Non-Engineered Opening Guide

To Assist in the Compliance and Measurement Documentation of Non-Engineered Flood Openings for the Elevation Certificate in accordance with the National Flood Insurance Program

# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Definitions Related to Flood Openings</td>
<td>4</td>
</tr>
<tr>
<td>Flood Opening Requirements</td>
<td>5</td>
</tr>
<tr>
<td>Non-Engineered Opening Identifier Notes</td>
<td>7</td>
</tr>
<tr>
<td>Non-Engineered Opening Identifier</td>
<td>8</td>
</tr>
<tr>
<td>Additional Resources</td>
<td>23</td>
</tr>
</tbody>
</table>

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To comment on this Guide or if you have identified a Non-Engineered Opening device that is not listed please contact:

**Smart Vent Products, Inc. | Carolina Flood Solutions**  
Phone: (800) 507-0129  
fieldguide@floodvent.com

For Non-Engineered Opening vents not listed: send pictures of the vent, dimensions and any markings identifying the manufacturer. The field guide committee will review your submission and work to include the vent in a future edition of the Field Guide.

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Sign up to receive automatic updates to this guide by sending an email to fieldguide@floodvent.com
INTRODUCTION

NFIP Floodplain Management Requirements 44 CFR 60.3 C (5)

Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.

This guide was developed by the collaborative efforts of Flood Risk Evaluator (F.R.E.), a division of Smart Vent Products, Inc., and Carolina Flood Solutions. A third party engineer conducted an independent evaluation of each Non-Engineered Opening vent included in this guide. Each vent was drawn to scale in AutoCAD® providing a 1/64th of an inch accurate calculation.

The guide assists Surveyors, Floodplain Management & Construction Officials, and Insurance Professionals with identifying the net free area of Non-Engineered Openings found in the field. Utilizing this guide to identify the net free area a Non-Engineered Opening vent provides will ensure sections A8 & A9 of the Elevation Certificate are accurately completed which will provide clear evidence of whether the structure is complying with the flood opening requirements or not.

Non-conforming flood openings contribute to more vulnerable structures in the floodplain and increased flood insurance costs for the property owners.
DEFINITIONS RELATED TO FLOOD OPENINGS

FLOOD OPENING – A Flood Opening is a passive opening used to equalize hydrostatic loads on enclosure walls below the Base Flood Elevation. If enclosure walls are not designed to relieve the floodwater pressures with flood openings, the walls can be damaged or fail causing collapse of the building. There are two FEMA/NFIP recognized flood openings, non-engineered and engineered.

NON-ENGINEERED OPENING – A Non-Engineered Opening is an opening or air vent device that is used to meet FEMA/NFIP's requirement of 1 square inch of net open area for every 1 square foot of enclosed area.

NET OPEN AREA – The permanently open area of a Non-Engineered Opening intended to provide automatic entry and exit of floodwaters. The measurement of the net open area must take into consideration any obstructions to the flow of flood water such as grills, fixed louvers, or faceplates.

ENGINEERED OPENING – An Engineered Opening is a mechanical opening, which is activated during a flood revealing an unobstructed area for which floodwater can flow through to equalize the hydrostatic loads on the enclosure wall. These openings are performance tested and certified to cover a square footage amount.

BASE FLOOD – The flood having a 1-percent annual chance of being equaled or exceeded in any given year. The Base Flood is the national standard used by the NFIP and all Federal Agencies for the purposes of requiring the purchase of flood insurance and regulating new development.

BASE FLOOD ELEVATION (BFE) – The height of the base flood in relation to a specified datum.

ELEVATION CERTIFICATE (OMB No. 1660-0008) – A form developed by FEMA to collect surveyed elevations and other information about a building that is necessary to obtain flood insurance. In addition is used by municipalities to regulate construction in the floodplain.

ENCLOSURE – Areas created by a crawlspace or full height solid walls that fully enclose areas below the BFE.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) – The Federal Agency that, in addition to carrying out other activities, administers the National Flood Insurance Program.

INTERNATIONAL CODE COUNCIL EVALUATION SERVICE (ICC-ES) – The ICC-ES is a nonprofit company that performs technical evaluations of building products, components, methods, and materials. After performance testing the evaluation process culminates with the issuance of technical Reports, which act as the products certification stating that they meet all of the Acceptance Criteria for the category. Acceptance Criteria (AC-364) has been established for Mechanically Operated Engineered Flood Vents. Products certified as to meeting this criteria are recognized by FEMA/NFIP.

