AHRI Standard 1310

2019 Standard for

Wind Load Design of HVACR Equipment

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IMPORTANT

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Note:

This is a new AHRI Standard.

Foreword

The codes and standards listed in Appendix A are used in conjunction with the requirements contained herein and together govern the wind load design, construction, and rating of Equipment within the scope of this standard. Evidence of compliance with this standard is deemed to satisfy the applicable provisions of the normative codes and standards.

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WIND LOAD DESIGN OF HVACR EQUIPMENT

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish for Heating, Ventilating, Air-conditioning, and Refrigeration (HVACR) Equipment the wind load design, construction, and rating requirements. This standard provides minimum requirements for the design, construction, and structural load rating of Equipment that must resist wind loads to maintain structural integrity and prevent separation of equipment Components that can become windborne debris.

1.1.1 *Intent.* This standard is intended to be used primarily by HVACR Equipment manufacturers and their agents. Other HVACR industry stakeholders that may use this standard include engineers, contractors, owners, insurers, and building officials.

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as building codes change and as technology advances.

1.1.3 This standard does not address Equipment functionality. Compliance with this standard will not ensure Equipment will continue to function after a design wind event, though design for structural integrity can improve functional survivability. The design and construction requirements for HVACR Equipment that must function after a wind event shall be defined by the authority having jurisdiction. Alternatively, critical Equipment should be protected from the effects of winds.

Section 2. Scope

2.1 *Included Equipment and Components*.

2.1.1 This standard shall apply, but not be limited to, the following types of HVAC Equipment that are exposed to wind:

2.1.1.1 Air handling units as defined in AHRI Standards 430 (I-P).
2.1.1.2 Air-to-air heat exchangers as defined in AHRI Standards 1060 (I-P).
2.1.1.3 Dehumidifiers as defined in AHRI Standards 910 (I-P).
2.1.1.4 DX-dedicated outdoor air system units as defined in AHRI Standard 920.
2.1.1.5 Furnaces as defined in 10 CFR § 430.2.
2.1.1.6 Humidifiers as defined in AHRI Standards 640 (I-P).
2.1.1.7 Liquid chillers as defined in AHRI Standards 550/590 (I-P).
2.1.1.8 Packaged terminal equipment as defined in AHRI Standard 310/380.
2.1.1.9 Single packaged vertical air conditioners and heat pumps as defined in AHRI Standard 390.
2.1.1.10 Thermal storage equipment as defined in ANSI/AHRI Standards 900 (I-P).
2.1.1.11 Unitary air conditioners and heat pumps (including ductless equipment) as defined in AHRI Standard 210/240 and AHRI Standard 340/360.
2.1.1.12 Variable refrigerant flow air conditioners and heat pumps as defined in AHRI Standard 1230.
2.1.1.13 Water-source heat pumps as defined in ANSI/AHRI/ASHRAE/ISO Standard 13256-1 & 2.

2.1.2 This standard shall also apply to the following Structural Elements and connections of Equipment:

2.1.2.1 Equipment Attachment Points (EAP) that transfer loads to Supports and Attachments.

2.1.2.2 Equipment Force-Resisting System (EFRS) that provides a continuous load path for transmitting loads to the EAP.

2.1.2.3 Equipment Components & Cladding (EC&C) parts that are directly exposed to wind loads. Components include items such as cowlings, exhaust or recovery sections, sound attenuators, and other appurtenances that are attached to Equipment and supplied by manufacturer of the Equipment. Cladding includes wall and roof panels forming the enclosure of Equipment. These parts also may be integral to the EFRS.

2.2 *Excluded Equipment and Components.* This standard shall not apply to Equipment that is indoors or fully shielded from wind by a wind load resistant enclosure independent of the Equipment. This standard also shall not apply to the following:

2.2.1 Nonstructural Elements including Components and parts that are internal to Equipment, are not directly exposed to wind loads, and are not a part of the EFRS.

