



# Coffee Break Training - Fire Protection Series

## Automatic Sprinklers: Calculating Pressure Changes Due to Temperature

No. FP-2013-REV18 April 30, 2013

**Learning Objective:** The student shall be able to calculate air pressure changes in a sprinkler system that result from temperature fluctuations.

During a dry pipe sprinkler system pneumatic test, a change in ambient temperature may cause the air in the system to expand or contract, resulting in what may appear to be an inconsistent pressure reading on the test gauge. To account for changes in air temperature, the inspector can use the following formula to assure the minimum requirement of 40 pounds per square inch (2.8 bar) has been sustained.

$$P1(T2/T1) = P2$$

Where,

P1 = gauge pressure at the start of the test (pounds per square inch gauge)

P2 = gauge pressure at the end of the test (psig)

T1 = ambient temperature at the start of the test

T2 = ambient temperature at the end of the test

It is important to note that for the formula to work, the temperatures need to be converted to the Rankine scale by adding 460 to the recorded temperature in Fahrenheit (273 for Celsius).

Here is an example in American Standard units where the temperature increases from 43 F to 78 F during the 24-hour test when the sprinkler system is pressurized to 40 psig and it is assumed that the system is at sea level. If there are no leaks in the system, the formula will provide the gauge pressure that would be expected at the end of the test.

Given,

$$P1 = 40 \text{ psig}$$

$$T1 = 43 \text{ F} + 460 = 503 \text{ R}$$

$$T2 = 78 \text{ F} + 460 = 538 \text{ R}$$

$$40(538/503) = 42.8 \text{ psig}$$

Conversely, if the temperature dropped by the same amount during the test, the results would appear as:

Given,

$$P1 = 40 \text{ psig}$$

$$T1 = 78 \text{ F} + 460 = 538 \text{ R}$$

$$T2 = 43 \text{ F} + 460 = 503 \text{ R}$$

$$40(503/538) = 37.4 \text{ psig}$$

In the second example, even though the gauge pressure reads less than the beginning 40 psig, the inspector can conclude that the system has passed the pressure test and the lower gauge reading is due to temperature fluctuations.



This air pressure gauge dropped below the 40 pounds per square inch (2.8 bar) threshold during a pneumatic test. The inspector must determine if the loss is a result of a leak or ambient temperature fluctuations.



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