ALERT: Building Codes require all foundation openings to be covered with a rodent screen. Therefore, all open runs and air vent devices that have fixed rodent screens that do not mechanically open to reveal an unobstructed area during a flood will be classified as Non-Engineered Openings.
FLOOD OPENING REQUIREMENTS

Compliant flood openings are required in all enclosed areas below the Base Flood Elevation in Special Flood Hazard Area Zones starting with A and V. For every 1 sq. ft. of enclosed area, 1 sq. in. of net free area is required if Non-Engineered Openings are used. If Engineered Openings are used, 1 sq. in. is converted to 1 sq. ft. Note that square footage of an enclosed area is measured from the outside of the walls.

Each enclosed area is required to have a minimum of two flood openings on different walls.

The bottom of each opening shall not be more than 1 foot above the highest of the final interior grade or finished exterior grade immediately under each opening.

Flood Openings are to provide passive hydrostatic relief to walls; human intervention is not acceptable to activate a flood opening. Therefore, any air ventilation devices that can be closed manually must be permanently disabled in the open position. Covers are not acceptable at any time over a Non-Engineered opening. If the Non-Engineered opening device has not been disabled in the open position or has a cover over the opening the result will be a "0" flood coverage rating for that opening. Standard foundation air ventilation devices that are designed to open and close based on temperature, Windows, and Entry & Garage Doors are not acceptable flood openings. See page 19 of FEMA Technical Bulletin 1-08 for a list of Unacceptable Measures.

Flood Openings must be below the BFE for them to perform their intended function. If any portion of the opening is above the BFE that area shall be deducted from the flood venting coverage the opening provides.

**Warning:** Debris is a fact of flood and because of rodent screens and other grills, Non-Engineered Openings have a tendency to clog. Clogged openings can lead to a build up of hydrostatic pressure causing walls to fail. When possible, professionals recommend to use ICC-ES Certified Engineered Flood Openings to ensure performance.
ASCE 24-14 Commentary C2.7.2.1

Any louvers, blades screens, and faceplates or other covers and devices should be selected or specified so as to minimize the likelihood of blockage by small debris and sediment. Where experience has shown that a particular device or type of device has been blocked or clogged by flood debris or sediment, use of such devices should be avoided.

Clogged Air Vent Image credit FEMA Technical Bulletin 1, 2008

"Non-Engineered Openings: Communities that administer the International Building Code® (IBC®) or the International Residential Code® (IRC®) should note the requirement to cover ventilation openings to keep animals and insects from entering. These codes provide a list of acceptable covering materials. The commentaries that accompany those codes note that some covering materials may reduce the gross open area of the vent by as much as 50 percent. In areas where floodwaters are expected to carry debris such as grass clippings and leaves, it is notable that screens tend to clog. Local officials may determine that additional openings are required to increase the likelihood that openings will perform as expected, even if some become clogged with debris.” TB-1 pg.20
Non-Engineered Opening Identifier Notes:

Flood opening documentation is done in sections A8 and A9 of the Elevation Certificate.

Openings and ventilation devices that can be manually closed, have a cover over them, or insulation stuffed behind them result in a “0” net free area rating. Crawlspace hatches with the door or cover left off during inspection result in a “0” rating as it is known that the door or cover will be installed over the opening after the inspection.

Only those portions of openings that are below the BFE can be counted towards the required net open area.

If you identify a Non-Engineered Opening in the field that is not identified below please email pictures of the opening or device, dimensions, and manufacturer distinguishing marks to fieldguide@floodvent.com. The identified opening or device will be located and will be drawn to scale in AutoCAD to provide you with a net open area.

Note: It’s recommended to have the owner of the building sign a Non-Engineered Opening Agreement acknowledging that the Non-Engineered Openings must remain in the open position at all times. Attached to this guide is an example of an agreement for your use. Submitting a copy to the municipality will assist them with their floodplain management efforts.
Material
White Plastic

Dimensions
Width: 15.56 inches
Height: 7.94 inches (excluding flange)

Net Open Area
52.04 sq. in.

Figure 1

Material
Black Plastic

Dimensions
Width: 17.5 inches
Height: 9.5 inches

Net Open Area
44 sq. in.

Figure 2
**Figure 3**

**Material**
Concrete

**Dimensions**
Width: 15.5 inches
Height: 7.5 inches
(excluding flange)

**Net Open Area**
32 sq. in.

---

**Figure 4**

**Material**
Concrete Block Turned Side Ways

**Compliancy Notes**
If used must have rodent screen attached per ICC Construction Codes.

**Dimensions**
Width: 15.5 inches
Height: 7.625 inches

**Net Open Area**
59 sq. in.
Material
Cedar

Dimensions
Width: 15.81 inches
Height: 8.0 inches

Net Open Area
29 sq. in.

