PART 6: BUILDING APPURTENANCES AND ROOFTOP STRUCTURES AND EQUIPMENT

30.9 PARAPETS

The design wind pressure for component and cladding elements of parapets for all building types and heights, except enclosed buildings with $h \leq 160$ ft (48.8 m) for which the provisions of Part 4 are used, shall be determined from the following equation:

$$p = q_p((GC_p) - (GC_{pi})) \qquad (30.9\text{-}1)$$

where

q_p = velocity pressure evaluated at the top of the parapet

(GC_p) = external pressure coefficient given in
- Fig. 30.4-1 for walls with $h \leq 60$ ft (48.8 m)
- Figs. 30.4-2A to 30.4-2C for flat roofs, gable roofs, and hip roofs
- Fig. 30.4-3 for stepped roofs
- Fig. 30.4-4 for multispan gable roofs
- Figs. 30.4-5A and 30-5B for monoslope roofs
- Fig. 30.4-6 for sawtooth roofs
- Fig. 30.4-7 for domed roofs of all heights
- Fig. 30.6-1 for walls and flat roofs with $h > 60$ ft (18.3 m)
- Fig. 27.4-3 footnote 4 for arched roofs

(GC_{pi}) = internal pressure coefficient from Table 26.11-1, based on the porosity of the parapet envelope

Two load cases, see Fig. 30.9-1, shall be considered:

- Load Case A: Windward Parapet shall consist of applying the applicable positive wall pressure from Fig. 30.4-1 ($h \leq 60$ ft (18.3 m)) or Fig. 30.6-1 ($h >$ 60 ft (18.3 m)) to the windward surface of the parapet while applying the applicable negative edge or corner zone roof pressure from Figs. 30.4-2 (A, B or C), 30.4-3, 30.4-4, 30.4-5 (A or B), 30.4-6, 30.4-7, Fig. 27.4-3 footnote 4, or Fig. 30.6-1 ($h > 60$ ft (18.3 m)) as applicable to the leeward surface of the parapet.
- Load Case B: Leeward Parapet shall consist of applying the applicable positive wall pressure from Fig. 30.4-1 ($h \leq 60$ ft (18.3 m)) or Fig. 30.6-1 ($h >$ 60 ft (18.3 m)) to the windward surface of the parapet, and applying the applicable negative wall pressure from Fig. 30.4-1 ($h \leq 60$ ft (18.3 m)) or Fig. 30.6-1 ($h > 60$ ft (18.3 m)) as applicable to the leeward surface. Edge and corner zones shall be arranged as shown in the applicable figures. (GC_p) shall be determined for appropriate roof angle and effective wind area from the applicable figures.

If internal pressure is present, both load cases should be evaluated under positive and negative internal pressure.

The steps required for the determination of wind loads on component and cladding of parapets are shown in Table 30.9-1.

User Note: Use Part 6 of Chapter 30 for determining wind pressures for C&C on roof overhangs and parapets of buildings. These provisions are based on the Directional Procedure with *wind pressures calculated from the specified equation* applicable to each roof overhang or parapet surface.

Table 30.9-1 Steps to Determine C&C Wind Loads Parapets

Step 1: Determine risk category of building, see Table 1.5-1

Step 2: Determine the basic wind speed, V, for applicable risk category, see Figure 26.5-1A, B or C

Step 3: Determine wind load parameters:
- Wind directionality factor, K_d, see Section 26.6 and Table 26.6-1
- Exposure category B, C or D, see Section 26.7
- Topographic factor, K_{zt}, see Section 26.8 and Fig. 26.8-1
- Enclosure classification, see Section 26.10
- Internal pressure coefficient, (GC_{pi}), see Section 26.11 and Table 26.11-1

Step 4: Determine velocity pressure exposure coefficient, K_h, at top of the parapet see Table 30.3-1

Step 5: Determine velocity pressure, q_p, at the top of the parapet using Eq. 30.3-1

Step 6: Determine external pressure coefficient for wall and roof surfaces adjacent to parapet, (GC_p)
- Walls with $h \leq 60$ ft., see Fig. 30.4-1
- Flat, gable and hip roofs, see Figs. 30.4-2A to 30.4-2C
- Stepped roofs, see Fig. 30.4-3
- Multispan gable roofs, see Fig. 30.4-4
- Monoslope roofs, see Figs. 30.4-5A and 30.4-5B
- Sawtooth roofs, see Fig. 30.4-6
- Domed roofs of all heights, see Fig. 30.4-7
- Walls and flat roofs with h > 60 ft., see Fig. 30.6-1
- Arched roofs, see footnote 4 of Fig. 27.4-3

Step 7: Calculate wind pressure, p, using Eq. 30.9-1 on windward and leeward face of parapet, considering two load cases (Case A and Case B) as shown in Fig. 30.9-1.

Wind Directionality Factor, K_d

Table 26.6-1

Structure Type	Directionality Factor K_d*
Buildings	
Main Wind Force Resisting System	0.85
Components and Cladding	0.85
Arched Roofs	0.85
Chimneys, Tanks, and Similar Structures	
Square	0.90
Hexagonal	0.95
Round	0.95
Solid Freestanding Walls and Solid Freestanding and Attached Signs	0.85
Open Signs and Lattice Framework	0.85
Trussed Towers	
Triangular, square, rectangular	0.85
All other cross sections	0.95

*Directionality Factor K_d has been calibrated with combinations of loads specified in Chapter 2. This factor shall only be applied when used in conjunction with load combinations specified in Sections 2.3 and 2.4.

Surface Roughness B: Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C: Open terrain with scattered obstructions having heights generally less than 30 ft (9.1 m). This category includes flat open country and grasslands.

Surface Roughness D: Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats, and unbroken ice.

26.7.3 Exposure Categories

Exposure B: For buildings with a mean roof height of less than or equal to 30 ft (9.1 m), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance greater than 1,500 ft (457 m). For buildings with a mean roof height greater than 30 ft (9.1 m), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance greater than 2,600 ft (792 m) or 20 times the height of the building, whichever is greater.

Exposure C: Exposure C shall apply for all cases where Exposures B or D do not apply.

Exposure D: Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance greater than 5,000 ft (1,524 m) or 20 times the building height, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 ft (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

For a site located in the transition zone between exposure categories, the category resulting in the largest wind forces shall be used.

EXCEPTION: An intermediate exposure between the preceding categories is permitted in a transition zone provided that it is determined by a rational analysis method defined in the recognized literature.

26.7.4 Exposure Requirements.

26.7.4.1 Directional Procedure (Chapter 27)

For each wind direction considered, wind loads for the design of the MWFRS of enclosed and partially enclosed buildings using the Directional Procedure of Chapter 27 shall be based on the exposures as defined in Section 26.7.3. Wind loads for the design of open buildings with monoslope, pitched, or troughed free roofs shall be based on the exposures, as defined in Section 26.7.3, resulting in the highest wind loads for any wind direction at the site.

26.7.4.2 Envelope Procedure (Chapter 28)

Wind loads for the design of the MWFRS for all low-rise buildings designed using the Envelope Procedure of Chapter 28 shall be based on the exposure category resulting in the highest wind loads for any wind direction at the site.

