Can equipment be located below the BFE and still be compliant? Well, yes. At least that’s the answer according to the NFIP requirements. Whether it can actually be done in real life is the question I’d like you to ponder today.

Have you ever had a builder or property owner try to convince you that it’s OK to put a heat pump or other building service equipment below Base Flood Elevation (BFE)? I have, but we’ll get to my story later. If you haven’t looked at your building code or local floodplain management ordinance in a while, the NFIP provision I refer to might not readily come to mind. I always express profound respect for the folks who, more than 40 years ago, wrote the National Flood Insurance Program (NFIP) regulations on which much of what we do is based: 44 Code of Federal Regulations Part 60. But this requirement about equipment has had me scratching my head for more than 30 years.

The requirement is in 44 CFR § 60.3(a)(3) where the broad goals for development and buildings are found (see below). Section 60.3(a)(3) is where “reasonably safe from flooding” is stated, along with other broad goals for new construction and substantial improvements. As with most regulations, broad goals are first established, followed by the details that will bring about the desired results. The NFIP regs are set up the same way: § 60.3(a) sets the goals and, depending on whether detailed analyses were conducted to produce the Flood Insurance Rate Map (FIRM) and depending on the nature of flooding, the details are found in § 60.3(b), (c), (d), and (e). [For most local officials, the designation or “level” of your ordinance doesn’t mean much, but if you’re curious: level (b) is Special Flood Hazard Areas (SFHA) without Base Flood Elevations; level (c) is SFHA with BFEs; level (d) is SFHA with BFEs and floodways; and level (e) is SFHAs that are coastal high hazard areas.]

The only place in § 60.3 where building equipment and utilities are called out is right up front with the broad goals: § 60.3(a)(3)(iv). It’s all right there; there aren’t any more details in any of the subsequent sections.

So, what does 60.3(a)(3)(iv) require? It requires equipment and utilities to be “designed and/or located” – the located part is easy. That turns into elevate (i.e., “locate”) all the equipment along with the elevated building. But what does the rest of the statement mean? What does it mean to be designed “to prevent water from entering or accumulating within the components during conditions of flooding”? And does that also mean that the equipment should function after being submerged by floodwaters?

Before we attempt to answer that question, let me point you to similar provisions in the International Code Series (on which virtually all state and local building codes are based). The International Residential Code has similar language, shown below, that requires equipment to be located at or above the elevation required for the building. An exception to that requirement allows equipment below the BFE if “designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy.” And the International Building Code, by reference to ASCE 24 Flood Resistant Design and Construction, uses similar language. The link to download flood excerpts from the I-Codes and “Highlights of ASCE 24” is shown below.
OK, so now we know that the rules do permit equipment below the BFE. But what about the rest of the question – can it actually be done? Is there equipment out there that can be submerged and still function? I think we can all agree that it is reasonable to interpret the NFIP rule to mean equipment should function after flooding – what good would it be to have equipment that is designed to prevent the entry and accumulation of water, but that didn’t function afterward?

Here’s where we pick up my story. Many years ago I was a permit engineer with the State of Maryland, working in the agency that regulates nontidal waterways and floodplains and also serves as the NFIP State Coordinating Agency. A “deep pocket” developer (haven’t we all dealt with at least one of those?) insisted he didn’t need to elevated the heat pumps for nearly 100 townhomes that he was planning for the floodplain of a large river. He didn’t contest elevating the homes (it turns out the site was so tight, he was already planning ground-level garages, which happened to put the lowest floors several feet above the BFE).

After several meetings about the heat pumps (including with the director of my agency!), I’m sure he thought he’d worn me down. Since he wouldn’t accept my “no,” I decided to exercise an option that all regulators have – the “show me” option. It’s the applicant’s responsibility to demonstrate that a proposal will satisfy the requirements. If we, as permit officials, can’t determine compliance based on the submittals, we should ask for more documentation.

All I said was this: Show me that the manufacturer states that the heat pumps will function after being submerged. Guess how long it took for us to get revised plans showing heat pumps elevated on platforms? To my knowledge, that riverfront development has flooded at least twice in the last 15-20 years. But I’ll bet none of the residents know they have my agency’s vigilance to thank for the fact they’re able to come home after floods and don’t have to call the HVAC guy to replace their heat pumps.

Now, let’s spend a minute on elevation of equipment. Have you ever permitted equipment to be lower than the lowest floor, but still compliant? This scenario might occur if the owner/builder elects to raise the home higher than required, but then installs the equipment at the minimum required elevation, the BFE. If the heat pump is flooded but the house isn’t, re-occupancy might be delayed or at least not as comfortable if flooding occurs in the dead of winter or middle of one of our record-hot summers. It only makes sense to match the equipment elevation to the lowest floor elevation. Important reminder! NFIP flood insurance policies will not be written using the best rates if heat pumps and other utilities and equipment are lower than the lowest floor, even if the lowest floor is several feet above the BFE. See my columns in the 2012 September and November editions of The Insider for more on “minus-rated” policies.
**NFIP Regulations:** 44 CFR § 60.3(a)(3) Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, (ii) be constructed with materials resistant to flood damage, (iii) be constructed by methods and practices that minimize flood damages, and (iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding. [underlining added for emphasis]

**International Residential Code:** R322.1.6 Protection of mechanical and electrical systems. Electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall be located at or above the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones). If replaced as part of a substantial improvement, electrical systems, equipment and components; heating, ventilation, air conditioning and plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

**Exception:** Locating electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones) provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided they conform to the provisions of the electrical part of this code for wet locations. [underlining added for emphasis]

**Link:**
Flood Excerpts from the I-Codes and Highlights of ASCE 24: [http://www.fema.gov/building-science/building-code-resources](http://www.fema.gov/building-science/building-code-resources)

[RCQ]