Figure 5

Material
Pictured: black plastic, brown plastic version also

Compliancy Notes
Temperature Controlled Louvers
Unacceptable Measure.
REF pg. 19 TB1

Dimensions
Width: 15.125 inches
Height: 7.5 inches

Net Open Area
0 sq. in. for flood opening documentation
Figure 6

Figure 6
Material
Metal

Compliancy Notes
Solid metal door must be removed or NET open area is 0.

Dimensions
Width: 15.75 inches
Height: 7.5 inches

Net Open Area
64 sq. in.

Figure 7

Material
Black Plastic

Compliancy Notes
Closing Slider must be permanently disabled in OPEN position.

Dimensions
Width: 15.75 inches
Height: 7.5 inches

Net Open Area
45 sq. in.

Figure 8
### Material
- Metal
- Grey Plastic

### Compliancy Notes
- **Material**
  - Metal
  - Grey Plastic

- **Closing Slider** must be permanently disabled and locked into the OPEN position.

- **Foam Inserts** cannot be used. If they are, results in 0 rating. Flaps must be removed.

### Dimensions
- **Width**: 15.75 inches
- **Height**: 7.5 inches

- **Width**: 16.0 inches
- **Height**: 7.3125 inches

### Net Open Area
- **42 sq. in.**
- **73 sq. in.**

---

**Figure 9**

**Figure 10**

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*Non-Engineered Opening Guide*  
*Vol. 2 / November 2015*
Material
Metal

Dimensions
Width: 13.5 inches
Height: 7.125 inches

Net Open Area
82 sq. in.

Figure 11

Material
Metal

Dimensions
Width: 15.38 inches
Height: 7.38 inches

Net Open Area
30 sq. in.

Figure 12
### Material
- Metal

### Dimensions
- **Width:** 15.56 inches
- **Height:** 7.94 inches (excluding flange)

### Net Open Area
- 52.04 sq. in.

**Figure 13**

---

### Material
- Aluminum

### Dimensions
- **Width:** 14.5 inches
- **Height:** 6.59 inches

### Net Open Area
- 43 sq. in.

**Figure 14**
<table>
<thead>
<tr>
<th>Material</th>
<th>Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliancy Notes</td>
<td>Slider must be permanently disabled into the OPEN position or NET open area is 0.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Width: 15.56 inches</td>
</tr>
<tr>
<td></td>
<td>Height: 7.94 inches (excluding flange)</td>
</tr>
<tr>
<td>Net Open Area</td>
<td>52.04 sq. in.</td>
</tr>
<tr>
<td>Figure</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Brown Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliancy Notes</td>
<td>Solid vent cover must be removed or NET open area is 0.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Width: 15.1 inches</td>
</tr>
<tr>
<td></td>
<td>Height: 7.6 inches</td>
</tr>
<tr>
<td>Net Open Area</td>
<td>65 sq. in.</td>
</tr>
<tr>
<td>Figure</td>
<td>16</td>
</tr>
</tbody>
</table>
Material
Black Iron

Dimensions
Oval Area: 60.99
Max Width: 16.25 inches
Max Height: 8.50 inches

Net Open Area
19.5 sq. in.

Figure 17

Material
White Metal

Dimensions
Width: 12 inches
Height: 11.88 inches
(Excluding flange)

Net Open Area
32.4 sq. in.

Figure 18
Material
White Metal

Dimensions
Width: 12 inches
Height: 11.88 inches (Excluding flange)

Net Open Area
32.4 sq. in.

Figure 19

Material
White Plastic

Dimensions
21.5 inches Diameter
17.25 inches Diameter (excluding flange)

Net Open Area
52 sq. in.

Figure 20
### Material
- **White Plastic**

### Dimensions
- **Width:** 17.73 inches
- **Height:** 17.73 inches (excluding flange)

### Net Open Area
- **54 sq. in.**

---

### Material
- **White Metal**

### Dimensions
- **Width:** 12 inches
- **Height:** 17.88 inches (excluding flange)

### Net Open Area
- **43.2 sq. in.**
Material
White Plastic

Dimensions
Width: 11 inches
Height: 15.94 inches
(excluding flange)

Net Open Area
42 sq. in.

Figure 23

Material
White Plastic

Dimensions
Width: 16 inches
Height: 24 inches
(excluding flange)

Net Open Area
88 sq. in.

