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WALL WETTING SPRINKLERS (DRENCHERS)

Fire and Security Consulting Services (FSCS) is frequently asked about the design of wall and window wetting sprinklers, sometimes called drenchers.

The Building Code of Australia (BCA) Part C3.2 requires certain specified separation distances between or protection of openings in external walls of buildings to prevent fire spread from one fire compartment to another. Compliance with these clauses is detailed in BCA C3.4 and Specification C3.4, including the use of "internal or external wall wetting sprinklers as appropriate".

The concept for protection is that either the distance from the fire source in the "emitter building" and/ or the sprinkler discharge on the "receiver building" surfaces will attenuate the heat flux (radiation) such that ignition of materials in or on the surface of the receiver building will be prevented. For further information on this subject refer to the paper *"Fire Spread from Openings in Sprinkler Protected Buildings*" by FSCS.

The concept is also commonly used to attenuate radiation from glazed compartments where occupant egress or fire fighter access is within proximity to the glazed opening.

Where the objective is to protect the compartment (with window) from fire / radiant heat from outside the building, the sprinkler should be installed on the outside of the window as shown in Figure 1.

Where the objective is to attenuate radiant heat from a fire within the compartment, the sprinkler should be installed in the inside of the glazing.

With respect to the type of sprinkler to be used, it is imperative that the spray pattern provides for both impingement and rundown of the water film without transom bars or mullions obstructing or interrupting the coverage.

AS2118.2, the Australian Standard for Wall Wetting Sprinklers, in Appendix C states:-

> ***"C1 – Scope*** *This Appendix sets out a test for assessing the performance of wall wetting sprinklers.*
>
> ***C2 - Rationale*** *– Where wall wetting sprinklers are used to protect glazed areas against the effects of radiant heat, the effectiveness of the system is strongly dependant on the continuity of the water film. Experiments at the Experimental Building Station (now CSIRO) have shown that dry areas are likely to crack first. The test method specified herein is therefore orientated towards the detection of potential dry areas…."*

Whilst any sprinkler can be used to "drench" window surfaces, the spray pattern is largely conical and provides little horizontal spray close to the head so the top and top corners will remain dry and wetting of the remainder of the window surface relies on "run down" of the water as referenced in AS2118.2. Note that any dry spots will negate the effect of the required attenuation.

FSCS has inspected several external window sprinkler system installations and in all cases Tyco model TY3431 Series TY-FRB sidewall sprinklers shown in Figure 1 with a 5mm bulb and usually set into recessed escutcheon plates into the eave soffit as shown circled in Figure 2.

Similar internal glazing protection has been observed using the same sprinkler recessed into the ceiling.

Figure 1 –Tyco Sidewall Sprinkler

Figure 2 - External Sprinkler Installation

FSCS has concerns regarding the efficacy of the installed systems in several respects;-

1. The recess of the sprinkler head significantly shields the glass bulb from the radiant heat effects from fire in an opposite compartment and it is likely that activation of the sprinkler will be delayed, or in the worst case scenario will not activate.
2. The Tyco TY3431 sidewall sprinkler head used is designed to be installed to provide sprinkler protection within a compartment. That is, the sidewall sprinkler is designed to be installed so that the deflector is between 100 and 300mm below the ceiling soffit and between 100 and 150mm from a wall with the deflector aimed into the room. Figure 3 shows a typical sidewall sprinkler installation.

Figure 3 – Sidewall Sprinkler Installation

3. The Tyco TY3431 sidewall sprinkler does not have any approvals or listings as a wall wetting or glazing sprinkler
4. FSCS has conducted a simple test with an identical sprinkler (Tyco TY3431) located 110mm from a window surface and 130mm down from the soffit as shown in Figure 5 below. These dimensions are within the listed criteria for installation and the running pressure was ~300kPa, within the listed operating pressure. The sprinkler was installed in line with the window mullion.

