

HIGH RISE - LOW PRESSURE

For plumbers fitting out high rise buildings, the battle of increasing pressure has been handled with plant rooms, but premium floor space warrants a new approach. **Deborah Andrich** investigates.

As high rise buildings become more prevalent and with ever increasing heights, the push by developers is to maximise floor space for tenants. For services this results in designs that call for smaller footprints or better still, no plant rooms.

Conventionally, water is brought in from mains to a basement plant room, where pumping systems are installed to adjust the pressures appropriately to reach storage tanks at the top levels of the building. As water is directed down through the building to each storey, pressure reduction valves would be incorporated in a single stage process.

In the past, this was sufficient for buildings that were in the order of 20 – 25 storeys.

A 36 storey building currently under construction in Sydney is pushing conventional methodologies to its limits, potentially creating noisy pipes, cavitation and reduced lifespan of the hydraulic infrastructure.

The company contracted to design the hydraulic system for the building, Wood & Grieve Engineers, had concerns about the suitability of a traditional single-stage pressure reduction system for 36 storeys.

Hydraulics principal with Wood & Grieve, David Steblina says that at 36 floors, the dynamic pressure

increase on valves to perform correctly needed to be considered. As a result, the company performed a number of tests in a simulation to verify product suitability and other options to meet the requirements of the building.

“We had to find the balance between cost and performance,” says David.

subjected to these conditions. This resulted in finding a different method for regulating the pressure.”

The investigation, initiated and led by Dr Houman Tamaddon, tested pressure reduction valves in a dual-stage configuration. A test rig was set up to replicate the pressures likely to be experienced in the building which can potentially reach 1,800kPa.

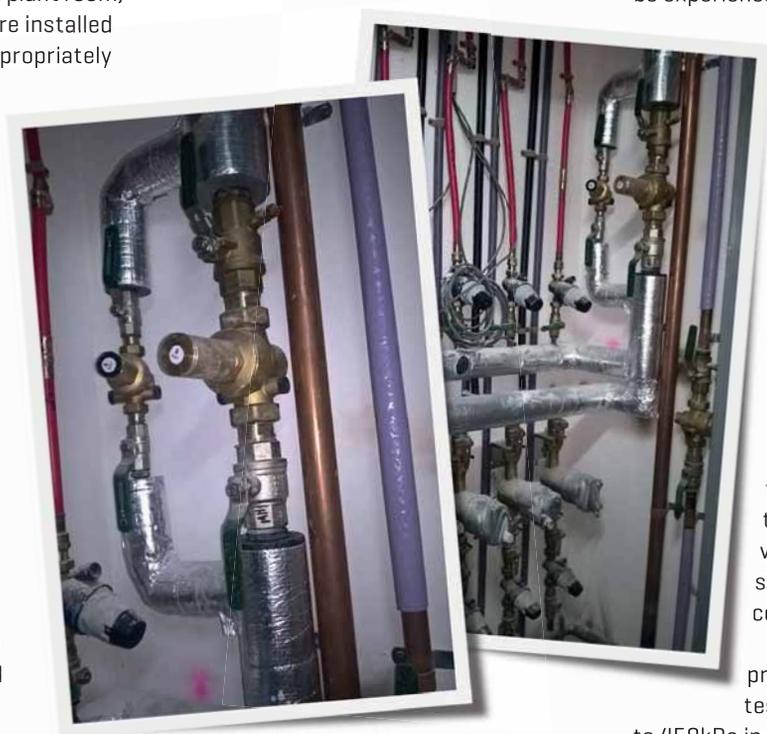
In Houman’s report on the test results, he says that a “dual-stage reduction concept was developed for the high pressure PRV [pressure reduction valve] station based on a simple concept: if the required pressure reduction ratio from the main riser pressure to the point of use is more than the optimal zone of the pressure reduction valves, implement a two-stage, serial reduction configuration.”

“To distribute the pressure reduction evenly we tested from 1800kPa down to 450kPa in a two to one ratio,” says Houman. “So it stepped down 1,800kPa to 900kPa to 450kPa.

“The first step down is still too high for most valves operating range, so a modification was needed on the valve. The second stage reduction would be suitable for standard products.”

“Operating outside normal valve range can lead to knock-on effects,” says David. “Excessive pressure can put the valves under serious stress which can create whistling, cavitation and reduced life spans.”

To develop a prototype to perform at the necessary pressure ratings, Wood & Grieve worked with Caleffi in Italy and All Valve Industries to modify the design of



Left: The hot water service is held in a separate access cabinet – first stage pressure reducing valve set in a bypass arrangement. **Right:** On Level 1, a dual-stage pressure reduction system meter cupboard arrangement for even levels incorporating first and second stage pressure reduction.

“The idea had to be cost effective, but still reliable and robust enough to deliver the performance needed. The available products that we reviewed were reported to perform, however we weren’t convinced they would not deteriorate and create noise when



Dr Houman Tamaddon, Hydraulic Project Engineer, Wood & Grieve

a direct acting pressure reduction valve that would have the capacity to be an off-the-shelf-product in the future.

The test rig used by Houman and his team allowed for individual isolation of the valves to create parallel and serial configurations. Noise levels were also recorded as part of the testing. All Pumps Sales & Service developed a pumping system to deliver a flow rate of up to 5L/s at 1,800kPa.

Using a range of flow rates and pressures, the test rig showed that a single stage setup created significantly higher noise levels than a double stage arrangement. The report concludes that "the dual stage pressure reduction valve setup can perform at considerably higher pressure ranges where the conventional single stage designs fail to deliver the required performance."

For the high rise building in Sydney, this means that a solution has been found to manage pressure reduction throughout the building without the

need for staged storage tanks. The knock-on effects that David eluded to can be minimised and noise levels within the building would be maintained to comply with the acoustic requirements for the project.

"If we didn't use this system," says David, "we would have to work out other ways and means to reduce the pressure. There are other design philosophies that could have been adopted, but I think we would have experienced more pipe work that would not necessarily be cost-effective."

The system has been designed to give a pressure reduction breakout on alternate floors, with smaller systems to cater for the next floor above.

"Using this configuration actually makes it easier for the facilities manager to maintain the system as any pressure drops can be quickly identified within a two floor location," says David. "We no longer need plant rooms at regular intervals, and access

to the valves can be achieved through a services cabinet. Ultimately it could be wired up to a BMS system for monitoring and alarm notifications."

Plumbing contractor for the Sydney apartment building, Andrew Khadi owner of AK Plumbing, is confident that Houman's design will be successful.

"It is a new way of approaching pressure reduction and it takes a bit to follow the concept, but once you understand it, it makes a lot of sense," says Andrew.

"On the odd floors, we have the pressure reduction system Houman has designed with low flow diversions to the even floors. The system will be used for the first 18 floors, after that, the pressures aren't such a problem."

The building, due to be completed by year's end is well under way and the building and plumbing contractors are confident that the solution Houman and his team found will be more than satisfactory. ■

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