	.03064
36	.23383	.15759	.09636	.05405	.02641
37	.48562	.40506	.33342	.26788	.20824
38	.24018	.17028	.11329	.06675	.03487
39	.23383	.16182	.10694	.06675	.03698
40	.23595	.16182	.10059	.06252	.03487
41	.23806	.15970	.09847	.05405	.02853
42	.25287	.17848	.12387	.08760	.06024
43	.46446	.38765	.31014	.24603	.18709
44	.24653	.17003	.10694	.06014	.02853
45	.24229	.16580	.10271	.06014	.02641
46	.24018	.16369	.10059	.05802	.02641
47	.24229	.16369	.10059	.05591	.02641
48	.46658	.39187	.31437	.24603	.18498
49	.24441	.17003	.10694	.05802	.02853
50	.22960	.16369	.10271	.05802	.02641
51	.21479	.15312	.09847	.05380	.02430
52	.24864	.16791	.10059	.05169	.01795
53	.24864	.17214	.10694	.05802	.02007
54	.24653	.17003	.10694	.05802	.02218
55	.24441	.16791	.10271	.05802	.02218
56	.45388	.37708	.30379	.23758	.17652
57	.25499	.17214	.10694	.05802	.02430
58	.25287	.17425	.10694	.05802	.02218
59	.24864	.17003	.10694	.05802	.02218
60	.46658	.39187	.31861	.25236	.19132
61	.24653	.16580	.10271	.05380	.02218
62	.22114	.15312	.09636	.04746	.01373
63	.19786	.13411	.08154	.04112	.01161
64	.18517	.12777	.07519	.03690	.00950
65	.18305	.12777	.07519	.03901	.01584
66	.37983	.31581	.25511	.19744	.14481
67	.13862	.10664	.07942	.05169	.03064
68	.06245	.04326	.02439	.00944	-.00319
69	.05610	.03903	.02227	.01155	-.00319
70	.05610	.03692	.02227	.01366	.00527
71	.06033	.03692	.02227	.01366	.00738
72	-.03912	-.03914	-.03911	-.03915	-.03913
73	-.04335	-.04126	-.04122	-.04337	-.04124
74	-.04546	-.04126	-.04122	-.04337	-.04336
75	-.04546	-.04337	-.04334	-.04548	-.04336
76	.03706	.03903	.03709	.03690	.03698
77	-.03700	-.03492	-.03699	-.03703	-.03702
78	.10900	.11087	.11117	.11083	.11098
79	-.03700	-.03492	-.03487	-.03703	-.03490
80	-.04335	-.04126	-.04122	-.04337	-.04124
81	-.04335	-.04337	-.04122	-.04337	-.04336

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(h) $\alpha = -5^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10° p_t = 4510.0 psf = 215.9 kN/m²	-5° p_t = 4511.4 psf = 216.0 kN/m²	0° p_t = 4510.6 psf = 216.0 kN/m²	5° p_t = 4513.7 psf = 216.1 kN/m²	10° p_t = 4512.9 psf = 216.1 kN/m²
1	0.92971	0.96105	0.97360	0.97773	0.96862
2	.69913	.71576	.72572	.72615	.71881
3	.69702	.71153	.71725	.71347	.70187
4	.68433	.69885	.70877	.70501	.69129
5	.68221	.69673	.70877	.70079	.68917
6	.67375	.69039	.70242	.69656	.68282
7	.58491	.59523	.60920	.59931	.58543
8	.17030	.17233	.17701	.17650	.17049
9	.03280	.03065	.03082	.03275	.03076
10	.03492	.04334	.04142	.04332	.03499
11	.03280	.03488	.03718	.03486	.02864
12	.03069	.03700	.03718	.03486	.02864
13	.55318	.57832	.58378	.59508	.58755
14	.04338	.04545	.04565	.05177	.05193
15	.03069	.03065	.02870	.03063	.02652
16	.02434	.02642	.02235	.02429	.02017
17	.02011	.02431	.02235	.02429	.01806
18	.02222	.02219	.02235	.02218	.01806
19	.02222	.02219	.02235	.02218	.02017
20	.01376	.01797	.02023	.02429	.02017
21	-.00527	.00528	.01176	.02218	.02017
22	-.01374	-.00107	.00540	.02006	.01806
23	-.02008	-.01587	-.00307	.02006	.01806
24	.40299	.32880	.25751	.20398	.15143
25	.15338	.11735	.08379	.06023	.03711
26	.12376	.08774	.05836	.04332	.02441
27	.11742	.07929	.04777	.03275	.02017
28	.10895	.07506	.04353	.03063	.02017
29	.09415	.06448	.03718	.02852	.02017
30	.06876	.05180	.02870	.02429	.01806
31	.65683	.56986	.47149	.38579	.30598
32	.23164	.17021	.11980	.08137	.05193
33	.21049	.14695	.09438	.06023	.03288
34	.21472	.14484	.08591	.05177	.02441
35	.21261	.14272	.08379	.04966	.02229
36	.21049	.14061	.07955	.04754	.02017
37	.54048	.45779	.37615	.30334	.24035
38	.24222	.17021	.11133	.06868	.03288
39	.23164	.16175	.10497	.06657	.03499
40	.22953	.15752	.09862	.06234	.03076
41	.22953	.15330	.09226	.05389	.02229
42	.24645	.17418	.12172	.07941	.05815
43	.50664	.42553	.34816	.27623	.21676
44	.24645	.17207	.10902	.06248	.03066
45	.23799	.16573	.10691	.05824	.02855
46	.23799	.16151	.10056	.05613	.02643
47	.23587	.15940	.09844	.05189	.02432
48	.50452	.42553	.34816	.27623	.21464
49	.23799	.16573	.10268	.05613	.02855
50	.20837	.14461	.08786	.04555	.01797
51	.19568	.13405	.08151	.04131	.01586
52	.24645	.16573	.10268	.05401	.02220
53	.24857	.17418	.10902	.05824	.02220
54	.24645	.16996	.10691	.05824	.02432
55	.24222	.16573	.10268	.05613	.02432
56	.48548	.40863	.33335	.26354	.20407
57	.25280	.17207	.11114	.06248	.03066
58	.25280	.17629	.11114	.06036	.02643
59	.24645	.16785	.10691	.05824	.02432
60	.50452	.42553	.35028	.28047	.22098
61	.24010	.16362	.10268	.05824	.02855
62	.21049	.14672	.09209	.04555	.01797
63	.18934	.12560	.07516	.03708	.00951
64	.18511	.12138	.06882	.03285	.00951
65	.18511	.12349	.07093	.03496	.01586
66	.40933	.34316	.27832	.21909	.17023
67	.15972	.12771	.09633	.06459	.04335
68	.08569	.06224	.03919	.02227	.00951
69	.09203	.06857	.04765	.02861	.01797
70	.09626	.06646	.04554	.02861	.01586
71	.10049	.06857	.04765	.02861	.01586
72	-.03700	-.03704	-.03700	-.04123	-.03913
73	-.04335	-.04126	-.04123	-.04546	-.04124
74	-.04547	-.04126	-.04123	-.04758	-.04336
75	-.04547	-.04126	-.04334	-.04758	-.04336
76	.03492	.03900	.03707	.03496	.03700
77	-.04124	-.03704	-.03700	-.04123	-.03913
78	.10895	.11082	.11114	.10904	.11313
79	-.03700	-.03492	-.03488	-.03911	-.03490
80	-.04335	-.04126	-.04123	-.04546	-.04124
81	-.04335	-.04126	-.04123	-.04758	-.04124

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), M = 3.71, AND $C_{p,max}$ = 1.7846 - Continued

(i) $\alpha = -2^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4509.4 psf = 215.9 kN/m^2	p_t = 4513.8 psf = 216.1 kN/m^2	p_t = 4510.5 psf = 216.0 kN/m^2	p_t = 4512.3 psf = 216.0 kN/m^2	p_t = 4513.3 psf = 216.1 kN/m^2
1	0.92779	0.96276	0.97254	0.97805	0.96527
2	.75007	.76830	.77783	.77926	.76439
3	.73737	.75562	.76302	.75812	.74325
4	.72679	.74716	.75455	.75389	.73902
5	.72679	.74716	.75455	.75177	.73690
6	.72468	.74082	.75243	.74754	.73268
7	.61889	.62457	.64450	.63546	.62272
8	.19997	.20183	.20428	.20195	.19981
9	.05186	.04964	.05190	.04969	.05180
10	.05398	.05598	.05825	.05815	.05391
11	.05186	.05175	.05401	.05392	.05180
12	.05398	.05810	.05825	.05815	.05180
13	.49406	.51888	.53021	.53819	.52968
14	.02647	.02850	.03073	.03489	.03700
15	.01589	.01794	.01803	.01797	.01585
16	.01166	.01582	.01592	.01374	.00951
17	.00955	.01371	.01380	.01374	.00316
18	.00320	.00948	.01380	.00951	.00316
19	.00955	.00948	.01168	.00528	.01162
20	-.00315	.00314	.00957	.01374	.01374
21	-.01584	-.00954	-.00313	.00740	.01162
22	-.02854	-.01588	-.00948	.00317	.00951
23	-.03488	-.02223	-.01160	-.00106	.00739
24	.36923	.30540	.24026	.18715	.13849
25	.12803	.09826	.06883	.04758	.02854
26	.10052	.07289	.04978	.03277	.01796
27	.08783	.05810	.03285	.01797	.01374
28	.07725	.04964	.02227	.00528	.00951
29	.05186	.03484	.01592	.00528	.00739
30	.04128	.02428	.00533	.00317	.00528
31	.65062	.56961	.47518	.38804	.30766
32	.22959	.17224	.12174	.08564	.05603
33	.20208	.14476	.09422	.05815	.03277
34	.19997	.13630	.08364	.04969	.02431
35	.19785	.13208	.07941	.04335	.02219
36	.19785	.12996	.07729	.03912	.01585
37	.56599	.48506	.39899	.32460	.25902
38	.24017	.17224	.11327	.06872	.03488
39	.22959	.16378	.10904	.06661	.03700
40	.22535	.15744	.10057	.06238	.03277
41	.22535	.15321	.09422	.05181	.02431
42	.24017	.15720	.11751	.07733	.05391
43	.52791	.45068	.36724	.29327	.22942
44	.24440	.17198	.11116	.06251	.03277
45	.23805	.16776	.10904	.06251	.03065
46	.23382	.16353	.10269	.05828	.02854
47	.23170	.15931	.10057	.05405	.02431
48	.52579	.44857	.36936	.29539	.23153
49	.22747	.15931	.10057	.05615	.02642
50	.19573	.13398	.07941	.03711	.01374
51	.18939	.12764	.07306	.03288	.01162
52	.24440	.16776	.10692	.05828	.02642
53	.25074	.17620	.11116	.06251	.02854
54	.24651	.16987	.11116	.06251	.02854
55	.24017	.16565	.10481	.05828	.02642
56	.50887	.43168	.35455	.28481	.22307
57	.25286	.17620	.11539	.06887	.03488
58	.25498	.17831	.11539	.06463	.03065
59	.24440	.16987	.10904	.06040	.02642
60	.52791	.44857	.37359	.30174	.23999
61	.23170	.15931	.10481	.06251	.03065
62	.20420	.14242	.08788	.04558	.01796
63	.18516	.12553	.07306	.03711	.01162
64	.18939	.12342	.07094	.03499	.01162
65	.19150	.12553	.07306	.03711	.01796
66	.41789	.35567	.29105	.23188	.18078
67	.17246	.13820	.10481	.07310	.05180
68	.10264	.07697	.05401	.03076	.01796
69	.11533	.08541	.06036	.04134	.02642
70	.12380	.08541	.05825	.03711	.02219
71	.13226	.09175	.06036	.03923	.02008
72	-.03700	-.03704	-.03699	-.03910	-.03913
73	-.04335	-.04127	-.04123	-.04334	-.04124
74	-.04546	-.04127	-.04123	-.04334	-.04336
75	-.04546	-.04338	-.04334	-.04546	-.04336
76	.03494	.03896	.03708	.03711	.03911
77	-.03912	-.03916	-.03911	-.03910	-.03913
78	.10899	.11075	.11116	.11121	.11312
79	-.03700	-.03493	-.03488	-.03699	-.03490
80	-.04335	-.04127	-.04123	-.04334	-.04124
81	-.04546	-.04127	-.04123	-.04334	-.04336

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), M = 3.71, AND $C_{p,max}$ = 1.7846 - Continued

(j) $\alpha = 0^{\circ}$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4510.2 psf = 215.9 kN/m^2	p_t = 4512.9 psf = 216.1 kN/m^2	p_t = 4509.0 psf = 215.9 kN/m^2	p_t = 4513.5 psf = 216.1 kN/m^2	p_t = 4511.9 psf = 216.0 kN/m^2
1	0.92550	0.95881	0.97199	0.97559	0.96355
2	.77954	.80447	.81089	.81492	.79855
3	.76473	.78755	.79182	.79167	.77317
4	.75204	.77698	.78122	.78321	.76471
5	.75204	.77487	.77910	.77898	.76259
6	.74781	.77064	.77698	.77687	.75836
7	.63146	.65647	.65828	.65849	.63779
8	.21896	.22515	.22375	.22723	.22107
9	.06665	.06658	.06478	.06657	.06876
10	.06877	.07081	.06902	.07080	.06876
11	.06877	.06870	.06690	.06868	.06665
12	.07300	.07293	.07114	.07291	.07088
13	.45800	.47887	.48659	.49359	.48760
14	.01800	.02007	.02027	.02429	.02646
15	.00953	.01161	.00755	.00103	.00953
16	.00319	.00950	.00755	.00526	.00107
17	-.00950	.00738	.00543	.00738	-.01585
18	-.00316	.00527	.00331	.00526	-.00739
19	-.00104	.00316	.00331	.00315	.00107
20	-.01162	-.00742	-.00093	.00738	.00953
21	-.02220	-.01799	-.01365	-.00319	.00530
22	-.03066	-.02433	-.02000	-.00742	.00107
23	-.03489	-.02644	-.02212	-.01165	-.00316
24	.35011	.28647	.22587	.17438	.13011
25	.11530	.08561	.05842	.03909	.02222
26	.08780	.06024	.03723	.02429	.01588
27	.07088	.04333	.01603	.00949	.00742
28	.05396	.03064	.00543	-.00319	.00319
29	.03703	.01796	-.00305	-.00954	-.00316
30	.02434	.00738	-.00729	-.01165	-.00527
31	.65050	.56767	.47387	.38789	.30779
32	.22754	.17230	.11989	.08559	.05607
33	.19992	.14270	.09022	.05811	.03069
34	.19357	.13213	.07750	.04543	.02222
35	.18934	.12578	.07326	.03909	.01799
36	.18723	.12156	.06902	.03486	.01376
37	.58281	.50424	.41452	.33927	.26972
38	.24011	.17230	.11141	.06868	.03492
39	.22954	.16596	.10717	.06868	.03703
40	.22530	.15750	.09870	.06234	.03280
41	.22107	.15116	.09022	.05177	.02434
42	.22742	.16993	.11758	.07925	.05395
43	.54261	.46560	.38224	.30756	.24222
44	.24434	.17415	.11334	.06868	.03280
45	.23800	.16993	.10911	.06445	.03069
46	.23165	.16359	.10276	.06023	.02857
47	.22742	.15726	.10064	.05600	.02434
48	.53838	.46349	.38012	.30968	.24222
49	.21896	.15303	.09640	.05388	.02434
50	.19146	.12769	.07311	.03486	.01165
51	.18723	.12347	.06888	.03274	.01165
52	.24223	.16993	.10699	.06445	.02857
53	.24857	.17627	.11334	.06445	.03069
54	.24434	.17204	.11122	.06445	.02857
55	.23800	.16359	.10487	.06023	.02646
56	.51723	.44448	.36530	.29699	.23164
57	.25069	.17627	.11758	.07291	.03915
58	.25280	.18049	.11758	.06868	.03280
59	.24011	.16993	.10911	.06234	.02857
60	.53838	.46349	.38647	.31390	.25068
61	.22107	.15937	.10276	.06234	.03280
62	.14704	.13825	.08582	.04754	.01799
63	.15761	.12769	.07523	.04120	.01588
64	.19357	.12558	.07311	.03909	.01376
65	.19569	.12769	.07523	.03909	.01799
66	.41992	.36000	.29543	.23780	.18511
67	.17877	.14670	.11122	.08137	.05607
68	.11530	.08968	.06464	.04331	.02646
69	.13011	.09812	.07100	.05177	.03280
70	.14280	.10235	.06888	.04754	.02434
71	.15338	.11080	.07311	.04754	.02434
72	-.03700	-.03493	-.03699	-.03702	-.03912
73	-.04335	-.04126	-.04122	-.04125	-.04124
74	-.04547	-.04126	-.04122	-.04125	-.04124
75	-.04547	-.04337	-.04334	-.04336	-.04335
76	.03703	.03899	.03500	.03909	.03915
77	-.03489	-.03915	-.03910	-.03702	-.03912
78	.10896	.11080	.10911	.11308	.11107
79	-.03700	-.03493	-.03487	-.03490	-.03277
80	-.04335	-.04126	-.04122	-.04125	-.04124
81	-.04547	-.04126	-.04122	-.04125	-.04124

