Compressor cooling

Compressed air – the fourth utility

A gas compressor is a mechanical device that converts power into kinetic energy by increasing the pressure of gas and reducing its volume.

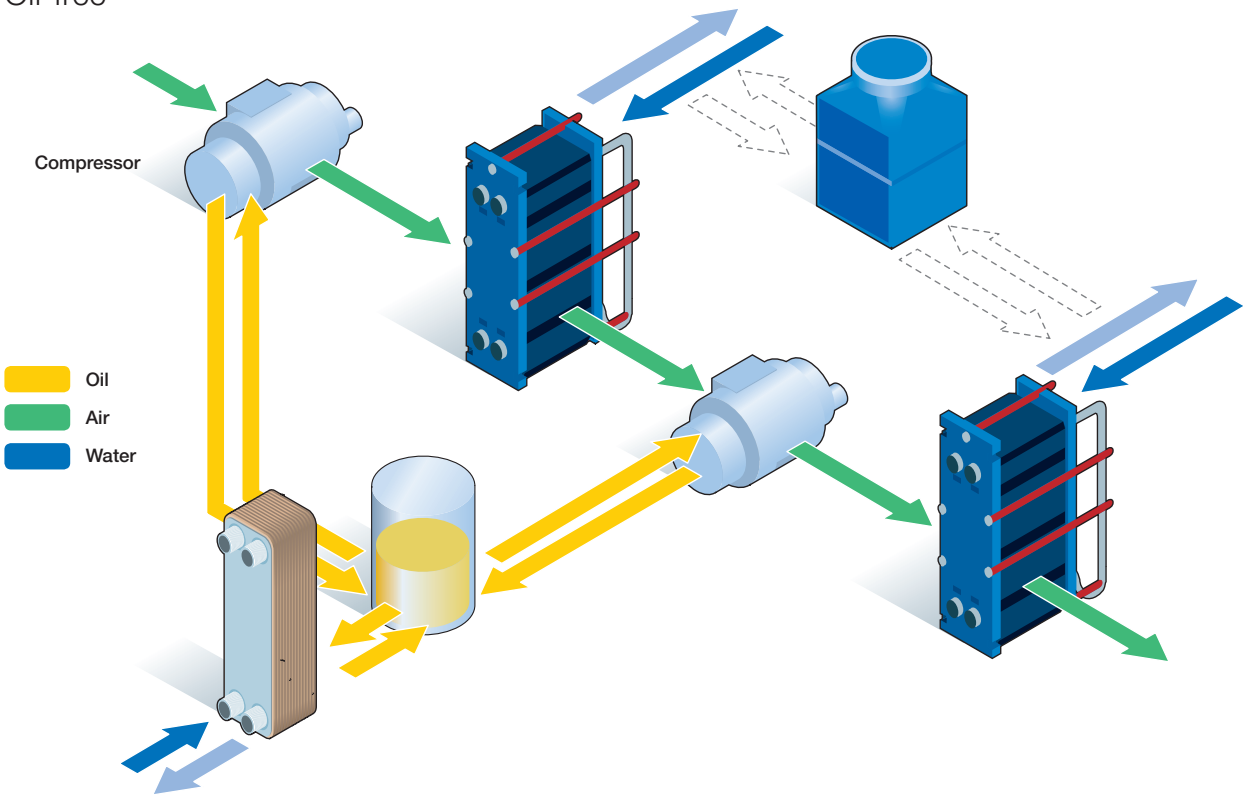
Compressed air has become one of the most important power media used in industry providing power for a multitude of manufacturing operations. In industry, compressed air is so widely used that it is often regarded as the fourth utility, after electricity, natural gas and water. General uses of compressed air are pneumatic tools, energy storage, production lines, automated assembly stations, refrigeration, gas dusters and air-start systems.

Another important power media is compressed natural gas (CNG), which is made by compressing natural gas to less than 1% of the volume it occupies at standard atmospheric pressure. CNG is generally used in traditional combustion engines.

