Title:	620 ASCE 7 Wind Update Phase 2	**Agenda Item # 620-1039**
Date:	5/4/2026	
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Purpose:	Improve standard to be more accurate, user-friendly, up-to-date, and cost-effective, revise the wind pressure on roofs so the pressure aligns with ASCE 7-16.	
Source:	Previous agenda items 650-1075 and 650-1095, 650-1122.	
Revision:	0	
Impact:	Most changes neutral; possible cost-increase due to height adjustment factor for wind pressure for tanks taller than 40-ft (cost neutral for tanks 80-ft or taller); possible minor cost-increase addition of wind stability criteria. Improvement in usability and clarity and removal of obsolete rules and references.	

Rationale and Background:

API 650 agenda item 650-1122 (passed to publication) was developed based on prior agenda items API 650-1074 and 650-1095 from Randy Kissell, which were introduced to align API 650 wind pressures with ASCE7-16 and to present wind load requirements more clearly and rationally. This agenda item for API 620 aligns the document with the updates made to API 650 in 650-1122 and also includes additional changes specific to API 620 tanks. These changes include the direct use of ASCE 7-16 wind speeds, removal of the use of obsolete wind speed maps, guidance on converting sustained wind speeds for DOT tanks, and other changes to make the standard more rational and improve clarity.

Thanks to everyone who helped with this massive undertaking:

- Randy Kissell — Major proposals to improve wind provisions
- Jim Schroeder — Detecting problem with published API 650-1074
- Bhana Mistry — Most work on wind provisions over time
- Doug Miller — Making the publications happen
- SCAST and leadership — Quality and technical acumen of API Standards
- SCAST Staff — Keeping agenda items and publications flowing
- Greg Soules — ASCE 7 Chair
- Members of the Wind Taskgroup

Summary of proposed changes to API 620 in each item:

- Item 1, 5.4.1.k:
  - Restructure 5.4.1.k wind loads to be same as API 650 5.2.1.k to improve clarity.
  - Change reference wind speed to 155 mph from 120 mph to allow for direct use of ASCE 7-16 wind speeds and avoid use of 0.6 or 0.78 factor.
  - Remove usage of fastest mile and ASCE 7-05 and 7-10 wind speeds.
  - Instead of referring users to use ASCE 7 wind pressure for 80-ft or greater height tanks, use adjustment factor $\left(\frac{H}{40}\right)^{0.21}$ to account for velocity pressure coefficient K_z.
  - Align API 620 wind with API 650 wind (650-1122).

- Item 2, 5.4.1.k: add note on shell-to-shell spacing to make API 620 users aware (aligns with similar item in 650-1122). Closely spaced tanks not addressed by API 620 and can result in large increases in shell and wind pressure. New note will allow alignment with ASCE7-16, allowing Owner to make decision as to whether to use the higher wind pressures based on judgement and risk.
- Item 3, 5.4.1.k: add note providing guidance to users on meeting DOT PHMSA 150 mph **sustained** wind speed criterion using a 3-sec gust wind speed.
- Item 4:
  - 5.10.6.1: Update intermediate wind girder equation to account for wind pressures different from default value, like API 650. Updated note giving basis for 31 psf wind pressure, like API 650. Incorporate similar informational notes like changes to 650 (650-1122).
  - 5.10.6.3: Explicitly state for users that shell thickness can be increased to remove need for intermediate wind girder (aligns with similar item in 650-1122)
  - 5.10.6.6: Update intermediate wind girder section modulus equation to account for wind pressures at different velocities. Allow use of portion of sidewall at distance $1.47\ (D\ t)^{0.5}$ (aligns with API 650).
- Item 5, new 5.10.7: Add buckling check for column-supported spheres
- Item 6, 5.11.3: Add overturning stability/uplift criteria for self-anchored API 620 tanks, aligning with API 650 5.11 and updates from 650-1122.
- Item 7, 5.11.4: Clarify wind sliding friction and show factor of safety is used.
- Item 8, Table 5-7: Change default value of 0.7 for Fp and Fpe to 1.0. Tank designer shall use Fp and equal to 1.0 unless specifically lower value is specified by owner (minimum 0.7).
- Item 9, Q.8.2.2 to 3: Improve grammar/clarity on how internal pressure and wind load are combined.

