U.S. Fire Administration / National Fire Academy

Coffee Break Training

Topic: Sprinkler Discharge Hydraulics

Learning objective: *The student shall be able to compute the water flow from an operating sprinkler.*

An essential skill when reviewing sprinkler system hydraulic calculations is to know how much water will flow from an open sprinkler.

The mathematical formula recognized in the fire protection standards is:

$$Q = K^*\sqrt{p}$$

Where:
Q = quantity in gallons per minute (gpm)
K = sprinkler K factor, a mathematical coefficient of its orifice size
p = flowing pressure

The photograph illustrates the orifices of two sprinklers: an Early Suppression, Fast Response (ESFR) on the left, and a standard spray sprinkler on the right. The ESFR has a K factor of 25.2 and the standard sprinkler has a K of 5.6.

Given these two sprinklers at an 85 pounds per square inch (psi) flowing pressure, how much water will each deliver?

ESFR	Standard Spray Sprinkler
$Q = K^* \sqrt{p}$	$Q = K^*\sqrt{p}$
$Q = 25.2(\sqrt{85})$	$Q = 5.6(\sqrt{85})$
$Q = 25.2\ (9.22)$	$Q = 5.6\ (9.22)$
$Q = 232.35$ gpm	$Q = 51.63$ gpm

For additional information, refer to NFPA 13, *Installation of Sprinkler Systems.*