2.2.2 Distribution system elements connecting Equipment, including piping, ducting, electrical wiring, and conduit.

2.2.3 Other appurtenances, including lightning, electrical boxes, and lightening protection that may be attached to Equipment but not supplied by the Equipment manufacturer.

2.2.4 Supports and Attachments, including hardware, stands, curbs, restrained isolators, and other structural members.

2.3 *Tornado Limitation.* The wind load effects of tornadoes are not within the scope of this standard.

2.4 *Missile Impact Resistance.* The design and test requirements for missile impact resistance of Equipment are not within the scope of this standard.

Section 3. Definitions

3.1 *General*. The definition of terms used in this standard shall be as provided in ASCE/SEI 7 and on *the ASHRAE Terminology* website (https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology) except as defined below.

3.1.1 *Attachments*. The devices or hardware, such as fasteners and welds, used to secure and restrain Equipment to Supports. Attachments also may be referred to as anchors.

3.1.2 *Building*. Any structure, other than Supports, on which Equipment is located or to which Equipment provides an HVACR service.

3.1.3 *Cladding.* The parts of Equipment that are directly exposed to wind loads including wall and roof panels forming the enclosure of Equipment. These parts also may be integral to the EFRS.

3.1.4 *Components.* Major parts or subassemblies of Equipment that are either directly exposed to wind loads or are internal to Equipment and not exposed.

3.1.5 *Equipment.* A product within the scope of this standard that provides a Heating, Ventilating, Air-conditioning, or Refrigeration (HVACR) function.

3.1.6 *Equipment Attachment Points (EAP).* The points on Equipment where it is attached to Supports and are designed in accordance with this standard to transfer loads from the EFRS to the Attachments and Supports.

3.1.7 *Equipment Force-Resisting System (EFRS).* A system of structural members, connections, and Components within Equipment that provides a continuous load path for transmitting loads to the EAP.

3.1.8 *Generic Design.* A procedure for wind load design of Equipment whereby the design wind pressures are determined based on the strength and deflection limit states of Structural Elements.

3.1.9 *Nonstructural Elements.* All parts of Equipment including Components that are internal to Equipment, are not directly exposed to wind loads, and are not part of the EFRS.

3.1.10 *"Shall," "Should," "Recommended," or "It is recommended."* "Shall," "should," "recommended," or "it is recommended" shall be interpreted as follows:

3.1.10.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.1.10.2 *Should, Recommended, or It is Recommended.* "Should," "recommended," or "it is recommended" is used to indicate provisions that are not mandatory but are desirable as good practice.

3.1.11 *Site-Specific Design.* A procedure for wind load design of Equipment whereby Structural Elements have acceptable strength to resist design wind pressures determined for the Equipment location using site-specific wind load design data.

3.1.12 *Structural Elements.* All parts of Equipment including EAP, EFRS, EC&C, and connections thereof that resist wind loads.

3.1.13 *Supports.* The structural members, structural frameworks, and devices that provide support for Equipment including structural steel frames, beams, slabs, curbs, stands, and restrained isolators.

3.1.14 *Wind Load Capacity.* The lesser of the horizontal design wind pressures determined using the Generic Design procedure. Wind Load Capacity is an attribute of Equipment that is independent of Wind Load Demand.

3.1.15 *Wind Load Demand.* The greater of the horizontal design wind pressures for the Equipment location using site-specific wind load design data.

Section 4. Symbols

4.1 *General.* The symbols used in this standard are provided below and have common meaning and usage as those in ASCE/SEI 7. Where differences exist, the meaning and usage herein shall take precedence.

