City of Charleston, South Carolina

Guidelines and Requirements for HVAC System Ducts Installed Below DFE in Existing Single Family Buildings

This policy is designed to assist installers of HVAC system duct works in existing buildings that are being renovated and are located in established flood zones in the City of Charleston. Installers shall use accepted engineering practices and should attempt to meet the South Carolina Residential Code and FEMA regulations. However, the City of Charleston does recognize that in some situations it is not possible or practical to fully meet those regulations. The City of Charleston Building Inspections Division must be contacted to evaluate the design and location of the duct system prior to start of installation. When at all possible, all of the HVAC system should be installed above the Designed Flood Elevation (DFE).

The following are the design requirements for duct systems installed below DFE:

- New or replaced HVAC mechanical units, compressor/condensers, and air handlers MUST be installed above DFE including zone dampers, electronic filters, dehumidifiers and other similar mechanical components.
- All ducts must be 26 gauge (min) sheet metal, round or rectangular, mechanically connected and taped/sealed per standard engineering practices.
- No flex ducts or fiber board constructed ducts allowed below DFE.
- Ducts located in unconditioned spaces must maintain a R-8 (min) insulation value.
- Ducts must be coated and sealed to provide wet flood proofing with a material that is on the approved list of products meeting the City of Charleston Test Procedures.
- All ducts below DFE will need to be secured to the underside of the building to resist damage, movement, and counteract buoyancy. Building Inspections Division will inspectors will determine compliance at on-site inspections.
- Wet flood proofing to be uniformly applied to the minimum thickness as determined from the testing requirements. Material thickness will be randomly checked during on-site inspections.
- Areas where coated ducts are subject to damage, such as above crawlspace openings, in garages or storage areas hanging below 6’8’’ in height above the floor, and other areas of high traffic and exposure.

For information on having a product tested for inclusion on the City of Charleston approved list, contact the City of Charleston Building Inspections Division for details.

Testing Application and Test Results for Wet Flood Proofing of HVAC Ducts

Applicant: Shelter, LLC Date: 10/17/21

Contact: Steve Blackburn Email: _____

Phone Number: (843) 514-2381 Cell Number: _____

Product Name/Description: SWD Quik-Shield 118 Spray-applied Polyurethane Foam

Application Method/Procedures: Spray applied with intumescent coating approx R 6.6/inch

Application Thickness Required: 2" + Insulation R-Value: 13

Test Data and Results:

Test Sample Number: #2

Start Date& Time of Test: 10/17/21 1800 hrs. Finish Date & Time of Test: 10/20/21

Weight of assembly dry (prior to submersion): 1lb 12oz Weight after submersion: 1lb 12 oz

Flame Spread Index: 25< Smoke Developed Index: 450 or <

Actual Thickness (min) of sample coating: 2½" Moisture/water interior: Yes (No)

Signs of Coating degradation: Yes (No) 1% or Less increase in Weight: (Yes) No

Test Results: (Acceptable) Unacceptable Test Site Location: Hanahan SC

Test Conducted By: Gary R. Pope Signature: Gary R. Pope

Rev: 1/24/21

Note:

Flame test OK

Testing Application and Test Results for Wet Flood Proofing of HVAC Ducts

Applicant: SES Foam LLC / Carolina Custom Air Date: 1/24/2021

Contact: John McCurry Email: johnmccurrycca@gmail.com

Phone Number: Cell Number:

Product Name/Description: Nexseal / Nexseal LE Spray Polyurethane Foam (SPF)

Application Method/Procedures: Nexseal 2.0 spray foam insulation is a spray-applied, two components, closed cell polyurethane foam insulation system compliant with ASTM C-1029 Type II foams. Foam is spray-applied on-site uniformly onto metal duct wrapped with fiberglass insulation with reflective

Application Thickness Required: 2" (min) Insulation R-Value: 7.2 R/in

Test Data and Results:

Test Sample Number: #1

Start Date& Time of Test: 1/20/21 1400 hrs Finish Date & Time of Test: 1/23/21 1400 hrs

