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## SECTION 312 TESTS AND INSPECTIONS

**312.1 Required tests.** The permit holder shall make the applicable tests prescribed in Sections 312.2 through 312.10 to determine compliance with the provisions of this code. The permit holder shall give reasonable advance notice to the code official when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the permit holder and the permit holder shall be responsible for determining that the work will withstand the test pressure prescribed in the following tests. All plumbing system piping shall be tested with either water or, for piping systems other than plastic, by air. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to final tests. The code official shall require the removal of any cleanouts if necessary to ascertain whether the pressure has reached all parts of the system.

**312.1.1 Test gauges.** Gauges used for testing shall be as follows:

1. Tests requiring a pressure of 10 pounds per square inch (psi) (69 kPa) or less shall utilize a testing gauge having increments of 0.10 psi (0.69 kPa) or less.
2. Tests requiring a pressure of greater than 10 psi (69 kPa) but less than or equal to 100 psi (689 kPa) shall utilize a testing gauge having increments of 1 psi (6.9 kPa) or less.
3. Tests requiring a pressure of greater than 100 psi (689 kPa) shall utilize a testing gauge having increments of 2 psi (14 kPa) or less.

**312.2 Drainage and vent water test.** A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot (3048 mm) head of water. In testing successive sections, at least the upper 10 feet (3048 mm) of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet (3048 mm) of the system, shall have been submitted to a test of less than a 10-foot (3048 mm) head of water.

This pressure shall be held for at least 15 minutes. The system shall then be tight at all points.

**312.3 Drainage and vent air test.** An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 5 psi (34.5 kPa) or sufficient to balance a 10-inch (254 mm) column of mercury. This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

**312.4 Drainage and vent final test.** The final test of the completed drainage and vent systems shall be visual and in sufficient detail to determine compliance with the provisions of this code. Where a smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be held for a test period of not less than 15 minutes.

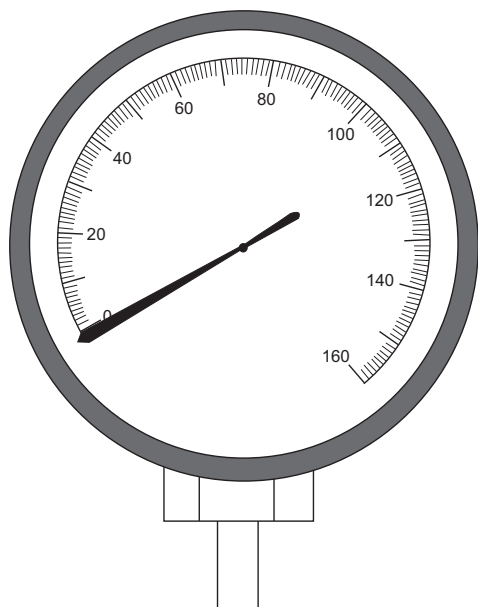
**Q:** Section 312.1 states that all plumbing system piping must be tested with either water or, for piping systems other than plastic, air. However Section 312.3 says that drainage and vents may be tested by air. It makes no mention of plastic or non-plastic pipe. It is my impression that Section 312.1 may supersede 312.3 and that only a water test can be performed on the drain or vent piping if it is plastic, but there is some disagreement locally about these testing requirements. Is testing with air permitted for plastic drainage and vent piping?

**A:** The Plastic Pipe and Fitting Association, the appropriate ASTM standards, and most manufacturers of plastic pipe warn against testing plastic pipe with air because it is a life-safety hazard. Compared to water, compressed air can release significantly greater amounts of energy if there is a failure in the piping system, with the potential for causing serious injury. One could argue that testing a DWV system with air at 5 psi presents much less of a risk than air testing water piping to not less than 50 psi. However, the intent of the code is that only water testing is permitted for plastic piping systems, as stated in Section 312.1. This requirement includes DWV piping. In cases where two code sections specify different requirements, Section 102.1 states that the more restrictive must be followed. In addition, the manufacturer's installation instructions and rec-

ommendations should always be followed. The code official would need to consider such information in determining the suitability of any alternative method to the prescribed water test. [3-18]

**Q**• Why is a gauge having increments of 2 psi required for test pressure greater than 100 psi? We are a commercial modular manufacturer and have been using gauges with 5 psi increments. These are typically smaller and easier to replace when damaged in the factory environment. We find that the smaller increment gauges are bigger, more expensive, and harder to locate. It follows that replacement would also be more costly.

**A**• The 2-psi increment gauges are necessary to provide more accurate readings to detect small drops in pressure during the test procedure. Increments of 5 psi in a smaller gauge result in very close spacing of the pressure indicators, making it



**PRESSURE GAUGE WITH  $\leq 2$  PSI INCREMENTS FOR TESTING AT  $> 100$  PSI  
FIGURE 3-19**

difficult for the installer and inspector to verify that there is no drop in pressure. See Figure 3-19. [3-19]

**Q**• We have encountered some practical difficulties regarding testing plumbing systems in modular buildings. All plumbing within the modular sections are fully tested at the factory and in accordance with the IPC. However, when the modules are stacked, there is very limited space for the installer to make the drain piping connections between floors. There is a panel in the ceiling of each lower floor to

gain access to these areas. Because there is basically only enough room to get a coupling on, adding a test fitting at this location is not feasible. Then, in order to perform the 10-foot head test, the plumber would have to stop all the fixtures and remove the water closets. This goes against the manufacturing process and defeats the purpose of factory-built structures.