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(k) $\alpha = 0^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10° p_t = 4505.0 psf = 215.7 kN/m^2	-5° p_t = 4506.0 psf = 215.7 kN/m^2	0° p_t = 4506.8 psf = 215.8 kN/m^2	5° p_t = 4506.0 psf = 215.7 kN/m^2	10° p_t = 4506.6 psf = 215.8 kN/m^2
1	0.94139	0.96876	0.97909	0.98255	0.97724
2	.79527	.81420	.81610	.81935	.80785
3	.77833	.79726	.79705	.79603	.78032
4	.76139	.78455	.78646	.78967	.77397
5	.75715	.78244	.78011	.78331	.76550
6	.75272	.77820	.78011	.78119	.75915
7	.63644	.65328	.65945	.65402	.63846
8	.21926	.22557	.22338	.22375	.21922
9	.06679	.06677	.06462	.06478	.06677
10	.06679	.07100	.07097	.06902	.06888
11	.06679	.06888	.06885	.06690	.06677
12	.07102	.07312	.07309	.07114	.06888
13	.46491	.48177	.49645	.50141	.49871
14	.01808	.02018	.02228	.02451	.02865
15	.00749	.01171	.01170	.00967	.00960
16	.00537	.00960	.00958	.00755	.00325
17	-.00945	.00960	.00958	.00967	-.01158
18	-.00310	.00536	.00535	.00543	-.00311
19	.00325	.00536	.00535	.00331	.00536
20	-.00945	-.00522	.00111	.00543	.01172
21	-.02216	-.01793	-.01159	-.00093	.00748
22	-.03063	-.02428	-.01794	-.00729	.00113
23	-.03698	-.02640	-.02006	-.00941	.00113
24	.36114	.29332	.23185	.17923	.13452
25	.11973	.08794	.06250	.04146	.02442
26	.09008	.06465	.04133	.02662	.01595
27	.07314	.04348	.02228	.00967	-.01581
28	.05831	.03289	.00958	-.00305	.00536
29	.03714	.01807	.00111	-.00941	.00113
30	.02867	.00960	-.00524	-.01153	-.00311
31	.66397	.57917	.48164	.39543	.31450
32	.23832	.17899	.12812	.08809	.05830
33	.20655	.14511	.09425	.05842	.03289
34	.20020	.13664	.08155	.04782	.02442
35	.19385	.13029	.07732	.04358	.02018
36	.19173	.12817	.07520	.03722	.02865
37	.59621	.51353	.42236	.34456	.27639
38	.24891	.17687	.11542	.07114	.03712
39	.24044	.17263	.11542	.07326	.04136
40	.22985	.16205	.10272	.06266	.03289
41	.22773	.15358	.09425	.05418	.02654
42	.23944	.16950	.12117	.08096	.05580
43	.55604	.47095	.38701	.31282	.24362
44	.25422	.17794	.11485	.07042	.03470
45	.24577	.17372	.11274	.06831	.03048
46	.23944	.16529	.10641	.06410	.03048
47	.23522	.16318	.10219	.05777	.02626
48	.54971	.47095	.38701	.31282	.24573
49	.22256	.15475	.10008	.05777	.02414
50	.19301	.12945	.07476	.03669	.00937
51	.19090	.12524	.07054	.03459	.00937
52	.25000	.17372	.11063	.06620	.02837
53	.25844	.18215	.11696	.06620	.03048
54	.25000	.17583	.11485	.06620	.03048
55	.24366	.16950	.10641	.06199	.02837
56	.52860	.45197	.37013	.30017	.23307
57	.25844	.18004	.12117	.07464	.03892
58	.26055	.18426	.11906	.06831	.03259
59	.24366	.17161	.11274	.06410	.02837
60	.54549	.47095	.38912	.31704	.25206
61	.22889	.16107	.10641	.06410	.03259
62	.20356	.14210	.08742	.04934	.01781
63	.19090	.12945	.07898	.04302	.01570
64	.19512	.12734	.07476	.03880	.01359
65	.19934	.13156	.07687	.04091	.01781
66	.42518	.36555	.29840	.24115	.18453
67	.18457	.14842	.11274	.08307	.05580
68	.11703	.09151	.06421	.04302	.02414
69	.13180	.09994	.07054	.05145	.03259
70	.14446	.10205	.07054	.04723	.02626
71	.15502	.11259	.07265	.04934	.02414
72	-.03494	-.03708	-.03706	-.03708	-.04128
73	-.04338	-.04340	-.04339	-.04130	-.04339
74	-.04549	-.04340	-.04339	-.04340	-.04339
75	-.04549	-.04340	-.04339	-.04340	-.04339
76	.03893	.03881	.03889	.03880	.03681
77	-.03705	-.03708	-.03917	-.03497	-.03917
78	.12336	.12313	.12539	.12312	.12122
79	-.03494	-.03497	-.03284	-.03497	-.03494
80	-.04338	-.04129	-.04128	-.04130	-.04339
81	-.04338	-.04340	-.04339	-.04340	-.04339

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(l) $\alpha = 2^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4509.3 psf = 215.9 kN/m^2	p_t = 4506.9 psf = 215.8 kN/m^2	p_t = 4506.9 psf = 215.8 kN/m^2	p_t = 4511.1 psf = 216.0 kN/m^2	p_t = 4505.0 psf = 215.7 kN/m^2
1	0.93363	0.96016	0.97606	.97810	0.97211
2	.82343	.84160	.84890	.84699	.83856
3	.80436	.82255	.82559	.82161	.81100
4	.79164	.81196	.81923	.81526	.80464
5	.78952	.80773	.81499	.80892	.79616
6	.78740	.80561	.81075	.80680	.79192
7	.65601	.67859	.67936	.67569	.65625
8	.24277	.25305	.24914	.25061	.24287
9	.08171	.08580	.08172	.08353	.08176
10	.08383	.08580	.08383	.08565	.08176
11	.08383	.08369	.08383	.08776	.08387
12	.09019	.09427	.09231	.09199	.09023
13	.42290	.44147	.45259	.45997	.45486
14	.00754	.01171	.01178	.01586	.01604
15	.00330	.00535	.00330	.00529	.00120
16	-.00518	-.00523	.00330	.00317	-.00940
17	-.02849	.00535	.00330	.00529	-.02848
18	-.02213	.00324	.00118	.00317	-.02424
19	-.01577	.00324	.00118	.00106	-.01576
20	-.02001	-.01370	-.00941	-.00106	.00544
21	-.02849	-.02428	-.02213	-.01163	-.00092
22	-.03061	-.03064	-.02849	-.01798	-.00728
23	-.03485	-.03064	-.02849	-.01798	-.00940
24	.33813	.27422	.21735	.16813	.12203
25	.10502	.07734	.05205	.03278	.01604
26	.07535	.05193	.03085	.02009	.00756
27	.05628	.03076	.01178	-.00106	.00120
28	.03721	.01594	-.00518	-.01586	-.00516
29	.02237	-.00100	-.01365	-.02009	-.00940
30	.01389	-.00100	-.01789	-.02221	-.01152
31	.65813	.57273	.48014	.39441	.31282
32	.23641	.17684	.12622	.08776	.05632
33	.20038	.14297	.09231	.05816	.02876
34	.19191	.13026	.07748	.04547	.02028
35	.18555	.12391	.07536	.03912	.01604
36	.17919	.12179	.06688	.03278	.00756
37	.61151	.52616	.43564	.35635	.28527
38	.24489	.17684	.11562	.07085	.03512
39	.24065	.17260	.11562	.07296	.03936
40	.23005	.16202	.10079	.06239	.03088
41	.22370	.15567	.09443	.05604	.02452
42	.23689	.16947	.11716	.08080	.05581
43	.57197	.48563	.39809	.32293	.25420
44	.25375	.17791	.11716	.07238	.03681
45	.24742	.17369	.11505	.07027	.03259
46	.24110	.16737	.10871	.06606	.03048
47	.23478	.16104	.10026	.05975	.02626
48	.56987	.48563	.40020	.32503	.25631
49	.21370	.14840	.09181	.05343	.02415
50	.19052	.12521	.07069	.03659	.00938
51	.19052	.12310	.06858	.03238	.00938
52	.24953	.17369	.11082	.06817	.03259
53	.26007	.18423	.11505	.07027	.03259
54	.25375	.18001	.11505	.06817	.03048
55	.24110	.16947	.10660	.06396	.02837
56	.54668	.46455	.38330	.31240	.24575
57	.25796	.18212	.12138	.07870	.04104
58	.26007	.18423	.11927	.07238	.03470
59	.23899	.16947	.11082	.06396	.02837
60	.56354	.48563	.40231	.32925	.26264
61	.22213	.15683	.10237	.06396	.03048
62	.20317	.14207	.08547	.04922	.01993
63	.19685	.13364	.07914	.04711	.01571
64	.20106	.13154	.07703	.04080	.01360
65	.20738	.13786	.07703	.04290	.01993
66	.43499	.36971	.30304	.24503	.18877
67	.19685	.15894	.11927	.09133	.06214
68	.13362	.10624	.07703	.05554	.03470
69	.13259	.11467	.08125	.05975	.03892
70	.16945	.12100	.08125	.05764	.03048
71	.17999	.12943	.08547	.05764	.03048
72	-.03498	-.03497	-.03915	-.03710	-.03916
73	-.04341	-.04340	-.04548	-.04342	-.04338
74	-.04551	-.04551	-.04548	-.04342	-.04338
75	-.04551	-.04551	-.04548	-.04342	-.04338
76	.03879	.03880	.03689	.03869	.03892
77	-.03919	-.03708	-.04126	-.03710	-.03916
78	.12308	.12310	.12349	.12291	.12123
79	-.03498	-.03497	-.03492	-.03500	-.03494
80	-.04341	-.04340	-.04337	-.04131	-.04338
81	-.04551	-.04340	-.04548	-.04342	-.04338

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(m) $\alpha = 5^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0°	5°	10°
	p_t = 4508.9 psf = 215.9 kN/m^2	p_t = 4507.8 psf = 215.8 kN/m^2	p_t = 4506.0 psf = 215.7 kN/m^2	p_t = 4508.4 psf = 215.9 kN/m^2	p_t = 4505.3 psf = 215.7 kN/m^2
1	0.92893	0.96207	0.98051	0.97873	0.96999
2	.86962	.89434	.90208	.89831	.88732
3	.84844	.87106	.87664	.87081	.85764
4	.83149	.85624	.86392	.86022	.84916
5	.82725	.84989	.85544	.85176	.84068
6	.82090	.84142	.84908	.84330	.83220
7	.68322	.69961	.70494	.69940	.68593
8	.28499	.29321	.29160	.29100	.28951
9	.11130	.11329	.10930	.11325	.11355
10	.11130	.11541	.11142	.11325	.11567
11	.11977	.12387	.11990	.12171	.12203
12	.12824	.13446	.13050	.13229	.13051
13	.37396	.39057	.40182	.40527	.40186
14	-.00097	.00111	-.00093	.00532	.00756
15	-.00520	-.00101	-.00305	-.00314	-.00516
16	-.02003	.00323	.00119	-.00102	-.02424
17	-.03909	.00323	-.00305	.00321	-.03696
18	-.03909	-.00101	-.00517	-.00314	-.03908
19	-.03698	-.00312	-.00940	-.00314	-.03696
20	-.02850	-.02429	-.02000	-.00949	.00332
21	-.03698	-.03276	-.03060	-.02430	-.00728
22	-.03909	-.03699	-.03484	-.02642	-.01576
23	-.04121	-.03699	-.03484	-.03065	-.01788
24	.31041	.25511	.20045	.15557	.11355
25	.08800	.06461	.04147	.02437	.00968
26	.05834	.03921	.02239	.01167	.00332
27	.03504	.01381	-.00517	-.01160	-.00728
28	.01598	-.00101	-.02000	-.02642	-.01364
29	.00559	-.00947	-.02636	-.03065	-.01576
30	-.00097	-.01371	-.02848	-.03065	-.01788
31	.65568	.57684	.48449	.39680	.31494
32	.23839	.18102	.13050	.08997	.06056
33	.19603	.14292	.09234	.05823	.03088
34	.18544	.12811	.07750	.04341	.01816
35	.17908	.11964	.07114	.03707	.01604
36	.17061	.11117	.06267	.03495	.00756
37	.63450	.55356	.46117	.37564	.30011
38	.24686	.17891	.11990	.07516	.03936
39	.24475	.17891	.12202	.07727	.04360
40	.22992	.16409	.10718	.06669	.03512
41	.22356	.15774	.09870	.05823	.02876
42	.23464	.16943	.12122	.08510	.05581
43	.59485	.51081	.42300	.34212	.27108
44	.25571	.18207	.12333	.07667	.04104
45	.25149	.17997	.12122	.07246	.03470
46	.24307	.17154	.11489	.06824	.03259
47	.23254	.16100	.10434	.06192	.02837
48	.59064	.50870	.42300	.34422	.27319
49	.20726	.14203	.08956	.05139	.02204
50	.19462	.12518	.07057	.03664	.00938
51	.19251	.12307	.07057	.03243	.00727
52	.25149	.17786	.11700	.07246	.03681
53	.26413	.18629	.12333	.07456	.03681
54	.25571	.18418	.12122	.07246	.03470
55	.23886	.16943	.11067	.06614	.03048
56	.56957	.48763	.40400	.32948	.26053
57	.25992	.18629	.12755	.08089	.04526
58	.26203	.18629	.12333	.07456	.03681
59	.23254	.16732	.10856	.06403	.02837
60	.58221	.50449	.42300	.34633	.27741
61	.21568	.15468	.10223	.06403	.03048
62	.21147	.14414	.09167	.05350	.02204
63	.20515	.13993	.08956	.05139	.01782
64	.21358	.13993	.08323	.04718	.01782
65	.21779	.14414	.08534	.04928	.01993
66	.44318	.37594	.31115	.25153	.19510
67	.21990	.17786	.13810	.10406	.07269
68	.16513	.13150	.10012	.07456	.05159
69	.18198	.13782	.10012	.07456	.04948
70	.20515	.15257	.10645	.07246	.04104
71	.21568	.16311	.11278	.07456	.04104
72	-.03288	-.03498	-.03494	-.03498	-.03916
73	-.04341	-.04341	-.04339	-.04130	-.04338
74	-.04552	-.04551	-.04550	-.04341	-.04338
75	-.04552	-.04551	-.04550	-.04341	-.04338
76	.03874	.03878	.03892	.03875	.03681
77	-.03920	-.03919	-.03917	-.03920	-.03916
78	.12300	.12307	.12333	.12302	.12123
79	-.03709	-.03498	-.03494	-.03288	-.03494
80	-.04341	-.04341	-.04339	-.04130	-.04338
81	-.04552	-.04341	-.04339	-.04341	-.04338

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81 × 10^6 (REYNOLDS NUMBER PER METER OF 9.22 × 10^6), M = 3.71, AND $C_{p,max}$ = 1.7846 - Continued

