



Dr Kelvin Lake

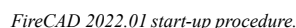
BEng (Hons) Mechanical & Manufacturing Engineering

All automatic Sprinkler systems have a hydraulic demand point which the system must comply to and not exceed. This leads to many projects having to increase pipe diameters and introduce larger pumps to operate the system within this demand point. Introducing pipework with an internal coating with a larger Hazen Williams coefficient will produce a system with a lower demand point due to the decrease in water flow restrictions, studies suggest (Brennison, M., 2003).

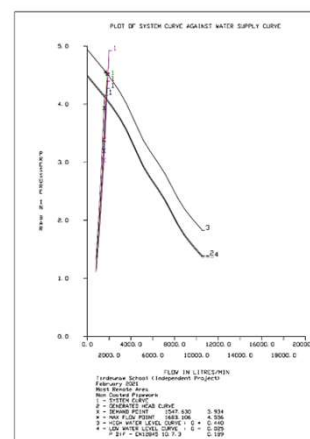
Real world potential for the introduction of favoured internal coating examined through cost analysis for materials on the Tirdeunaw Project.

Candidate	Pressure (b)	Flow (lt/min)	Velocity (m/sec)
Uncoated	3.934	1547.630	6.948
HSSC	3.020	1514.111	6.798
FBEC	3.385	1528.457	6.862
LLEPC	3.199	1521.350	6.830
IAC	3.390	1543.525	6.952

- To better understand how the internal surface quality of sprinkler system pipework effects fluid flow and pressure within the system.
- To understand how increasing the Hazen Williams Coefficient can alter and benefit the system hydraulically.
- To complete table scheme calculations, whilst manipulating pipe specifications and altering the Hazen Williams Coefficient replicating the conditions that would be implemented if an additional internal coating was applied to the pipework.



Hand Calculation hydraulic testing procedure chosen to mimic the original Tirdeunaw project to understand the real-world hydraulic implications of the introduction of the internal coatings.



Graph showing comparison of all internal coating results overlayed on the base results showing the reduction in hydraulic system demand after the introduction of each internal coating.

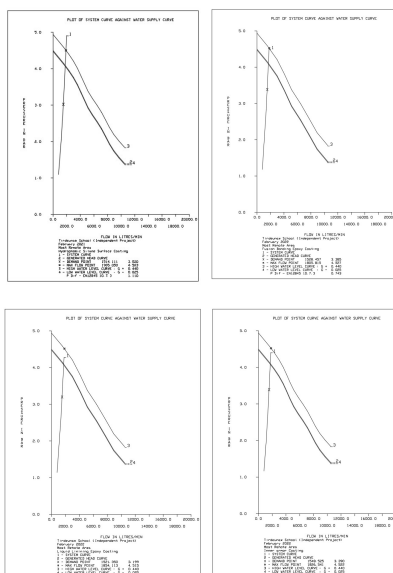
Previous studies concluded that an introduction of an internal coating or altering the pipework material with a higher Hazen Williams coefficient hydraulically benefitted a system. In order to test whether this would also be the case within a sprinkler system, firstly research into candidates needed to be undertaken and calculate their Hazen Williams (HW) coefficient (shown below). HW coefficient implemented into current Johnson control Hydraulic testing procedures. Results collated and compared to base un-coated system results.

where:

p is the pressure loss in the pipe, in bar;
 Q is the flow through the pipe, in litres per minute;
 d is the mean internal diameter of the pipe, in millimetres;
 C is a constant for the type and condition of the pipe (see Table 22);
 L is the equivalent length of pipe and fittings, in metres.

Hazen Williams Calculation for pressure loss calculation in water flow pipework. (Canutesoft.com. n.d.)

Implementing the internal coatings to the fire suppression system showed reductions in all key areas, compared to the base results with no internal coating being applied.



The introduction of all the candidates has seen reductions across all three major components. All showed reductions in pressure and total fluid flow within the systems and reduced the velocities in which the fluid to reach the targeted area of the system. The most suitable internal coating to be introduced into the system is the Liquid Lined Epoxy Coating (LLEPC) compared to the other candidates, Hydrophobic Silane Surface coating (HSSC), Fusion bonded Epoxy Coating (FBEC), and the Inner Armor Coating (IAC).

Canutesoft.com. n.d. *Hazen Williams equation for use in fire sprinkler systems*. [online] Available at: <<https://canutesoft.com/hydraulic-calculation-for-fire-protection-engineers/the-hazen-williams-formula-for-use-in-fire-sprinkler-systems>>

Brennison, M., 2003. *An Experimental Investigation of Friction Reduction In Hydraulic Tubing With an Advanced Oligomeric Silane Coating*. [online]
Gpmaintenancesolutions.com. Available at:
<https://www.gpmaintenancesolutions.com/pdf/tests/Product-Testing-AD35-Laminar-Flow-Study-Auburn-University.pdf?r=sm_rdc&_sm_rid=jn0F7fjNZHF5BnsnMZfBBR1TcVr5r7ZchOrtZ>