Figure 24
### Material
White Metal

### Dimensions
**Width:** 11 inches  
**Height:** 11 inches (excluding flange)

**Net Open Area**  
30 sq. in.

---

### Material
White Plastic

### Dimensions
**Width:** 16 inches  
**Height:** 16 inches  
(excluding trim flange)

**Net Open Area**  
54 sq. in.

---

**Figure 25**

**Figure 26**
Material
White Plastic

Dimensions
Width: 14 inches
Height: 20 inches
(excluding trim flange)

Net Open Area
93 sq. in.

Figure 27

Material
Black Plastic

Dimensions
Width: 16 inches
Height: 16 inches

Net Open Area
109.9 sq. in.

Figure 28
<table>
<thead>
<tr>
<th>Material</th>
<th>Black Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>Width: 24 inches</td>
<td>Height: 24 inches</td>
</tr>
<tr>
<td>Net Open Area</td>
<td>246.26 sq. in.</td>
</tr>
</tbody>
</table>

Figure 29

<table>
<thead>
<tr>
<th>Material</th>
<th>Black Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>Width: 32 inches</td>
<td>Height: 12 inches</td>
</tr>
<tr>
<td>Net Open Area</td>
<td>135.8 sq. in.</td>
</tr>
</tbody>
</table>

Figure 30
Material
Galvanized Steel and Aluminum

Compliancy Notes
These Louvers can be pivoted closed either by hand or by the force of flood water. This causes the opening to be covered over, resulting in a "0" rating. If louvers are removed, use the Net Open Area without louvers listed below.

Dimensions
Width: 15.125 inches
Height: 7.875 inches

Net Open Area
With Louvers: 0
Without Louvers: 96.25 sq. in.

Figure 31

Material
Cast Aluminum

Dimensions
Width: 17 inches
Height: 9.5625 inches

Net Open Area
48.58 sq. in.

Figure 32
Material
Galvanized Steel and Styrofoam

Compliance Notes
This device does not meet the FEMA automatic entry and exit of flood water requirements.

Dimensions
Width: 15.875 inches
Height: 8.125 inches

Net Open Area
0 sq. in.

Figure 33

Material
Galvanized Steel and Styrofoam Insert

Compliance Notes
If Styrofoam Insert is installed, the device does not meet the FEMA automatic entry and exit of flood water requirements. If Styrofoam Insert is permanently removed, use the Net Open Area without styrofoam listed below.

Dimensions
Width: 15.375 inches
Height: 8 inches

Net Open Area
With Styrofoam: 0 sq. in.
Without Styrofoam: 32.85 sq. in.

Figure 34
ADDITIONAL RESOURCES

NFIP Floodplain Management Requirements - 44 CFR 60.3 C (5)

(5) Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria: A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

NFIP Insurance Requirements - NFIP Manual Lowest Floor Guide

One of the following criteria must be met to satisfy this proper openings requirement for rating purposes:

a. A minimum of 2 openings must be present, with positioning on at least 2 exterior walls, having a total net area of not less than 1 square inch for every square foot of enclosed area. The bottom of all openings must be no higher than 1 foot above the higher of the exterior or interior grade (adjacent) or floor immediately below the openings.

b. If the enclosure floor is partially subgrade, a minimum of 2 openings must be present, with positioning on a single exterior wall adjacent to the lowest grade next to the building, having a total net area of not less than 1 square inch for every square foot of enclosed area. The bottom of all openings must be no higher than 1 foot above the higher of the exterior or interior grade (adjacent) or floor immediately below the openings.

If engineered openings are used as an alternative, the Write Your Own (WYO) Company or NFIP Servicing Agent must obtain a copy of the following documentation for its underwriting files:

a. For engineered openings designed for installation in a specific building, a copy of the certification is required. This certification will verify to community officials that the openings are designed in accordance with the requirements of the NFIP, applicable building codes, and accepted standards of practice. The original certification statement must include the design professional’s name, title, address, type of license, license number, the state in which the license was issued, and the signature and applied seal of the certifying registered design professional. In addition, this certification shall identify the building in which the engineered openings will be installed and it shall address the following: (1) a statement certifying that the openings are designed to automatically equalize hydrostatic flood loads on exterior walls by allowing for the automatic entry and exit of floodwaters; (2) description of the range of flood characteristics tested or computed for which the certification is valid, such as rates of rise and fall of floodwaters; and (3) description of the installation requirements or limitations that, if not followed, will void the certification; or
b. For engineered openings for which the International Code Council Evaluation Service, Inc., has issued an Evaluation Report, a copy of the Evaluation Report is required. The Evaluation Report identifies the model numbers of the engineered openings addressed in the report, specifies the number of engineered openings that are required for a specified square footage of enclosed area below the BFE, and lists installation requirements. Acceptable documentation must include the model numbers of the engineered openings, which must match the model numbers provided in the International Code Council Evaluation Report.

