2.7 ENCLOSURES BELOW THE DESIGN FLOOD ELEVATION

Enclosed areas that are used solely for parking of vehicles, building access, or storage shall be permitted below the DFE, provided the enclosed areas meet the requirements of this section.

2.7.1 Required Openings in Foundation Walls and Walls of Enclosures

Foundation walls and exterior walls that form enclosures below the DFE that do not meet the dry-floodproofing requirements of Section 6.2 shall contain openings to allow for automatic entry and exit of floodwaters during design flood conditions. Openings shall meet the requirements of Section 2.7.2 and Section 2.7.3.

2.7.1.1 Openings in Breakaway Walls

Openings to allow for automatic entry and exit of floodwaters during design flood conditions shall be installed in breakaway walls in all flood hazard areas. Openings shall meet the requirements of Section 2.7.2 and be installed in accordance with Section 2.7.3.

2.7.2 Design of Openings

Openings shall meet the non-engineered opening requirements of Section 2.7.2.1 or the engineered opening requirements of Section 2.7.2.2. Installation of all openings shall meet the requirements of Section 2.7.3.

2.7.2.1 Non-Engineered Openings

Non-engineered openings shall meet the following criteria: (1) The total net open area of all openings shall be at least 1 sq ft for each sq ft of enclosed area, where the enclosed area is measured on the exterior of the enclosure walls; (2) openings shall not be less than 3 in. in any direction in the plane of the wall; and (3) the presence of louvers, blades, screens, and faceplates or other covers and devices shall not block or impede the automatic flow of floodwaters into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

2.7.2.2 Engineered Openings

Engineered openings shall meet the following criteria:

1. Each individual opening shall be designed to allow automatic entry and exit of floodwaters during design flood or lesser flood conditions;
2. The performance of engineering openings shall account for the presence of louvers, blades, screens, grilles, faceplates, or other covers and devices;
3. Openings shall not be less than 3 in. in any direction in the plane of the wall;
4. The performance of engineered openings shall ensure that the difference between the exterior and interior floodwater levels shall not exceed 1 ft;
5. In the absence of reliable data on the rates of rise and fall, assume a minimum rate of rise and fall of 5 ft/h; where an analysis indicates the rates of rise and fall are greater than 5 ft/h, the total net area of the required openings shall be increased to account for the higher rates of rise and fall; where an analysis indicates the rates of rise and fall are less than 5 ft/h, the total net area of the required openings shall remain the same or shall be decreased to account for the lower rates of rise and fall; and
6. The minimum total net area of the required openings in enclosure walls shall be calculated using the equation

\[ A_c = 0.033 \left( \frac{1}{c} \right) \left( R / A_e \right) \]

where

- \( A_c \) = the total net area of openings required (in.²)
- 0.033 = coefficient (in.² · h/ft³) corresponding to a factor of safety of 5.0
- \( c \) = opening coefficient of discharge given in Table 2-2
- \( R \) = worst case rate of rise and fall (ft/h)
- \( A_e \) = the total enclosed area (ft²).

2.7.3 Installation of Openings

Installation of openings shall meet the following criteria:

1. Each enclosed area shall have a minimum of two openings.
2. Openings shall be in at least two walls of each enclosed area.
3. The bottom of each opening shall be no more than 1 ft above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening, and
4. Openings meeting requirements of Section 2.7.2.1 or Section 2.7.2.2 that are installed in doors and windows are permitted.