26.7.4.3 Directional Procedure for Building Appurtenances and Other Structures (Chapter 29)

Wind loads for the design of building appurtenances (such as rooftop structures and equipment) and other structures (such as solid freestanding walls and freestanding signs, chimneys, tanks, open signs, lattice frameworks, and trussed towers) as specified in Chapter 29 shall be based on the appropriate exposure for each wind direction considered.

26.7.4.4 Components and Cladding (Chapter 30)

Design wind pressures for components and cladding shall be based on the exposure category resulting in the highest wind loads for any wind direction at the site.

26.8 TOPOGRAPHIC EFFECTS

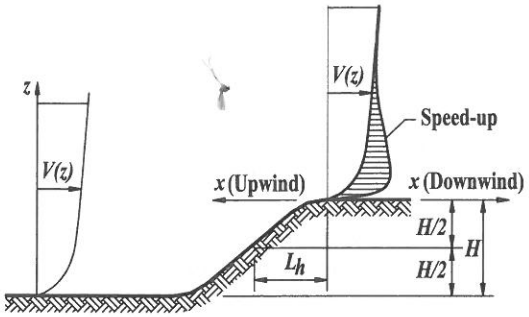
26.8.1 Wind Speed-Up over Hills, Ridges, and Escarpments

Wind speed-up effects at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, shall be included in the determination of the wind loads when buildings and other site conditions and locations of structures meet all of the following conditions:

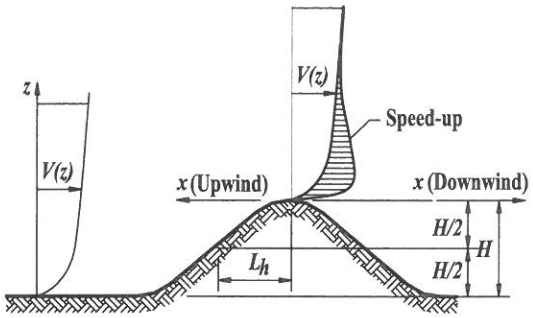
1. The hill, ridge, or escarpment is isolated and unobstructed upwind by other similar topographic features of comparable height for 100 times the height of the topographic feature ($100H$) or 2 mi (3.22 km), whichever is less. This distance shall be measured horizontally from the point at which the height H of the hill, ridge, or escarpment is determined.
2. The hill, ridge, or escarpment protrudes above the height of upwind terrain features within a 2-mi (3.22-km) radius in any quadrant by a factor of two or more.
3. The structure is located as shown in Fig. 26.8-1 in the upper one-half of a hill or ridge or near the crest of an escarpment.

Topographic Factor, K_{zt}

Figure 26.8-1



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

Topographic Multipliers for Exposure C

H/L_h	K_1 Multiplier			x/L_h	K_2 Multiplier		z/L_h	K_3 Multiplier		
	2-D Ridge	2-D Escarp.	3-D Axisym. Hill		2-D Escarp.	All Other Cases		2-D Ridge	2-D Escarp.	3-D Axisym. Hill
0.20	0.29	0.17	0.21	0.00	1.00	1.00	0.00	1.00	1.00	1.00
0.25	0.36	0.21	0.26	0.50	0.88	0.67	0.10	0.74	0.78	0.67
0.30	0.43	0.26	0.32	1.00	0.75	0.33	0.20	0.55	0.61	0.45
0.35	0.51	0.30	0.37	1.50	0.63	0.00	0.30	0.41	0.47	0.30
0.40	0.58	0.34	0.42	2.00	0.50	0.00	0.40	0.30	0.37	0.20
0.45	0.65	0.38	0.47	2.50	0.38	0.00	0.50	0.22	0.29	0.14
0.50	0.72	0.43	0.53	3.00	0.25	0.00	0.60	0.17	0.22	0.09
				3.50	0.13	0.00	0.70	0.12	0.17	0.06
				4.00	0.00	0.00	0.80	0.09	0.14	0.04
							0.90	0.07	0.11	0.03
							1.00	0.05	0.08	0.02
							1.50	0.01	0.02	0.00
							2.00	0.00	0.00	0.00

Notes:

1. For values of H/L_h, x/L_h and z/L_h other than those shown, linear interpolation is permitted.
2. For $H/L_h > 0.5$, assume $H/L_h = 0.5$ for evaluating K_1 and substitute $2H$ for L_h for evaluating K_2 and K_3.
3. Multipliers are based on the assumption that wind approaches the hill or escarpment along the direction of maximum slope.
4. Notation:
   - H: Height of hill or escarpment relative to the upwind terrain, in feet (meters).
   - L_h: Distance upwind of crest to where the difference in ground elevation is half the height of hill or escarpment, in feet (meters).
   - K_1: Factor to account for shape of topographic feature and maximum speed-up effect.
   - K_2: Factor to account for reduction in speed-up with distance upwind or downwind of crest.
   - K_3: Factor to account for reduction in speed-up with height above local terrain.
   - x: Distance (upwind or downwind) from the crest to the building site, in feet (meters).
   - z: Height above ground surface at building site, in feet (meters).
   - μ: Horizontal attenuation factor.
   - γ: Height attenuation factor.

Topographic Factor, K_{zt}

Figure 26.8-1 (cont'd)

Equations:

$$K_{zt} = (1 + K_1 K_2 K_3)^2$$

K_1 determined from table below

$$K_2 = (1 - \frac{|x|}{\mu L_h})$$

$$K_3 = e^{-\gamma z / L_h}$$

Parameters for Speed-Up Over Hills and Escarpments

Hill Shape	$K_1/(H/L_h)$ Exposure			γ	μ	
	B	C	D		Upwind of Crest	Downwind of Crest
2-dimensional ridges (or valleys with negative H in $K_1/(H/L_h)$)	1.30	1.45	1.55	3	1.5	1.5
2-dimensional escarpments	0.75	0.85	0.95	2.5	1.5	4
3-dimensional axisym. hill	0.95	1.05	1.15	4	1.5	1.5

Main Wind Force Resisting System and Components and Cladding		All Heights
Table 26.11-1	Internal Pressure Coefficient, (GC_{pi})	Walls & Roofs
Enclosed, Partially Enclosed, and Open Buildings		

Enclosure Classification	(GC_{pi})
Open Buildings	0.00
Partially Enclosed Buildings	+0.55 -0.55
Enclosed Buildings	+0.18 -0.18

Notes:

1. Plus and minus signs signify pressures acting toward and away from the internal surfaces, respectively.
2. Values of (GC_{pi}) shall be used with q_z or q_h as specified.
3. Two cases shall be considered to determine the critical load requirements for the appropriate condition:

   (i) a positive value of (GC_{pi}) applied to all internal surfaces
   (ii) a negative value of (GC_{pi}) applied to all internal surfaces