Weight of assembly dry (prior to submersion): 108 oz Weight after submersion: 108 oz

Flame Spread Index: less than 25 Smoke Developed Index: less than 450

Actual Thickness (min) of sample coating: 2" Moisture/water interior: Yes/**No**

Signs of Coating degradation: Yes/**No** 1% or Less increase in Weight: **Yes**/No

Test Results: **Acceptable**/Unacceptable Test Site Location: Hannahan, SC

Test Conducted by: Gary R. Pope, CBO Signature:

Rev: 1/24/21

Note!
Flame test OK

City of Charleston, South Carolina
Testing Procedures for HVAC ducts to be installed below Design Flood Elevation

Scope

The intent of the testing procedures is to determine if prescribed wet flood proofing procedures provided on HVAC ducts to be installed below the Design Flood Elevation (DFE) meet the intent of Section 602.4 of the South Carolina Mechanical Code and the documents referenced in that section (ASCE 24 & FEMA P-348). As stated in the South Carolina Mechanical Code and the referenced documents, ducts should be installed above the DFE when possible as the first preference. However, we do recognize that in some situations that it may be infeasible to install ducts above the DFE particularly in renovation projects in older buildings. This testing procedure is designed to test for the ability to prevent water from entering the test sample of the wet flood proofed duct, ability to sustain the waterproof condition for up to 72 hours of submersion, and the ability for the ducts and protective enclosures to not sustain damage after submersion for 72 hours. There does not appear to be a recognized test for this condition that has been adopted in the previously mentioned Codes.

Therefore, this test is for use by the City of Charleston Building Official to determine if ducts constructed consistent with the approved method of wet flood proofing as the submitted test sample will meet the requirements as stated in Section 602.4 of the South Carolina Mechanical Code. Type testing and modeling are accepted engineering procedures for this type of situation. On-site testing would be very impractical anddifficult to accomplish.

Test Sample

The test sample provided shall meet the following requirements:

- The test section of duct shall be 18 to 24 inches in length consisting of at least one elbow and two duct seams or joints. Duct shall be either 6 inch round or 4 inch/ 14-inch rectangular duct 26-gauge sheet metal. All joints and seams shall meet the requirements of Section 603.9 of the South Carolina Mechanical Code and be constructed to SMACNA HVAC Duct Construction Standard – Metal and Flexible. All joints shall connect with screws or fasteners typical of types to be used on proposed installation and shall be taped and sealed as required by Code and shall have the elbow end of the duct capped and sealed. The Opposite end shall be left open for visual examination during testing. Details shall be provided with the test sample.
- Wet flood proofing material / coating shall be uniformly applied and will be measured for thickness at three points around the duct in an area of least amount of coating. Specifications of coating material including smoke and fire related data shall be provided with test sample. Installation detailsshall be provided with the test sample.

Test Procedures

- The test sample will be suspended vertically in an approximate 30-gallon container with the open end of the sample pointing upward for visualization. The sample will be restrained to counteractbuoyancy and to allow complete submersion around the sample.
- The container will be filled to a level where 12" – 16" of the sample is submerged in water. The sample will remain submerged for 72 hours.The sample will be weighed prior to submersion and after submersion allowing surface drainage ofthe water (approximately 10 – 15 minutes).
- After submersion, the sample will be examined for any presence of water on the interior of thesample.
- Core sample will be taken to determine actual coating thickness at three locations around the sample at a location representative of the minimum thickness of area submerged during testing.

Test Results Evaluated

- Any presence of water on the interior will be considered as unacceptable.
- An increase of more than one per cent (1%) in weight after submersion will be consideredunacceptable.
- The minimum thickness of the coating core sample will be established as the tested and requiredminimum thickness for future application requirements.
- Any visual signs of degradation of the wet flood proofing exterior coating, during the 72-hour testing, including but not limited to; delaminating, separation, softening, dissolving, absorbing, or other disfigurement will be considered unacceptable.
- Material coating must meet minimum requirements of ASTM E-84 for Flame Spread and SmokeDeveloped

Summary

- This procedure is considered as "type testing" and will consider duct installations completed consistent with the prescribed methods of the approved samples as meeting City of Charleston requirements for wet flood proofing of HVAC ducts. Coatings shall meet minimum thickness requirements and must be the same product brands and specifications of tested samples.
- Only 26-gauge minimum sheet metal ducts, round or rectangular, will be acceptable for below DFE. Ducts installed below DFE need to resist intrusion of flood waters and be resilient to damage from floating objects typical of flooding conditions. No flexible duct or fiberboard style duct will be acceptable.

