

Figure 1: Ruptured water tank

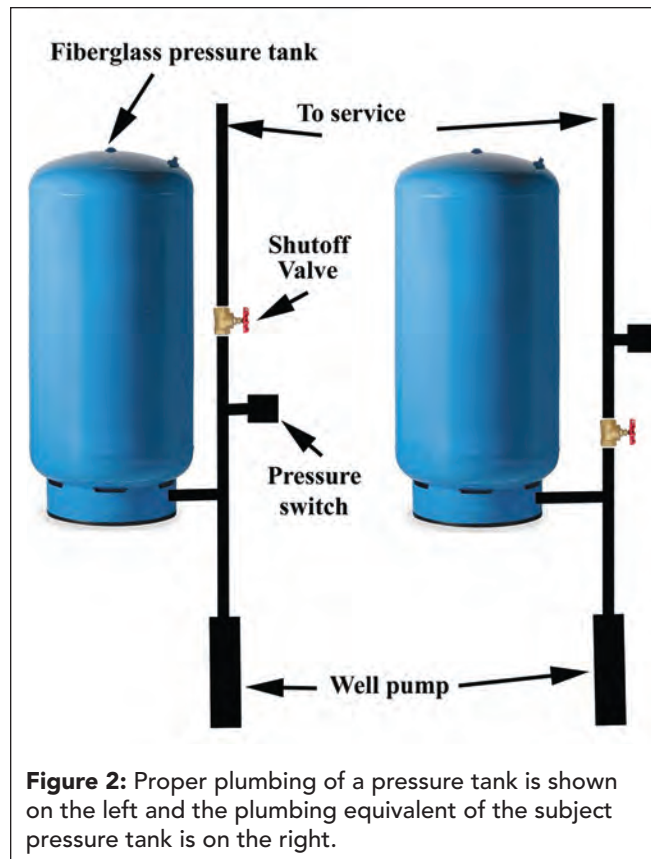


Figure 2: Proper plumbing of a pressure tank is shown on the left and the plumbing equivalent of the subject pressure tank is on the right.

# Analysis of a Domestic Water Tank Failure

By Charles C. Roberts, Jr., Ph.D., P.E.

**MANY HOMES ARE EQUIPPED** with a well, well pump and well storage tank. The well pump delivers water to the storage tank with a pressure of approximately 40 to 60 psi and is controlled by a pressure switch. In this particular case, a plumber was working on the water service piping and had closed the shutoff valve to eliminate the water pressure so that repairs could be made. Shortly afterward, the water storage tank ruptured causing extensive water damage to the home. Figure 1 shows the ruptured water tank as indicated by the arrow.

Examination of the plumbing system around the subject tank yielded an unusual array of piping. The pressure switch worked properly. The apparent cause of

the rupture was the improper placement of the shutoff valve.

Figure 2 is a simplified diagram of the improper placement of the shutoff valve in this case. The plumbing system to the left displays the typical, proper placement of the components. The pressure switch is placed such that if the shutoff valve is closed, it can still sense the amount of water pressure in the pressure tank. The plumbing system to the right, which in this case has the shutoff valve placed such that the pressure switch cannot sense the water pressure in the tank when the shutoff valve is closed.

Consequently, when the shutoff valve was closed and the water drained from the home system using a faucet valve,

the water pressure began to drop. Sensing this condition, the pressure switch turned on the well pump. This resulted in increased pressure in the water pressure tank without the shutoff protection provided by the pressure switch. This led to over-pressurization of the fiberglass tank and the failure.

The root cause of the pressure tank failure was an improperly designed plumbing system connected to the tank. However, the plumber should have recognized the deficiency, turned off the water pump and alerted the owner as to the system deficiency before performing any work. When practical, it is good practice to turn off the water pump before performing repairs.

---

Charles C. Roberts, Jr., Ph.D., P.E., (ccr@croberts.com) is president of C. Roberts Consulting Engineers, Inc., which provides professional engineering services in accident reconstruction, failure analysis, fire causation, explosion analysis, and biomechanics.