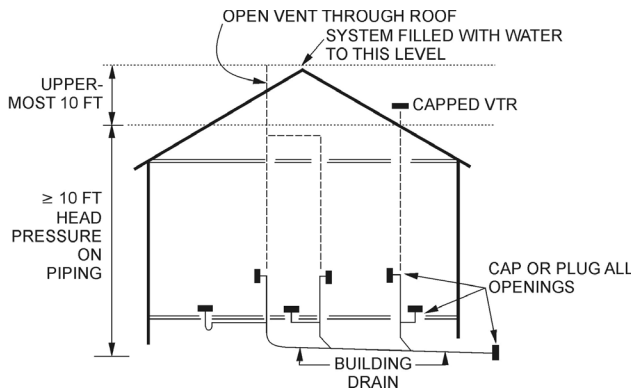
Since these connections are part of a vertical stack and not under pressure, would it be satisfactory to perform an operational test by running water down the drains from above and visually inspecting these connections?

**A**• Under IPC Section 312, the drainage and vent stacks are required to be tested, which typically occurs as part of the rough-in inspection. This means that the connections between stories of the modular buildings must be tested in the same manner that the rest of the DWV piping was tested at the factory. This creates understandable difficulty in the case of modular factory-built buildings. All of the DWV system is pretested before it comes to the job site, so the only part that remains to be tested is the mechanical coupling that connects the pipe from the upper module to the pipe in the lower module. To accomplish the code-required test, the plumbing fixtures would have to be disconnected and the piping capped or plugged to allow a water test. It does not seem like a good idea to disassemble a factory-assembled plumbing system to allow testing of such a tiny portion of the entire system. In light of these unusual circumstances and practical hardships, it seems reasonable for the code official to approve an alternative and allow a visual inspection of the module interconnection couplings under a modified test procedure. The code official is given the authority for such modifications or alternatives in Sections 105.1 and 105.2. Similar logic is expressed in the *International Fuel Gas Code* where the point of interconnection between existing gas piping and new branch piping is allowed to be excluded from the pressure test provided that such interconnection is tested by a soap bubble test or other leak-detection method. [3-20]

**Q**• Section 312.2 requires a water test of the drainage system with at least a 10-foot head of water above all sections being tested. When tested in sections, does that require an additional 10 feet from the top of the vent with a test pipe and coupling?

**A**• The 10-foot head of water describes the minimum pressure that every part of the drain, waste, and vent piping system must be exposed to during the test for leaks. The piping system may be tested in sections, or a test may be placed on the entire system at one time. There is an exception within Section 312.2 that exempts the uppermost 10 feet of the building's DWV system from being subjected to this pressure.

A common method for performing DWV testing is for the installer to plug all the openings in the DWV system except for the highest vent opening, which is usually through the roof of the structure. A water hose is placed into the vent pipe opening above the roof, and the entire system is filled with water to the point of overflowing the top of the vent pipe. The pressure in the DWV system measured at an elevation 10 feet below the top of the vent pipe represents a 10-foot head of water. The exception for this highest 10 feet of vent pipe recognizes the difficulty of installing an additional 10 feet of vertical pipe above the through-the-roof vent and bracing it in place so it can be filled with water. In addition, the highest part of the DWV system is practically all vent piping that is open to the outside atmosphere, and the actual in-service pressures in the piping at this elevation are negligible. Simply filling the last 10-foot section of pipe with water is deemed to provide adequate pressure in testing for leaks. See Figure 3-21. [3-21]



**WATER TEST ON DWV SYSTEM  
FIGURE 3-21**

**Q**• For the parts of an existing cast-iron drainage and vent system that have been replaced with PVC piping, are there any alternative test methods al-

lowed in the IPC to test the drainage system other than the water test as prescribed in Section 312.2?

**A**• Repairs and alterations to existing systems often present challenges in complying with the current codes. Section 102.4 intends to provide some relief by permitting alterations to be installed to match the existing methods of construction. Section 105.1 permits modification to the code where following the code is not feasible and the installation complies with the intent of the code and is not hazardous. Section 105.2 gives authority to the code official to approve alternatives. One alternative would be to place a smoke test on the system as described in Section 312.4. The low pressure of 1-inch water column for a smoke test may be satisfactory for the plastic piping and may give adequate assurance that there are no leaks in the drainage system. Any such alternative testing method requires the approval of the code official. Acceptance will hinge on a number of factors, including the extent of new piping in the system and the difficulty of applying a water test on a portion of an existing system. [3-22]