Sprinkler Systems in Malaysia: Design and Installation Guideline

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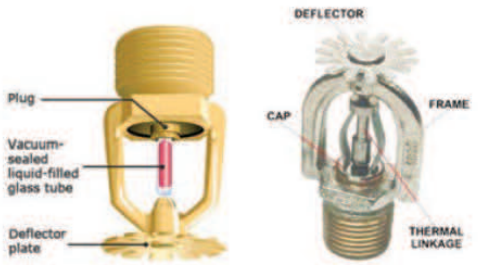
Construction of properties and businesses are becoming bigger and larger investments, so it is becoming more critical to protect these operations. As such, it is essential to have in place adequately designed and correctly installed fire protection systems. This means that, in the event of a fire, the risk of losing the business entirely and loss of human lives, can be avoided.

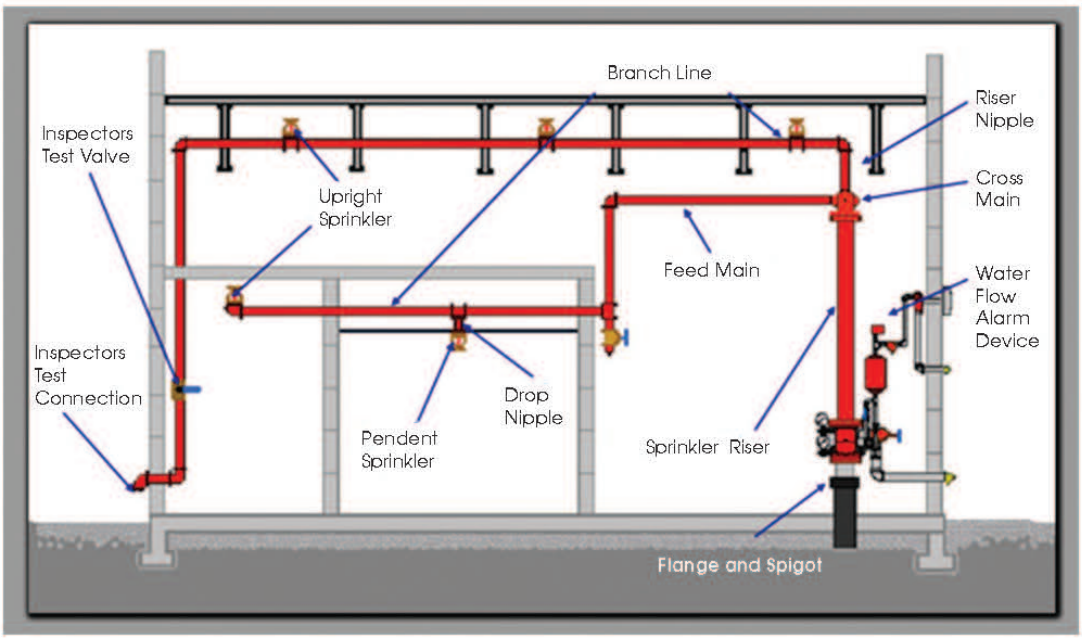
Of all the fire protection systems available, the automatic wet sprinkler system is the most widely used as it is cost effective and has proven reliable. This article serves as reference material on what to look out for when evaluating a sprinkler system.



Different types of sprinkler heads

Before we begin analysing a sprinkler system drawing, it is essential to first identify what code, standard or local rule is being applied to its design. This is because, different codes have different recommended guidelines and it is important to deduce this first to avoid complications. It is also important to verify that all parties involved in designing the system are properly trained or certified. This includes the designer, plan reviewer, installation contractor, maintenance company and any inspection personnel. Other interested stakeholders (such as investors, building operator or key tenant, brokers, insurance company, etc.) should be engaged for input as early as possible as they may have certain predetermined industrial or higher international standards to adhere to.