C_f	Force coefficient for determination of horizontal design wind pressure on ground mounted Equipment
D	Dead load of Equipment, lb
d	Diameter of circular Equipment cross sections and least horizontal dimension of square, hexagonal, or octagonal Equipment cross sections normal to the wind direction, ft
d'	Depth of protruding parts of Equipment such as stiffeners and fins that affect surface roughness, ft
G	Gust-effect factor
$(GC_r)_h$	Combined gust-effect factor and force coefficient for determination of horizontal design wind pressure on roof mounted Equipment
$(GC_r)_v$	Combined gust-effect factor and force coefficient for determination of vertical uplift design wind pressure on roof mounted Equipment
h	Height of Equipment, ft
h_r	Building mean roof height, ft
K_d	Wind directionality factor depending on Equipment mounting location, shape, and type of EFRS
K_e	Ground elevation factor evaluated using the ground elevation above sea level z_{gr}
K_z	Velocity pressure exposure coefficient evaluated at the relevant height z
K_{zt}	Topographic factor in accordance with ASCE/SEI 7
P_C	Wind Load Capacity, lb/ft^2
P_D	Wind Load Demand, lb/ft^2
p_h	Horizontal design wind pressure, lb/ft^2
p_v	Vertical design wind pressure, lb/ft^2
q_z	Velocity pressure evaluated at the relevant height, z, lb/ft^2
V	Basic wind speed in accordance with ASCE/SEI 7, mph

W	Wind load on Equipment expressed as design wind pressure, lb/ft^2
z	Relevant height for determination of velocity pressure, ft
z_g	Terrain exposure constant, ft
z_{gr}	Ground elevation above sea level, ft
α	Terrain exposure constant

Section 5. Basic Requirements

5.1 *Strength and Stiffness*. Structural Elements shall be designed and constructed with adequate strength and stiffness to provide structural stability and to prevent separation of Nonstructural Elements that can become windborne debris.

Acceptable strength shall be demonstrated using either the strength design or allowable stress design procedure as follows:

5.1.1 *Strength Design*. Structural Elements shall have adequate strength to resist the effects of the load combinations provided in Section 5.6 without exceeding the applicable strength limit states determined in accordance with Section 5.13 for the materials of construction.

5.1.2 *Allowable Stress Design.* Structural Elements shall have adequate strength to resist the effects of the load combinations provided in Section 5.7 without exceeding the applicable allowable stresses determined in accordance with Section 5.13 for the materials of construction.

Lateral drift and deflections of Structural Elements shall be limited to ensure Nonstructural Elements cannot separate from Equipment. Load combination indicated in equation 4 shall be used for calculation of lateral drift and deflections regardless of the procedure used for strength design.

It shall be permitted to use alternative procedures for different Structural Elements of Equipment.

5.2 *Structural Continuity.* Structural Elements shall be provided with a continuous load path for transmitting forces to Supports and Attachments. The Structural Elements that form a continuous load path shall be positively connected without consideration of frictional resistance produced by the effects of gravity.

Note: Structural Elements that form a continuous load path should have consistent design strengths. Significant weak links should be avoided in order to maximize structural efficiency.

5.3 *Overturning***.** Structural Elements shall be designed to resist the maximum overturning effects of the load combinations provided in Section 5.6 or Section 5.7.

5.4 *Analysis*. Load effects on Structural Elements shall be determined by methods of structural analysis that account for equilibrium, general stability, geometric compatibility, and both short- and long-term material properties.

Lateral loads shall be distributed to the various vertical parts of the EFRS in proportion to their rigidities, considering the rigidity of any horizontal load distribution systems such as diaphragms and diagonal braces.

5.5 *Wind Load Design Procedure.* Wind load design shall be performed using either the Site-Specific Design or Generic Design procedure as follows:

5.5.1 *Site-Specific Design.* Equipment shall be designed to meet the requirements in this section using site-specific wind loads determined in accordance with Section 6.

5.5.2 *Generic Design.* Equipment shall be designed to meet the requirements in this section using generic wind loads determined in accordance with Section 7.

Where the Generic Design procedure is used, wind load compliance of Equipment shall be determined for each Equipment location in accordance with Section 8.