(n) α = 10°

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4506.7 psf = 215.8 kN/m²	p_t = 4506.2 psf = 215.8 kN/m²	p_t = 4507.2 psf = 215.8 kN/m²	p_t = 4509.5 psf = 215.9 kN/m²	p_t = 4506.4 psf = 215.8 kN/m²
1	0.90516	0.93484	0.96002	0.95259	0.94636
2	.93057	.95390	.97061	.96105	.95060
3	.91151	.93061	.94520	.93356	.92305
4	.89669	.91790	.93462	.92722	.91245
5	.89034	.91155	.92827	.92088	.90186
6	.87975	.90308	.91769	.91030	.89338
7	.74214	.76334	.77163	.76440	.74715
8	.36528	.37376	.37790	.37532	.36781
9	.16838	.17051	.17046	.17021	.17072
10	.17473	.17686	.17469	.17656	.17496
11	.19802	.20015	.19586	.19770	.19615
12	.20649	.21074	.20856	.20827	.20463
13	.29541	.30813	.32287	.32035	.32119
14	-.01158	-.01158	-.00947	-.00952	-.00730
15	-.01158	-.00946	-.00947	-.01164	-.01365
16	-.03699	.00113	.00111	-.00952	-.03697
17	-.04546	-.01158	-.00947	-.01587	-.04544
18	-.04546	-.02216	-.01371	-.02221	-.04544
19	-.04122	-.02640	-.02006	-.02644	-.04332
20	-.03699	-.03275	-.03064	-.02855	.00542
21	-.03910	-.03910	-.03699	-.03490	-.02425
22	-.04122	-.04122	-.03911	-.03490	-.02425
23	-.04546	-.04334	-.03911	-.03490	-.02849
24	.27212	.22132	.17681	.13215	.09655
25	.06887	.04559	.02863	.01162	-.00094
26	.03500	.01806	.00746	-.00318	-.00942
27	.00959	-.00734	-.02006	-.03067	-.02213
28	-.00523	-.02005	-.03064	-.03701	-.02425
29	-.00946	-.02428	-.03487	-.03701	-.02637
30	-.01581	-.02852	-.03699	-.03701	-.02637
31	.64686	.56644	.48163	.38801	.31271
32	.24243	.18321	.13659	.09197	.06052
33	.19590	.14087	.09425	.05603	.02873
34	.18108	.12393	.07943	.04545	.01813
35	.17050	.11334	.07097	.03911	.01602
36	.15779	.10275	.06250	.03488	.00754
37	.66168	.57914	.49221	.39858	.31907
38	.25095	.18109	.12389	.07506	.03933
39	.25730	.18533	.13024	.07929	.04568
40	.23825	.17262	.11965	.07294	.03933
41	.22766	.16204	.10695	.06449	.03297
42	.22671	.16739	.12328	.08515	.05986
43	.62342	.54259	.45662	.36756	.29590
44	.25625	.18636	.12961	.08305	.04722
45	.25625	.18636	.12750	.07672	.04089
46	.24570	.17793	.12117	.07040	.03668
47	.22460	.16106	.10640	.06197	.03246
48	.62342	.54470	.45873	.36967	.29801
49	.20139	.14209	.09163	.05143	.02403
50	.19928	.13155	.07476	.03668	.01560
51	.19928	.13366	.07476	.03668	.01139
52	.25414	.18425	.12539	.07672	.04300
53	.26680	.19057	.12961	.07672	.04300
54	.25625	.18636	.12539	.07251	.03879
55	.22882	.16317	.10640	.06197	.03246
56	.60021	.51940	.43764	.35281	.28326
57	.25836	.18846	.13383	.08515	.05143
58	.25625	.18636	.12539	.07672	.04300
59	.22460	.15895	.10429	.05986	.02825
60	.61287	.53416	.45451	.36756	.29801
61	.20983	.15052	.10218	.06197	.03246
62	.21827	.15474	.10218	.05775	.03036
63	.22038	.15474	.10007	.05775	.03036
64	.23093	.15474	.09796	.05143	.02403
65	.23515	.16317	.10007	.05354	.02403
66	.46727	.39715	.33004	.26218	.20949
67	.26258	.21798	.17392	.12941	.09990
68	.21827	.18003	.14438	.10623	.08304
69	.24148	.18636	.14016	.10412	.07461
70	.27313	.21165	.14860	.10412	.06829
71	.27735	.22219	.16126	.11044	.07040
72	-.03495	-.03286	-.03495	-.03708	-.03498
73	-.04550	-.04551	-.04339	-.04551	-.04130
74	-.04761	-.04551	-.04339	-.04551	-.04130
75	-.04761	-.04551	-.04550	-.04551	-.04341
76	.03680	.03880	.03889	.03668	.03879
77	-.04339	-.03919	-.04128	-.04130	-.03919
78	.12120	.12312	.12328	.12098	.12309
79	-.03917	-.03708	-.03495	-.03708	-.03076
80	-.04761	-.04551	-.04339	-.04341	-.04130
81	-.04761	-.04551	-.04339	-.04551	-.04130

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(o) $\alpha = 15^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4505.9 psf = 215.7 kN/m^2	p_t = 4505.8 psf = 215.7 kN/m^2	p_t = 4508.4 psf = 215.9 kN/m^2	p_t = 4506.0 psf = 215.7 kN/m^2	p_t = 4506.9 psf = 215.8 kN/m^2
1	0.85862	0.88623	0.90685	0.90518	0.89116
2	.97083	.99210	.99996	.99622	.98651
3	.95601	.97728	.98303	.97716	.96532
4	.94331	.96457	.97457	.96869	.95684
5	.93907	.95610	.97033	.96234	.94837
6	.92637	.94552	.95975	.95175	.93989
7	.80569	.82482	.83701	.82684	.81275
8	.45210	.46274	.47090	.46691	.45888
9	.23402	.23617	.23811	.23825	.24062
10	.25943	.26793	.26986	.26578	.26393
11	.28060	.29334	.29314	.28695	.28300
12	.28272	.29122	.29314	.28695	.28088
13	.22979	.24040	.25081	.25096	.25122
14	-.02005	-.02216	-.02007	-.02005	-.01790
15	-.02216	-.01793	-.01583	-.02005	-.02425
16	-.04334	-.01369	-.00948	-.02005	-.04333
17	-.04757	-.02851	-.02007	-.03063	-.04756
18	-.04757	-.03487	-.02430	-.03487	-.04756
19	-.04545	-.03910	-.02641	-.03910	-.04544
20	-.04122	-.03910	-.03700	-.03699	-.00730
21	-.04334	-.04334	-.04123	-.03910	-.03061
22	-.04545	-.04545	-.04123	-.03910	-.03273
23	-.04757	-.04545	-.04334	-.04122	-.03273
24	.23402	.18747	.14712	.10910	.07746
25	.04982	.02866	.01591	.00112	-.00942
26	.01383	-.00099	-.00948	-.01793	-.02425
27	-.00734	-.02216	-.03065	-.03699	-.03061
28	-.01581	-.03063	-.03700	-.04122	-.03061
29	-.01793	-.03063	-.03911	-.04122	-.03061
30	-.02428	-.03487	-.04123	-.04334	-.03273
31	.62360	.54320	.45609	.37164	.29995
32	.24038	.18111	.13230	.09005	.06051
33	.19380	.13877	.09421	.05829	.02872
34	.17686	.12394	.08151	.04770	.02236
35	.16415	.11124	.07093	.04135	.01813
36	.14722	.09642	.06035	.03076	.00753
37	.67441	.58978	.50053	.40763	.32750
38	.25096	.18111	.12384	.07734	.04355
39	.26155	.18747	.13019	.08158	.04779
40	.24461	.17900	.12172	.07523	.04143
41	.22767	.16417	.11114	.06887	.03508
42	.22219	.16344	.12323	.08728	.05998
43	.64798	.56441	.47547	.38660	.30891
44	.26013	.18876	.13167	.08728	.05154
45	.26013	.18454	.12745	.08096	.04099
46	.24538	.17610	.11901	.07464	.03677
47	.22008	.15288	.10425	.06199	.02834
48	.65009	.56652	.48180	.39081	.31524
49	.21376	.14655	.09581	.05777	.02623
50	.21376	.14444	.08738	.04934	.01990
51	.21376	.14233	.08738	.04723	.01779
52	.25592	.18243	.12745	.08096	.04521
53	.26646	.18876	.12956	.08307	.04521
54	.25381	.17821	.12323	.07674	.04099
55	.22219	.15499	.10214	.06199	.02834
56	.62460	.53909	.45438	.36973	.29837
57	.25592	.18454	.13167	.08728	.05154
58	.24959	.17610	.12112	.07674	.04099
59	.22430	.15288	.10214	.05988	.02834
60	.63534	.55386	.46914	.38449	.31102
61	.21587	.15077	.10425	.06410	.03466
62	.23273	.16344	.10847	.06620	.03466
63	.24327	.16555	.10847	.06620	.03255
64	.25592	.17399	.10636	.05988	.02412
65	.25592	.17399	.10636	.05988	.01990
66	.50043	.42091	.34681	.28120	.22242
67	.31915	.26474	.21182	.16527	.12749
68	.28121	.23308	.19073	.15052	.11483
69	.31494	.24996	.19073	.14419	.10428
70	.34023	.27529	.20549	.15052	.10217
71	.34023	.27740	.21182	.15684	.10428
72	-.03076	-.03494	-.03285	-.03286	-.03495
73	-.04340	-.04550	-.04339	-.04340	-.04339
74	-.04551	-.04761	-.04550	-.04340	-.04550
75	-.04551	-.04761	-.04550	-.04551	-.04550
76	.03880	.03681	.03886	.03880	.03888
77	-.03919	-.04339	-.04128	-.03919	-.03917
78	.12312	.12123	.12323	.12312	.12116
79	-.03708	-.03916	-.03707	-.03497	-.03495
80	-.04551	-.04761	-.04339	-.04130	-.04339
81	-.04551	-.04761	-.04550	-.04340	-.04339

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), M = 3.71, AND $C_{p,max} = 1.7846$ - Continued

(p) $\alpha = 20^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0°	5°	10°
			p_t = 4506.7 psf = 215.8 kN/m^2		
1			0.83523		
2			1.02365		
3			1.01941		
4			1.01306		
5			1.00883		
6			1.00248		
7			.90298		
8			.57272		
9			.32291		
10			.38218		
11			.39277		
12			.39277		
13			.18742		
14			-.02640		
15			-.02005		
16			-.02005		
17			-.02852		
18			-.03487		
19			-.03487		
20			-.03910		
21			-.04334		
22			-.04546		
23			-.04546		
24			.11967		
25			.00324		
26			-.02429		
27			-.03699		
28			-.03910		
29			-.04122		
30			-.04122		
31			.42453		
32			.12814		
33			.09427		
34			.08580		
35			.07521		
36			.06040		
37			.50286		
38			.12391		
39			.13026		
40			.12179		
41			.11120		
42			.12119		
43			.49044		
44			.13385		
45			.12752		
46			.11697		
47			.10009		
48			.49888		
49			.10220		
50			.10009		
51			.09798		
52			.12752		
53			.12752		
54			.12119		
55			.10009		
56			.47145		
57			.13174		
58			.11697		
59			.10642		
60			.48411		
61			.11064		
62			.11908		
63			.11486		
64			.10853		
65			.11275		
66			.36806		
67			.25834		
68			.24568		
69			.25201		
70			.26467		
71			.26467		
72			-.02862		
73			-.04128		
74			-.04339		
75			-.04550		
76			.03890		
77			-.03917		
78			.12330		
79			-.03495		
80			-.04339		
81			-.04339		

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(q) $\alpha = 25^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10°	-5°	0° (p_t = 4506.8 psf = 215.8 kN/m²)	5°	10°
1			0.74841		
2			1.01939		
3			1.02786		
4			1.02574		
5			1.02574		
6			1.02362		
7			.96011		
8			.67432		
9			.42451		
10			.49438		
11			.49014		
12			.49014		
13			.13660		
14			-.03064		
15			-.02005		
16			-.02852		
17			-.03699		
18			-.03699		
19			-.03911		
20			-.04122		
21			-.04546		
22			-.04546		
23			-.04757		
24			.09215		
25			-.00735		
26			-.03064		
27			-.03911		
28			-.04122		
29			-.04122		
30			-.04334		
31			.38853		
32			.11755		
33			.09426		
34			.08580		
35			.07733		
36			.06251		
37			.48591		
38			.12390		
39			.12814		
40			.12179		
41			.10908		
42			.11908		
43			.49465		
44			.13385		
45			.12541		
46			.11486		
47			.09798		
48			.50520		
49			.11275		
50			.10220		
51			.10853		
52			.12541		
53			.12541		
54			.11486		
55			.10431		
56			.47566		
57			.12963		
58			.11064		
59			.11064		
60			.48832		
61			.12119		
62			.12752		
63			.11486		
64			.09587		
65			.09587		
66			.39126		
67			.30686		
68			.30686		
69			.31530		
70			.31319		
71			.31319		
72			-.02440		
73			-.04128		
74			-.04128		
75			-.04128		
76			.03890		
77			-.03917		
78			.12541		
79			-.03495		
80			-.04128		
81			-.04128		

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Continued

(r) $\alpha = 30^\circ$

Orifice	$C_p/C_{p,max}$ at β of: -10° p_t = 4508.3 psf = 215.9 kN/m²	-5° p_t = 4508.2 psf = 215.9 kN/m²	0° p_t = 4506.5 psf = 215.8 kN/m²	5° p_t = 4509.1 psf = 215.9 kN/m²	10° p_t = 4506.5 psf = 215.8 kN/m²
1	0.62963	0.64023	0.65187	0.65274	0.64344
2	.96189	.98519	.99523	.99126	.97622
3	.99575	1.01694	1.02278	1.01876	1.00378
4	.99575	1.01905	1.02702	1.02511	1.01226
5	1.00210	1.02540	1.03126	1.02723	1.01226
6	1.00210	1.02964	1.03338	1.02934	1.01438
7	.97670	1.00001	1.00794	.99972	.98470
8	.75026	.76721	.77268	.77122	.76638
9	.53228	.53865	.53954	.54483	.54594
10	.57058	.58944	.60100	.58926	.57561
11	.56191	.57886	.58829	.57657	.56289
12	.55556	.57251	.58193	.56811	.55442
13	.08363	.08575	.09021	.09418	.09446
14	-.03488	-.03488	-.03696	-.03488	-.03484
15	-.04546	-.03276	-.02637	-.04123	-.04544
16	-.04546	-.03911	-.04120	-.04123	-.04968
17	-.04758	-.04123	-.04332	-.04335	-.04968
18	-.04969	-.04546	-.04756	-.03912	-.04544
19	-.04334	-.04546	-.04332	-.03912	-.04544
20	-.04546	-.04546	-.04756	-.04123	-.03484
21	-.04758	-.04758	-.04756	-.04546	-.04120
22	-.04969	-.04969	-.04968	-.04758	-.04120
23	-.04758	-.04758	-.04968	-.04546	-.04756
24	.12384	.09210	.06477	.04551	.02451
25	.00321	-.00948	-.02001	-.02642	-.03060
26	-.02218	-.03065	-.03908	-.04123	-.04332
27	-.02853	-.03488	-.04332	-.04546	-.03908
28	-.02853	-.03488	-.04332	-.04546	-.04332
29	-.02853	-.03699	-.04332	-.04546	-.04544
30	-.02641	-.03488	-.04332	-.04546	-.04756
31	.47515	.40532	.34242	.28036	.22587
32	.20214	.14924	.10292	.07090	.04358
33	.19156	.13654	.08597	.04975	.02027
34	.18310	.12608	.07961	.04763	.02027
35	.16405	.11538	.07325	.04340	.01815
36	.15559	.10268	.06053	.03070	.00967
37	.63175	.55134	.46112	.37980	.30854
38	.23389	.17041	.11564	.07725	.04358
39	.24870	.17887	.12412	.07937	.04570
40	.23601	.17041	.11352	.07302	.03934
41	.22119	.15559	.10080	.06244	.03087
42	.22659	.16543	.11679	.08102	.05579
43	.65266	.57463	.48775	.39943	.32168
44	.24557	.18019	.13154	.08524	.05157
45	.24135	.17175	.12100	.07469	.04102
46	.22448	.15910	.10625	.06415	.03258
47	.22237	.15277	.09992	.05571	.02625
48	.66551	.58518	.50040	.40998	.33012
49	.24346	.16965	.11679	.07258	.04313
50	.25100	.17386	.10835	.05782	.02414
51	.25401	.17386	.11257	.05993	.01570
52	.23714	.17175	.12100	.07680	.04102
53	.23925	.17175	.11889	.07469	.04102
54	.22659	.15910	.10625	.06415	.03258
55	.22870	.15910	.10625	.06204	.03047
56	.64000	.55775	.47299	.38467	.30902
57	.23292	.16965	.12311	.07891	.04524
58	.22659	.15910	.10625	.06204	.03047
59	.23714	.16754	.11046	.06626	.03258
60	.65688	.57463	.48775	.39733	.31957
61	.24979	.18230	.12732	.08313	.04946
62	.25612	.18441	.12732	.08102	.04524
63	.25190	.16543	.09992	.04728	.01570
64	.24768	.15699	.08306	.03673	.00515
65	.24768	.14644	.08306	.03673	.00937
66	.59149	.50080	.41187	.32774	.26049
67	.51977	.43331	.35285	.28556	.22672
68	.51767	.44174	.36972	.30243	.24572
69	.53032	.45229	.37182	.29611	.23094
70	.51977	.44174	.36550	.28767	.22250
71	.51345	.43542	.36128	.28767	.22039
72	-.02019	-.02230	-.02022	-.02653	-.02861
73	-.03918	-.04128	-.03919	-.04129	-.04128
74	-.04128	-.04128	-.03919	-.04129	-.04128
75	-.04128	-.04128	-.03919	-.04340	-.04339
76	.03676	.03676	.03880	.03673	.03891
77	-.03918	-.03917	-.03497	-.03707	-.03917
78	.12113	.12113	.12522	.12108	.12121
79	-.03496	-.03496	-.03287	-.03496	-.03495
80	-.04128	-.04128	-.03919	-.04129	-.04128
81	-.04128	-.04128	-.03919	-.04129	-.04339