Proposed Verbiage:
(rev 0 changes in red, comment to reader of agenda item in blue)

Item 1: Wind speed update for 5.4.1.k

5.4.1

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Replace item k) with the following:

(k) Wind (W): The design wind speed (V) shall be either:

— the 3-sec gust design wind speed determined from ASCE 7-16 for risk category specified by the Purchaser (Figure 26.5-1A, Figure 26.5-1B, ~~or~~ Figure 26.5-1C, or Figure 26.5-1D); or

— the 3-sec gust design wind speed specified by the Purchaser, which shall be for a 3-sec gust based on a mean recurrence interval consistent with the Purchaser's risk assessment.

The 3-sec gust wind speed used shall be reported to the Purchaser.

1) Design wind pressure (P_{WS} and P_{WR}) using design wind speed (V): The average uniform design wind pressure on shell (P_{WS}) shall be 18.6 lbf/ft^2 $(V/155)^2$ $(0.5\ (H+40)/40)^{0.21}$ on vertical projected areas of cylindrical surfaces. The design wind uplift pressure on roof (P_{WR}) shall be 31 lbf/ft^2 $(V/155)^2$ $(H/40)^{0.21}$ (see item 2) on horizontal projected areas of conical or doubly curved surfaces. The uniform average design wind pressure on shell wind girder (P_{WG}) to be used for design of intermediate wind girder shall be 18.6 lbf/ft^2$(V/155)^2$$(H/40)^{0.21}$ on vertical projected areas of cylindrical surfaces.

   P_{WS} = the design wind pressure on the shell in lbf/ft^2
   P_{WR} = the design wind uplift pressure on the roof in lbf/ft^2,
   P_{WG} = the design wind pressure on the shell wind girder in lbf/ft^2, and
   V = the design wind speed in mph
   H = shell height for P_{WS}, roof center height above grade for P_{WR}, or intermediate wind girder elevation for P_{WG}. (ft)

2) The design wind pressure on shell (P_{WS}) shall be 15.5 lbf/ft^2 $(V/155)^2$ $(H/40)^{0.21}$ on vertical projected areas of Spherical surfaces. The design wind uplift pressure on a spherical surface (P_{WR}) shall be 31 lbf/ft^2 $(V/155)^2$$(H/40)^{0.21}$.

3) These design wind pressures are in accordance with ASCE 7-16 for wind exposure Category C. As alternatives, pressures may be determined in accordance with:

   a. ASCE 7-16 (exposure category and risk category provided by Purchaser); or

   b. A national standard for the specific conditions for the tank being designed, provided a wind pressure can be determined from the standard and that the procedures of API 620 are used based on the pressures determined by the standard.

4) Windward and leeward horizontal wind loads on the roof are conservatively equal and opposite and therefore they are not included in the above pressures.

5) Average Wind Pressure P_{WS} is to be used for the lateral loads on the vertical projected surfaces of the cylindrical sidewall and spherical/spheroid shells, design of the intermediate wind girder, and wind sliding resistance. Maximum wind pressure P_{wv} is to be used for the sidewall buckling check, for maximum height of unstiffened widewall, and for design of the compression ring. P_{WR} is to be used for roof uplift pressure. Average uniform wind pressure P_{WG} is to be used for design of the intermediate wind girder.

NOTE The wind speeds of ASCE7-05 were increased to ultimate wind speeds starting with ASCE7-10 and later. As a result, ASCE7-05 wind speeds are less than later editions of ASCE7 by a factor of 0.78 (equivalent to a factor of 0.6 on pressure). In all cases, there is design wind speed and pressure parity between ASCE7-05 and later editions.

Item 2: Note on shell-to-shell spacing

Append following to 5.4.1k:

NOTE When tank shell-to-shell spacing is close to 0.25D, wind speed up effects (including increases in the magnitude of pressure) can be significant. In these cases, tank owners and operators should consider the operational parameters and risks associated with the need to increase the design wind pressure beyond the rules presented here. Further guidance can be found in ASCE 7.

Item 3: Note on sustained wind speeds for DOT PHMSA criteria

Append following to 5.4.1k:

NOTE Sustained wind speeds, as used in the criteria of PHMSA 49 CFR Part 193, are averaged over a greater period than the 3-sec gust wind speeds used in this standard and ASCE 7 and are not to be used in the wind provisions of this standard. A minimum equivalent 3-sec gust wind speed of 183 mph is recommended as a design floor for LNG tanks subject to the PHMSA 49 CFR Part 193 sustained wind speed criterion of 150 mph.

