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Air in cooling and heating systems

The directly perceptible consequences of the presence of air in a sealed cooling or heating system are:
- irritating noises;
- reduced efficiency from elements.

The presence of air can also lead to:
- reduced operational life of the system as a result of internal corrosion of essential parts, such as pump, boiler and radiators;
- damage to the circulating pump, such as wear of the pump bearing, and cavitation erosion of the pump blades;
- degraded operation of the circulating pump.

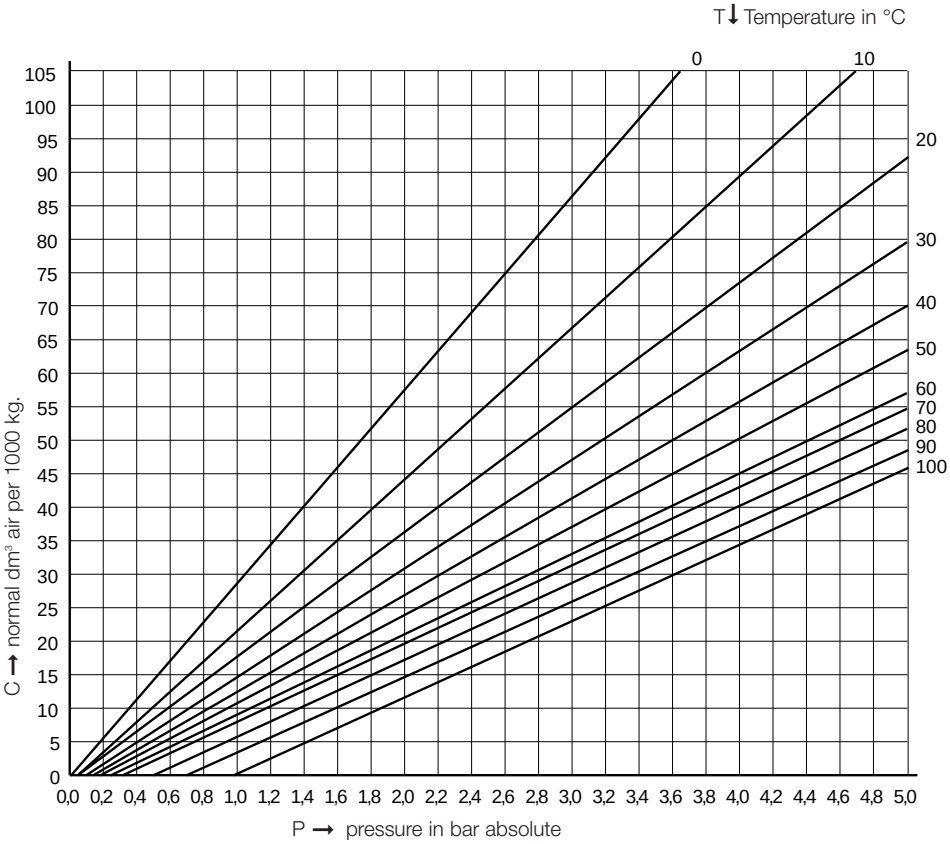
The causes of air occuring in cooling and heating systems

In order to avoid or solve the above-mentioned problems, it is necessary to analyse the causes of air being present in a system.

Air present in a cooling or heating system may consist of:
- air which is present before or during the filling of the system;
- air bubbles in the water which come to collect after the system is filled;
- air which arrives in the system in the form of bubbles or micro-bubbles entrained in the water;
- air which is dissolved in the water of the system.

The presence of air dissolved in water can be explained by reference to Henry's law.
This states that: $C = K \times P$ where

C = concentration of dissolved air
K = absorption factor (dependent on the temperature)
P = pressure



From this diagram it is apparent that the amount of air which is dissolved in water, is dependent on the temperature and the pressure. Air dissolved in water is liberated when the temperature rises or the pressure falls.

Flamco UK Limited
Unit 4, St. Michael's Road
Lea Green Industrial Estate
St. Helens, Merseyside
WA9 4WZ
Tel.: +44 (0) 1744 818100
info@flamco.co.uk

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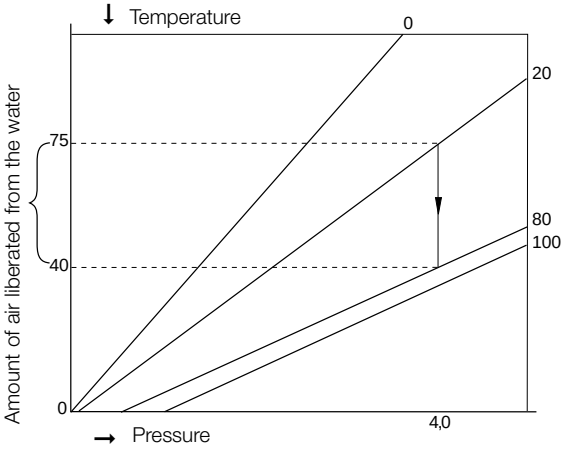
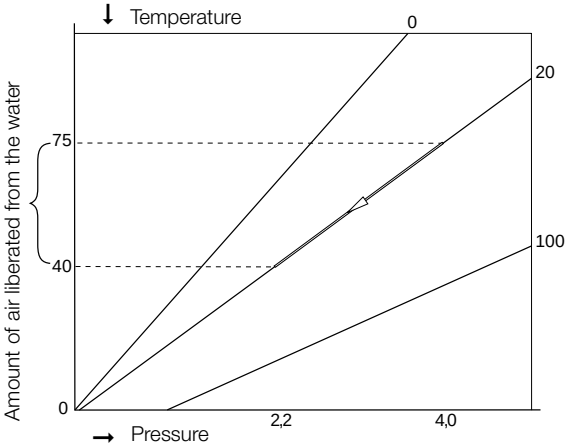


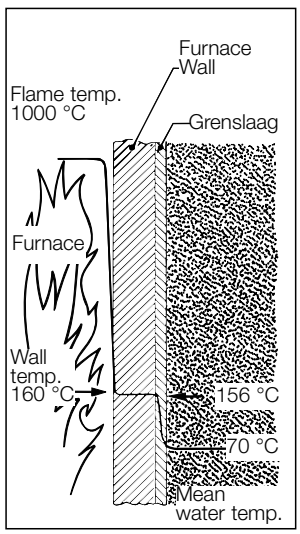
When the temperature of water at constant **pressure is raised**, for example from 20 °C to 80 °C, Henry's law can be used to determine the amount of dissolved air which is liberated from the water.



Lowering the pressure of the water at constant temperature also results in dissolved air being liberated.

If the temperature falls and the pressure increases, the reverse happens, and any air bubbles present will then be dissolved (absorbed) in the water.

The above-described natural phenomenon is for example encountered in a central heating system.
Very high temperatures occur at the combustion-chamber wall of the boiler. It is here that very small air bubbles will be liberated from water containing air. These so-called 'micro-bubbles' will be redissolved elsewhere in the central heating system where the temperature is lower, unless they are immediately removed.



If the micro-bubbles are removed immediately upon leaving the boiler, then air-free (unsaturated) water results. Air present elsewhere in the system can be dissolved (absorbed) in this water. This absorption effect is utilized to bind all the free air in the system and to vent it to the outside by way of the combination of boiler and Flamcovent air separator.
This venting process proceeds continuously until eventually the water that remains is strongly unsaturated and absorbent.