Velocity Pressure Exposure Coefficients, K_h and K_z

Table 30.3-1

Height above ground level, z		Exposure		
		B	C	D
ft	(m)			
0-15	(0-4.6)	0.70	0.85	1.03
20	(6.1)	0.70	0.90	1.08
25	(7.6)	0.70	0.94	1.12
30	(9.1)	0.70	0.98	1.16
40	(12.2)	0.76	1.04	1.22
50	(15.2)	0.81	1.09	1.27
60	(18)	0.85	1.13	1.31
70	(21.3)	0.89	1.17	1.34
80	(24.4)	0.93	1.21	1.38
90	(27.4)	0.96	1.24	1.40
100	(30.5)	0.99	1.26	1.43
120	(36.6)	1.04	1.31	1.48
140	(42.7)	1.09	1.36	1.52
160	(48.8)	1.13	1.39	1.55
180	(54.9)	1.17	1.43	1.58
200	(61.0)	1.20	1.46	1.61
250	(76.2)	1.28	1.53	1.68
300	(91.4)	1.35	1.59	1.73
350	(106.7)	1.41	1.64	1.78
400	(121.9)	1.47	1.69	1.82
450	(137.2)	1.52	1.73	1.86
500	(152.4)	1.56	1.77	1.89

Notes:

1. The velocity pressure exposure coefficient K_z may be determined from the following formula:

   For $15 \text{ ft.} \le z \le z_g$ $\quad K_z = 2.01\,(z/z_g)^{2/\alpha}$

   For $z < 15$ ft. $\quad K_z = 2.01\,(15/z_g)^{2/\alpha}$

   Note: z shall not be taken less than 30 feet in exposure B.

2. α and z_g are tabulated in Table 26.9.1.
3. Linear interpolation for intermediate values of height z is acceptable.
4. Exposure categories are defined in Section 26.7.

– Gust Effect Factor (Section 26.9)
– Enclosure classification (Section 26.10)
– Internal pressure coefficient (GC_{pi}) (Section 26.11).

30.2.2 Minimum Design Wind Pressures

The design wind pressure for components and cladding of buildings shall not be less than a net pressure of 16 lb/ft^2 (0.77 kN/m^2) acting in either direction normal to the surface.

30.2.3 Tributary Areas Greater than 700 ft^2 (65 m^2)

Component and cladding elements with tributary areas greater than 700 ft^2 (65 m^2) shall be permitted to be designed using the provisions for MWFRS.

30.2.4 External Pressure Coefficients

Combined gust effect factor and external pressure coefficients for components and cladding, (GC_p), are given in the figures associated with this chapter. The pressure coefficient values and gust effect factor shall not be separated.

30.3 VELOCITY PRESSURE

30.3.1 Velocity Pressure Exposure Coefficient

Based on the exposure category determined in Section 26.7.3, a velocity pressure exposure coefficient K_z or K_h, as applicable, shall be determined from Table 30.3-1. For a site located in a transition zone between exposure categories, that is, near to a change in ground surface roughness, intermediate values of K_z or K_h, between those shown in Table 30.3-1, are permitted, provided that they are determined by a rational analysis method defined in the recognized literature.

30.3.2 Velocity Pressure

Velocity pressure, q_z, evaluated at height z shall be calculated by the following equation:

$$q_z = 0.00256\, K_z K_{zt} K_d V^2 \text{ (lb/ft}^2\text{)} \qquad (30.3\text{-}1)$$

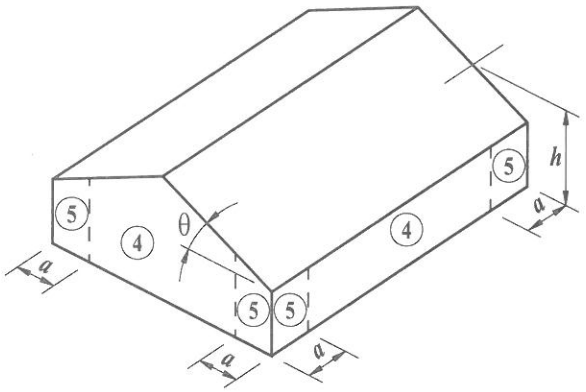
[In SI: $q_z = 0.613\, K_z K_{zt} K_d V^2$ (N/m^2); V in m/s]

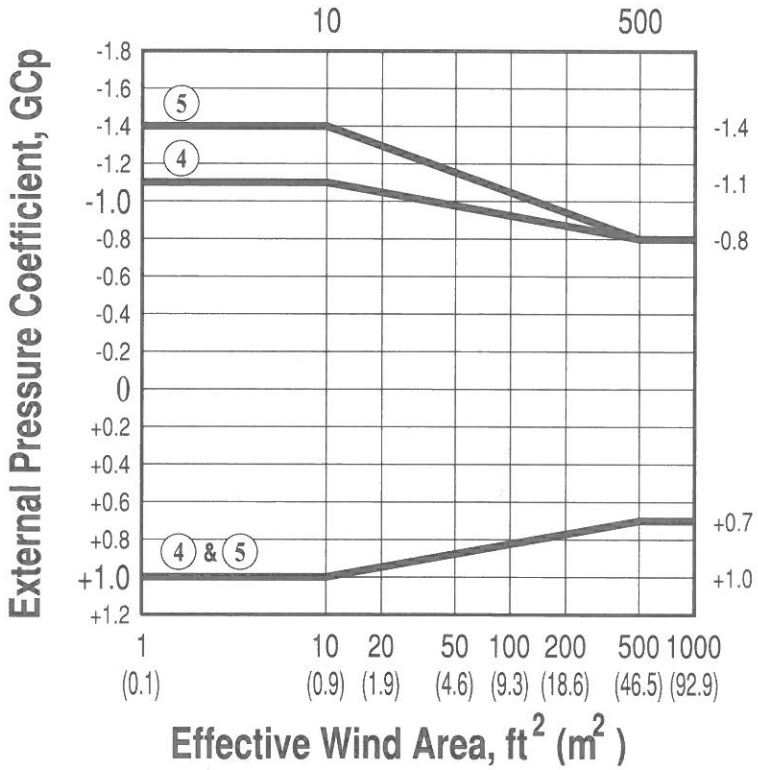
where

K_d = wind directionality factor defined in Section 26.6
K_z = velocity pressure exposure coefficient defined in Section 30.3.1
K_{zt} = topographic factor defined in Section 26.8
V = basic wind speed from Section 26.5
q_h = velocity pressure calculated using Eq. 30.3-1 at height h

The numerical coefficient 0.00256 (0.613 in SI) shall be used except where sufficient climatic data are available to justify the selection of a different value of this factor for a design application.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-1	External Pressure Coefficients, GC_p	Walls
Enclosed, Partially Enclosed Buildings		

