

How to recover heat from a compressed air system

Much of the electrical input to a compressor is dissipated as heat loss. There is an opportunity to recover some of this heat and use it to displace other heating fuels on-site.

The temperature of heat recovered varies with the type of cooling used on compressors; for example there is the possibility of obtaining hot air at up to 80°C from air cooled compressors and up to 95°C from water cooled compressors. When considering heat recovery, a use for any recovered heat must first be identified to warrant the investment.

Application

Heat can be recovered either directly from the process (for example the ducting of warm air into a neighbouring area that requires heating), or indirectly via a heat exchanger.

Depending on the type of compressor, it is possible to produce either warm air, hot water or a combination of both for re-use. Generally, air cooled compressors will provide hot air up to a maximum temperature of 60°C on a continuous basis and possibly up to 80°C on an intermittent one depending upon the compressor loading. A water cooled compressor can provide higher water temperatures, with a maximum of 90°C, but again, this depends upon the compressor loading.

Sites with large hot water or heating demands are particularly suitable for installing heat recovery systems. The plant that could benefit from heat recovery includes:

- Building services
 - water heating
 - space heating
- Process plant
 - drying
 - heating
- Boiler houses
 - feed water
 - combustion air
- Compressed air plant
 - use the heat to regenerate desiccant

The technology

The technology used depends upon the type of compressor cooling system and the use for the recovered heat. The following diagrams show the type of heat recovery possible from compressors and the technology needed to utilise this heat.

Hot air

Generally smaller reciprocating, screw and vane machines (air cooled).

Typical applications include:

- Space heating
- Process drying
- Drying compressed air
- Combustion air pre-heating.

Hot water

Generally larger centrifugal, reciprocating, end screw machines (water-cooled or heat exchanger on air-cooled machines).

Typical applications include:

- Domestic hot water production
- Space heating
- Process heating
- Drying compressed air
- Pre-heating boiler make-up water.

Figure 1 Hot air

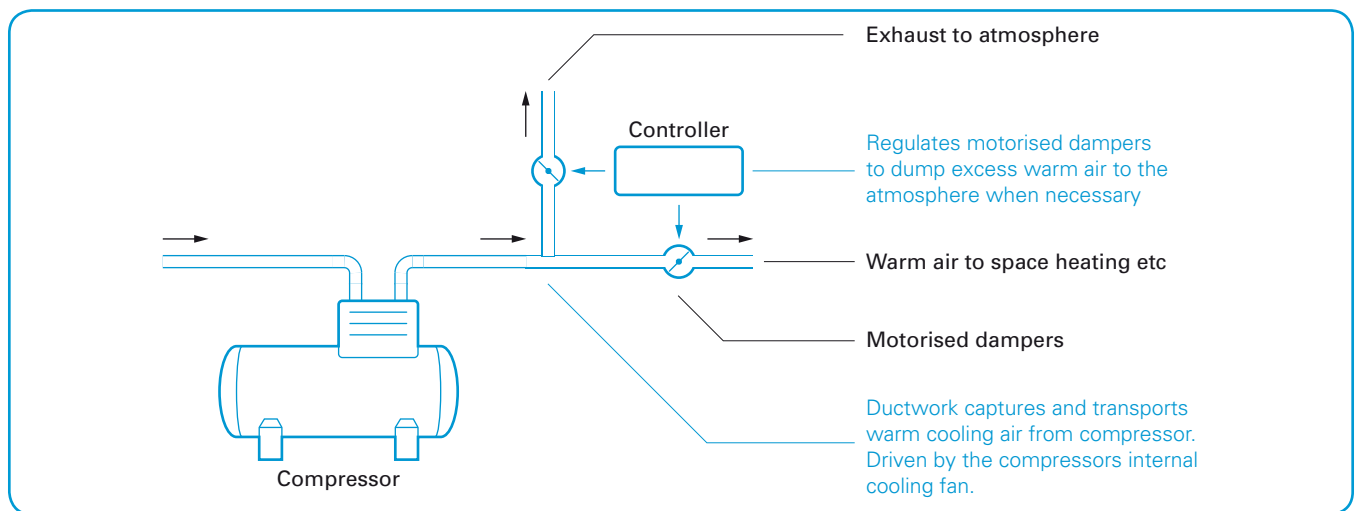
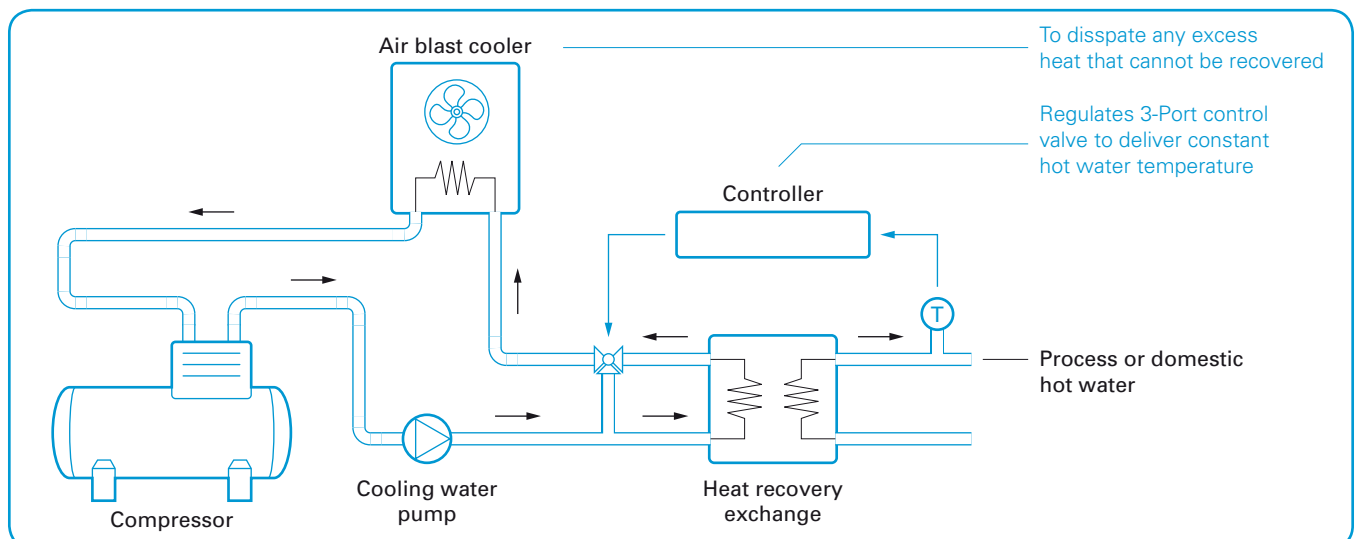