It is important to select the sprinkler system according to the occupancy of the building. Occupancy refers to the activities that take place in the building; these can range from a basic office to a chemical plant with hazardous processes. Every occupancy category has its own recommended sprinkler demand. Once the right demand is selected, the correct



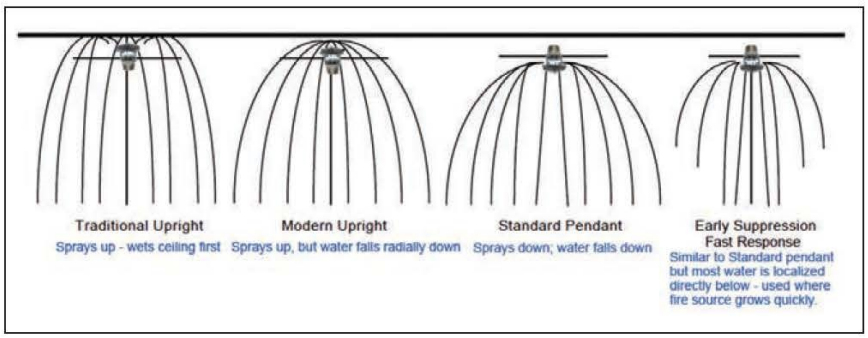
Section view of a typical wet type automatic sprinkler system arrangement (source: http://www.baylinefinre.com)

sprinkler type needs to be selected. These features include the sprinkler orifice size (K factor), response time index (RTI) rating, rated temperature and orientation (pendant, upright or side wall). The pipes, valves and fittings selected should also conform to the codes used. Other considerations could also be aesthetic (for instance, an interior designer may prefer concealed sprinklers), corrosion protection (wax coated sprinklers in waste water treatment plant), environment condition (dry pendant sprinkler to cold store rooms) or increased safety function (deluge sprinkler system to LPG tanks).

Once the demand and sprinkler type have been determined, the sprinkler drawings can then be produced. These include both on-scale plan and sectional view drawing. The main items to look out for in these drawings are as follows:

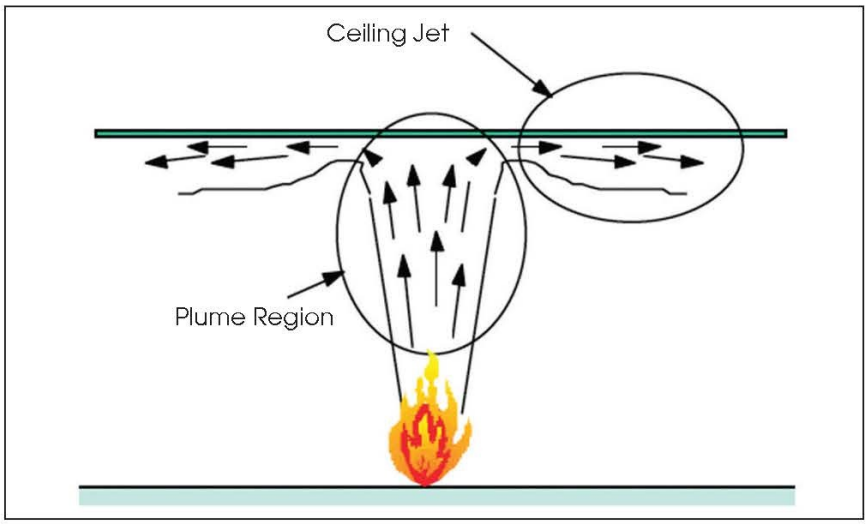
a) **Design criteria should be stated on the drawings:** The occupancy, design standard, sprinkler density, area of coverage, sprinkler type, etc. should be stated on the drawing. This serves as the basis for design verification as well as future reference when the drawings become as-built. Ideally, a summary of the sprinkler hydraulics should be tabulated on the drawings.

b) **Sprinkler head linear and area spacing.** Every sprinkler head has its own effective coverage area and the sprinkler spacing ensures that all areas on the protected floor will be covered by water discharged from the sprinkler heads in an event of a fire. For example, this can be as wide as 36.0 sq. m for extended coverage sprinklers in light occupancies down to just 9.0 sq. m maximum allowable for storage sprinklers.



Different types of sprinkler heads

c) **Vertical distance of sprinkler heads from the ceiling.** A fire creates heat and the heat plume rises to the ceiling. Sprinkler heads operate when the thermal sensing element breaks at a given temperature. When the sprinkler head is installed within the fire plume, the effectiveness of the heads to operate quickly increases.