5.6 *Load Combinations for Strength Design.* Structural Elements shall be designed so that their design strength equals or exceeds the effects of dead, snow and wind loads in the following combinations. Each relevant strength limit state determined in accordance with Section 5.13 shall be investigated.

$$1.2 \cdot D + 1.0 \cdot W + 0.5 \cdot S \quad (1)$$
$$1.2 \cdot D + 1.6 \cdot S + 0.5 \cdot W \quad (2)$$
$$0.9 \cdot D + 1.0 \cdot W \quad (3)$$

5.7 *Load Combinations for Allowable Stress Design.* Structural Elements shall be designed so that their allowable strength equals or exceeds the effects of dead, snow and wind loads in the following combinations. Each relevant strength limit state determined in accordance with Section 5.13 shall be investigated.

$$1.0 \cdot D + 0.6 \cdot W \quad (4)$$
$$1.0 \cdot D + 0.45 \cdot W + 0.75 \cdot S \quad (5)$$
$$0.6 \cdot D + 0.6 \cdot W \quad (6)$$

5.8 *Dead Load.* Where the dead load, D, of Equipment varies between operational, non-operational, and shutdown functional states, the weight used in load combinations shall be the value producing the most severe effect in the Structural Element being considered.

5.9 *Snow Load.* The snow load, S, used in load combinations shall be determined in accordance with Chapter 7 of ASCE/SEI 7.

5.10 *Wind Load.* The wind load, W, used in load combinations shall be the design wind pressure determined in accordance with Section 6 or Section 7.

5.11 *Other Loads.* Other loads including but not limited to live and seismic loads shall be considered in design of Equipment but need not be combined with wind load in accordance with this standard. For seismic load design of Equipment, refer to ANSI/AHRI Standard 1270 (I-P).

5.12 *Design Reports.* The design and analysis work performed in accordance with this standard shall be documented in a report and shall contain, as a minimum, the following information:

5.12.1 For all reports:

5.12.1.1 Date the work is completed.
5.12.1.2 Revision log to document significant changes to the report.
5.12.1.3 Equipment information relevant to the work in accordance with this standard:

5.12.1.3.1 Equipment description.
5.12.1.3.2 Overall configuration and identification of Structural Elements.
5.12.1.3.3 Materials of construction for Structural Elements.
5.12.1.3.4 Equipment Attachment Point locations.
5.12.1.3.5 Equipment Support configurations.

5.12.1.4 Material design procedure(s) used.
5.12.1.5 Wind load design procedure used.
5.12.1.6 Assumptions used in the work and their justification.
5.12.1.7 Design references used in support of the work.
5.12.1.8 Software applications used.
5.12.1.9 Calculations in a form that facilitate review by a third party if required.

5.12.2 For the Site-Specific Design procedure and for wind load compliance determination of Equipment designed using the Generic Design procedure:

5.12.2.1 Equipment information:

5.12.2.1.1 Unique identification number.
5.12.2.1.2 Dimensions.
5.12.2.1.3 Weight(s).

5.12.2.2 Wind load design data.
5.12.2.3 Wind Load Demand value.

5.12.3 For the Generic Design procedure:

5.12.3.1 Equipment information:

5.12.3.1.1 Range of models addressed.
5.12.3.1.2 Range of configurations addressed.
5.12.3.1.3 Range of sizes addressed.
5.12.3.1.4 Range of weights addressed.

5.12.3.2 Wind Load Capacity value(s).

5.13 *Material Design.* The design of Structural Elements shall be in accordance with this section for the specific materials of construction used.

5.13.1 *Cold-formed Carbon and Low-alloy Steel.* The design of cold-formed carbon and low-alloy steel Structural Elements shall be in accordance with AISI S100.

5.13.2 *Cold-formed Stainless Steel.* The design of cold-formed stainless steel Structural Elements shall be in accordance with ASCE 8.

5.13.3 *Structural Steel Plates and Shapes.* The design of structural steel Structural Elements shall be in accordance with ANSI/AISC 360.

5.13.4 *Aluminum.* The design of aluminum Structural Elements shall be in accordance with ADM1.