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81 × 10^6 (REYNOLDS NUMBER PER METER OF 9.22 × 10^6), M = 3.71, AND $C_{p,max}$ = 1.7846 - Continued

(s) $\alpha = 35^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4506.4 psf = 215.8 kN/m^2	p_t = 4506.4 psf = 215.8 kN/m^2	p_t = 4509.2 psf = 215.9 kN/m^2	p_t = 4507.9 psf = 215.8 kN/m^2	p_t = 4506.7 psf = 215.8 kN/m^2
1	0.54735	0.56429	0.56814	0.57462	0.56451
2	.94538	.97502	.98073	.98307	.97115
3	.99620	1.00890	1.02093	1.02117	1.00716
4	.99831	1.01737	1.02516	1.02540	1.00927
5	1.00255	1.01948	1.02728	1.02328	1.00716
6	1.00255	1.01948	1.02939	1.02540	1.00927
7	1.00255	1.02372	1.03151	1.02752	1.00716
8	.83741	.85223	.86224	.86033	.84831
9	.64898	.65533	.66123	.66139	.65770
10	.66592	.68285	.69509	.68467	.66617
11	.65745	.67438	.68874	.67409	.65346
12	.65321	.66803	.67816	.66562	.64711
13	.05617	.06040	.06245	.06670	.06680
14	-.03910	-.03910	-.03912	-.03911	-.03910
15	-.04757	-.03699	-.03277	-.04546	-.04757
16	-.04546	-.04334	-.04123	-.04546	-.04757
17	-.04546	-.04546	-.03912	-.04758	-.04545
18	-.04546	-.04122	-.04546	-.03699	-.04545
19	-.04334	-.03910	-.03700	-.03911	-.04333
20	-.04546	-.04757	-.04546	-.04123	-.03910
21	-.04546	-.04969	-.04758	-.04546	-.04333
22	-.04546	-.04969	-.04969	-.04758	-.04545
23	-.04122	-.04546	-.04546	-.04546	-.04545
24	.09640	.07099	.04763	.02861	.01173
25	-.00735	-.01793	-.02642	-.03065	-.03698
26	-.02640	-.03487	-.03912	-.04334	-.04545
27	-.03063	-.03699	-.04123	-.04546	-.04121
28	-.02852	-.03699	-.04123	-.04546	-.04545
29	-.02640	-.03487	-.04123	-.04546	-.04545
30	-.02640	-.03487	-.04123	-.04546	-.04545
31	.42667	.36951	.30577	.25083	.20023
32	.18955	.13662	.09418	.06036	.03715
33	.18955	.13259	.08360	.04977	.02232
34	.18320	.12815	.08149	.04766	.02020
35	.16626	.11545	.07303	.04131	.01597
36	.16626	.11122	.06456	.03284	.00750
37	.61510	.53465	.44965	.37569	.30612
38	.23401	.17050	.11534	.07729	.04138
39	.24672	.17685	.12169	.07940	.04562
40	.23401	.16626	.11111	.07094	.03715
41	.21919	.15144	.09842	.06036	.02868
42	.23726	.16763	.12320	.08527	.05979
43	.65085	.57277	.48170	.39745	.32306
44	.23937	.17607	.12531	.08316	.05136
45	.23304	.16763	.11477	.07051	.03873
46	.22249	.15286	.10211	.05996	.03241
47	.22671	.15497	.10211	.05996	.03241
48	.66351	.58121	.49224	.40588	.32938
49	.24570	.17185	.11687	.07262	.04505
50	.24781	.17185	.11055	.05785	.02188
51	.24781	.16974	.10633	.04520	.01345
52	.22882	.16763	.11477	.07262	.04083
53	.23093	.16341	.11266	.07051	.03873
54	.22460	.15497	.10211	.05996	.03241
55	.23093	.16130	.10633	.06418	.03241
56	.63397	.55167	.46061	.37846	.30411
57	.22249	.16341	.11687	.07473	.04294
58	.22671	.15919	.10633	.06418	.03241
59	.24359	.17185	.11898	.07684	.04294
60	.65085	.56222	.47537	.39112	.31464
61	.25625	.19084	.13585	.09160	.05768
62	.24992	.17607	.11898	.07473	.04294
63	.22882	.14441	.08313	.04098	.01135
64	.21194	.13175	.07892	.03676	.00924
65	.19928	.12753	.07681	.03676	.01135
66	.60653	.51580	.42265	.34050	.27041
67	.58121	.49048	.40367	.32573	.26198
68	.58965	.50947	.43109	.35737	.28936
69	.58543	.50103	.41844	.33839	.26830
70	.57277	.49259	.41211	.32784	.25988
71	.56855	.48626	.40789	.32784	.25988
72	-.01596	-.01807	-.02020	-.02441	-.02657
73	-.03706	-.03706	-.03707	-.03917	-.03499
74	-.03917	-.03917	-.03707	-.03917	-.03710
75	-.03917	-.03917	-.03918	-.04128	-.03920
76	.03891	.03891	.04096	.03887	.04083
77	-.03495	-.03495	-.03496	-.03707	-.03499
78	.12331	.12120	.12531	.12113	.12297
79	-.03284	-.03284	-.03074	-.03285	-.03078
80	-.03917	-.03917	-.03707	-.03917	-.03710
81	-.03917	-.03917	-.03707	-.04128	-.03710

TABLE II.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 2.81×10^6 (REYNOLDS NUMBER PER METER OF 9.22×10^6), $M = 3.71$, AND $C_{p,max} = 1.7846$ - Concluded

(t) $\alpha = 40^\circ$

Orifice	$C_p/C_{p,max}$ at β of:				
	-10°	-5°	0°	5°	10°
	p_t = 4507.2 psf = 215.8 kN/m^2	p_t = 4507.5 psf = 215.8 kN/m^2	p_t = 4507.7 psf = 215.8 kN/m^2	p_t = 4508.0 psf = 215.8 kN/m^2	p_t = 4508.1 psf = 215.8 kN/m^2
1	0.34663	0.35671	0.37994	0.39261	0.37189
2	.72810	.80967	.77994	.84761	.84642
3	.85950	.84989	.94502	.92803	.93327
4	.93156	.89434	.95984	.96612	.96505
5	.93580	.98112	.98947	1.00210	.98623
6	.97606	1.00864	1.02545	1.01268	1.00742
7	1.02269	1.05520	1.06778	1.06347	1.04767
8	.93580	.95149	.97042	.96612	.95234
9	.77897	.79062	.80111	.79893	.78922
10	.76413	.78427	.79264	.78412	.76380
11	.74930	.77157	.78418	.76719	.74685
12	.74506	.76311	.77571	.75872	.73838
13	.01390	.01804	.02015	.02226	.02446
14	-.04120	-.04546	-.04334	-.04334	-.04333
15	-.04120	-.04546	-.04123	-.04758	-.04968
16	-.04332	-.04546	-.04546	-.04758	-.04757
17	-.04120	-.04757	-.04546	-.04546	-.04545
18	-.04120	-.04334	-.04123	-.04123	-.04121
19	-.03908	-.03911	-.03911	-.03911	-.03909
20	-.04332	-.04757	-.04758	-.04546	-.04121
21	-.04332	-.04969	-.04758	-.04758	-.04757
22	-.04120	-.04334	-.04334	-.04546	-.04545
23	-.03697	-.03699	-.03699	-.03700	-.03697
24	.04357	.02651	.01168	.00110	-.00943
25	-.02637	-.03276	-.03699	-.03911	-.04333
26	-.03697	-.04122	-.04546	-.04758	-.04757
27	-.03485	-.03911	-.04334	-.04758	-.04757
28	-.03273	-.03699	-.04123	-.04546	-.04757
29	-.02849	-.03487	-.04123	-.04546	-.04545
30	-.03061	-.03699	-.03911	-.03911	-.03697
31	.27033	.24452	.20428	.17040	.13250
32	.13682	.09847	.06883	.04342	.02446
33	.15589	.11117	.07094	.03919	.01387
34	.16013	.11117	.07094	.03919	.01387
35	.15589	.10482	.06459	.03496	.00539
36	.16225	.10906	.06459	.03284	.01175
37	.46319	.43926	.38206	.32066	.25961
38	.18980	.14292	.09634	.06035	.03082
39	.20252	.15139	.10481	.06670	.03717
40	.20252	.14504	.09846	.06035	.02870
41	.20040	.13869	.08787	.05189	.02234
42	.22668	.16546	.12094	.08316	.05573
43	.53051	.49245	.40750	.35736	.28140
44	.19925	.15069	.10619	.07051	.03886
45	.20347	.14226	.09776	.05996	.02831
46	.20980	.14226	.09355	.05363	.02199
47	.21824	.15280	.09987	.05785	.02620
48	.57692	.53254	.44753	.37002	.30249
49	.23934	.16757	.11462	.07261	.04097
50	.24145	.16546	.10198	.04941	.01566
51	.23934	.15913	.09144	.04519	.00933
52	.20136	.14647	.09987	.06207	.03042
53	.20347	.14647	.09987	.05785	.02831
54	.21613	.14858	.09987	.05785	.02620
55	.22879	.16124	.11041	.06840	.03253
56	.58114	.50089	.42014	.35525	.28562
57	.14228	.14858	.10408	.06629	.03675
58	.22668	.15913	.10619	.06418	.03253
59	.23934	.17179	.12094	.07894	.04729
60	.61279	.53675	.45596	.38056	.30038
61	.26255	.19500	.14201	.09793	.05995
62	.23301	.16124	.10619	.06418	.03253
63	.20136	.13382	.08091	.04098	.00933
64	.18870	.12749	.07880	.03887	.00933
65	.18659	.12538	.07880	.04098	.01355
66	.63389	.53886	.43910	.35736	.28140
67	.64233	.55363	.46439	.37845	.30038
68	.66976	.58106	.50232	.41642	.33834
69	.64444	.55574	.46860	.38478	.30671
70	.62756	.53886	.45596	.37002	.29827
71	.62123	.53464	.45385	.37002	.29616
72	-.01385	-.01597	-.01812	-.02230	-.02652
73	-.03917	-.03495	-.03287	-.03707	-.03707
74	-.03917	-.03495	-.03498	-.03707	-.03707
75	-.04128	-.03706	-.03498	-.03707	-.03707
76	.03890	.04099	.04087	.03887	.03886
77	-.03706	-.03284	-.03077	-.03496	-.03496
78	.12329	.12116	.12726	.12113	.12111
79	-.03284	-.02862	-.02655	-.03074	-.03074
80	-.04128	-.03495	-.03498	-.03707	-.03496
81	-.04128	-.03706	-.03498	-.03707	-.03496

TABLE III.- TABULATION OF PRESSURE MEASUREMENTS AT A REYNOLDS NUMBER PER FOOT OF 4.68×10^6 (REYNOLDS NUMBER PER METER OF 15.35×10^6), $M = 3.71$, $C_{p,max} = 1.7846$, AND $\beta = 0^\circ$

Orifice	$C_p/C_{p,max}$ at α of:					
	0°	10°	20°	30°	35°	40°
	p_t = 7500.1 psf = 359.1 kN/m^2	p_t = 7500.1 psf = 359.1 kN/m^2	p_t = 7509.6 psf = 359.6 kN/m^2	p_t = 7509.6 psf = 359.6 kN/m^2	p_t = 7500.1 psf = 359.1 kN/m^2	p_t = 7509.6 psf = 359.6 kN/m^2
1	0.97197	0.94898	0.81939	0.63332	0.54795	0.33740
2	.81280	.96299	1.01525	.98542	.96815	.81182
3	.79370	.94007	1.01144	1.01339	1.00890	.90976
4	.78352	.92861	1.00635	1.01847	1.01526	.92629
5	.77970	.92224	1.00126	1.02101	1.01526	.96318
6	.77970	.91333	.99236	1.02355	1.02036	1.01024
7	.66382	.77327	.89952	1.00195	1.02800	1.05221
8	.22070	.38493	.57775	.77569	.86628	.96827
9	.06281	.16975	.32720	.54943	.67528	.81182
10	.07045	.17867	.39079	.61044	.70457	.79910
11	.06790	.20286	.40097	.60028	.70075	.78638
12	.07300	.21432	.40097	.59138	.69056	.78384
13	.49320	.32000	.17713	.08421	.05517	.01180
14	.01697	-.01487	-.03018	-.03782	-.04160	-.04671
15	.00933	-.01232	-.02000	-.02511	-.03396	-.04544
16	.00806	-.00214	-.02255	-.04163	-.04415	-.04798
17	.00806	-.00977	-.03145	-.04290	-.04160	-.04798
18	.00551	-.01614	-.03654	-.04545	-.04033	-.04417
19	.00551	-.01996	-.03527	-.04290	-.04033	-.04035
20	-.00213	-.03524	-.04290	-.04672	-.04797	-.05053
21	-.01741	-.04033	-.04544	-.04799	-.05052	-.05053
22	-.02123	-.04161	-.04671	-.05053	-.05179	-.04544
23	-.02250	-.04161	-.04926	-.05053	-.04797	-.03781
24	.23089	.17103	.11481	.06133	.04244	.00798
25	.06026	.02460	-.00093	-.02257	-.02887	-.04035
26	.03862	.00296	-.02763	-.03909	-.04288	-.04798
27	.02079	-.02251	-.03908	-.04290	-.04415	-.04671
28	.00806	-.03397	-.04162	-.04290	-.04415	-.04417
29	-.00086	-.03651	-.04290	-.04290	-.04415	-.04290
30	-.00722	-.03906	-.04417	-.04290	-.04288	-.04035
31	.48428	.48042	.42259	.34351	.30092	.19495
32	.11756	.12646	.11608	.09437	.08318	.05631
33	.09337	.09208	.09319	.08675	.08191	.06903
34	.08191	.07935	.08428	.08166	.08064	.06903
35	.07554	.06917	.07284	.07277	.07045	.06140
36	.07300	.06025	.06012	.06005	.06408	.06522
37	.42698	.49061	.49890	.46427	.44863	.36666
38	.11374	.12137	.11862	.11471	.11247	.09193
39	.11247	.12646	.12498	.11980	.11756	.09829
40	.10101	.11628	.11862	.11344	.10865	.09320
41	.09464	.10736	.10972	.10073	.09592	.08557
42	.10393	.10645	.10500	.10003	.10519	.10266
43	.38884	.45592	.49075	.48853	.48128	.41542
44	.11026	.12544	.12903	.12407	.11912	.10012
45	.11026	.12417	.12523	.11521	.10899	.09379
46	.10519	.11911	.11385	.10382	.09759	.08873
47	.10013	.10645	.09614	.09623	.09886	.09759
48	.38884	.45972	.50087	.49865	.49014	.44202
49	.09506	.08619	.09741	.11015	.11152	.11025
50	.07227	.07479	.09741	.10635	.11026	.10139
51	.06847	.07479	.09614	.10888	.10266	.08746
52	.10899	.12417	.12650	.11648	.11152	.09379
53	.11406	.12671	.12650	.11521	.10899	.09253
54	.11279	.12291	.11765	.10382	.09759	.09379
55	.10773	.10771	.09741	.10256	.10519	.10899
56	.37111	.44072	.47305	.46954	.46102	.43189
57	.11532	.12924	.12650	.11521	.10899	.09633
58	.11532	.12291	.11259	.10129	.10139	.10266
59	.11279	.10138	.10247	.10888	.11912	.11912
60	.39137	.45592	.48696	.48726	.47241	.45974
61	.10139	.09758	.10626	.12154	.13052	.13685
62	.08620	.09885	.11891	.12280	.11279	.09886
63	.07733	.09885	.11638	.08737	.07733	.07607
64	.07354	.09632	.10879	.07725	.07480	.07353
65	.07354	.09632	.11132	.07598	.07354	.07353
66	.29893	.33310	.37439	.41386	.42809	.44835
67	.10899	.17229	.25803	.35692	.40783	.47114
68	.06087	.14317	.24665	.37210	.43569	.50786
69	.07100	.13937	.25424	.37590	.42303	.46987
70	.07100	.15076	.26942	.36831	.42050	.45974
71	.07480	.16596	.26942	.36324	.41543	.45848
72	-.03916	-.03663	-.03160	-.02652	-.02270	-.02144
73	-.04423	-.04423	-.04425	-.04297	-.03790	-.03537
74	-.04423	-.04550	-.04551	-.04297	-.03790	-.03663
75	-.04423	-.04550	-.04551	-.04297	-.03916	-.03663
76	.00262	.00135	.00129	.00132	.00262	.00389
77	-.04170	-.04423	-.04425	-.04044	-.03790	-.03537
78	.05074	.04947	.05061	.04941	.05074	.05074
79	-.03916	-.04170	-.04172	-.03918	-.03537	-.03283
80	-.04423	-.04550	-.04551	-.04297	-.03790	-.03663
81	-.04423	-.04550	-.04551	-.04171	-.03790	-.03663