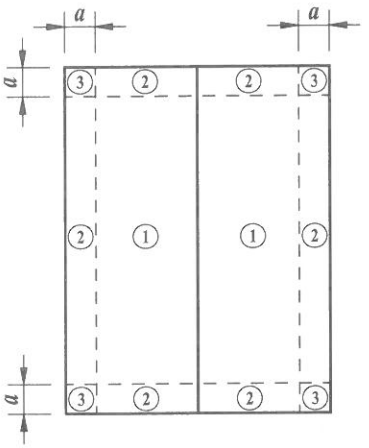


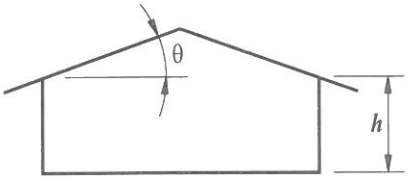


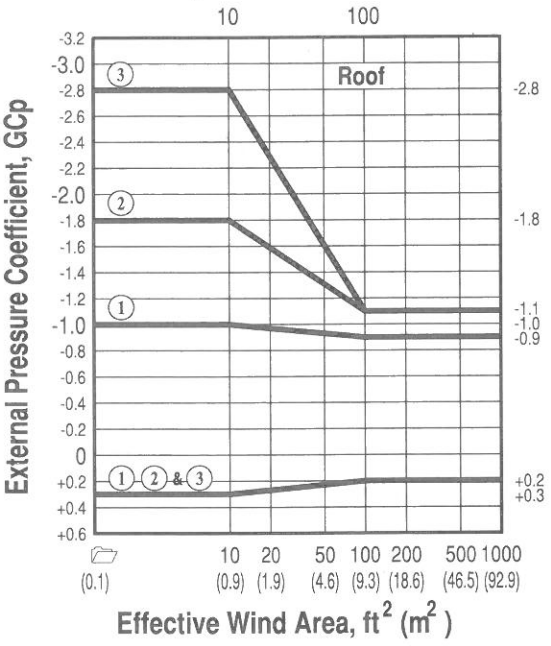
Notes:

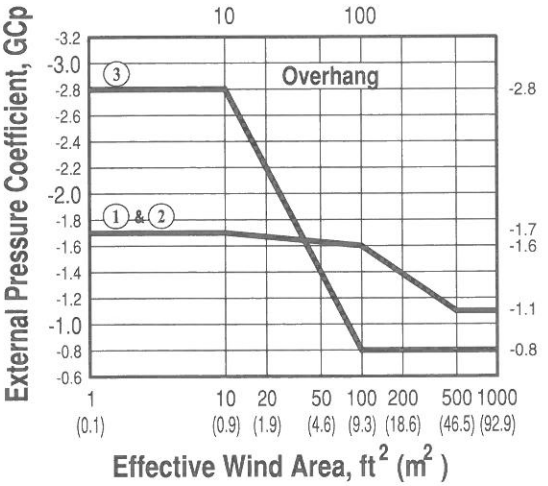
1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of GC_p for walls shall be reduced by 10% when $\theta \leq 10°$.
6. Notation:
   - *a*: 10 percent of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
   - *h*: Mean roof height, in feet (meters), except that eave height shall be used for $\theta \leq 10°$.
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-2A	External Pressure Coefficients, GC_p	Gable Roofs θ ≤ 7°
Enclosed, Partially Enclosed Buildings		





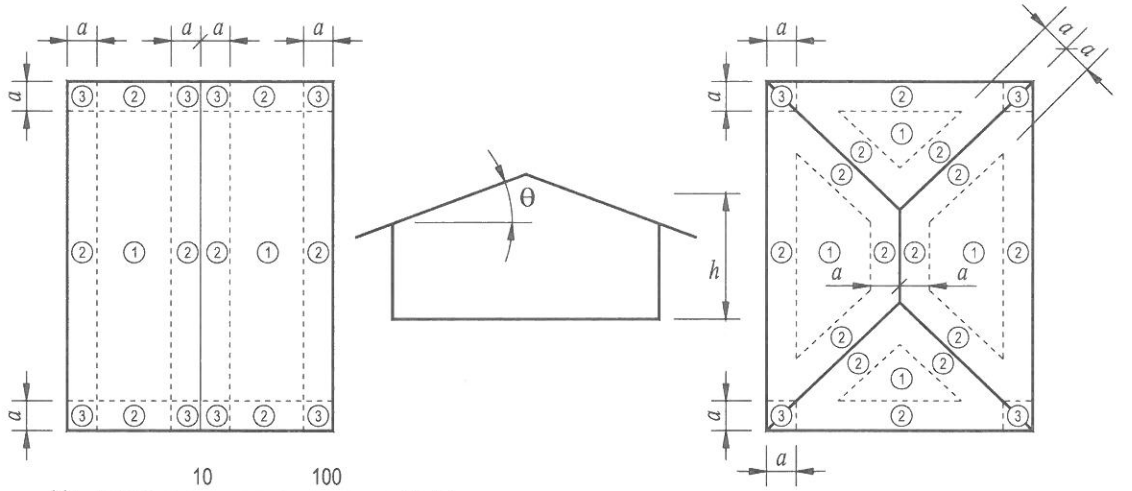


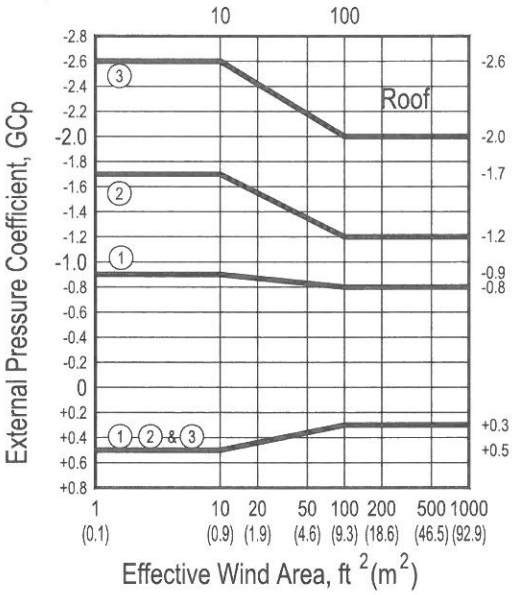


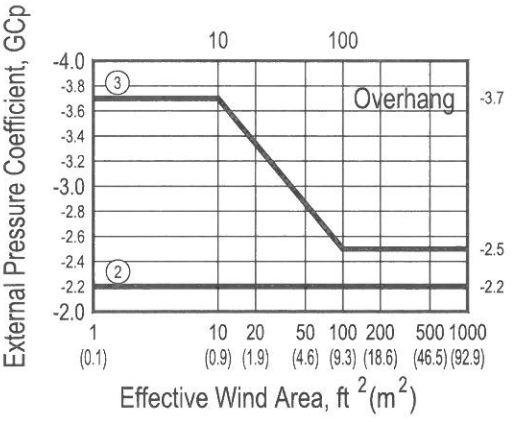
Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. If a parapet equal to or higher than 3 ft (0.9m) is provided around the perimeter of the roof with θ ≤ 7°, the negative values of GC_p in Zone 3 shall be equal to those for Zone 2 and positive values of GC_p in Zones 2 and 3 shall be set equal to those for wall Zones 4 and 5 respectively in Figure 30.4-1.
6. Values of GC_p for roof overhangs include pressure contributions from both upper and lower surfaces.
7. Notation:
   - *a*: 10 percent of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
   - *h*: Eave height shall be used for θ ≤ 10°.
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-2B	External Pressure Coefficients, GC_p	Gable/Hip Roofs 7°< θ ≤ 27°
Enclosed, Partially Enclosed Buildings		



