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CAGI
Compressed Air & Gas Institute

TECHNICAL BRIEF

Technical Brief – Heat Recovery From Industrial Compressed Air Systems

The rise in energy prices is an unwelcome reality in today's business environment. And while the rate of price increases for natural gas, heating oil, and electricity may vary from year to year, the upward trajectory is clear. Energy cost reduction strategies are vital to staying competitive.

With manufacturing plants and other facilities doing what they can to streamline their operations, facility engineers face the challenges of optimizing the energy efficiency of their operations and extracting as much productivity out of every unit of energy consumed.

Compressed Air as an Energy Source

The heat generated by compressed air systems can be a very good source of energy savings. Nearly all (96%) of the electrical energy used by an industrial air compressor is converted into heat, and usually that heat is simply ejected into the compressor room or ducted outside. But here's the good news: nearly all this thermal energy can be put to use and significantly lower a facility's energy costs. Some uses of recovered energy from compressed air systems:

Heat Recovery with Rotary Screw Compressors

The most common compressor equipment found in manufacturing plants is the air-cooled, lubricated rotary screw design. The amount of heat recovered using these systems will vary if the compressor has a variable load; however, in general, very good results will be achieved when the primary air compressor package is an oil-injected rotary screw type design.

Oil-less rotary screw compressors are also well-suited for heat recovery activities. As with other compressor systems, the input electrical energy is converted into heat. Because they operate at much higher internal temperatures than fluid injected compressors, they produce greater discharge temperatures (as high as 300˚F or even greater).

Warm Air Applications

By integrating standard HVAC ductwork and controls, warm exhaust air can be channeled to remove or provide heat in the compressor room and adjacent areas. Space heating can be regulated easily using thermostatically controlled, motorized louver flaps for venting, thereby maintaining consistent room temperature by making continuous adjustments to the heating air flow. This also means that when heating is not required, the hot air can be ducted outside the building to reduce cooling costs.

CAGI is the leading organization representing manufacturers of compressed air system equipment, including air compressors, blowers, pneumatic tools, and air and drying and filtration equipment. This document is for information purposes and should not be used as a substitute for instructions from individual manufacturers. Always consult with individual manufacturers for specific instructions regarding their equipment.

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Water/Fluid Heating

Rejected heat can also be used to heat water or other process fluids. It can be done with either air-cooled or water-cooled compressors, although the best efficiencies are usually obtained from water-cooled compressor installations where discharge cooling water is connected directly to a continuous process heating application such as a heating boiler's return circuit for year-round energy savings.

Some compressor manufacturers offer built-in heat recovery heat exchangers as options. In some cases, they are fully integrated inside the compressor cabinet and require very little onsite engineering.

Energy Savings … and More

Most facilities can benefit from heat recovery from compressed air systems throughout the year, not just during the cold-weather months. In many regions, space heating is required during three seasons. And during the warmer months, removing the heat of compression will improve compressor efficiency and facilitate air treatment. Moreover, controlling operating temperatures will extend compressor air equipment life.

Generally, the larger the system the faster the payback, but payback on heat recovery also depends on the amount of rejected heat that can be used and the cost of the alternative energy source.

Beyond energy savings, an important argument can also be made that heat recovery activities benefit the environment. After all, substantial energy savings also mean a reduction in the carbon footprint of a plant. As energy policies and regulations continue to evolve in the United States and other countries, these considerations are only expected to become more important.