Figure 2 Hot water



Specification checklist

Before any investment is sanctioned a feasibility study needs to be undertaken to identify the source of the heat, the quantity available and the area where the heat is to be used. Consider the points in *table 1* when specifying a heat recovery system.

The use of air direct from a compressor may mean that filtration or noise suppression is needed before it can be used.

There are restrictions on the size of compressors based on financial viability. In general terms, compressors below 15kW are accepted as not being viable options. However this is worth checking against current energy costs which are changing all the time.

Commissioning procedure

The commissioning of any heat recovery system is vital to its successful operation. The basic steps in *table 2* below, need to be undertaken for all types of systems.

Table 1 Specification checklist

Heat availability	Heat requirements	Matching heat to demand
How much heat is available?	How much heat can be utilised?	Is the heat available at the required temperatures?
When is the heat available?	When is the heat needed?	Do the heat recovery times match the demand times?
Where is the heat available from?	Where will the heat be used?	Are the locations close?

Table 2 Commissioning procedure

Item No	Action	Comments
1	Carry out all health and safety checks on rotating equipment.	
2	Ensure that all operating and maintenance manuals are in place.	
3	Complete training for all operating and maintenance personnel and inform any personnel of the new system and its benefits.	
4	Test the operation of each element.	This will identify any local problems with the equipment.
5	Open the air dampers, if air is to be re-circulated. If it is a water based system, open the valves.	
6	Start any pumps or fans.	
7	Measure the heat flow from the compressor and the heat recovered against the design conditions.	This will confirm the system is meeting the design and the payback periods.
8	Monitor the energy consumption on the areas where the recovered heat is being used.	This is to ensure that the present control systems are reducing the energy consumption.

Common problems

The following should be considered in any heat recovery project:

- If warm air is being used for space heating, automatic controls should be used to avoid overheating the building and wasting the re-used air.
- When used for pre-heating boiler combustion air, check with the burner manufacture that the present fans can tolerate the raised air temperature.
- It may be necessary to utilise the expertise of either consultants or contractors to determine the plant sizes for any heating plant. The following organisations have personnel who are competent in such technology.

The business case

There are significant business benefits of installing heat recovery equipment, especially if the site has long operating hours. In appropriate applications the recovery of warm air can provide a payback period of less than one year, while hot water schemes can payback in under five years.

Further Information

The Heating and Ventilating Contractors Association(HVCA)

0207 313 4900

www.hvca.org.uk

Chartered Institution of Building Service Engineers(CIBSE)

0208 675 5211

www.cibse.org