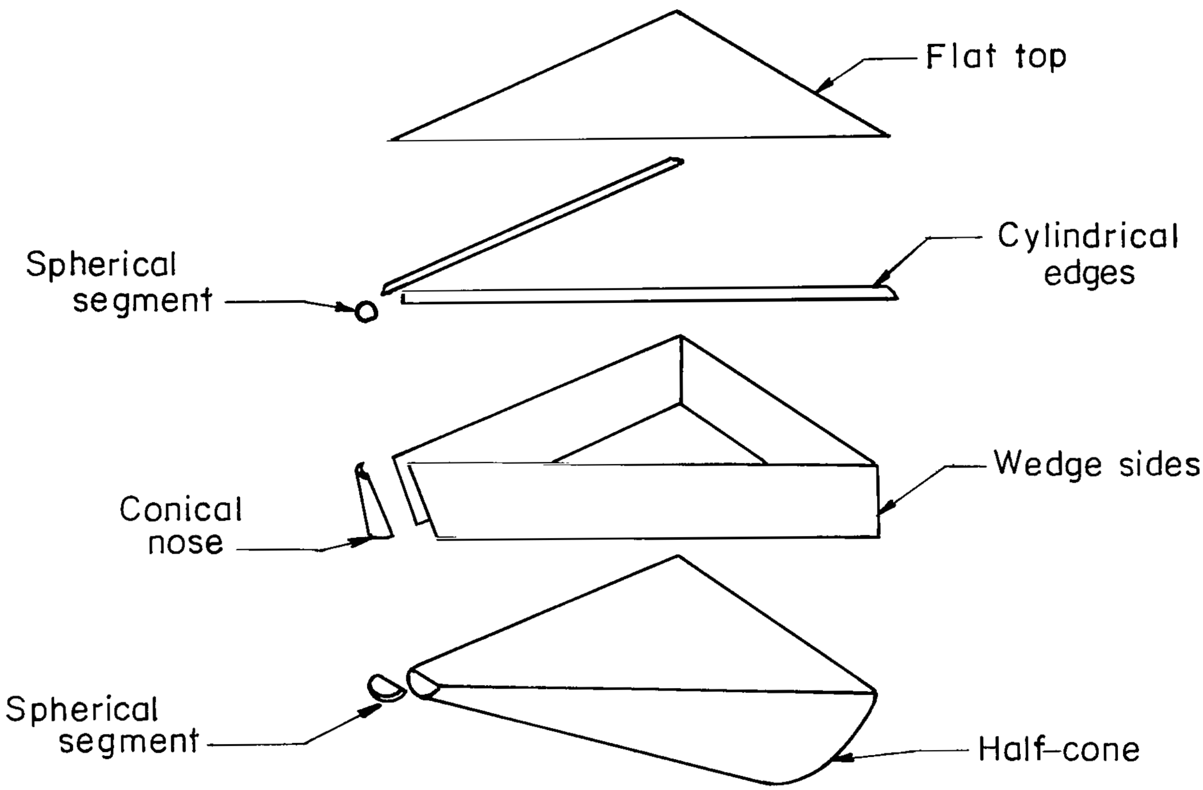
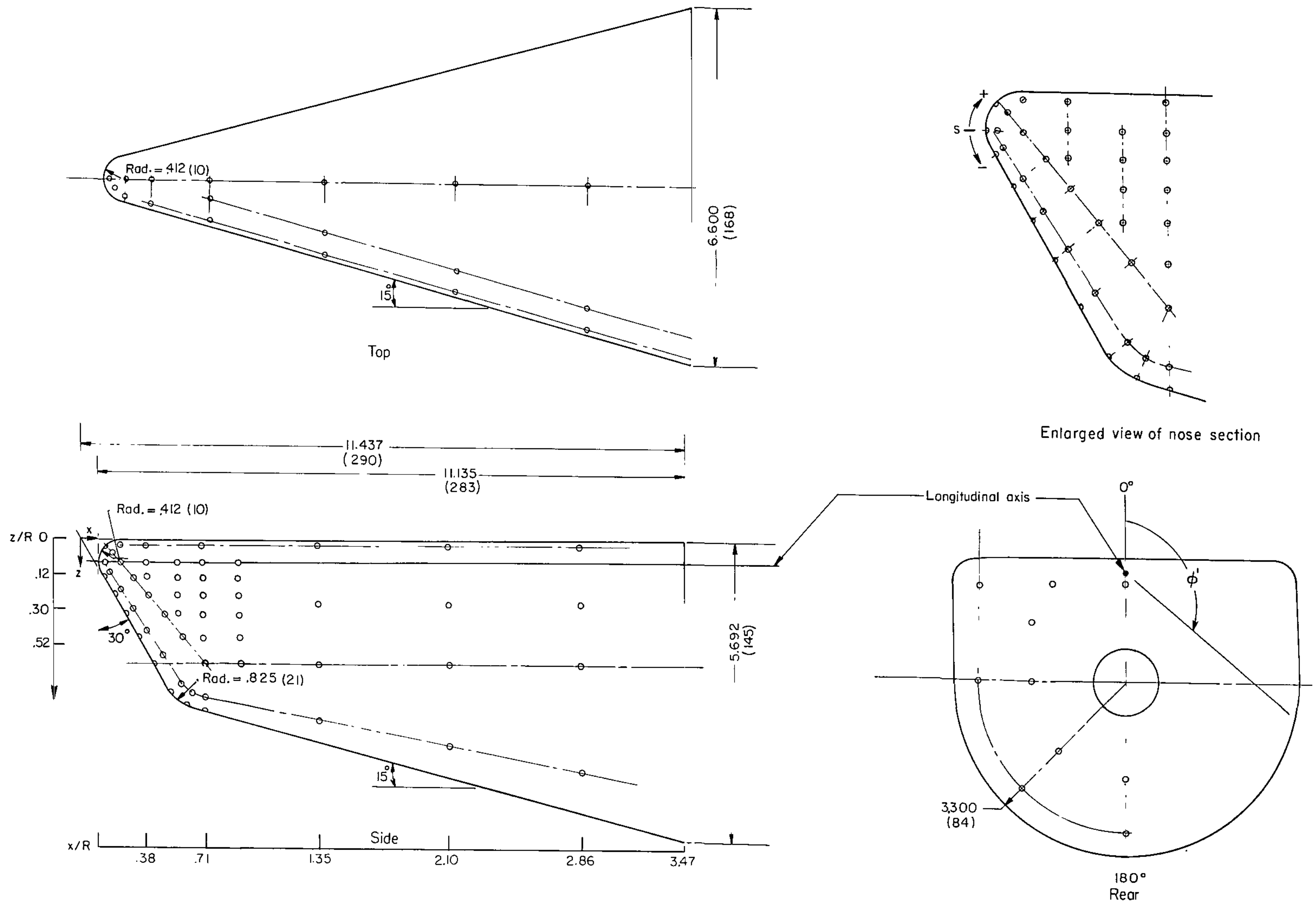
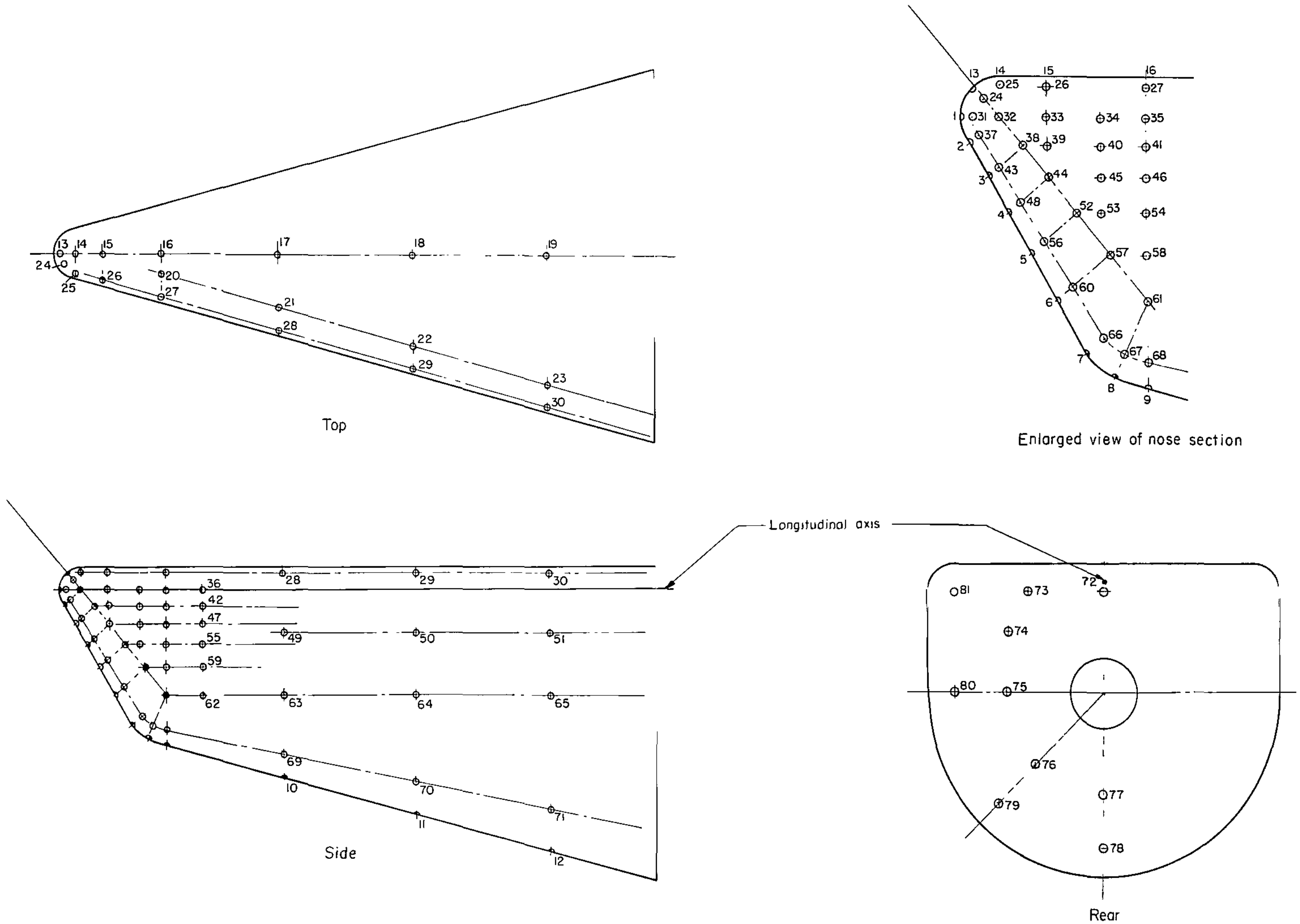


Figure 1.- Exploded view of model to show relationship of parts.



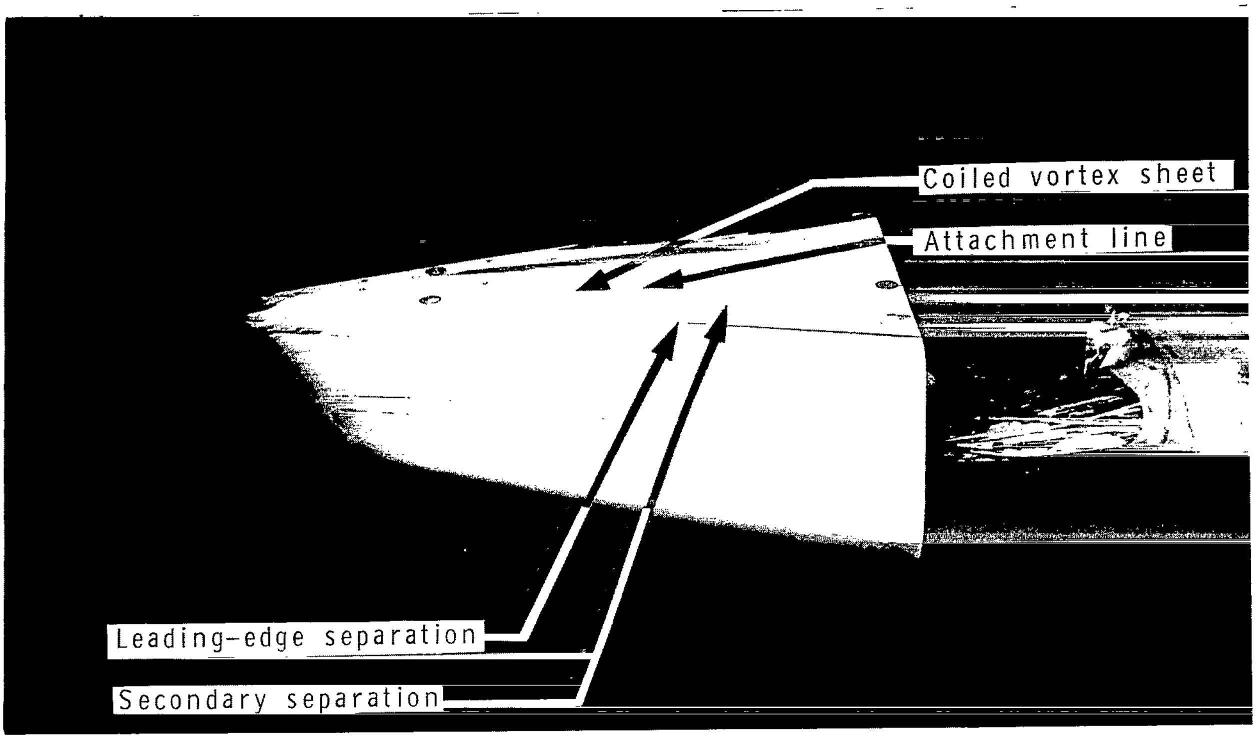
(a) Coordinate systems and model dimensions. (Dimensions are in inches (millimeters).)

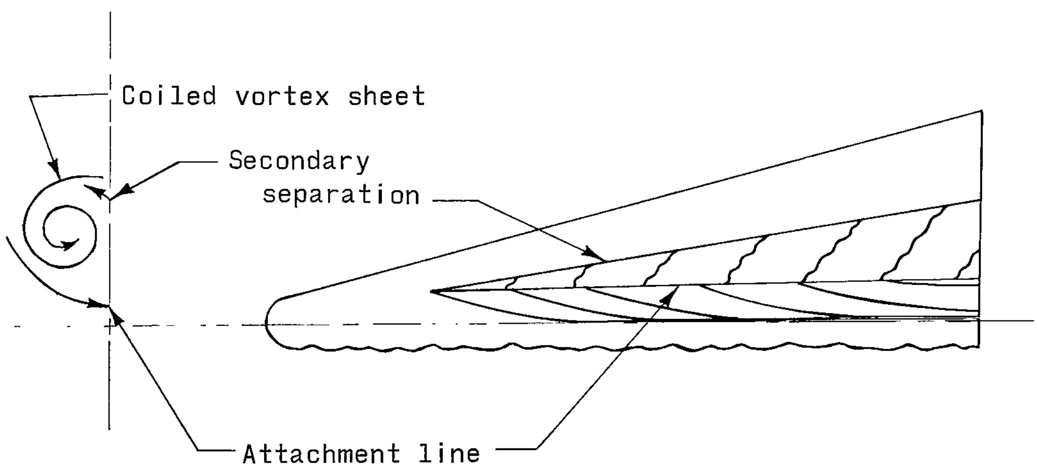
Figure 2.- Model description.



(b) Orifice identification.