2015 International Residential Code Requirements - R322.2.2 & R322.2.2.1

R322.2.2 Enclosed area below design flood elevation.

2. Be provided with flood openings that meet the following criteria and are installed with accordance with section R322.2.2.1:

2.1. The total net area of openings shall be not less than 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area where the enclosed area is measured on the exterior of the enclosure wall, or the openings shall be designed as engineered openings and the construction documents shall include a statement by a registered design professional that the design of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in section 2.6.2.2 of ASCE 24.

2.2. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.

R322.2.2.1 INSTALLATION OF OPENINGS. The walls of enclosed areas shall have openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.

2. The bottom of each opening shall be not more than 1 foot (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.

3. Openings shall be permitted to be installed in doors, and windows; doors and windows without installed openings do not meet the requirements of this section.
2015 International Building Code Requirements - Section 1612.5 1.2

1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.6.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.6.2.2 of ASCE 24.

ASCE/SEI 24-14 – Flood Resistant Design and Construction (2.7)

2.7.1.1 Openings In Breakaway Walls

Openings to allow for the 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 installed in accordance with section 2.7.3.

C2.7.2 Design of Openings

Flood openings can be engineered or non-engineered but should safely allow equalization of hydrostatic pressure outside and inside any enclosure below the DFE. FEMA Technical Bulletin 1, Openings in Foundation Walls and Walls of Enclosures (FEMA 2008d) has an expanded discussion of opening requirements.

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 in. 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.

2.7.2.1 Engineered Openings

Engineered Openings shall meet the following criteria:

1) Each individual opening shall be designed to allow automatic entry and exist 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.

C2.7.2.2 The NFIP and building codes require the design of engineered openings to be certified by a registered design professional. Certification requires more than simply applying the equation in this section; it requires consideration of a number of factors that represent expected base flood conditions. Worst case rates of rise and fall must be determined, opening shape and size (which affect flow efficiency) must be assessed, the potential for debris blockage must be evaluated, and the effect of any louvers, blades, screens, grilles, faceplates or other covers and devices must be considered. The best means to certify performance is to test engineered opening devices under
conditions that mimic a range of rising and falling floodwaters, preferably floodwaters that contain debris typical of floodwaters around buildings.

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.

C2.7.3 Openings and opening devices may be distributed around the perimeter of an enclosed area and may be grouped. If grouped, whether side-by-side or stacked vertically, the installation requirements apply. If stacked vertically, a closely space group of openings or opening devices can be assumed to function as a single opening and the bottom of the lowest opening or opening device should be positioned to meet the height-above-grade requirement.
NOTES
Non-Engineered Opening Agreement
for Owners of Structures in a Special Flood Hazard Area: A and V type zones

Subject Property Address:

Lot and Block Number:

Property Owner Name(s):

Property is in compliance with Non-Engineered Opening requirements? Yes □ No □

The property owner acknowledges and agrees to the following:

1. That they are an owner of the above property.

2. That they understand that the flood openings identified on the Elevation Certificate under section A8 and A9, when applicable, are Non-Engineered Openings intended for hydrostatic flood relief.

3. That they must remain open at all times and cannot be covered, closed off, or blocked in any way.

4. That modifications to these openings could result in a greater risk to their property and personal safety in addition to increased Flood Insurance costs.

5. At the time of the flood opening survey this property required ______ square inches of net open area. ______ Non-Engineered Openings were identified providing ______ square inches of flood venting relief.

Date __________________________ Signature of Property Owner

Date __________________________ Signature of Property Owner

DISCLAIMER: A copy of this agreement will be sent to the local municipality office for floodplain management purposes.
DEMO LUTION PLAN - PART II - FIRE PROTECTION

PLAN FIRE PROTECTION DEMO NOTES

1. EXISTING UPRIGHT TYPE SPRINKLER HEADS AND PIPING ARE SHOWN FOR REFERENCE ONLY. CONTRACTOR SHOULD VERIFY LOCATION AND QUANTITY PRIOR TO HYDRAULIC CALCULATIONS AND FABRICATION IS BEGUN.

2. DISCONNECT, REMOVE HEADS AND PIPING FOR NEW HEAD LOCATIONS IN NEW CEILING TILE LAYOUT.