The major cooling applications for compressors where heat exchangers are used are:

- Air cooling
- Oil cooling
- Water cooling
- Heat recovery

Oil-free

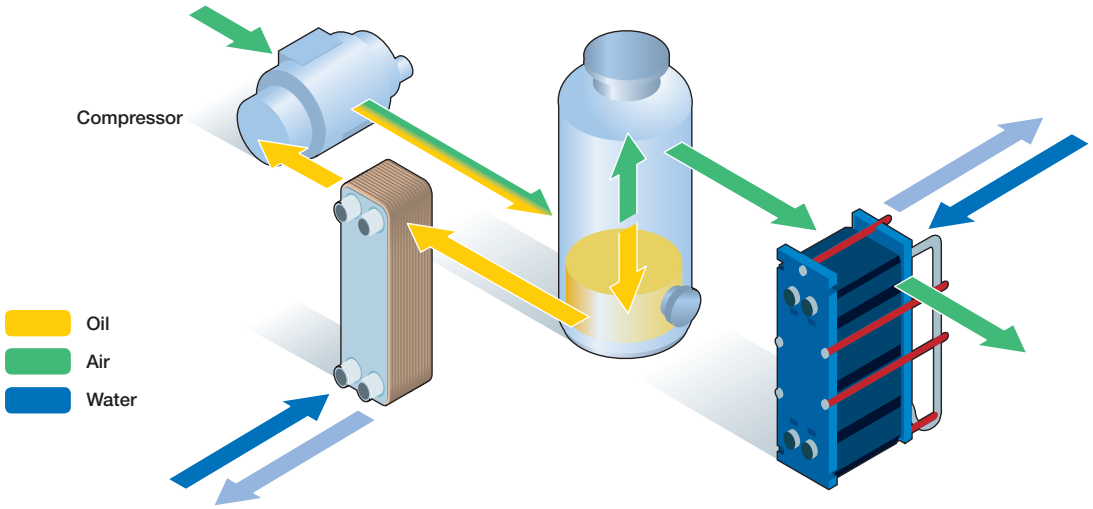


Air cooling
A multi-stage compressor can contain one or several intercoolers. Since compression generates heat, the compressed gas needs to be cooled between stages, making the compression less adiabatic and more isothermal. The inter-stage coolers typically result in some partial condensation that is removed in vapor-liquid separators.

The compressed gas from the compressor is hot after compression, often 70-200°C. An aftercooler is used to lower the temperature, which also results in condensation. The aftercooler is placed directly after the compressor in order to precipitate the main part of the condensate as quickly as possible that would otherwise follow out into the system. The aftercooler is generally fitted with a vapor-liquid separator with automatic drainage.

Oil cooling
Both lubricated and oil-free compressors need oil cooling. In oil-free compressors it is the lubrication oil for the gearbox that has to be cooled. In oil-injected compressors it is the oil which is mixed with the compressed air for lubrication, sealing and cooling that has to be cooled.

Oil-injected



Water cooling
A water cooler is generally used, direct or indirect, to cool the closed loop cooling water to the air/gas and oil coolers. Since this is typically an outdoor installed air heat exchanger, the water is mixed with anti-freeze such as glycol. This is a common cooling method for CNG compressors. Air heat exchangers are particularly suitable when the availability of water is limited or as an alternative to cooling towers. As air heat exchangers have a closed cooling water loop – make-up water, water contamination and chemicals to prevent algae can be avoided.

Heat recovery
When a gas is compressed heat is emitted. The thermal energy is concentrated in the decreasing volume and the excess is led off before the gas leaves the compressor. The energy used to produce compressed air or gas typically represents 80% of the total cost. Over 90% of the energy supplied to the compressor can be recovered.

For water cooled compressors, the cooling water from the compressor can supplement a hot water flow. If the water is used for e.g., washing, cleaning or showers, a normal hot water boiler is still required. However, the recovered heat is a supplement that can reduce the load on the boiler. This saves fuel and can possibly result in the use of a smaller boiler.

For compressor cooling Alfa Laval offers:

Air cooling
- AlfaNova fusion-bonded plate heat exchangers
- Copper brazed plate heat exchangers
- Gasketed plate heat exchangers

Oil cooling
- Copper brazed plate heat exchangers
- Gasketed plate heat exchangers

Water cooling
- AlfaBlue air heat exchangers

Heat recovery
- Copper brazed plate heat exchangers
- Gasketed plate heat exchangers