8/8/2018 https://www.meyerfire.com/blog/compare-flow-of-k-factors-with-new-calculator

When conducting or reviewing hydraulic calculations, I very often face scenarios where the initial (very first) hydraulic demand exceeds the potential for the water supply.

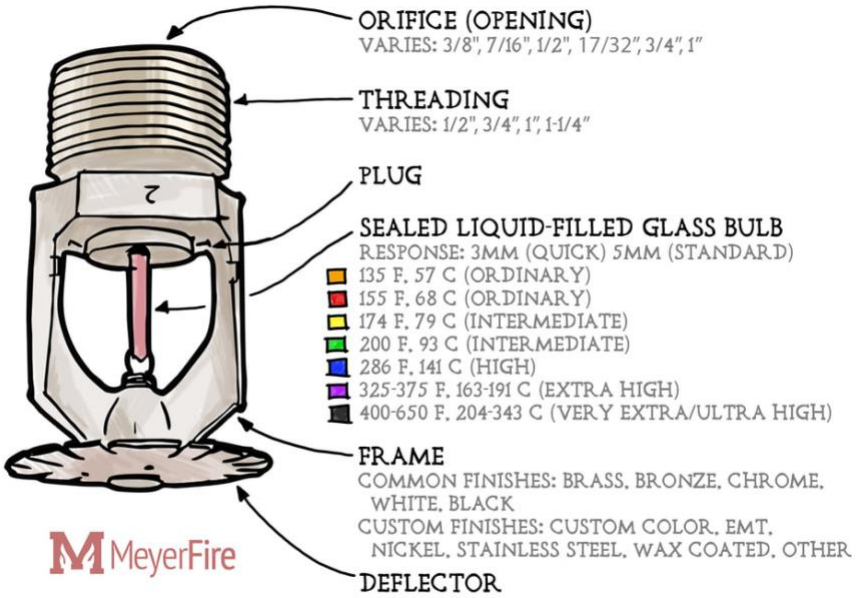
At that point I lose all hope and add a fire pump to the job.

Just kidding, of course - there's at least a half dozen hydraulic elements I analyze and refine to better match the capabilities of the water supply to the design of the sprinkler system.

Refining Hydraulic Calculations with K-Factors
One of the more fine-tooth aspects I look at is the k-factor used on the sprinklers.

The k-factor for a fire sprinkler is the *discharge coefficient*, or in normal human terms just relates to the amount of water that is permitted through the sprinkler.

The k-factor is dependent upon the orifice diameter of the sprinkler - a low k-factor (such as K2.8) restricts the flow of water, while a larger k-factor (such as K22.4, K25.2, or K28.0) permit much more water to flow through. K-factors were originally created to be multiples of the discharge of a K5.6 sprinkler. A K2.8 sprinkler, for example, is 50% discharge of a K5.6 sprinkler, while a K11.2 sprinkler is 200% of the discharge of a K5.6. NFPA 13-2016 Table 6.2.3.1 shows this well.



Use In Design

We find K5.6 sprinklers in light hazard all the time. Residential sprinklers often have k-factors less than 5.6. ESFR and CMSA require minimum K11.2 (NFPA 13-2016 6.2.3.5). ESFR are tied directly to the hazard it protects.

Back to refining the hydraulics in a system - increasing the k-factor of a sprinkler allows more water to flow through a sprinkler with less pressure loss. This becomes very important when trying to reduce pressure loss in a system.

Light Hazard Example
A light hazard system (0.10 gpm/sqft) with widely spaced sprinklers (at 225 sqft each) would require a minimum flow through each sprinkler of 22.5 gpm (0.10 gpm/sqft x 225 sqft = 22.5 gpm).

In order to flow 22.5 gpm, a sprinkler with a k-factor of 5.6 now requires 16.1 psi to do so (Q=k**√**p, or rearranged, p=(Q/k)^2). This is 9.1 psi higher than 7 psi, or the minimum that NFPA 13 requires.

In order to flow 22.5 gpm, a sprinkler with k-factor of 8.0 only requires 7.9 psi to do so, or less than 1 psi more than the minimum NFPA 13 requires.

In this scenario, flowing the same amount of water (22.5 gpm) results in a 8.2 psi difference in the pressure required at the most remote sprinkler. Can 8.2 psi be important? Absolutely!