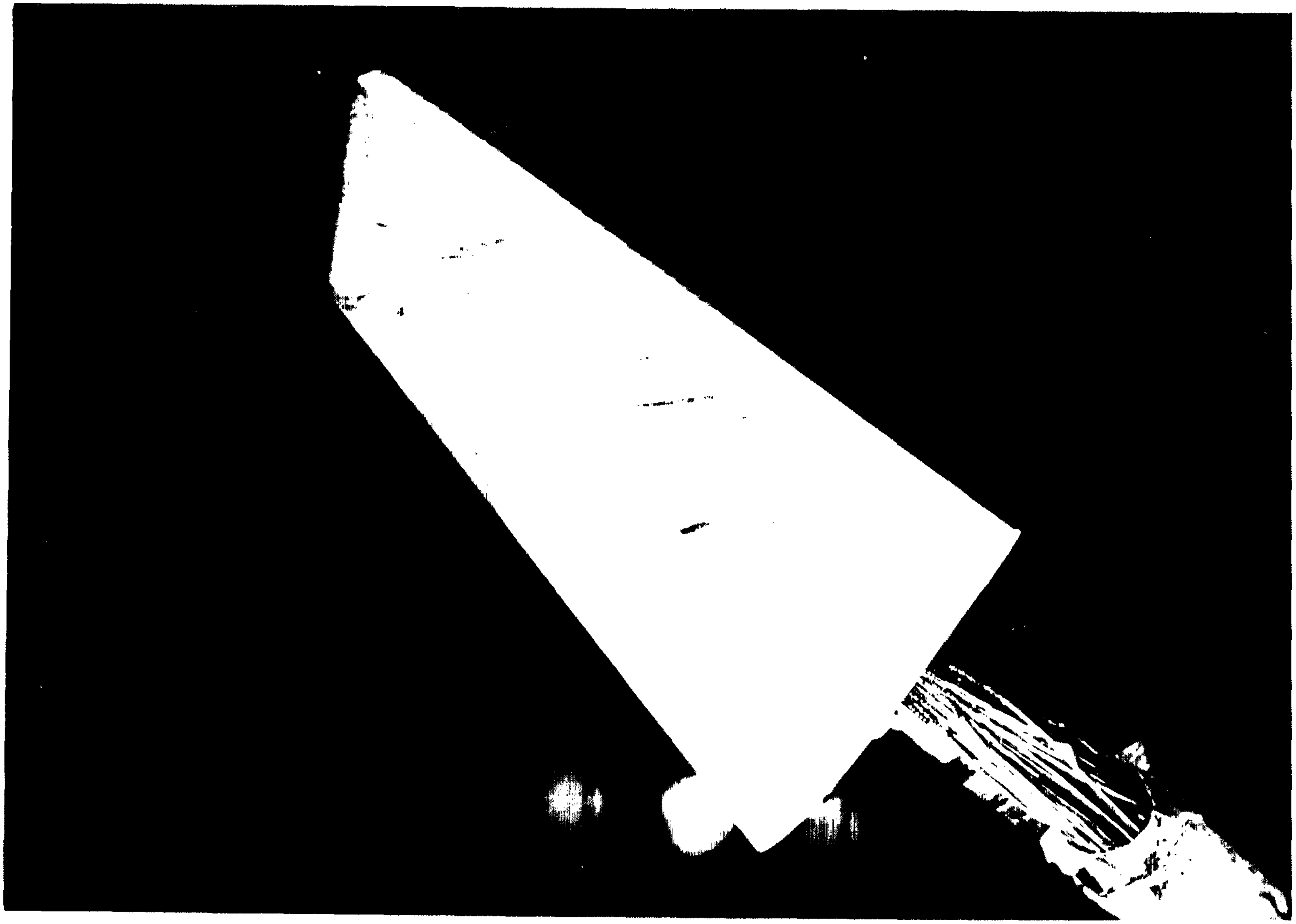
Figure 2.- Concluded.





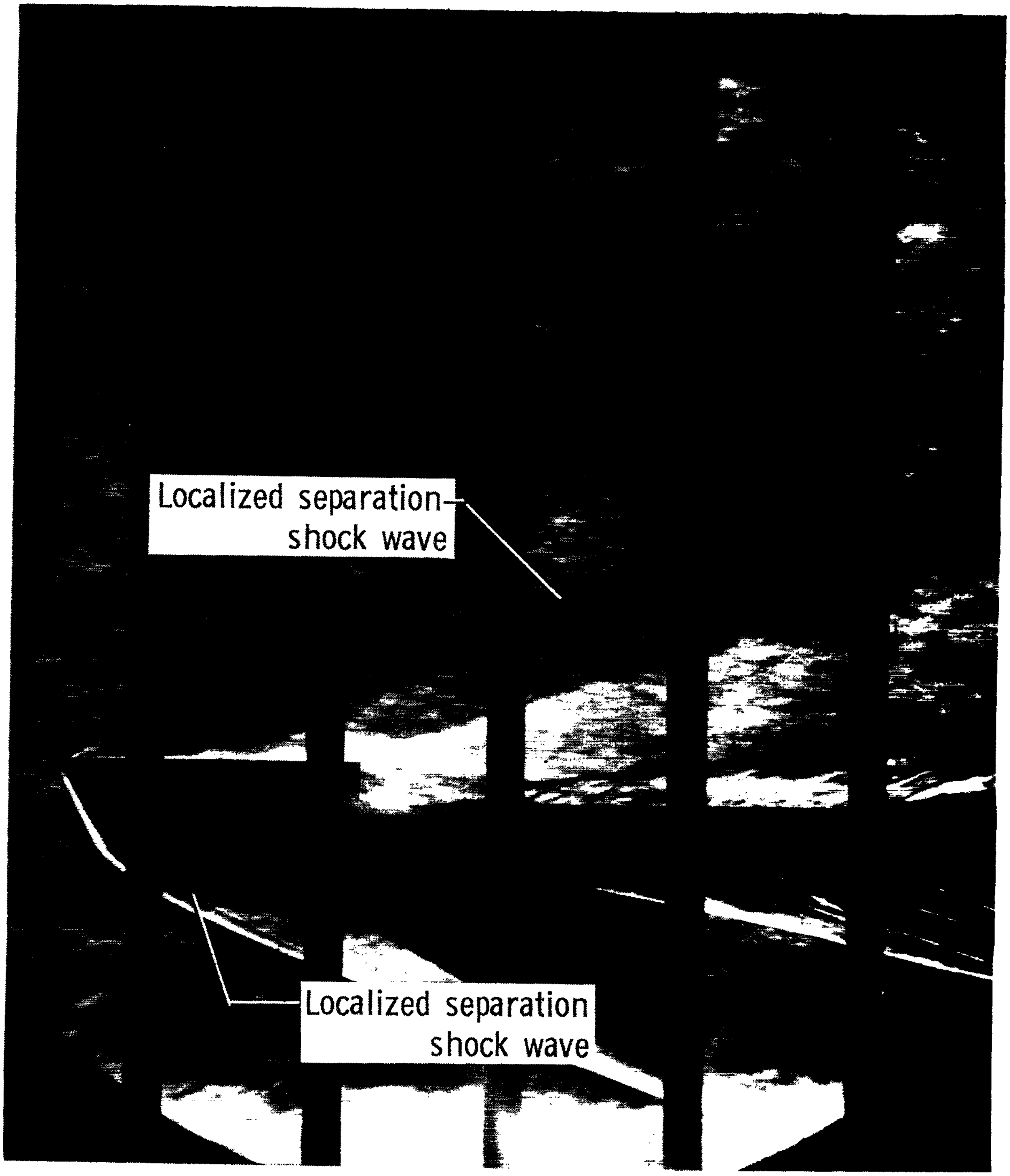
(a) $\alpha = 0^{\circ}$. L-68-805

Figure 3.- Oil-flow photographs of the model at $M = 3.71$ and $\beta = 0^{\circ}$.



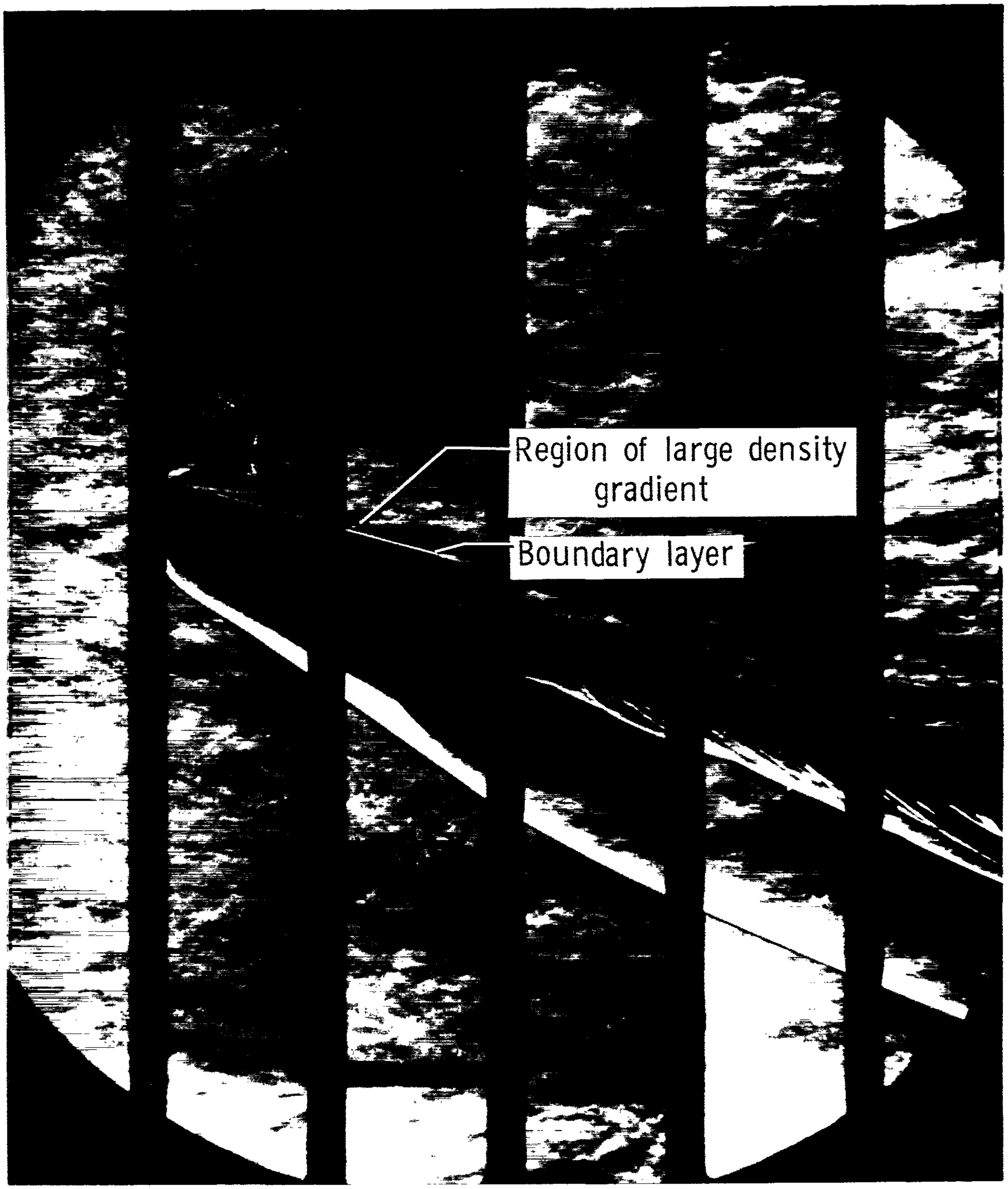
(b) $\alpha = 40^{\circ}$. L-68-806

Figure 3.- Concluded.



(a) $\alpha = 0^{\circ}$. L-68-807

Figure 4.- Schlieren photographs of the model at $M = 3.71$ and $\beta = 0^{\circ}$.



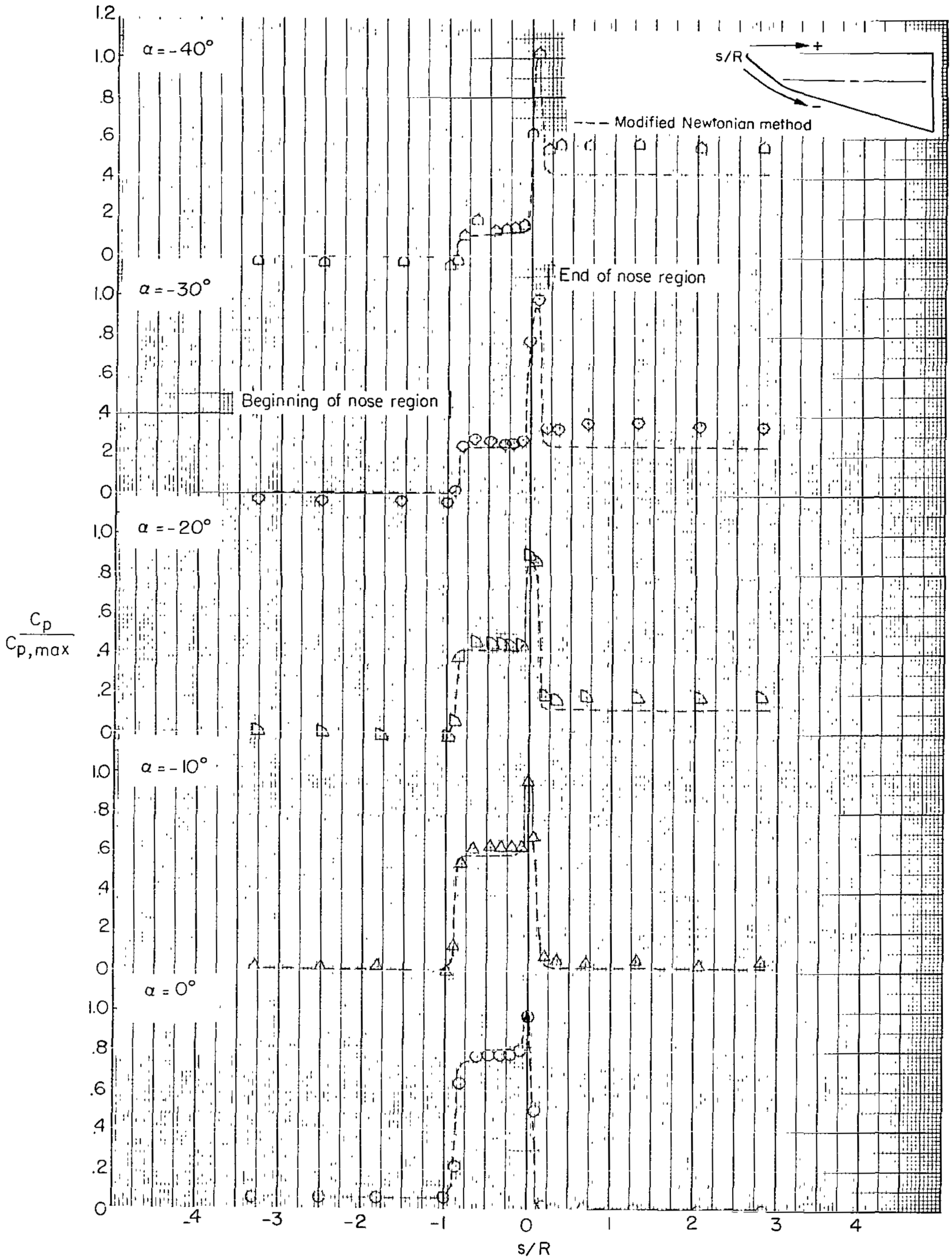
(b) $\alpha = 15^{\circ}$. L-68-808

Figure 4.- Continued.

(c) $\alpha = 40^{\circ}$.