Item 4: Update for intermediate wind girders

5.10.6.1 The maximum height of unstiffened sidewall, in ft, shall not exceed:

$$\cancel{H_1 = 6(100t)\sqrt{\left(\frac{100t}{D}\right)^3}}$$

$$H_1 = 600{,}000\, t\sqrt{\left(\frac{t}{D}\right)^3\left(\frac{36}{P_{WD}}\right)}$$

where

*H*1 is the maximum height of the unstiffened sidewall ~~vertical distance between the intermediate wind girder and the top of the sidewall~~ or in the case of formed heads the ~~vertical distance between the intermediate wind girder and~~ height to the head-bend line plus one third the depth of the formed head, in ft;

t is the thickness of the ~~top~~ thinnest sidewall course, as ordered condition unless otherwise specified, in inches;

D is the nominal tank diameter, in ft.

P_{wd} is the design wind pressure including inward drag=P_{wv}+5, in lbf/ft2;

P_{wv} is the maximum wind pressure at sidewall height H ft above ground, in lbf/ft^2. P_{wv} = 31 lbf/ft^2 $(V/155)^2(H/40)^{0.21}$, where V is the design wind speed (3-sec gust) in mph (see 5.4.1k), or;

P_{wv} is the maximum wind pressure at sidewall height H ft above ground per applicable building code considering all applicable factors, such as gust factor, exposure factor, and elevation factor.

NOTE This formula is based on the following factors (for the background for the factors given in this note, see ASCE7 and R.V. McGrath's "Stability of API 650 Standard Tank Shells"): ~~.~~

~~a) A 3-sec gust design wind velocity, *V*, of 120 mph which imposes a dynamic pressure of 25.6 lbf/ft². The velocity is increased by 10 % for either a height above the ground or a gust factor. The pressure is thus increased to 31 lbf/ft². An additional 5 lbf/ft² is added for internal vacuum. This pressure is intended by these rules to be the result of a 120 miles per hour 3-sec wind gust at approximately 33 ft above the ground. H_1 may be modified for other wind velocities, as specified by the purchaser, by multiplying the formula by $(120/V)^2$. When a design wind pressure, rather than a wind velocity, is stated by the purchaser, the preceding increase factors should be added, unless they are contained within the design wind pressure.~~

a) The velocity pressure is

$$p = 0.00256 K_z K_{zt} K_d 0.6 V^2 G = 31 \text{ lbf/ft}^2$$

where

> K_z equals the velocity pressure exposure coefficient = 1.04 for exposure *C* at a height of 40 ft;
> K_{zt} is 1.0 for all structures except those on isolated hills or escarpments;
> K_d is the directionality factor = 0.95 for round tanks[18];
> *V* equals the 3-second gust design wind speed = 155 mph at 33 ft above ground [see 5.4.1k)][19];
> *G* equals the gust factor = 0.85 for exposure *C*.

As API 620 tanks can be significantly taller than typical API 650 tanks, an additional height adjustment factor of $(H/40)^{0.21}$ for the roof and $(0.5\,(H+40)/40)^{0.21}$ for the shell is used to account for the change in K_z for different tank heights. A 5 lbf/ft² internal vacuum is added for external pressure on closed top tanks for a total 36 lbf/ft².

b) ~~The formula is based on the wind pressure being~~ The wind pressure is uniform over the theoretical buckling mode in the tank sidewall, which eliminates the necessity of a shape factor for the wind loading.

c) ~~The formula is based on t~~The modified U.S. Model Basin formula for the critical uniform external pressure on thin-wall tubes free from end loading, subject to the total pressure in Item a.

~~d) When other factors are specified by the purchaser which are greater than those in (a) through (c), the total load on the sidewall shall be modified accordingly and H_1 shall be decreased by the ratio of 36 lbf/ft2 to the modified total pressure.~~

~~e) The background for the criteria given in the note is covered in R. V. McGrath, "Stability of API Standard 650 Tank Shells," Proceedings of the American Petroleum Institute, Section III—Refining, American Petroleum Institute, New York, 1963, Vol. 43, pp. 458 to 469.~~

Add Footnotes:

18: Although ASCE7 has changed the directionality factor from 0.95 to 1.0, the 0.95 value is retained here so that that the 31 psf value is consistent regardless of changes per edition of ASCE7 or API 650. While 0.95 is less conservative than 1.0, other factors ensure that the reference wind pressure 31 psf is still a reasonable selection for the design wind speed.