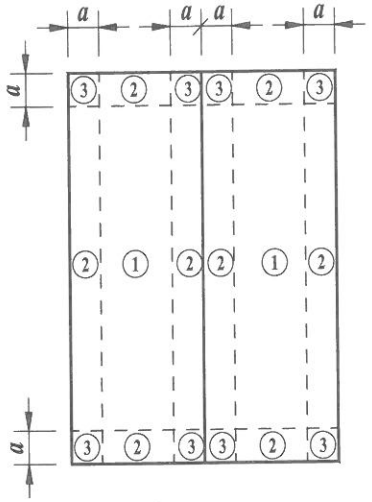


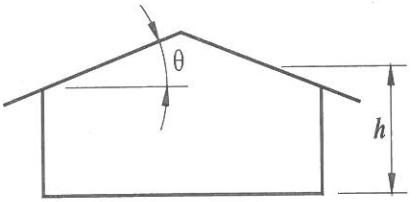


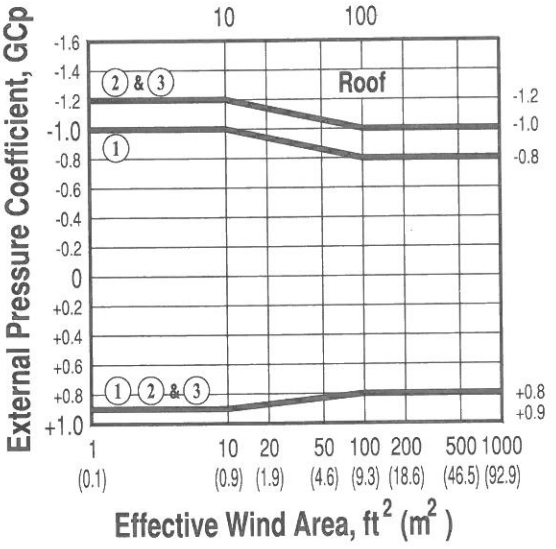
Notes:

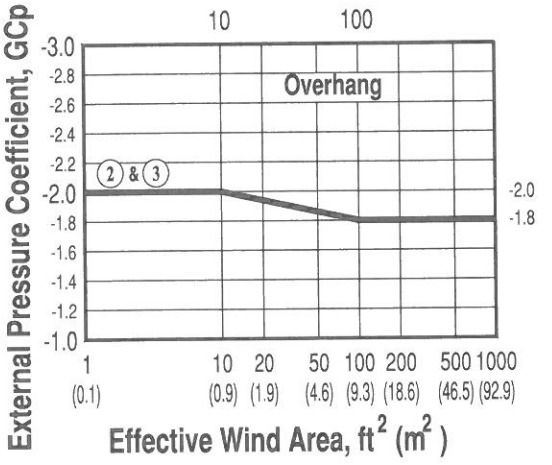
1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of GC_p for roof overhangs include pressure contributions from both upper and lower surfaces.
6. For hip roofs with 7° < θ ≤ 27°, edge/ridge strips and pressure coefficients for ridges of gabled roofs shall apply on each hip.
7. For hip roofs with θ ≤ 25°, Zone 3 shall be treated as Zone 2.
8. Notation:
   - *a*: 10 percent of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
   - *h*: Mean roof height, in feet (meters), except that eave height shall be used for θ ≤ 10°.
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-2C	External Pressure Coefficients GC_p	Gable Roofs 27°< θ ≤ 45°
Enclosed, Partially Enclosed Buildings		





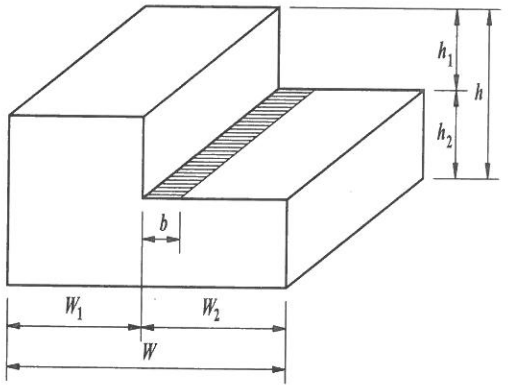




Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of GC_p for roof overhangs include pressure contributions from both upper and lower surfaces.
6. Notation:
   - a: 10 percent of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
   - h: Mean roof height, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-3	External Pressure Coefficients, GC_p	**Stepped Roofs**
Enclosed, Partially Enclosed Buildings		



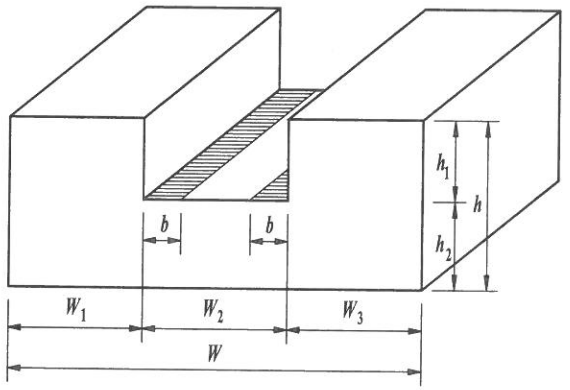
$h_1 \geq 10$ ft. (3 m)

$b = 1.5\,h_1$

$b < 100$ ft. (30.5 m)

$\frac{h_i}{h} = 0.3$ to 0.7

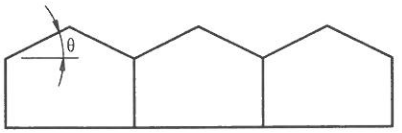
$\frac{W_i}{W} = 0.25$ to 0.75



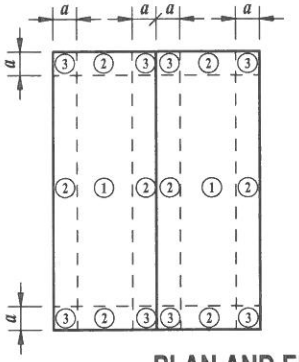
Notes:

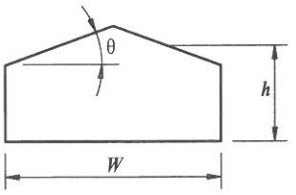
1. On the lower level of flat, stepped roofs shown in Fig. 30.4-3, the zone designations and pressure coefficients shown in Fig. 30.4-2A shall apply, except that at the roof-upper wall intersection(s), Zone 3 shall be treated as Zone 2 and Zone 2 shall be treated as Zone 1. Positive values of GC_p equal to those for walls in Fig. 30.4-1 shall apply on the cross-hatched areas shown in Fig. 30.4-3.
2. Notation:
   - b: $1.5h_1$ in Fig. 30.4-3, but not greater than 100 ft (30.5 m).
   - h: Mean roof height, in feet (meters).
   - h_i: h_1 or h_2 in Fig. 30.4-3; $h = h_1 + h_2$; $h_1 \geq 10$ ft (3.1 m); $h_i/h = 0.3$ to 0.7.
   - W: Building width in Fig. 30.4-3.
   - W_i: W_1 or W_2 or W_3 in Fig. 30.4-3. $W = W_1 + W_2$ or $W_1 + W_2 + W_3$; $W_i/W = 0.25$ to 0.75.
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-4	External Pressure Coefficients, GC_p	Multispan Gable Roofs
Enclosed, Partially Enclosed Buildings		