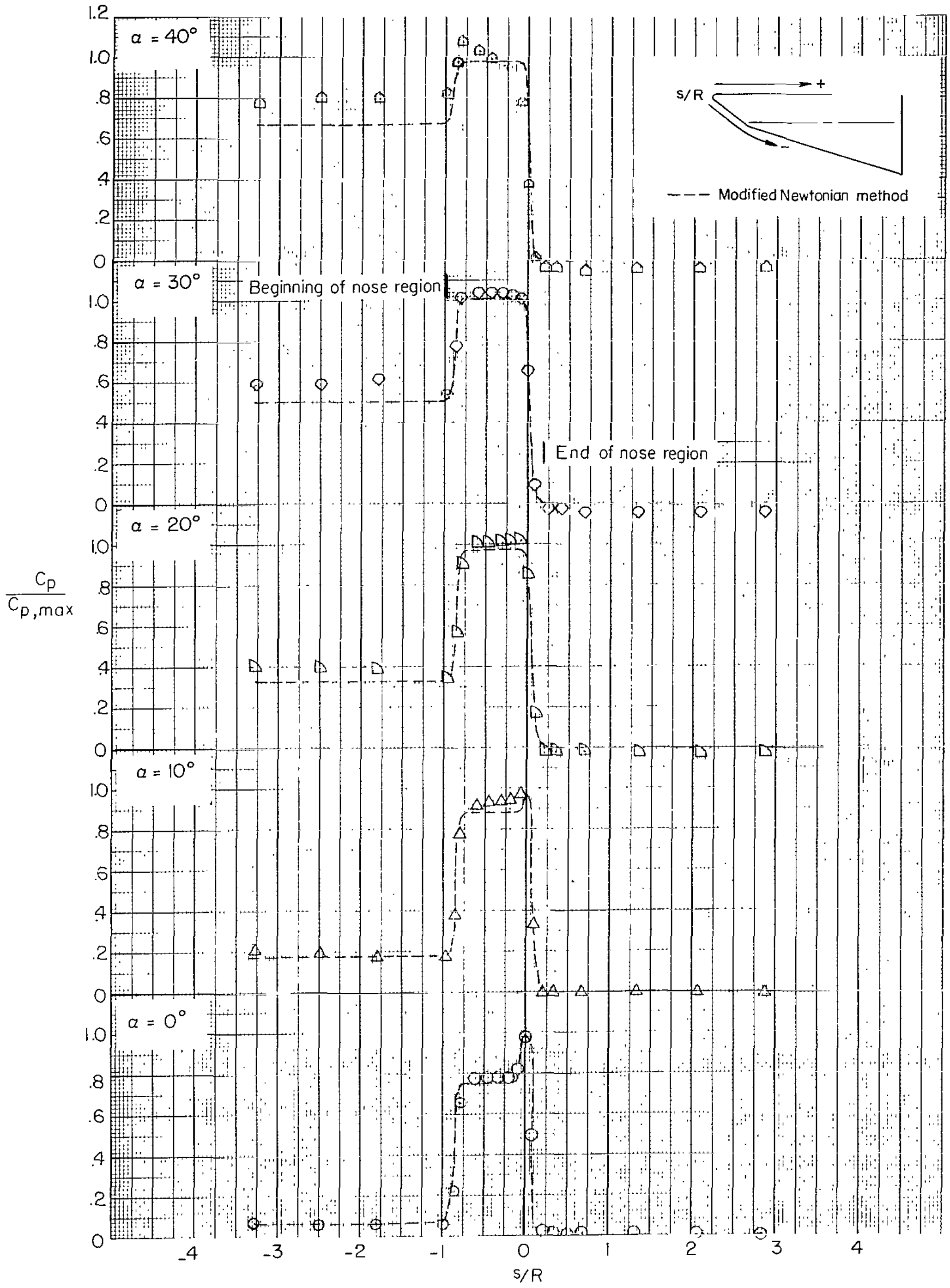
L-68-809

Figure 4.- Concluded.



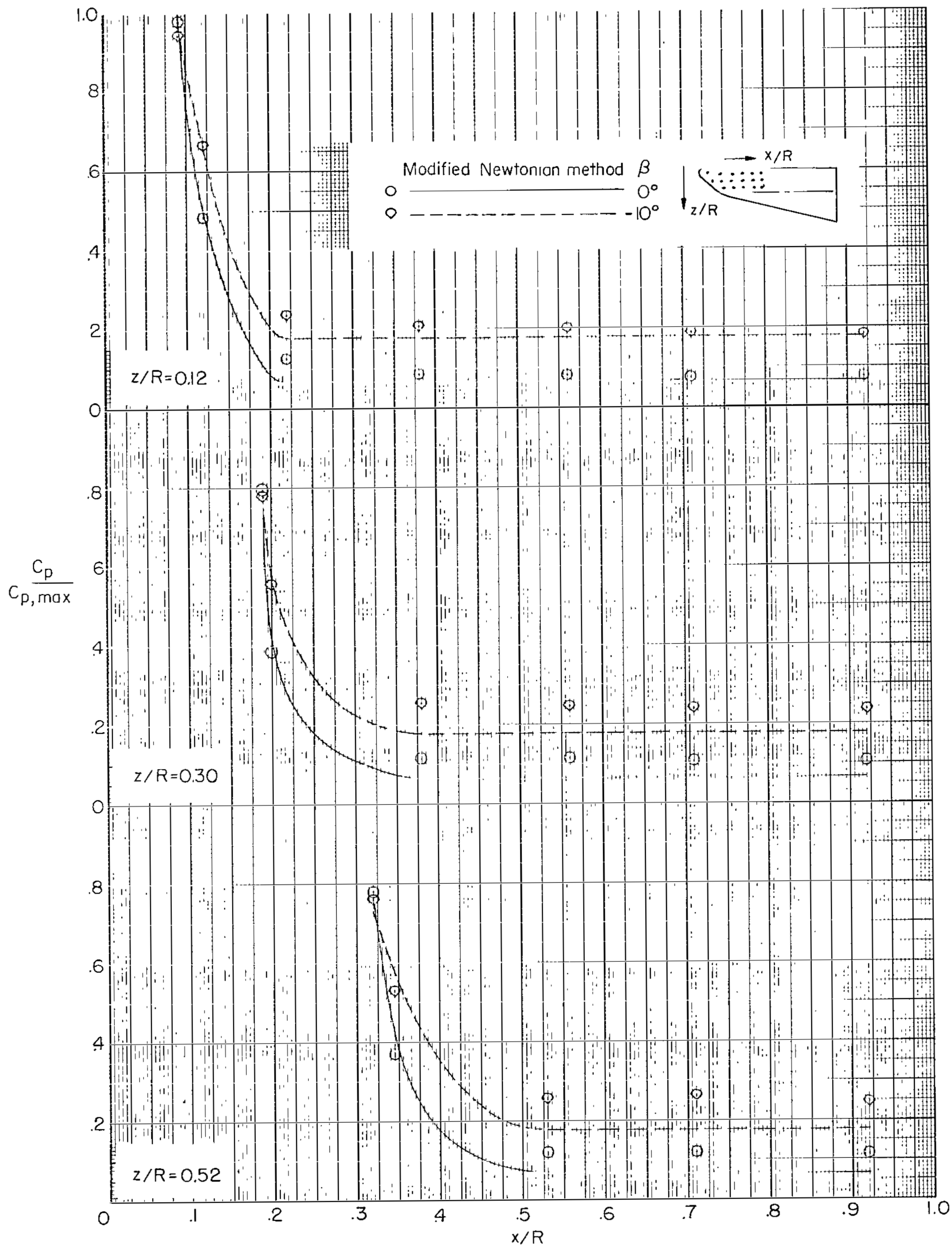
(a) Negative angles of attack.

Figure 5.- Variation of pressure-coefficient ratio along the midline of the upper and lower body surfaces in the vertical plane of symmetry for various angles of attack. $\beta = 0^{0}$.



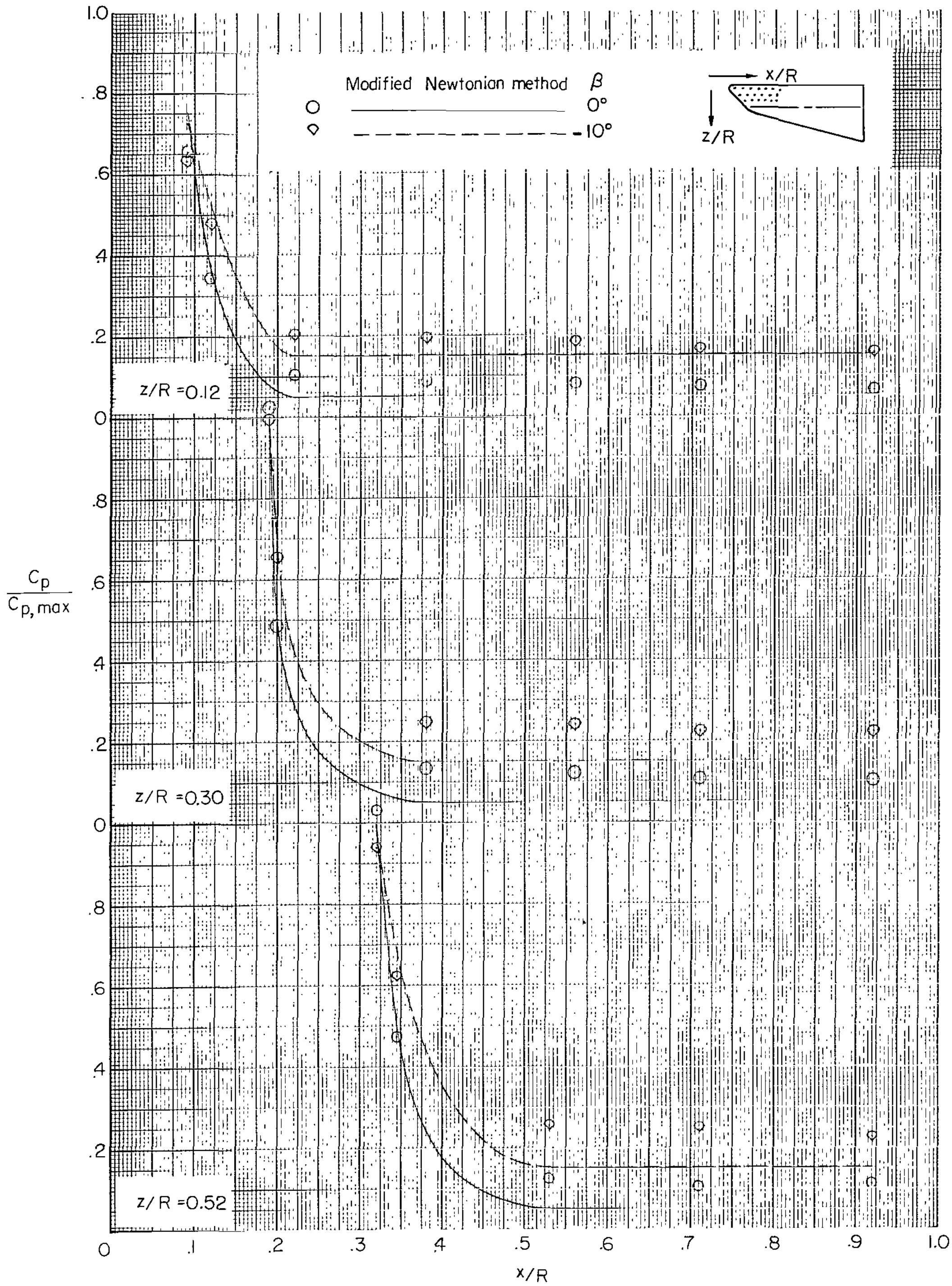
(b) Positive angle of attack.

Figure 5.- Concluded.



(a) $\alpha = 0^{0}$.

Figure 6.- Variation of the pressure-coefficient ratio on the model windward side for three z/R stations.



(b) α = 30°.

Figure 6.- Concluded.

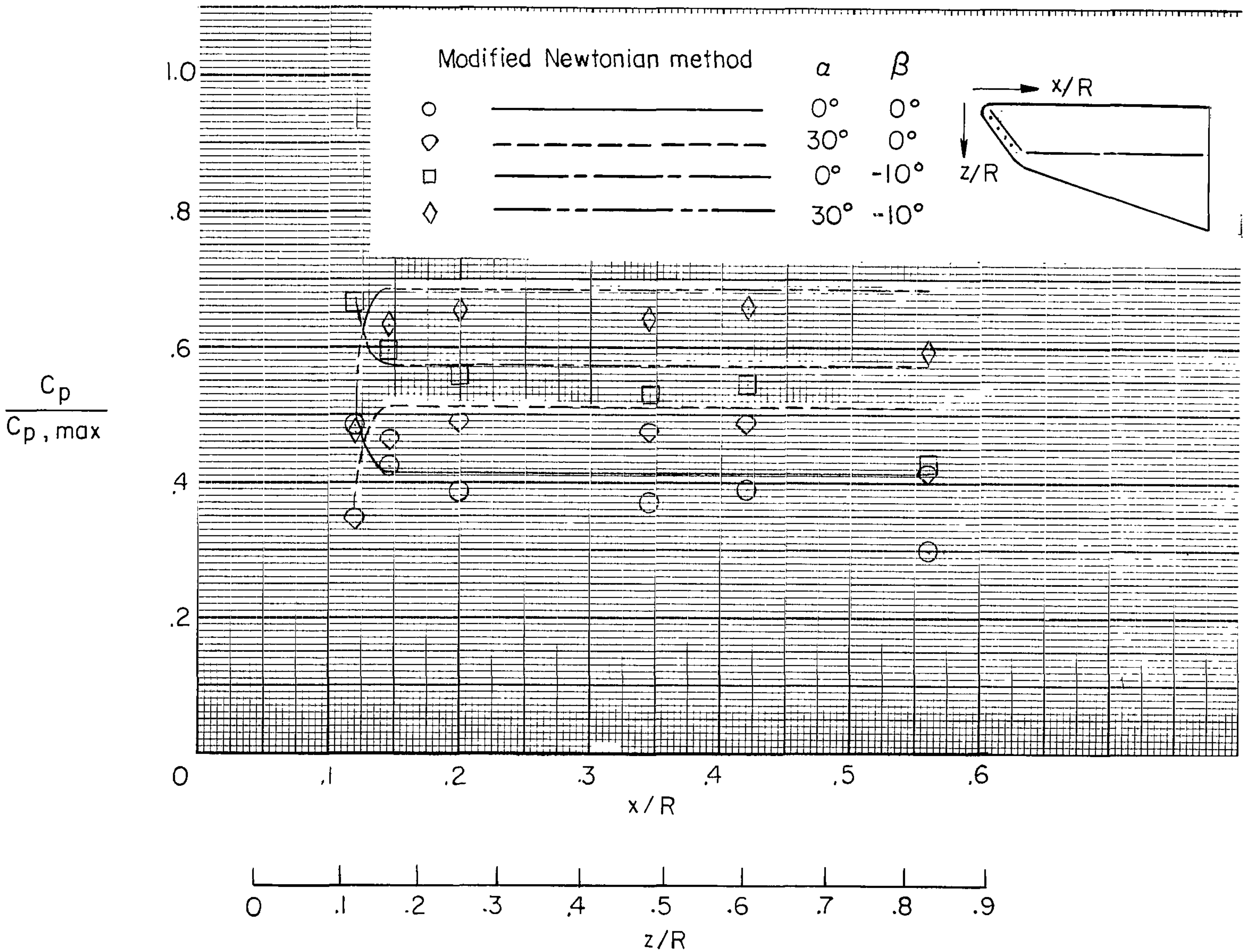


Figure 7.- Variation of pressure-coefficient ratio in the nose region.

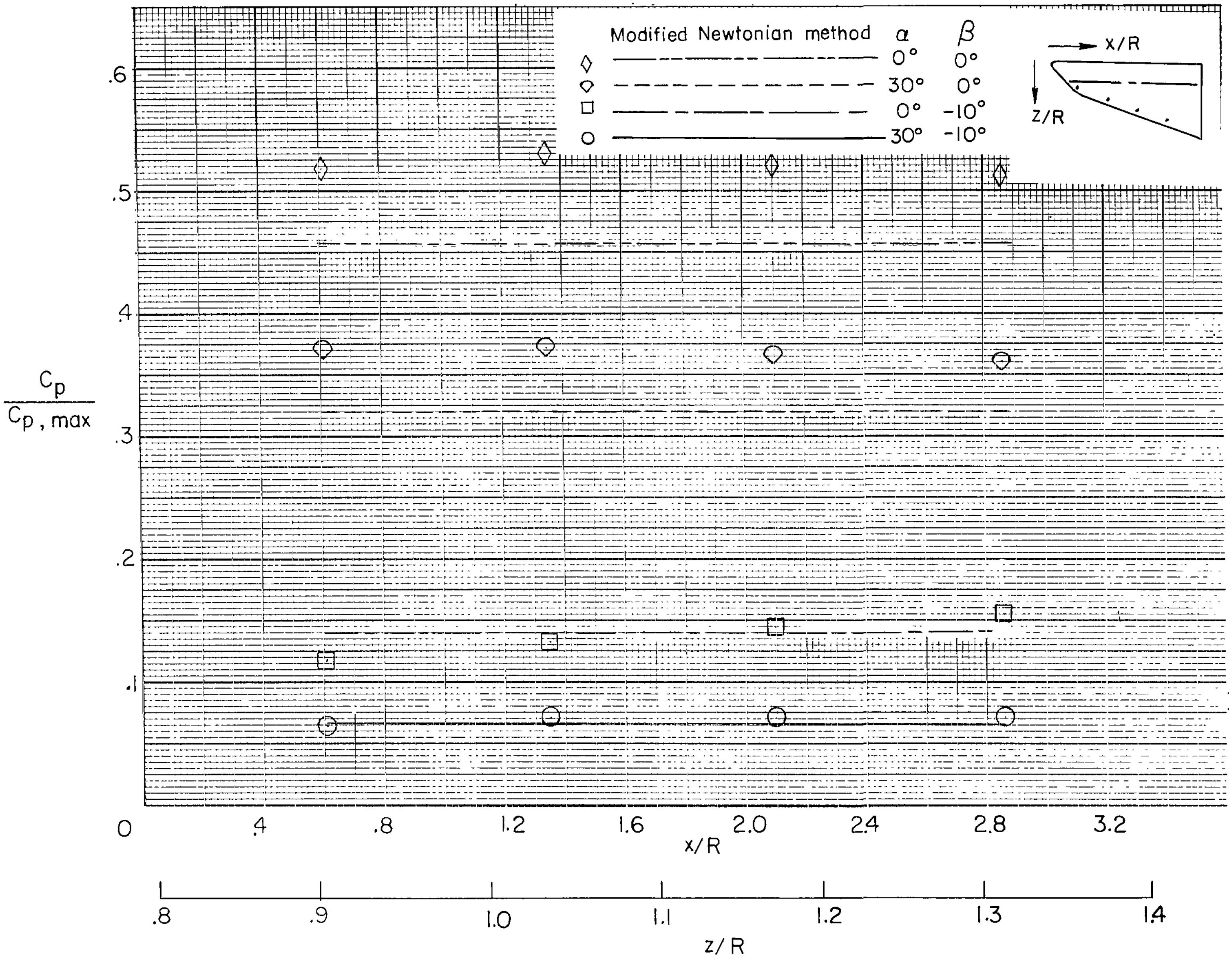


Figure 8.- Variation of pressure-coefficient ratio on the half-cone region of the body.