Heat spread of a fire towards the ceiling (source: National Institute of Standards and Technology)

d) **Any obstruction to the sprinkler head discharge pattern.** Even though the horizontal spacing of sprinkler heads is within the recommended range, at times there may be elements (building members, ducts, cable conduits, lighting, etc.) within the sprinkler discharge pattern area which may affect the efficiency of water distribution and hence floor wetting. In such cases, additional sprinkler heads may need to be installed under these elements. A ceiling coordination layout drawing will be able to assist in determining if such obstructions exist.

e) **Sprinkler pipe hanger spacing.** When the sprinkler pipes are filled with water, they are subjected to added weight. The design standards usually give the recommended spacing for sprinkler pipe hangers, based on the pipe material and size. This hanger should be considered as a system, meaning the pipe hanger assembly (struts, rods, brackets, straps, etc.) and the structural member attachment (concrete anchor, beam clamp, etc.)

f) **Seismic bracing (where applicable).** Several regions in Malaysia are being recognised as earthquake prone. A seismic bracing system provides both rigidity and flexibility to the sprinkler piping, to avoid pipe swaying and breakage during an earthquake. This needs to be evaluated in the drawings as well.

Lateral and longitudinal sprinkler pipe seismic bracing (source:http:// www.naffcoflow.com)

g) **Valve location.** Automatic sprinkler systems utilise water to extinguish a fire. For water control purpose, valves are usually installed into the system. It is important to identify the location of all these control valves. The valves include the main sprinkler header (riser) and any ceiling level isolation valve. Where valves are provided, they should be installed in easy accessible locations. As a rule of thumb, valves should be within the 1.0 to 1.8 metres high for easy operation. They should be no more than 2.1 metres high and definitely not above concealed spaces, such as above ceiling.

h) **Sprinkler flow switch (water flow detection device) location.** Once a sprinkler head operates, the water flow in the pipes needs to be detected. A flow switch in the system will pick up the flow and sends a signal to the fire

alarm panel. The fire department will then be notified. For quick detection, it is recommended that the flow switch be installed just downstream of the every sprinkler header valve.

i) **Correct installation of Inspector's Test Connections (ITCs).** To ensure the sprinkler flow switch functions well, it needs to be tested. However, it is not practical to break a sprinkler head during each test. An ITC is normally tapped from the furthest branch line of the sprinkler system. A sprinkler head of similar type is then installed at the end of the pipe. This test point sprinkler head should be open and controlled by a valve. When this ITC valve is opened, it simulates one sprinkler head operating at the most remote point (worst case scenario), and the time taken for the flow switch to detect water flow and to send a signal to the fire alarm panel, is measured. Current standard calls for an alarm within 90 seconds.

j) **Crossmain flushing connections.** During the commissioning of the sprinkler system, it is recommended to flush the pipes with water to remove all debris from pipe welding, threading works or infiltrated when left on the floor. To facilitate this test, crossmain flushing connections should be installed at the end of each crossmain at the lowest point.

k) **Water supply.** All sprinkler systems need a water source. This usually comprises a pump and tank. A tank should contain the required water demand for the expected fire duration. This can be one hour for light occupancy (like an office) to several hours for high challenge fires (such as rubber tyre storage). As the pump is the heart of the system, it should be reliable and sized to provide the needed flow and pressure of the highest sprinkler demand. An internationally recognised pump would be the best bet, such as FM Approved, LPC, VdS, UL Listed pump.

Once the sprinkler drawings are produced, a head-by-head hydraulic calculation needs to be performed. This is to ensure that the water supply is able to supply adequate water, based on the resultant flow and pressure of the hydraulic calculation. The drawings and hydraulic calculation are then submitted for approval by a professional engineer and the authorities. Today, of course, there are various computer software available to do the calculations. But a designer should still be aware of the above, as proper input is crucial for the software to crunch out the desired results.

Installation works should begin only after all drawings and calculations have been reviewed and approved, and the sprinkler system components properly selected and approved. As every operation is crucial, it is important that a facility has adequate fire protection, to mitigate large fire losses. Or else, there may be financial penalties for having an improper or inadequate sprinkler installation. In the worst case, the premise could even be denied a building permit by the authorities. An investment done right initially may eliminate the need to spend a lot more in the future. ■