5.13.5 *Other Materials of Construction.* The design of Structural Elements constructed with materials other than those listed in this section shall be in accordance with nationally recognized standards or rational design methods considering the unique properties of the materials used, subject to the approval of the authority having jurisdiction.

Section 6. Site-Specific Wind Loads

6.1 *General*. Site-specific wind loads shall be determined in accordance with this section and shall be expressed as design wind pressures in lb/ft^2.

6.2 *Wind Load Design Data.* The following wind load design data shall be provided by the registered design professional in responsible charge of the project:

6.2.1 Risk category for the Building(s) on which the Equipment is located and to which the Equipment provides an HVACR service.
6.2.2 Basic wind speed or map coordinates for the Equipment location.
6.2.3 Exposure category or map coordinates for the Equipment location.
6.2.4 Equipment mounting location (e.g. ground or roof of the Building).
6.2.5 Elevation above ground to the bottom of the Equipment.
6.2.6 For roof mounted Equipment, Building mean roof height.
6.2.7 Ground elevation above sea level at the Equipment location.

6.3 *Risk Category.* Equipment risk category shall be equal to the greater of the following:

6.3.1 Risk category per IBC Table 1604.5 for the Building on which the Equipment is located.
6.3.2 Risk category per IBC Table 1604.5 for the Building(s) to which the Equipment provides an HVACR service.

6.4 *Basic Wind Speed.* The basic wind speed, V, shall be equal to the value provided in the wind load design data or shall be determined from Figures 26.5-1A, B, C, D, and Figures 26.5-2A, B, C, D of ASCE/SEI 7 at the Equipment location and for the risk category determined in accordance with Section 6.3. For locations identified in ASCE/SEI 7 as special wind regions, basic wind speed values shall be obtained from the authority having jurisdiction.

Alternatively, the basic wind speed shall be permitted to be determined using the ASCE/SEI 7 Hazard Tool provided by the American Society of Civil Engineers or the ATC Hazards by Location tool provided by the Applied Technology Council.

The wind shall be assumed to come from any horizontal direction.

6.5 *Wind Directionality Factor.* The wind directionality factor, K_d, shall be determined from Table 1.

Table 1. Wind Directionality Factor (K_d)

Equipment Mounting Location	Equipment Shape	Equipment Force-Resisting System	Directionality Factor (K_d)
Ground	Square	All	0.90
Ground	Hexagonal	All	0.95
Ground	Octagonal	Axisymmetric	1.00
Ground	Octagonal	Nonaxisymmetric	0.95
Ground	Round	Axisymmetric	1.00
Ground	Round	Nonaxisymmetric	0.95
Building Roof	All	All	0.85

Where ground mounted Equipment is composed of parts with different shapes, the wind directionality factor used in design of Structural Elements shall be equal to the greater of the factors for each part.

6.6 *Exposure Category.* The exposure category shall be equal to the value provided in the wind load design data or shall be determined in accordance with Section 26.7 of ASCE/SEI 7 at the Equipment location for each wind direction considered.

6.7 *Topographic Factor.* The topographic factor, K_{zt}, shall be determined in accordance with Section 26.8 of ASCE/SEI 7 at the Equipment location for each wind direction considered.

6.8 *Ground Elevation Factor.* The ground elevation factor, K_e, shall be calculated using the Equation 7 where z_{gr} is the ground elevation above sea level at the Equipment location:

$$K_e = e^{-0.0000362 \cdot Z_{gr}} \quad (7)$$

K_e shall be permitted to be taken as 1.0 in all cases.

6.9 *Velocity Pressure Exposure Coefficient.* The velocity pressure exposure coefficient, K_z, shall be calculated using the Equations 8 and 9 where the height, z, is determined in accordance with Section 6.12. The α and z_g terrain exposure constants shall be determined from Table 2.