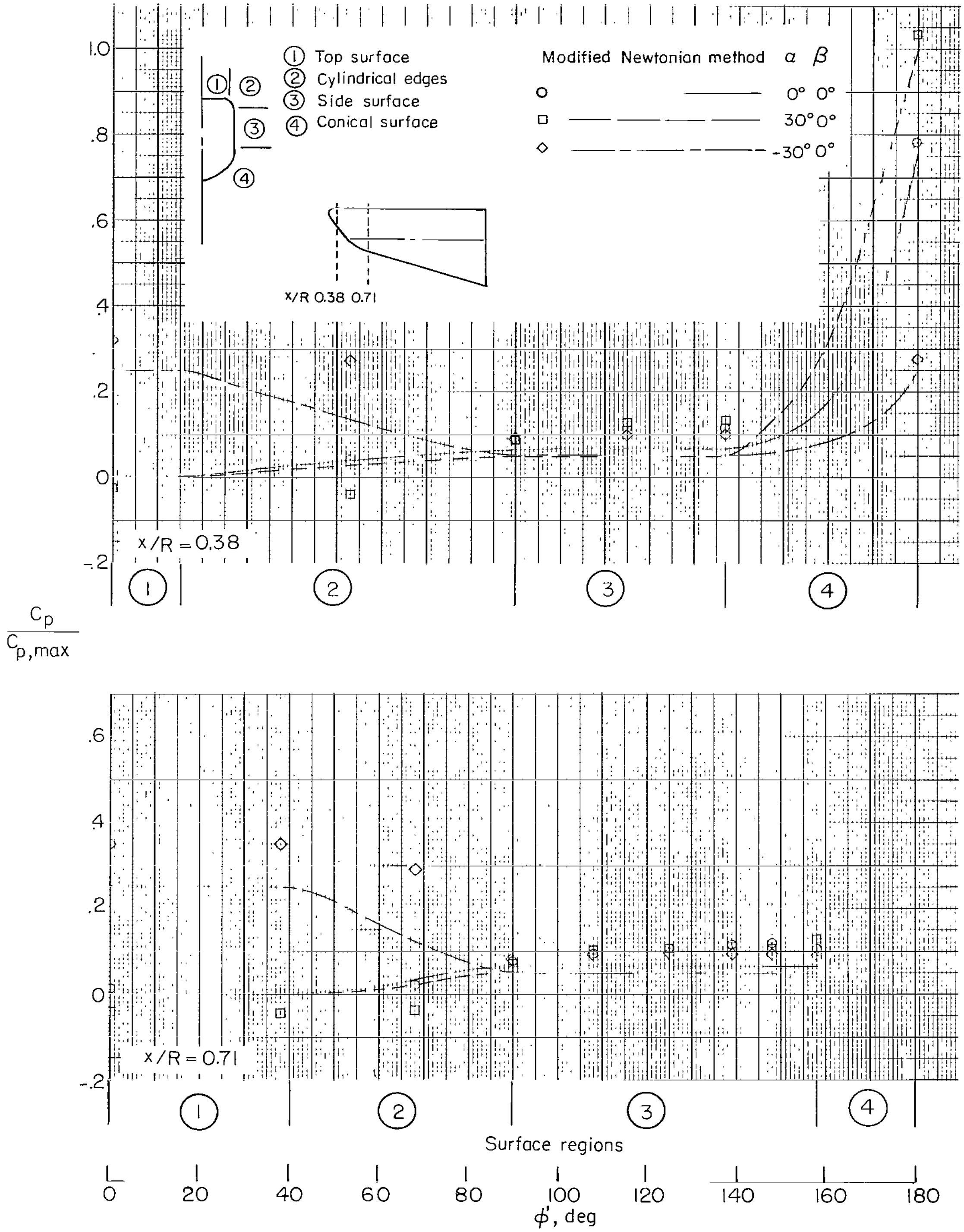


Figure 9.- Variation of pressure-coefficient ratio around the body at selected cross-sectional body stations for $\alpha = 0^{0}$, 30^{0}, and -30^{0}. $\beta = 0^{0}$.

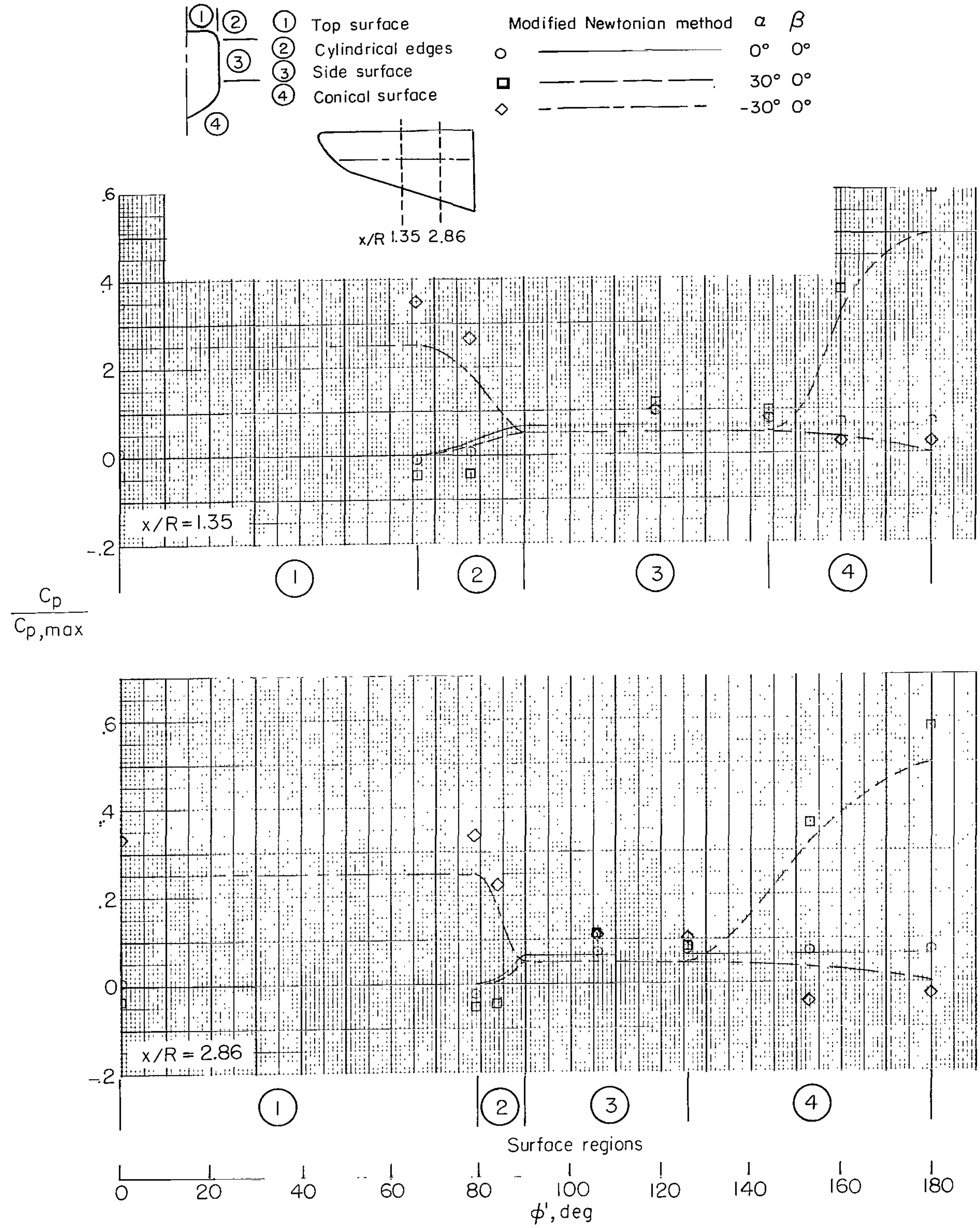


Figure 9.- Concluded.

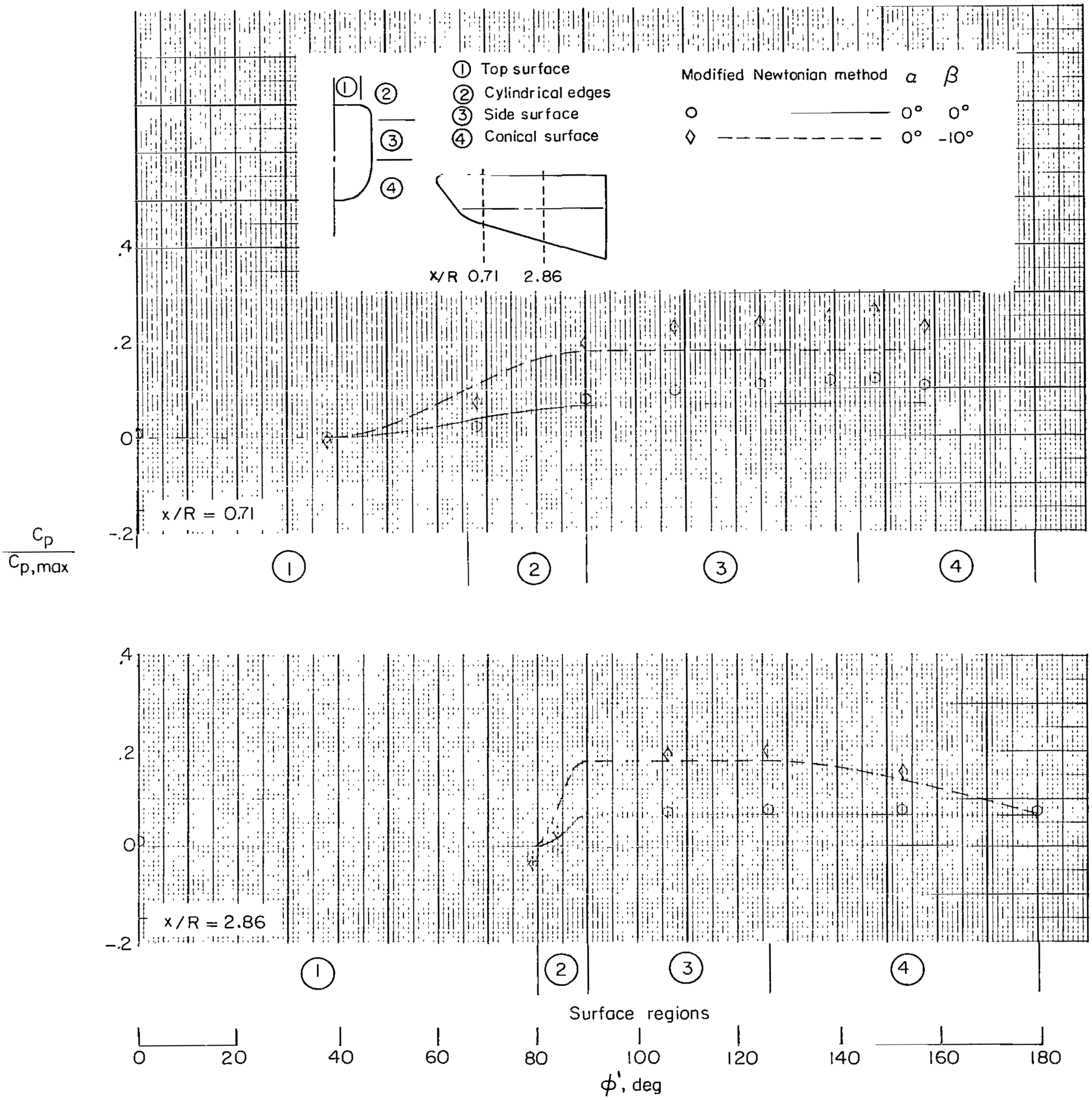


Figure 10.- Variation of pressure-coefficient ratio around the body at $x/R = 0.71$ and 2.86 for $\beta = 0^0$ and -10^0. $\alpha = 0^0$.

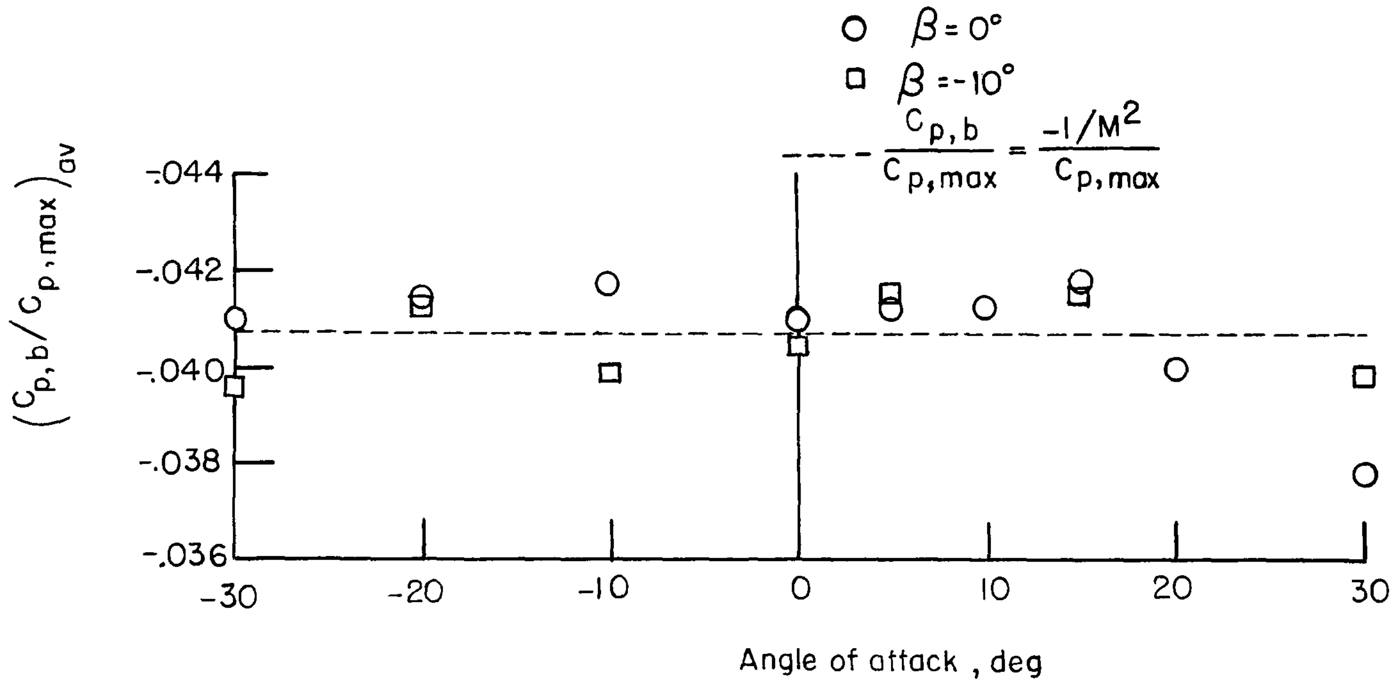


Figure 11.- Variation of the average base-pressure-coefficient ratio with angle of attack for angles of sideslip of 0° and -10°.

NASA-Langley, 1968 — 1 L-5325

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