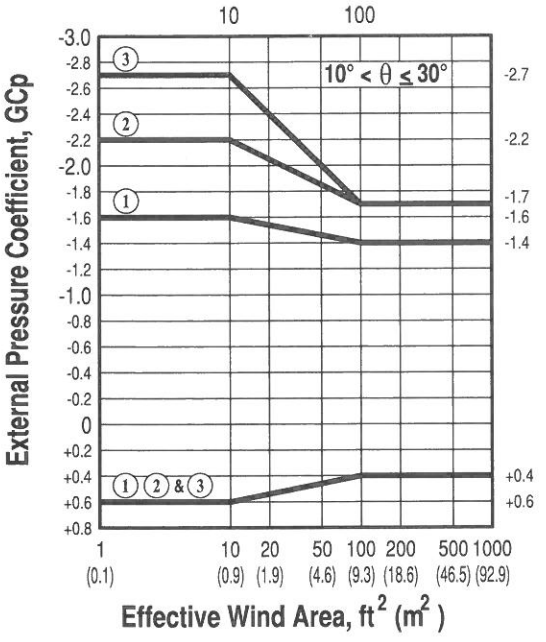


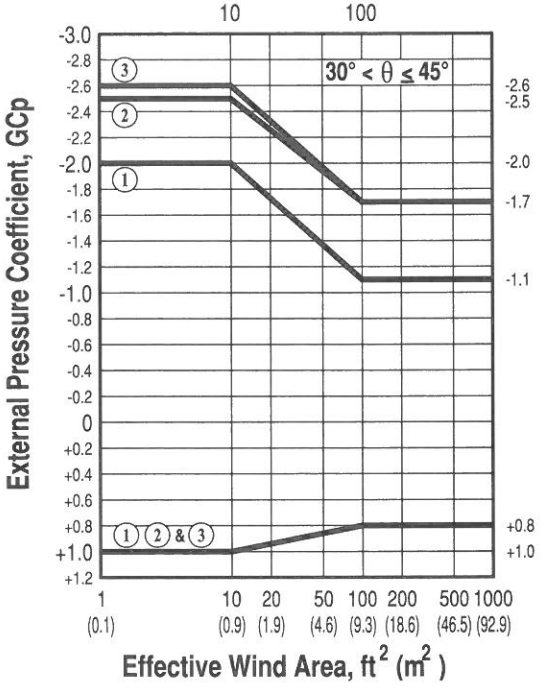
ELEVATION OF BUILDING
(2 or More Spans)





PLAN AND ELEVATION OF
A SINGLE SPAN MODULE

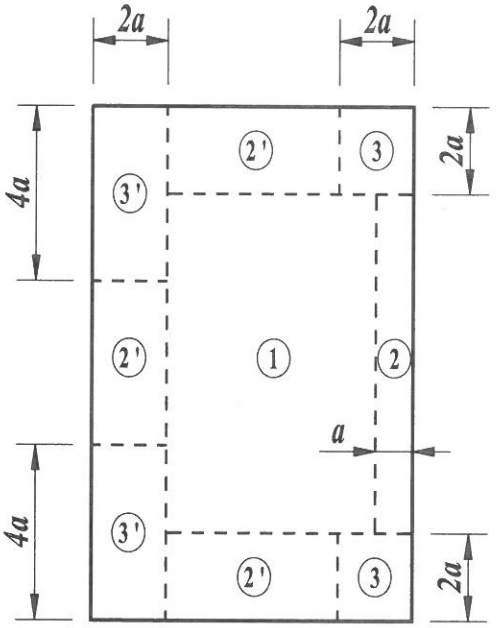


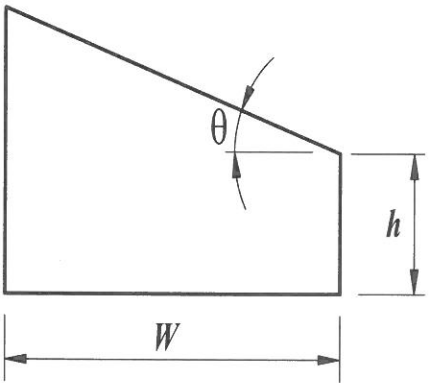


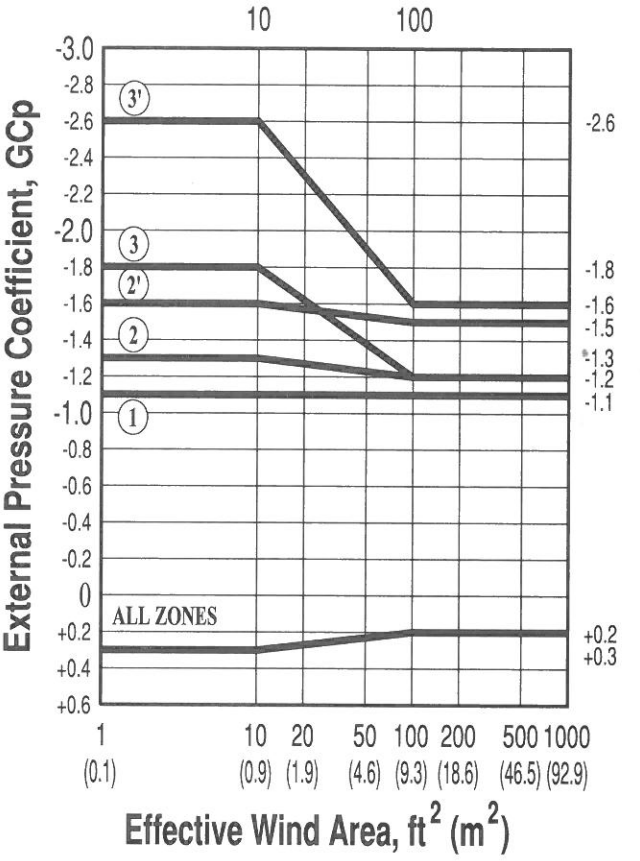
Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area A, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. For $\theta \leq 10°$, values of GC_p from Fig. 30.4-2A shall be used.
6. Notation:
   - a: 10 percent of least horizontal dimension of a single-span module or $0.4h$, whichever is smaller, but not less than either 4 percent of least horizontal dimension of a single-span module or 3 ft (0.9 m).
   - h: Mean roof height, in feet (meters), except that eave height shall be used for $\theta \leq 10°$.
   - W: Building module width, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-5A	External Pressure Coefficients, GC_p	Monoslope Roofs $3° < \theta \leq 10°$
Enclosed, Partially Enclosed Buildings		



