FLORIDA BUILDING COMMISSION
INFORMATIONAL NOTICE ON WIND RESISTANCE AS IT RELATES TO MECHANICAL EQUIPMENT
NOTICE #2
February 12, 2002

In consultation with the Building/Structural Technical Advisory Committee (TAC), the Florida Building Commission staff developed information necessary to provide for an interim clarification to the intent of Section 301.13 of the Florida Mechanical Code which states "Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the Florida Building Code."

Background:

- The Florida Air Conditioning Contractors Association and Emilio Guzman filed a petition with the Florida Building Commission seeking a Declaratory Statement on an interpretation of Section 301.13 of the Florida Mechanical Code. The Petitioners concern is that currently there is no HVAC equipment available which meets the wind resistance requirements of Chapter 16 of the Florida Building Code.

- At the January Commission meeting, the Joint Mechanical and Building/Structural TACs recommended that the Commission undertake the following clarification: "Clarify that only the equipment's fastening systems (how the equipment is attached to the stand and how the stand is attached to the roof, structure, etc.) are required to be designed
meet the wind load requirements of the Code. The equipment's fastening systems, at a minimum, must be designed to resist overturning and sliding forces due to the wind pressures." The Commission debated the TACs' recommendation and decided to table the issue until further notice.

- At the last Commission meeting, February 11, 2002, the Building/Structural TAC debated the issue again and provided an interim recommendation on the subject and expressed that there is a need to work jointly with the air-conditioning industry to re-write the code requirements for possible code changes in the future and to hold a public workshop to solicit public comments on the of the issue of concern.

Staff provide the following guidance in consultation with the Building/Structural TAC:

1. Clarify that only the equipment's fastening systems (how the equipment is attached to the stand and how the stand is attached to the roof, structure, etc.) are required to be designed to meet the wind load requirements of the Code. The equipment's fastening systems, at minimum, must be designed to resist overturning and sliding forces due to the wind pressures.

2. Table 6-10, Other Structures, of ASCE 7 - 98, may be used to design the equipment's fastening/strapping system necessary to resist overturning and sliding forces due to the wind pressures. (See attached)

OR

The attached recommendations of Section 12.8.2.1, High Winds, of FEMA Coastal Construction Manual may be used as the fastening system for residential mechanical units. (See attached)

ASCE 7-98

Other Structures	All h

Table 6-10	Force Coefficients, C_r	Chimneys, Tanks & Similar Structures

Cross-Section	Type of Surface	h/D		
		1	7	25
Square (wind normal to face)	All	1.3	1.4	2.0
Square (wind along diagonal)	All	1.0	1.1	1.5
Hexagonal or octagonal	All	1.0	1.1	1.4
Round ($D\sqrt{q_z} > 2.5$) ($D\sqrt{q_z} > 5.3$, D in m q_z in N/m^2)	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 ($D\sqrt{q_z} \leq 2.5$) ($D\sqrt{q_z} \leq 5.3$, D in m, q_z in N/m^2)	All	0.7	0.8	1.2

Notes:

1. The design wind force shall be calculated based on the area of the structure projected on a plane normal to the wind direction. The force shall be assumed to act parallel to the wind direction.

2. Linear interpolation is permitted for *h/D* values other than shown.

3. Notation:

   D: diameter of circular cross-section and least horizontal dimension of square, hexagonal or octagonal cross-sections at elevation under consideration, in feet (meters);

   D': depth of protruding elements such as ribs and spoilers, in feet (meters); and

   h: height of structure, in feet (meters); and
   q_z: velocity pressure evaluated at height z above ground, in pounds per square foot (N/m^2).

Coastal Construction Manual Chapter 12, Designing the Building, pages 12-143 through 12-145.

12.8.2 Design of Exterior-Mounted Mechanical Equipment
High winds, flooding, and seismic events are the natural hazards that can cause the greatest damage to exterior-mounted mechanical and electrical equipment.

12.8.2.1 High Winds
Blowoff of exhaust fans, fan cowlings, and vent hoods commonly occurs during high winds. The resulting windblown debris can cause damage to other buildings, and water can enter the building that lost the equipment. Tearing away of the equipment typically occurs because of inadequate anchorage of the equipment to the roof, inadequate strength of the equipment itself (i.e., loss of fan cowlings), and corrosion.

Considering the small size of most exhaust fans, vent hoods, and air-conditioning units used on residential buildings, the following prescriptive attachment recommendations should be sufficient for most residences:

- For curb-mounted units, specify #14 screws with gasketed washers.
- For curbs with sides less than 12 inches, specify one screw at each side of the curb.
- For curbs between 12 and 24 inches, specify two screws per side.
- For curbs between 24 and 36 inches, specify three screws per side.
- For buildings within 3,000 feet of the ocean, stainless steel screws are recommended.

For units that have flanges attached directly to the roof, attachment with #14 pan-head screws is recommended. A minimum of two screws per side, with a maximum spacing of 12 inches o.c., is recommended.

If the equipment is more than 30 inches above the curb, the attachment design should be based on calculated wind loads. ASCE 7-98 does not provide adequate guidance for determining equipment loads. Until such criteria are provided, the following approach is recommended:

- Assume a negative (i.e., uplift) load on the top of the equipment, a negative (i.e., suction) load on one side of the equipment, and a positive load on the opposite side of the equipment.
- Apply the loads to the longest side of the equipment.
- Consider the equipment as partially enclosed.
- Use component and cladding coefficients (consider the top of the equipment as the roof, and the sides as walls).
- Select coefficients for the field of the roof and field of the wall (i.e., do not use perimeter or corner coefficients).

Until equipment manufacturers produce more wind-resistance equipment, job site strengthening of fan cowlings and vent hoods is recommended. One approach is to use 1/8 inch diameter stainless steel cables, as shown in Figure 12-113. Tow or four cables are recommended, depending on design wind conditions. Alternatively, additional, heavy straps could be screwed to the cowling and curb.

Figure 12-113
Typhoon Paka (1997), Guam. Stainless steel cables for strengthening fan cowlings and vent hoods. (Not available.)

To avoid corrosion problems, nonferrous metal, stainless steel, or steel with minimum G-90 hot-dip galvanized coating is recommended for the equipment itself, equipment stands, and equipment anchors when the equipment is on buildings located within 3,000 feet of the ocean. Stainless steel fasteners are also recommended.

12.8.2.2 Flooding
Flood damage to mechanical equipment is typically caused by failure to sufficiently elevate equipment as shown in Figure 12-114. Figure 12-115 shows proper elevation of an air-conditioning condenser in a floodprone area.

Figure 12-114
Hurricane Georges (1998), U.S. Gulf Coast. Mechanical equipment damaged as a result of insufficient elevation. (Not available.)

Figure 12-115
Proper elevation of mechanical equipment in a floodprone area. (Not available.)

Outdoor or exposed mechanical equipment for one-to-four family residental buildings will normally be limited to the following:

- air-conditioning condensers
- ductwork (air supply and return)
- exhaust fans
- well pumps

Flood waters can force mechanical equipment from its supports and sever its connection to mechanical or electrical systems. Mechanical equipment can also be damaged or destroyed by inundation in flood waters, especially salt
(end of page 12-145)