

APPENDIX I: CRITICAL SYSTEMS

Boiler, Furnace and Forced Air Heating Systems

Many components to heating systems are vulnerable to flood damage. Relocating boilers, furnaces or other forced air systems to an upper story is ideal but may not be practical. If relocation is infeasible, try to elevate as high as possible at the current location. Property owners should consider required equipment clearances and venting before determining if and where to relocate. Systems using a storage tank require the tank to be anchored to resist buoyancy and lateral loads.

Clearances

Before relocating equipment, ample consideration must be given to minimum clearances required for equipment, conduits, piping and duct work in order to maintain the recommended horizontal and vertical clearances as required by building code, the National Electric Code (NEC) or as recommended by manufacturers. Designing for the minimum clearance is important to maintain air circulation; to meet insurance or code requirements related to the equipment's requirements; and to maintain distance from combustible building materials. The use of heat shields as specified by code may reduce clearance requirements. Failure to maintain clearances can result in safety issues, such as fire, and can void equipment warranties.

Electrical Panels

Electrical panels should be relocated above the DFE. If a location above the DFE cannot be readily accessed, panels may be located in a closet within a living space. An emergency service disconnect may need to be incorporated into the system to meet National Electrical Code requirements. Relocation may also require significant rewiring to bring up to code. To protect against temporary inundation encapsulated strategies may be used, as discussed below.

Encapsulate Electrical Equipment

Stainless steel enclosures provide a certain degree of flood protection for equipment below the DFE. However, this is only intended for temporary protection during a flood event due to the fact that enclosures can fail after prolonged submersion. Enclosure does not provide guaranteed protection against water damage. Wiring should be encased in a non-corrosive metal or plastic conduit when allowed by code.

Fuel Tanks

When located below the DFE, fuel tanks should be contained within dry floodproofed enclosures per ASCE 24, be bolted down, or heavy enough to resist buoyancy pressure of water and debris. Above-grade vents for below grade storage tanks must be located a minimum distance above the DFE to prevent fuel contamination of water and vice versa. When fuel tanks are located above the DFE in interior spaces, their enclosure must comply with the Department of Building and Fire Code requirements. This may require up to a three-hour rated enclosure within an additional fire-rated enclosure, as well as additional structure to support the new loads.

Structural Implications

It is important to consider the weight of the mechanical equipment (referred to in technical terms as the dead load) on the building structure when elevating equipment to a higher floor. The additional load may require structural reinforcement of the space where the equipment is being relocated.

Sump Pump

Sump pumps help to remove flood waters below grade in combination with other mitigation measures. Installation of the pump may require demolition of a portion of the basement floor. Install a sump pump with a battery backup system to keep the pump working in the event of a power failure. To be effective, the sump pump needs to be away from the basement walls and have positive drainage away from the building.

Tankless Water Heater

When relocating a traditional water heater is not feasible, tankless water heaters should be considered. Tankless water heaters are located adjacent to the fixture that requires heating, and work instantaneously but providing little storage capacity. Therefore, they take up less space making it easier to retrofit buildings using these systems. Natural gas systems require little work for conversion, though electrical systems may require upgrades to provide more power for the system.

Venting

Oil- or gas-fueled boilers, furnace and water heaters require adequate combustion air and venting of exhaust gases. Venting requirements may affect if and how equipment can be elevated. Use of impact resistant louvers is required.

Washer/Dryer Units

Elevation of these systems to an upper story or attaching them to a permanent pad or platform will prevent becoming risk to debris force. However, it will not prevent damage to the equipment.

Water Heaters

As with all systems, the safest option is to elevate the water heater above the DFE, though relocation will require additional plumbing and electrical work. Oil or gas-fired heaters will require ventilation. Water heaters often require a small pad or platform to sit upon.

SOURCES

- American Society of Civil Engineers. 2005. Flood Resistant Design and Construction. ASCE Standard ASCE 24-05.
- American Society of Civil Engineers. 2010. Minimum Design Loads of Buildings and Other Structures. ASCE Standard ASCE 7-10.
- Federal Emergency Management Agency. 2008. Flood Preparation and Safety.
- Federal Emergency Management Agency. 2008. P-942 Mitigation Assessment Team Report: Hurricane Sandy in New Jersey and New York.
- Federal Emergency Management Agency. 2011. FEMA P-55, Coastal Construction Manual, Fourth Edition.
- Federal Emergency Management Agency. 2012. P-259 Engineering Principles and Practices of Retrofitting Floodprone Residential Structures, Third Edition.
- Federal Emergency Management Agency. 2013, June. Preliminary Work Maps.
- Federal Emergency Management Agency. 2013. RA3 Restoring Mechanical, Electrical, and Plumbing Systems.
- Federal Emergency Management Agency. 2014. P-312 Homeowner's Guide to Retrofitting, Third Edition.
- Federal Emergency Management Agency. Flood Insurance Rate Maps (FIRMs) <http://www.region2coastal.com/preliminaryfirms>.
- International Code Council. 2012. International Building Code.
- New York City. 2011. PlaNYC: A Greener, Greater New York.
- New York City. 2013. Special Initiative for Rebuilding and Resiliency.
- New York City Fire Department. Fire Code. <http://www.nyc.gov/html/fdny/html/firecode/index.shtml>.
- New York City Mayor's Office. 2013. Emergency Order to Suspend Zoning Provisions to facilitate Reconstruction in Accordance with Enhanced Flood Resistant Construction. Executive Order No. 230. http://www.nyc.gov/html/om/pdf/eo/eo_230.pdf.
- NYC Department of Buildings. 2013. Building Code, Appendix G.
- NYC Department of City Planning. 2011. Vision 2020: The New York City Comprehensive Waterfront Plan. www.nyc.gov/waterfront.
- NYC Department of City Planning. 2011. Zoning Handbook.
- NYC Department of City Planning. 2013. Flood Resilience Zoning Text Amendment. http://www.nyc.gov/html/dcp/html/flood_resiliency/index.shtml
- NYC Department of City Planning. 2013. Designing for Flood Risk.
- NYC Department of City Planning. 2013. Urban Waterfront Adaptive Strategies.
- NYC Department of City Planning. 2014. New York City Zoning Resolution.
- NYC Department of City Planning. 2014. Primary Land Use Tax Output Lot (PLUTO) 14v1
- NYC Department of Finance Mass Appraisal System. 2013.
- NYC Department of Information Technology and Telecommunication. Orthophoto Base Map
- NYC Housing Recovery Office. 2013. Post-Sandy Housing Reconstruction Analysis.
- NYC Office of Emergency Management. Ready New York: Flooding. http://www.nyc.gov/html/oem/html/ready/flooding_guide.shtml.

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