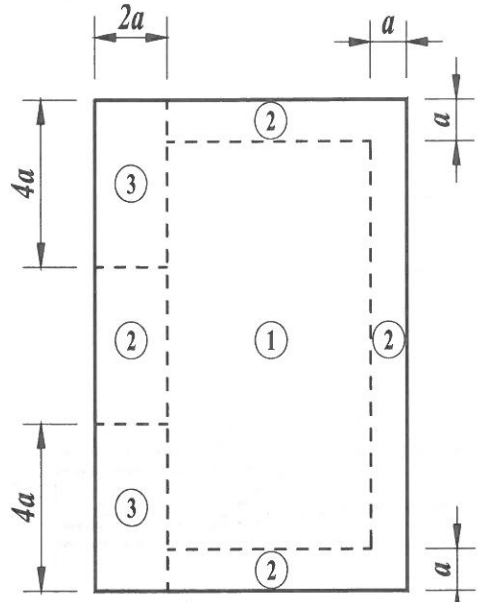


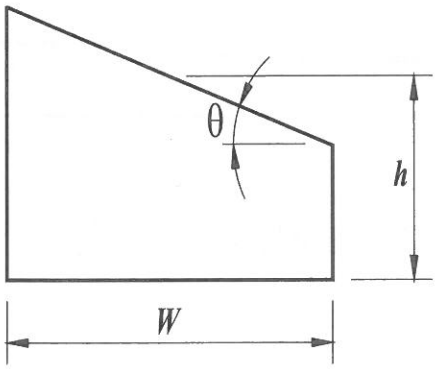


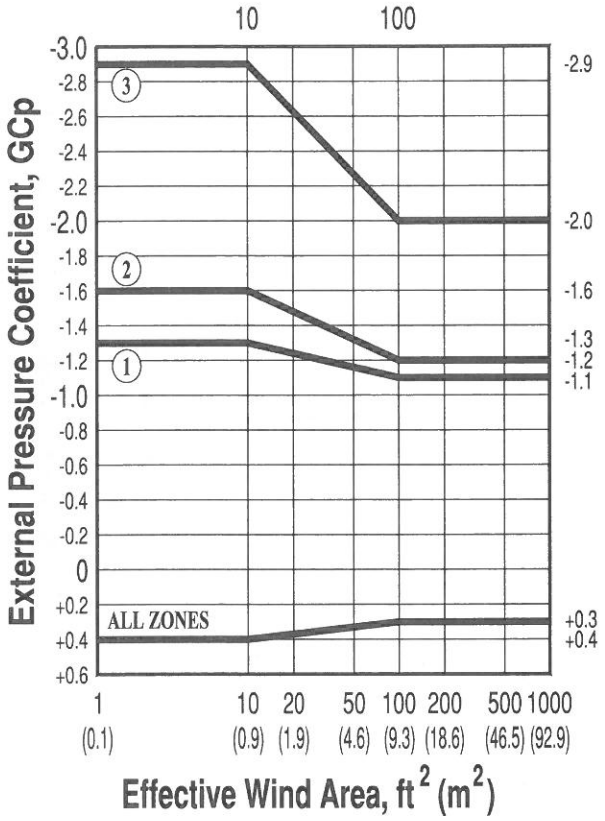
Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area A, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. For $\theta \leq 3°$, values of GC_p from Fig. 30.4-2A shall be used.
6. Notation:
   - a: 10 percent of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 ft (0.9 m).
   - h: Eave height shall be used for $\theta \leq 10°$.
   - W: Building width, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-5B	External Pressure Coefficients, GC_p	Monoslope Roofs $10° < \theta \leq 30°$
Enclosed, Partially Enclosed Buildings		



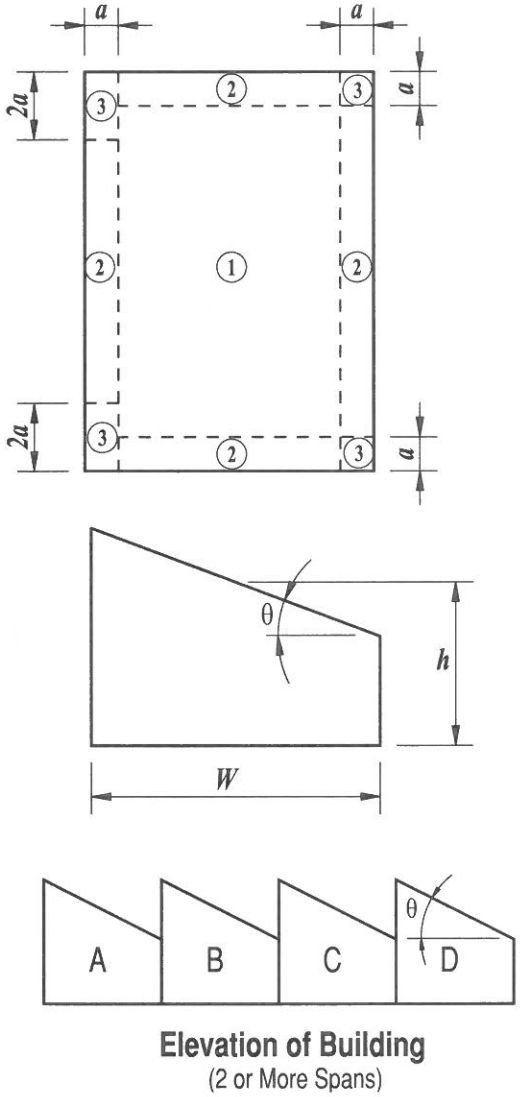




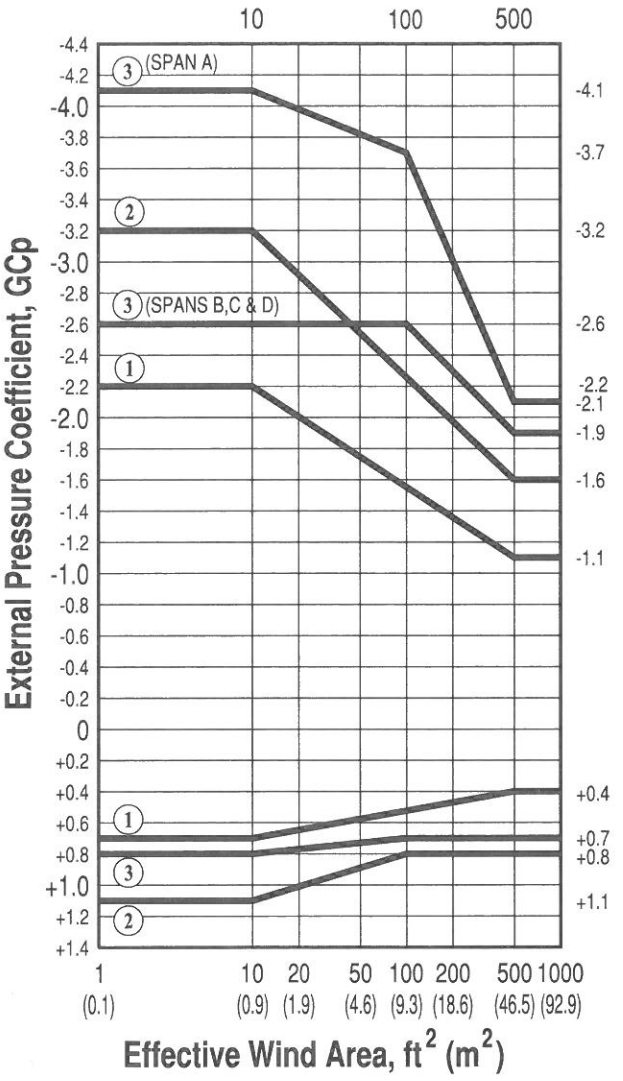
Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area A, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Notation:
   - a: 10 percent of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 ft (0.9 m).
   - h: Mean roof height, in feet (meters).
   - W: Building width, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		h ≤ 60 ft.
Figure 30.4-6	External Pressure Coefficients, GC_p	**Sawtooth Roofs**
Enclosed, Partially Enclosed Buildings		



