Aquatech Pressmain

Water Technology Pressure Maintained

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The Advantages of Fire Priority Demand Valves and the different types explained.

Fire Priority Demand Valves (PDV) have proved a useful way of helping combined residential sprinkler booster sets to meet the requirements of BS 9251. However, the release of the 2021 update to this standard has made the PDV even more beneficial. The following aims to highlight some of the hidden details and important considerations when selecting a PDV.

Improved water quality

The main use of a priority valve is to shut off the water flow to domestic water outlets during a fire sprinkler operation. By only supplying water to the sprinkler outlets the flow rate and storage requirements are greatly reduced, allowing a combined domestic and sprinkler booster pumpset to be smaller. It also allows smaller break tanks to be used reducing capital cost and helping to keep the water more wholesome.

BS 9251:2021 introduces building Category 4. This is the default standard for any building over 4 storeys or 18m height and requires a minimum sprinkler operation time of 60 minutes with a discharge density of 2.8mm/minute. Without a PDV, a combined domestic and sprinkler pumpset (and the break-tank feeding it) have to supply both the sprinkler and domestic water demands, and it becomes very difficult to meet the above requirement without exceeding the recommended maximum storage volume of 80 litres per person as outlined in BS EN 806-2:2005, Section 19.1.4 which would compromise water quality.

It is also important to remember that all fittings installed in a wholesome water system should be correctly approved for potable use, the de facto standard being the Water Regulations Advisory Scheme (WRAS) but other comparable approvals are available.

Guaranteed tank level

The next advantage of a PDV is its ability to be wired into the low water level alarm switch. This means should the tank level drop to a level where the remaining volume would be insufficient to operate the sprinklers, the priority valve can be used to stop the domestic flow and preserve a minimum level of water in a break-tank. If a PDV is not installed, the only other way of achieving this would be to inhibit the pumps. Without a constant pressure source, normal sprinkler activation methodology (i.e. a flow switch) would fail to operate meaning added complication of installing, commissioning and regularly testing an additional pressure switch in the sprinkler riser.

Types of PDV – The advantages and disadvantages

PDV's come in two standard designs: For smaller sizes, DN50 or less, it is common to see an electro-magnetic solenoid valve used; for larger sizes a rotary type such as a butterfly valve are the standard. Whilst the use of solenoid valves gives a cost saving for smaller sizes, their use does come with potential issues that should not be overlooked.

The first is valve heating. BS 9251: 2021 states that electrical PDVs should automatically close on loss of power. This forces PDV manufacturers that use electro-magnetic solenoids to use a 'normally closed' type valve, which means that, in normal operation, the coil must be energised to hold the valve open. The permanently energised electro-magnet produces heat, which in normal operation is dispersed by the flow of water through the valve; however at 3am in the morning it is doubtful that the flow would be sufficient to provide this cooling and it is extremely unlikely that the water held within such a valve will remain below the 20°C widely regarded as the safe temperature for water to remain wholesome.

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In contrast, a rotary actuator uses no power when held in a fixed position and therefore does not become warm. The requirement for the PDV to close on power loss is easily met by using a rotary valve with internal battery back-up. This means that in the event of power loss, or damage to the supply cables or controls, the valve will default to a closed position. This is the fastest way to raise the alarm when an issue has occurred and leaves the whole system 'safe'.

The next issue is Hydraulic Shock in the domestic riser. This is a phenomenon that can occur in pressure boosted risers and is caused by the pressure in the riser dropping due to supply interruption. The falling pressure causes the water to be pulled away from the top of the riser leaving a vacuum. When the water supply is restored, the created vacuum means that the rising water level is not slowed before reaching the top of riser, causing the water with significant momentum to impact the top. This in turn causes a pressure spike that had been proven to reach 200bar, often damaging the pipework or fittings and causing extensive flood damage. A solenoid PDV sharply closing at the bottom of the riser, causes these exact conditions for this to occur. The best way to prevent this is a combination of installing a combined anti-vacuum-air-release valve, at the top of the riser and by limiting the refill rate. Here a motorised PDV can help as high-end models can regulate the refill rate drastically reducing the risk of riser damage. A solenoid-based valve cannot do this as it only has two states, fully open or fully closed.

Self-testing – Ensuring the system is always ready should there be a fire.

The last consideration is controls. Most PDVs have very simple controls, and whilst there is an argument that "simple is best" this means that the only time that the PDV is actuated is during a fire or sprinkler system test. By using advanced controls, some PDVs have a daily self-test program. This partially actuates the PDV, proving that it remains fully operable whilst reducing the possibility of it sticking open. This is done in a way that does not disrupt the supply of domestic water so building occupants remain unaware. If at any time the valve does not move or operate as intended, then the alarm can be raised, and the issue fixed before it is too late.

Conclusion

To conclude, whilst PDVs have huge benefits and there is an argument to make them standard fit in all 'combined' residential sprinkler systems, it is important that system designers and specifiers have a good understanding of valve types and issues that can occur with some models. Whilst simpler solenoid-based models may be cheaper to purchase, their shortcomings should be considered.

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