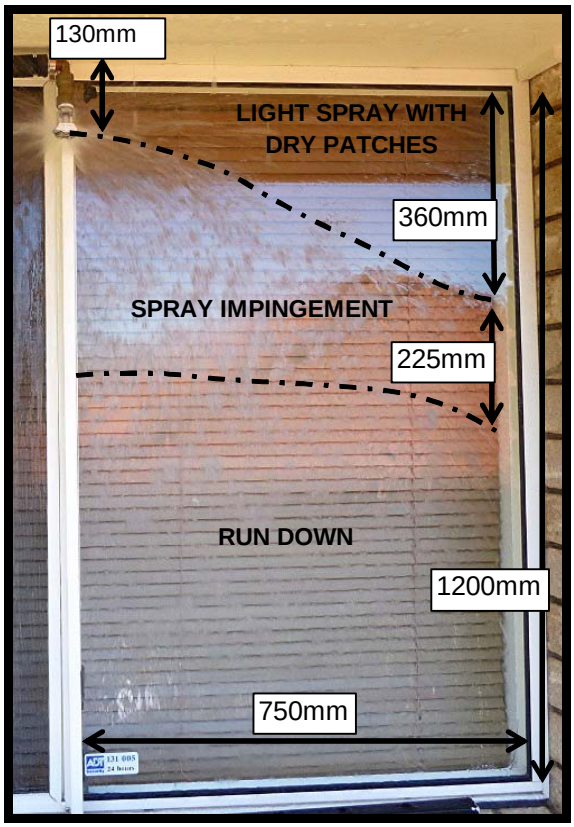

Figure 4 – Sidewall Sprinkler Spray Test

The results 4 indicate that_;

- Light spray with predominately dry patches was observed on the upper parts of the glazing.
- Direct spray impingement was observed from about 360mm down from the deflector.
- Run down occurred on the lower parts of the glazing.

Whilst not a formally implemented test, these results indicate that as discussed earlier, the requirements in AS2118.2 Appendix C would preclude this sidewall sprinkler from compliance because of the dry patches in the test.

There are listed and approved sprinklers suitable for the application, one being the Tyco Model WS sealed sprinkler. Other listings include the Viking Model C-1 and Tyco Issue A and B open sprinklers.

With respect to the Tyco WS sprinkler, the National Research Council of Canada developed and tested a method of protecting glazing in Canadian hospitals using specially developed sprinklers. There are a variety of combinations of tested assemblies available dependant on whether the glazing is inside or to the outside of the building and whether a fire source can be present on one or both sides.

Figure 5 is a representation of the Tyco WS sprinkler coverage in comparison to a standard sidewall sprinkler; note the absence of dry spots with this listed window sprinkler.

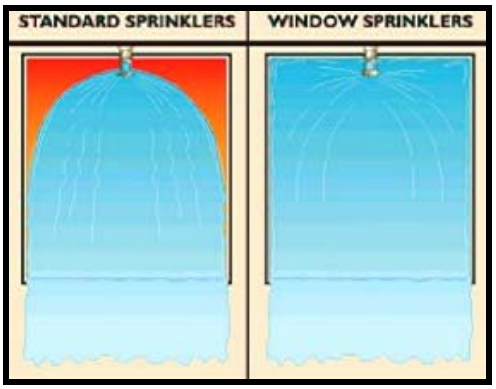

Figure 5 – Spray Pattern Comparison

Whilst the attributed fire rating of the WS sprinkler and tempered glass assembly is not relevant to this paper, the NRC reports concluded that:

> ***1. Glazed assemblies protected by sprinklers, as described, will withstand a fire exposure equivalent to that provided by the standard exposure; at least 2 h for single-glazed assemblies and at least 90 min for double-glazed assemblies.***
>
> *2. When sprinklers are installed on the fire-exposed side, both quick response and standard sprinklers respond in sufficient time to prevent tempered glass from breaking.*
>
> *3. Minimum sprinkler water flow rates to prevent dry spots on the glass appear to be 70 to 90 L/min/m width, but lower flow rates may provide sufficient protection. Window height may play a role in minimum flow rates.*
>
> *4. Tempered-glass assemblies with areas greater than five times and dimensions greater than 1.8 times those specified for wired glass in the National Building Code of Canada are able to withstand the standard fire exposure for at least 2 h if sprinklers are located on the fire-exposed side.*
>
> ***5. Radiated heat flux levels on the unexposed side are reduced by more than 90% by the window sprinkler systems used in these tests.***

Accordingly FSCS recommends that only listed and approved sprinklers are used as wall or glazing wetting sprinklers.

I trust that this paper provides useful advice on wall and window wetting sprinklers.

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