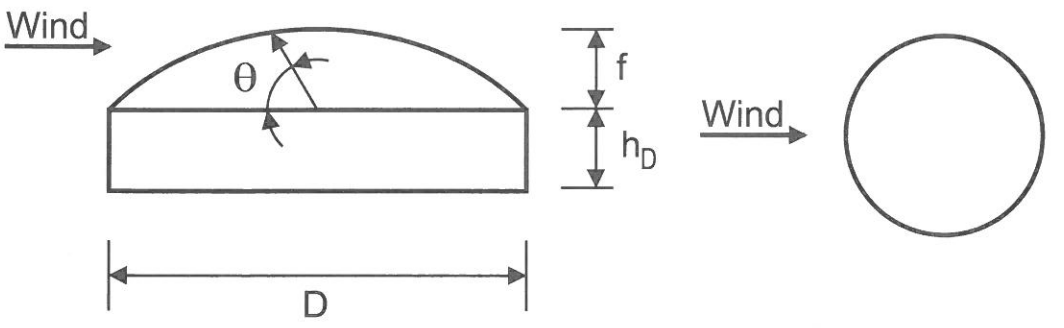
Elevation of Building
(2 or More Spans)



Notes:

1. Vertical scale denotes GC_p to be used with q_h.
2. Horizontal scale denotes effective wind area A, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. For $\theta \leq 10°$, values of GC_p from Fig. 30.4-2A shall be used.
6. Notation:
   - a: 10 percent of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 ft (0.9 m).
   - h: Mean roof height, in feet (meters), except that eave height shall be used for $\theta \leq 10°$.
   - W: Building module width, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.

Components and Cladding		All Heights
Figure 30.4-7	External Pressure Coefficients, GC_p	**Domed Roofs**
Enclosed, Partially Enclosed Buildings and Structures		

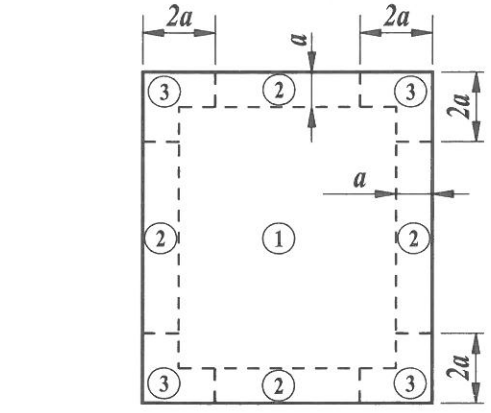


External Pressure Coefficients for Domes with a Circular Base			
	Negative Pressures	Positive Pressures	Positive Pressures
θ, degrees	0 – 90	0 – 60	61 – 90
GC_p	-0.9	+0.9	+0.5

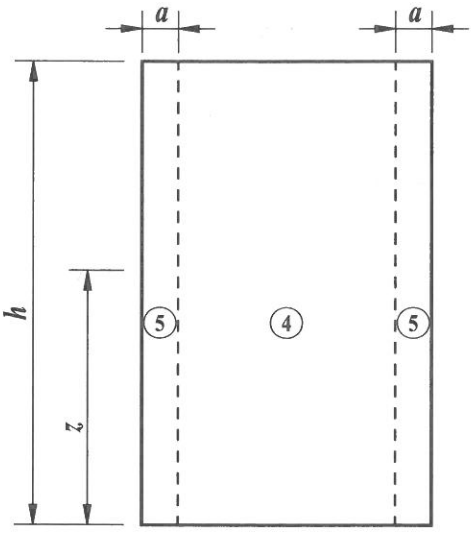
Notes:

1. Values denote GC_p to be used with $q_{(h_D+f)}$ where $h_D + f$ is the height at the top of the dome.
2. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
3. Each component shall be designed for the maximum positive and negative pressures.
4. Values apply to $0 \le h_D/D \le 0.5$, $0.2 \le f/D \le 0.5$.
5. $\theta = 0$ degrees on dome springline, $\theta = 90$ degrees at dome center top point. f is measured from springline to top.

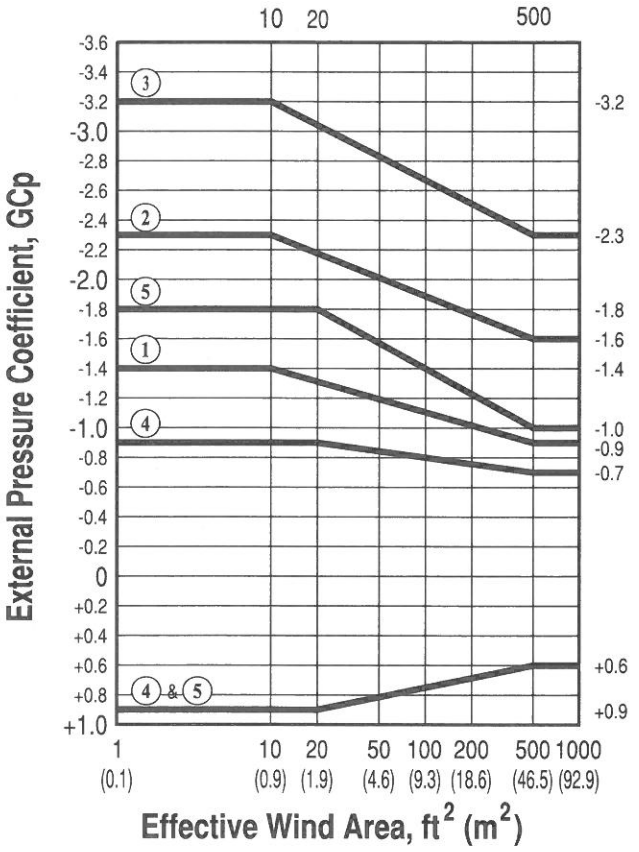
Components and Cladding		h > 60 ft.
Figure 30.6-1	External Pressure Coefficients, GCp	Walls & Roofs
Enclosed, Partially Enclosed Buildings		



ROOF PLAN



WALL ELEVATION



Notes:

1. Vertical scale denotes GC_p to be used with appropriate q_z or q_h.
2. Horizontal scale denotes effective wind area A, in square feet (square meters).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Use q_z with positive values of GC_p and q_h with negative values of GC_p.
5. Each component shall be designed for maximum positive and negative pressures.
6. Coefficients are for roofs with angle $\theta \leq 10°$. For other roof angles and geometry, use GC_p values from Fig. 30.4-2A, B and C and attendant q_h based on exposure defined in Section 26.7.
7. If a parapet equal to or higher than 3 ft (0.9m) is provided around the perimeter of the roof with $\theta \leq 10°$, Zone 3 shall be treated as Zone 2.
8. Notation:
   - a: 10 percent of least horizontal dimension, but not less than 3 ft (0.9 m).
   - h: Mean roof height, in feet (meters), except that eave height shall be used for $\theta \leq 10°$.
   - z: height above ground, in feet (meters).
   - θ: Angle of plane of roof from horizontal, in degrees.