

Pressure Testing with Air vs. Pressure Testing with Water

Pressure testing of water mains and sewage force mains to detect leakage prior to final payment, is common construction practice. The EJP Service Department does pressure tests with either air or water, as required. We are often asked why air testing must be done at lower pressures than with water. The following questions and answers discuss the reasons for lower air test pressures.

Question: 150 (lbs./sq. inch) of water pressure equals how many (lbs./sq. inch) of air pressure?

Answer: *150 (lbs./sq. inch) of water pressure equals 150 (lbs./sq. inch) of air pressure. The force experienced on the interior of the pipe is the same for either air or water. This would be significant if a pressure test were performed to determine if the pipe had structural integrity, (i.e. will it burst during its service life?). However, this is not the purpose of a pressure test for leakage.*

Question: If the forces are the same for both air and water, why should people refuse to test to 150 (lbs./sq. inch) with air?

Answer: *It's very dangerous!!! Unlike water, which is incompressible, air is very compressible, making it hydraulically equivalent to a large mechanical spring. If something were to break or come free during a high pressure air test, the released air could propel an object a great distance with much force. This is why the necessary elimination of trapped air when initially filling pipelines can be so hazardous; air tries to move things to relieve built up pressure; water, because it is incompressible, does not.*

Question: In finding leaks, why is a low pressure (30-50 lbs./sq. inch) air test as effective as a high pressure (150 lbs./sq. inch) water test?

Answer: *The viscosity and surface tension of water are each greater than that of air. Both of these are unique forces that prevent water from escaping through a very small hole, but do not prevent air from escaping from the same small hole.*

Reasonings: Dynamic Viscosity of Water @ 40 degrees F = 0.0000323 lb. ft. per sq. ft.
Dynamic Viscosity of Air @ 40 degrees F = 0.000000363 lb. ft. per sq. ft.

So, the viscosity of water is about 89 times greater than the viscosity of air, where...Viscosity is the internal friction of water and makes it resist the tendency to flow, particularly through a small opening.

Surface Tension of a Water to Air Surface = 0.005 lb. ft./ft.
Air has no surface tension (no free surface).