IMI Hydronic Engineering

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The performance, efficiency and service life of water-based heating and cooling systems are inextricably linked to the quality of the system's water.

Several factors contribute to gas build-up within water-based systems. During the water make-up process, gases in the water, which are lighter, are transported through the system and are later released to the surface. If venting is not performed effectively air will accumulate at high points and, under pressure, will dissolve in the water again. As the water heats up, due to the temperature rise, the water solubility decreases, and dissolved gas will desorb causing bubbles to be generated that circulate within the flow.

Once commissioned, if the overall system pressure is too low, air will be drawn from the outside on a continuous basis. Common causes of under pressure within installations include expansion vessels that are too small or incorrectly located, inadequate initial pressure settings and leaky valves and connection components.

Accumulated gases in airlocks and micro and macro bubbles, together with invisible gases dissolved in the water, all threaten the efficient operation of the heating and cooling system and its lifespan. Air locks and bubbles impair water flow and, as a result, heat transfer capacity, which reduces the system's heating power performance and increases running costs. Extreme accumulation of gases also impedes circulation. Air pockets in radiators and other terminal units prevent water circulation and can dramatically reduce the power output of the unit by up to 80%. And, as a consequent, energy consumption will go up as users increase boiler temperature and pump velocity to try and address the discomfort the lower radiator emissions create. Nitrogen, the main component of air, and oxygen can also create noise in pipes and fittings and "gurgling" in radiators. And as the oxygen in the air travels through the system it can react with key metal components, including the iron and steel HVAC hydraulic system and cause rusting because of electro-chemical corrosion and the deposit of dirt and sludge.

Examples of corrosion linked to water quality

As corrosion and contaminants have a very damaging effect eliminating oxygen from the system is essential. Buildup of dirt and sludge can cause local overheating while rust particles can increase the roughness of internal pipe surfaces and diameters resulting in reduced heat transfer, increased pressure drops and fluid velocity within the hydraulic system, all of which can contribute to an increase in electrical pumping costs of up to 35% during the system's first year of operation. Rust particles that are carried along with the flow can also block valves and perforate expensive components leading to additional maintenance costs and costly unplanned shutdowns, and in the worst-case scenario, total system breakdown.

All these problems can be easily prevented by incorporating permanent air removal solutions within the system. By installing vents on the top of the heating system accumulated air can be evacuated safely and automatically. For these vents to effectively operate the water within the system must be static to avoid the accumulated air being carried through the system by the water flow. While this requirement makes air vents unsuitable for installation on flow pipes when systems are up and running, vents are an effective air elimination solution during system filling and draining and decentralized venting of radiators.

The removal of both macro and micro bubbles from flow in operating systems is best achieved using separator devices which slow the speed of the flow causing bubbles to rise and separate from the water. The separated gases are then expelled, usually by an integrated automatic air vent within the separator device. As separators are only capable of removing bubbles already present in the system they need to be installed within the system where bubbles occur naturally, either at the lowest pressure or highest temperature points.

In the case of dissolved gases, which make up a large portion of the air in a system, degassing offers the most effective solution.

For more information about or water quality range please click here