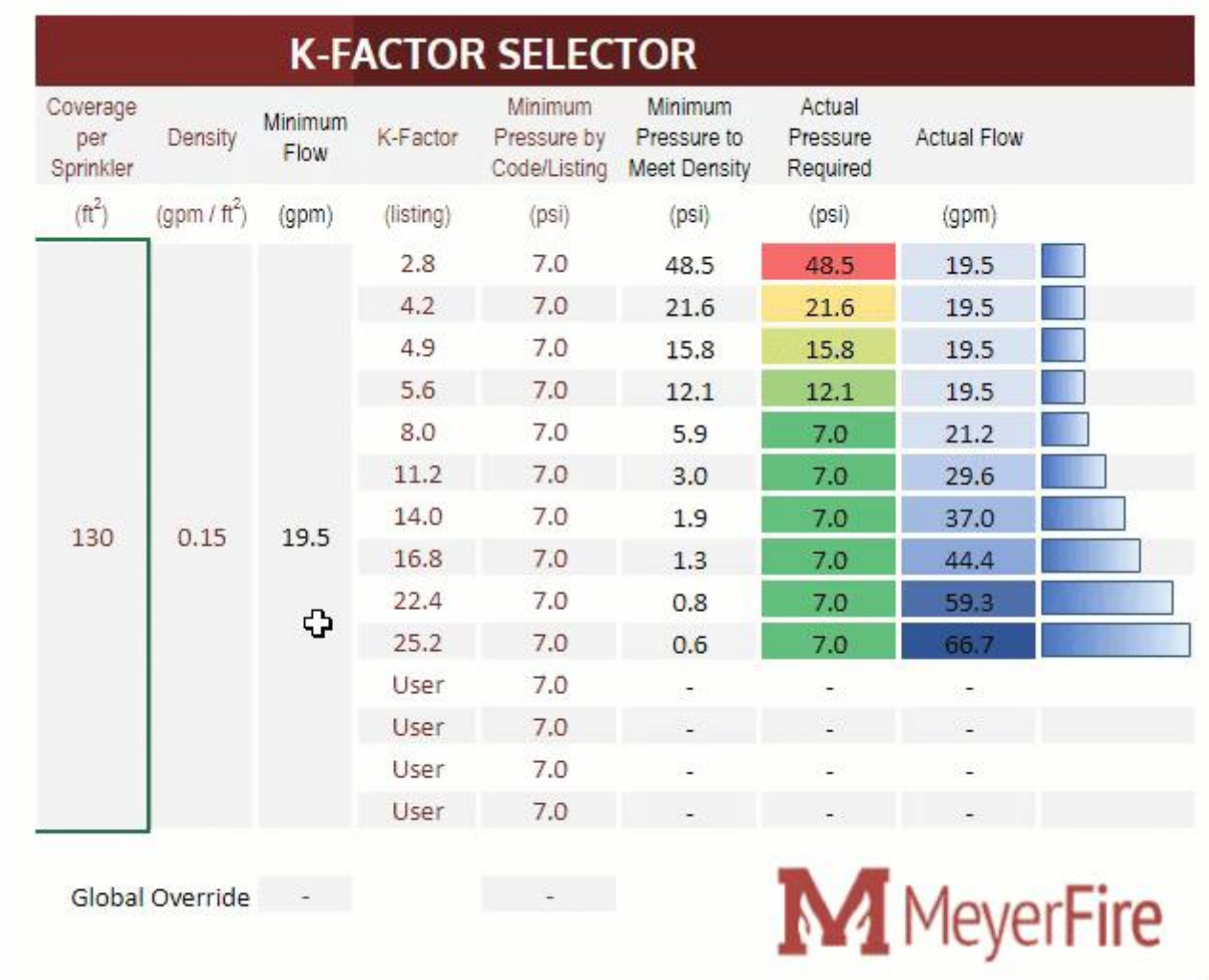
Other Scenarios
Similarly, consider Ordinary Hazard Group 1 (0.15 gpm/sqft) and Ordinary Hazard Group 2 (0.20 gpm/sqft) systems.

For Ordinary Hazard Group 1 and sprinklers spaced at 130 sqft, a K8.0 sprinkler requires 5.1 psi less than a K5.6 sprinkler (7.0 psi vs 12.1 psi).

This same methodology applies to extended coverage sprinkler requirements, specific densities for traditional storage design, and more.

The K-Factor Selector
Want to quickly compare fire sprinkler k-factors across different design densities and sprinkler spacing? Easy.

Here's the calculator I've created that quickly compares pressure requirements and flow rates across different sprinkler k-factors.



K-FACTOR SELECTOR

Coverage per Sprinkler	Density	Minimum Flow	K-Factor	Minimum Pressure by Code/Listing	Minimum Pressure to Meet Density	Actual Pressure Required	Actual Flow
(ft^2)	(gpm / ft^2)	(gpm)	(listing)	(psi)	(psi)	(psi)	(gpm)
130	0.15	19.5	2.8	7.0	48.5	48.5	19.5
			4.2	7.0	21.6	21.6	19.5
			4.9	7.0	15.8	15.8	19.5
			5.6	7.0	12.1	12.1	19.5
			8.0	7.0	5.9	7.0	21.2
			11.2	7.0	3.0	7.0	29.6
			14.0	7.0	1.9	7.0	37.0
			16.8	7.0	1.3	7.0	44.4
			22.4	7.0	0.8	7.0	59.3
			25.2	7.0	0.6	7.0	66.7
			User	7.0	-	-	-
			User	7.0	-	-	-
			User	7.0	-	-	-
			User	7.0	-	-	-
Global Override		-		-			

MeyerFire

Toolkit Update

Want all these tools in a downloadable, printable & PDF-saving capability? Great! The MeyerFire Toolkit will include this tool as well. You can download and try it out now through September for free.

Sprinkler Database

Other than the Toolkit, users of the comprehensive Fire Sprinkler Database can sort & search among k-factors as one of the parameters when comparing sprinklers.

Please Share

Do you get these articles & tools? If not, follow the fight for better fire protection by subscribing here.

Know someone that might be interested in these tools or articles? Please do me a favor and send them a link or email to share these resources. Thanks!