19: The 0.6 factor is applied to ensure that the reference wind speed pressure resulting from changes in ASCE7 from allowable stress design to strength design does not result in a change in the 31 psf reference wind pressure.

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5.10.6.3 If the height of the transposed sidewall is greater than the maximum height, *H*1, an intermediate girder is required. Alternatively, thickness of the upper sidewall courses shall be increased as required such that maximum unstiffened sidewall height H1 is greater than or equal to the transposed sidewall height. In such cases, the intermediate wind girder is not required.

a) For equal stability above and below the intermediate wind girder, the latter should be located at the mid-height of the transposed sidewall. The location of the girder on the actual sidewall should be at the same course and relative position as on the transposed sidewall using the foregoing thickness relationship.

b) Other locations for the girder may be used provided the height of the unstiffened sidewall on the transposed sidewall does not exceed *H*1 (see 5.10.6.5).

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5.10.6.6 The required minimum elastic section modulus Z, in inches cubed, of the intermediate wind girder shall be determined by the equation:

$$\cancel{Z = \frac{1.5(D^2 * H_1)}{0.5 * F_y}}$$

$$Z = \frac{1.5(D^2 h_1)}{0.5\ F_y}\left(\frac{P_{WG}}{18.6}\right)$$

Where

D is the nominal tank diameter, in feet;

h1 is the vertical distance, in feet, between the intermediate wind girder and the top angle of the shell~~;~~

Fy is the least minimum yield strength of the shell and wind girder at maximum operating temperature in psi ~~or 30,000 psi, whichever is less~~.

P_{WG} is the wind pressure at sidewall height H ft above ground, in lbf/ft^2. P_{WG} = 31 lbf/ft^2 (V/155)^2(H/40)$^{0.21}$, where V is the design wind speed (3-sec gust) in mph (see 5.4.1k), or;

P_{WG} is the maximum wind pressure at sidewall height H ft above ground per applicable building code considering all applicable factors, such as gust factor, exposure factor, and elevation factor.

The section modulus of the intermediate wind girder shall be based on the properties of the applied members and may include a portion of the tank sidewall for a distance 1.47 (D t)$^{0.5}$ below and, if applicable, above the shell-ring attachment where t is the as-built shell thickness, unless otherwise specified, in inches.

NOTE This equation is based on a 3 sec gust wind velocity of ~~120~~ 155 miles per hour. ~~If specified by the purchaser, other wind velocities may be used by multiplying the equation by (V/120)2.~~ Refer to Item a of notes to 5.10.6.1 for a description of the loads on the tank sidewall which are used for the ~~120~~ 155 mile per hour 3 sec gust design wind velocity.

Item 5: Buckling check for column-supported spheres

Add new section 5.10.7

5.10.7 Buckling check on spherical tank supported by columns

The peak wind pressure on a spherical tank supported by columns shall not exceed the maximum allowable external pressure Pa,

$$P_a = 0.0625\, E / \left(\frac{12\, R_O}{t}\right)^2 * 144$$

where

Pa= Maximum allowable external pressure, in lbf/ft^2;

E= Modulus of elasticity, in lbf/in^2;

Ro = Sphere outside radius, in feet;

t = Sphere Thickness, in inches.

Item 6: Uplift criteria for self-anchored tanks

5.11.3

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Append the following at end of 5.11.3:

Add below figure similar to Fig. 5-27 of API 650, except change cone roof to dome roof.