6.9.1 For 15 ft $\leq z \leq z_g$

$$K_z = 2.01 \cdot (z/z_g)^{2/\alpha} \quad (8)$$

6.9.2 For z < 15 ft,

$$K_z = 2.01 \cdot (15/z_g)^{2/\alpha} \quad (9)$$

Table 2. Terrain Exposure Constants		
Exposure Category	α	z_g, **ft**
B	7.0	1200
C	9.5	900
D	11.5	700

6.10 *Gust-Effect Factor.* The gust-effect factor, G, shall be taken as 0.85. Where combined gust-effect and force coefficient factors are used, the gust-effect factor shall not be applied separately.

6.11 *Velocity Pressure.* The velocity pressure, q_z, evaluated at height z shall be calculated using Equation 10:

$$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 \quad (10)$$

6.12 *Design Wind Pressure for EFRS and EAP.* The design wind pressures for EFRS and EAP shall be determined in accordance with this section. The calculated design wind pressures shall be assumed to act on the full vertical and horizontal projected areas of Equipment without reduction for openings, such as air inlets and outlets, in the direction being considered.

6.12.1 *Ground Mounted Equipment.* The horizontal design wind pressure, p_h, shall be calculated using Equation 11 and shall be assumed to act parallel to the wind direction:

$$p_h = q_z \cdot G \cdot C_f \quad (11)$$

Concurrent vertical uplift pressure, p_v, shall be calculated using Equation 12.

$$p_v = 0.80 \cdot p_h \quad (12)$$

The velocity pressure, q_z, shall be evaluated at the centroid height of the Equipment vertical projected area. The force coefficient, C_f, shall be determined from Table 3. Linear interpolation shall be permitted for h/d values other than shown.

Table 3. Force Coefficients (C_f)				
Equipment Cross Section	**Type of Surface**	***h*/*d***		
		1	**7**	**25**
Rectangular (wind normal to face)	All	1.3	1.4	2.0
Rectangular (wind along diagonal)	All	1.0	1.1	1.5
Hexagonal or Octagonal	All	1.0	1.2	1.4
Round, $d\sqrt{q_z} > 2.5$	Moderately smooth	0.5	0.6	0.7
	Rough ($d'/d = 0.02$)	0.7	0.8	0.9
	Very Rough ($d'/d = 0.08$)	0.8	1.0	1.2
Round, $d\sqrt{q_z} \leq 2.5$	All	0.7	0.8	1.2

6.12.2 *Roof Mounted Equipment.* The horizontal design wind pressure, p_h, shall be calculated using Equation 13:

$$p_h = q_z \cdot (GC_r)_h \quad (13)$$

The combined horizontal gust-effect and force coefficient factor, $(GC_r)_h$, shall be taken as 1.9. Where the vertical projected area of Equipment is greater than 10% of the vertical projected area of the Building on which the Equipment is located, a reduction of the $(GC_r)_h$ factor shall be permitted to be determined in accordance with Section 29.4.1 of ASCE/SEI 7.

The vertical uplift design wind pressure, p_v, shall be calculated using Equation 14:

$$p_v = q_z \cdot (GC_r)_v \quad (14)$$

The combined vertical gust-effect and force coefficient factor, $(GC_r)_v$, shall be taken as 1.5. Where the horizontal projected horizontal area of Equipment is greater than 10% of the horizontal projected area of the Building on which the Equipment is located, a reduction of the $(GC_r)_v$ factor shall be permitted to be determined in accordance with Section 29.4.1 of ASCE/SEI 7.

The velocity pressure, q_z, shall be evaluated at the mean roof height, h_r, of the Building on which the Equipment is located. The horizontal and vertical design wind pressures shall be assumed to act concurrently.

6.13 *Design Wind Pressure for EC&C.* Wall EC&C design wind pressures shall be equal to the horizontal design wind pressure determined in accordance with Section 6.12. The horizontal pressure shall be considered to act normal to the surface in both the inward and outward directions and shall be applied in the design of all wall EC&C parts and connections thereof.