Summary (continued)

- Ducts installed below DFE will need to be secured to resist movement both from lateral flood forces and from buoyancy. Inspector judgement will determine acceptability of the installation procedures.
- Ducts installed in non-climate controlled locations will need to meet insulation requirements fornon-climate controlled areas (R-8).
- Data will be maintained by the City of Charleston on approved methods of meeting HVAC duct wetflood proofing.
- Samples submitted for testing will become property of the City of Charleston Building InspectionsDivision.
- Request for sample testing must be sent to the City of Charleston Building Inspections Division. Testing will be conducted within two weeks of when samples are submitted including all requireddata and information. Results will be disclosed as acceptable or unacceptable only.

What are the requirements for ducts that are installed between floor joists on an elevated building?

he National Flood Insurance Program (NFIP) requires that the heating, ventilation, and air conditioning (HVAC) system in new construction or Substantial Improvement in a Special Flood Hazard Area (SFHA) be elevated above the base flood elevation (BFE) or designed so that floodwaters cannot infiltrate or accumulate within any component of the system.

All structural and nonstructural building components at or below the BFE must be constructed of materials resistant to flood damage. Flood damage-resistant materials must be used for all building elements subject to exposure to floodwaters, including floor joists, insulation, and ductwork. Building components that do not use flood damage-resistant materials must be elevated above the BFE. A *flood damage-resistant material* is defined as any building material capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. Prolonged contact is defined as contact with floodwaters for a minimum of 72 hours and significant damage refers to any damage requiring more than low-cost cosmetic repair (such as painting). The cost of repair should be less than the cost of replacement for the material or system. This requirement applies regardless of the expected or historical flood duration.

The NFIP does not recommend installing ductwork below the BFE in new construction or Substantial Improvement located in an SFHA. There is no known cost-effective technique for designing air ducts to keep floodwaters from entering or accumulating within the system components during a flood. If ductwork must be installed below the BFE, it should be minimized as much as possible. The ducts must be composed of impermeable and watertight material, such as welded seamless ductwork or large-diameter PVC pipe. Such material is expensive, but practical when a short length of ductwork descends below the BFE.

In a Coastal High Hazard Area, structures in the Coastal A Zone (areas in Zone A that are subject to wave heights more than 1.5 feet) and Zone V can be significantly damaged by wave action. In Zone V, the lowest horizontal structural member must be installed at or above the BFE. Anything below the BFE is regarded as an obstruction and can result in increased flood insurance premiums. Ductwork below the BFE should be avoided at all costs in Zone V and Coastal A Zones because it is difficult to design and construct a ductwork system that will sustain not only the hydrostatic loading, but also the additional hydrodynamic, wave forces and debris impact loads in these flood zones.

For more information on this topic, see:

- FEMA. 2001. *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*. NFIP Technical Bulletin 11. Washington, DC, November 2001.
- FEMA. 2008. *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*. NFIP Technical Bulletin 2. Washington, DC, August 2008.
- FEMA. 2010. *Substantial Improvement/Substantial Damage Desk Reference*, FEMA P-758. Washington, DC. May 2010.
- FEMA. 2010. *Home Builder's Guide to Coastal Construction*. FEMA P-499. Washington, DC. December 2010.
- FEMA. 2017. Protecting Building Utility Systems from Flood Damage: Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems. FEMA P-348, Edition 2 Washington, DC, February 2017.
- National Archives and Records Administration. 2017 44 Code of Federal Regulations Ch. 60.3(a) through (ef), "Flood plain management criteria for flood-prone areas." Washington, DC. October 2017

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