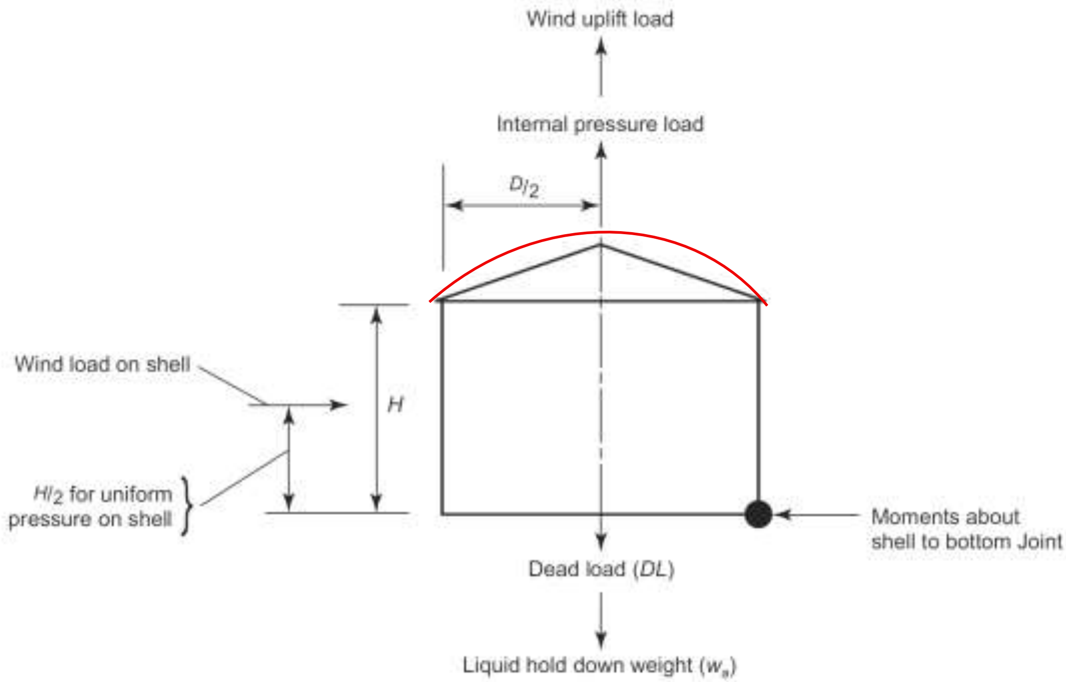

Figure 5.27—Overturning Check for Self-anchored Tanks

Add following text:

Additionally, self-anchored tanks shall satisfy all of the following uplift criteria:

1) $0.6Mw + MPi < M_{DL}/1.5 + M_{DLR}/1.5$
2) $Mw + Fp(MPi) < (M_{DL} + M_F)/2 + M_{DLR}/2$
(3) $Mws + Fp\ (MPi) < M_{DL}/1.5 + M_{DLR}/1.5$

Where
F_P is the pressure combination factor, see Table 5-7.
MPi is the moment about the shell-to-bottom joint from design internal pressure;
Mw is the overturning moment about the shell-to-bottom joint from horizontal plus vertical wind pressure;
M_{DL} is the moment about the shell-to-bottom joint from the nominal weight of the shell and roof structure supported by the shell that is not attached to the roof plate;
M_F is the moment about the shell-to-bottom joint from liquid weight;
M_{DLR} is the moment about the shell-to-bottom joint from the nominal weight of the roof plate supported by shell plus any attached structural supported by shell. When internal design pressure exceeds roof plate weight, M_{DLR} shall be based on the entire roof plate.
M_{WS} is the overturning moment about the shell-to-bottom joint from horizontal wind pressure.

For Spherical tank supported on columns, maximum uplift shall be calculated as below:

$$F_{up} = -D_{LS}/Nc + 4Mw/(Nc\ Dc) \geq 0$$

Where
F_{up}= Maximum uplift, in lbf;
D_{LS}= Sphere empty erected weight, in lbf;
Nc= Number of support columns;
Mw= Total wind moment at column base, foot-lbf;
Dc= Column circle diameter = sphere diameter, in feet.

Item 7: Sliding updates

5.11.4 Additional Considerations

Unless otherwise required, tanks that may be subject to sliding due to wind shall use a maximum allowable sliding friction of 0.40 times the force against the tank bottom. Sliding friction force shall be calculated based on empty tank weight using nominal thickness and shall be equal or greater than lateral shear force due to wind.

$F_{ws} =< W_{DT} \times \mu$

Where
Fws= Lateral wind shear force at bottom of shell = Pws x D x H
Pws= Lateral average uniform Wind Pressure on projected surface of cylindrical shell
D= Tank Diameter
H= Tank Height
W_{DT}= Empty weight of tank using nominal thicknesses of all components.
μ = Coefficient of friction; 0.4. This includes a Safety Factor of 1.5

Sliding friction force on a spherical tank supported on columns shall be calculated based on empty tank weight using nominal thickness and shall be equal or greater than lateral shear force due to wind.