Roof EC&C design wind pressures shall be equal to the vertical uplift design wind pressure determined in accordance with Section 6.12. The roof pressure shall be considered to act normal to the surface in the upward direction and shall be applied in the design of all roof EC&C parts and connections thereof.

The EC&C design wind pressures determined herein shall be applied without reduction for design of air-permeable parts unless test data or recognized literature demonstrates lower pressures for the type of air-permeable part being considered.

For EC&C parts that are integral to the EFRS, the effects of EC&C and EFRS design wind pressures shall be considered separately.

6.14 *Minimum Design Pressure.* The horizontal and vertical uplift design wind pressures for design of Structural Elements shall be not less than 16 lb/ft^2 and shall be applied in accordance with the requirements in Sections 6.12 and 6.13.

6.15 *Shielding.* There shall be no reductions in design wind pressures due to apparent shielding afforded by buildings and other structures or terrain features. Where the extent of shielding provided by walls or screening surrounding Equipment is specified in contract documents and approved by the authority having jurisdiction, reductions in design wind pressures may be considered.

Section 7. Generic Wind Loads

7.1 *General*. Generic wind loads shall be determined in accordance with this section and shall be expressed as design wind pressures in lb/ft^2.

7.2 *Design Wind Pressure for EFRS and EAP.* A uniform horizontal pressure shall be applied as defined in Section 6.12. Vertical uplift pressure shall be applied concurrently with horizontal pressure and shall be equal to 80% of the horizontal pressure.

The design wind pressure for EFRS and EAP shall be equal to the lowest horizontal pressure that when combined with other loads in accordance with Section 5 results in a strength or deflection limit state being reached in the most critical Structural Element.

7.3 *Design Wind Pressure for EC&C.* A uniform horizontal pressure shall be applied to wall EC&C parts as defined in Section 6.13. The design wind pressure for wall EC&C parts shall be equal to the lowest horizontal pressure that when combined with other loads in accordance with Section 5 results in a strength or deflection limit state being reached in the most critical Structural Element.

A uniform vertical uplift pressure equal to 80% of the horizontal EC&C pressure shall be applied to roof EC&C parts as defined in Section 6.13. The design wind pressure for roof EC&C parts shall be equal to the lowest horizontal pressure that when combined with other loads in accordance with Section 5 results in a strength or deflection limit state being reached in the most critical Structural Element.

The design wind pressure for EC&C shall be equal to the lesser of the wall and roof EC&C design wind pressures.

The EC&C design wind pressures determined herein shall be considered without reduction in the design of air-permeable parts unless test data or recognized literature demonstrates lower pressures for the type of air-permeable part being considered.

For EC&C parts that are integral to the EFRS, the effects of EC&C and EFRS design wind pressures shall be considered separately.

7.4 *Minimum Design Pressure.* Structural Elements shall be capable of resisting horizontal and vertical uplift pressures not less than 16 lb/ft^2 combined with other loads in accordance with Section 5. The pressures shall be applied as defined in Sections 6.12 and 6.13.

Section 8. Wind Load Compliance

8.1 *General*. Wind load compliance of Equipment designed using the Generic Design procedure shall be determined in accordance with this section.

8.2 *Wind Load Capacity.* The Wind Load Capacity, P_C, of Equipment shall be equal to the lesser of the horizontal design wind pressures determined in accordance with Sections 7.2 and 7.3 but shall not be less than the minimum design pressure defined in Section 7.4.

8.3 *Wind Load Demand.* Wind Load Demand, P_D, shall be determined in accordance with Section 6 for each Equipment location and shall be equal to the greater of the horizontal design wind pressures determined in accordance with Sections 6.12 and 6.14.

Where shielding is considered at the Equipment location, the Wind Load Demand, P_D, shall be equal to the greater of the horizontal design wind pressures determined in accordance with Sections 6.14 and 6.15.