$F_{ws} =< W_{DT} \times \mu/Nc$

Where
Fws= Lateral wind shear force at bottom of each column = Pws /Nc x 0.7854 D_2 *2
Pws= Lateral average uniform Wind Pressure on projected surface of Spherical shell
D= Sphere Diameter
W_{DT}= Empty weight of sphere using nominal thicknesses of all components.
Nc= Number of support columns.
μ = Coefficient of friction; 0.4. This includes a Safety Factor of 1.5.

Item 8: Default value of Fp

Modify Table 5-7 as follows:

Table 5-7—Uplift Loads (USC)

Uplift Load Case	Net Uplift Formula, U (lbf)	Allowable Anchor Bolt Stress (lbf/in.^{2})	Allowable Shell Stress at Anchor Attachment (lbf/in.^{2})
Design Pressure	$[P_i \times D^2 \times 4.08] - W_1$	$5/12 \times F_y$	$2/3\, F_{ty}$
Test Pressure	$[P_t \times D^2 \times 4.08] - W_3$	$5/9 \times F_y$	$5/6\, F_{ty}$
Wind Load	$P_{WR} \times D^2 \times 4.08 + [4 \times M_{WS}/D] - W_2$	$0.8 \times F_y$	$5/6\, F_{ty}$
Seismic Load	$[4 \times M_{rw}/D] - W_2 (1 - 0.4A_v)$	$0.8 \times F_y$	$5/6\, F_{ty}$
Design Pressure + Wind	$[(F_p (P_i + P_{WR}) \times D^2 \times 4.08] + [4\, M_{WS}/D] - W_1$	$5/9 \times F_y$	$5/6\, F_{ty}$
Design Pressure + Seismic	$[F_p P_i \times D^2 \times 4.08] + [4\, M_{rw}/D] - W_1 (1 - 0.4A_v)$	$0.8 \times F_y$	$5/6\, F_{ty}$

where

A_v is the vertical earthquake acceleration coefficient, in % g;

D is the tank diameter, in feet;

F_p is the pressure combination factor, defined as the ratio of normal operating internal pressure to design internal pressure~~, with a minimum value of 0.7~~;

A value of Fp equal to 1.0 shall be used unless a lower value not less than 0.7 is specified by the Owner.

F_{ty} is the minimum yield strength of the bottom shell course, in psi;

F_y is the minimum yield strength of the anchor bolt; bolts are limited to specified material minimum yield strength or 55,000 psi, whichever is less, in psi;

H is the tank height, in feet;

M_{WS} equals P_{WS} x D x $H^2/2$, in ft-lbs;

M_{rw} is the seismic moment, in ft-lbs (see Equation L-2);

P_i is the design internal pressure, in inches of water column;

P_t is the test pressure, in inches of water column;

P_{WR} is the wind uplift pressure on roof, in inches of water column;

P_{WS} is the wind pressure on shell, in lbs/ft^2;

W_1 is the corroded weight of the roof plates plus the corroded weight of the shell and any other corroded permanent attachments acting on the shell, in lbf;

W_2 is the corroded weight of the shell and any corroded permanent attachments acting on the shell including the portion of the roof plates and framing acting on the shell, in lbf;

W_3 is the nominal weight of the roof plates plus the nominal weight of the shell and any other permanent attachments acting on the shell, in lbf.

Item 9: Clarify language when combining pressure and loads.

Q.8.2.2 For tanks with an internal design pressure less than 1 lbf/in.^{2} gauge, the uplift shall be taken as the smaller of the maximum uplift values computed under the following conditions:

a) The internal design pressure times 1.5 ~~plus~~ and the design wind load on the shell and roof.

b) The internal design pressure plus 0.25 lbf/in.^{2} gauge ~~plus~~ and the design wind load on the shell and roof.

Q.8.2.3 For tanks with an internal design pressure of 1 lbf/in.^{2} gauge and over, the uplift, if any, shall be calculated under the combined conditions of 1.25 times the internal design condition ~~plus~~ and the design wind load on the shell and roof.