8.4 *Wind Load Compliance.* Equipment shall be considered to comply with the requirements of this standard where Wind Load Capacity equals or exceeds Wind Load Demand according to either Equation 15 or Equation 16, as appropriate.

8.4.1 Where the strength of Structural Elements is determined using the strength design procedure in accordance with Section 5.1.1:

$$P_C \geq P_D \quad (15)$$

8.4.2 Where the strength of Structural Elements is determined using the allowable stress design procedure in accordance with Section 5.1.2:

$$P_C \geq 0.6 \cdot P_D \quad (16)$$

APPENDIX A – NORMATIVE REFERENCES

A1 The following normative references shall be used in conjunction with the requirements herein and together shall govern the wind load design, construction, and rating of HVACR Equipment within the scope of this standard.

A1.1 ADM1-2015, *Aluminum Design Manual: Part 1 – A Specification for Aluminum Structures*, 2015, Aluminum Association, 1400 Crystal Drive, Suite 430, Arlington, VA 22202.

A1.2 AHRI Standard 1060 (I-P)-2018, *Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment,* 2018, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.3 AHRI Standard 1230-2014, *Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment (with Addendum 1),* 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.4 AHRI Standard 210/240-2017, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment,* 2017, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.5 AHRI Standard 310/380 (CSA-C744-17)-2017, *Packaged Terminal Air-conditioners and Heat Pumps,* 2017, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.6 AHRI Standard 340/360-2019, *Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment,* 2019, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.7 AHRI Standard 390 (I-P)-2003, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*, 2003, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.8 AHRI Standard 430 (I-P)-2014, *Performance Rating of Central Station Air-handling Unit Supply Fans (with Addendum 1),* 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.9 AHRI Standard 550/590 (I-P)-2018, *Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle (with Errata),* 2018, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.10 AHRI Standard 640 (I-P)-2017, *Performance Rating of Commercial and Industrial Humidifiers,* 2017, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.11 AHRI Standard 910 (I-P)-2014, *Performance Rating of Indoor Pool Dehumidifiers,* 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.12 AHRI Standard 920-2015, *Performance Rating of DX-Dedicated Outdoor Air System Units,* 2015, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.13 AISI S100-16, *North American Specification for the Design of Cold-Formed Steel Structural Members*, 2016, American Iron and Steel Institute, 25 Massachusetts Avenue, NW, Suite 800, Washington, DC 20001.

A1.14 ANSI/AHRI Standard 1270 (I-P)-2015, *Requirements for Seismic Qualification of HVACR Equipment,* 2015, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.15 ANSI/AHRI Standard 900 (I-P)-2014, *Performance Rating of Thermal Storage Equipment Used for Cooling,* 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.16 ANSI/AISC 360-16, *Specification for Structural Steel Buildings*, 2016, American Institute of Steel Construction, 130 East Randolph Street, Suite 2000, Chicago, IL 60601-6219.

A1.17 ANSI/AHRI/ASHRAE/ISO Standard 13256-1, 2012, *Water-to-Air and Brine-to-Air Heat Pumps — Testing and Rating for Performance*, 2012, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.18 ANSI/AHRI/ASHRAE/ISO Standard 13256-2, 2012, *Water-to-Water and Brine-to-Water Heat Pumps — Testing and Rating for Performance,* 2012, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.19 ASCE 8, *Specification for the Design of Cold-Formed Stainless Steel Structural Members*, 2002, American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191.

A1.20 ASCE/SEI 7-16, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, 2016, American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191.

A1.21 ASHRAE Terminology website https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology, 2019, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.22 IBC, *2018 International Building Code*, 2018, International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, U.S.A.

A1.23 Title 10 CFR § 430.2. Title 10, Code of Federal Regulations (CFR), Part 430.2, U.S. National Archives and Records Administration, 8601 Adelphi Road, College Park, MD 20740-6001 or www.ecfr.gov.

APPENDIX B – INFORMATIVE REFERENCES

B1 Listed here are standards, handbooks and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered as part of the standard.

None