1300 Sumner Avenue, Cleveland, OH 44115
P: 216-241-7333 F: 216-241-0105
E: cagi@cagi.org
URL: WWW.CAGI.ORG

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 the business environment of today. 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

Recovering and using the heat generated by compressed air systems can be a very good source of energy savings. Nearly 96% of the electrical energy consumed 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 of this thermal energy can be put to use and significantly lower energy costs.

Heat Recovery with Rotary Screw Compressors

The most common compressor equipment found in manufacturing plants is the air-cooled, oil-injected, rotary screw design. Although the amount of recoverable heat from these compressors is directly proportional to the load on the compressor, 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 oil-injected compressors, they produce greater discharge temperatures (as high as 300˚F or even greater) which benefits heat recovery systems.

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 is easily regulated by using thermostatically controlled, motorized louver flaps to make continuous adjustments to the heating air flow to maintain consistent room temperature. This also means that when heating is not required, the hot air can be ducted outside the building to reduce cooling costs.

Water/Fluid Heating

Recovered 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 the hot, discharge cooling water is connected directly to the process heating application. Reheating water in a boiler return water circuit is an application that lends itself well to year-round energy savings through compressor heat recovery.

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 the life of all compressed air equipment.

Generally, the larger the compressor system the faster the payback of a heat recovery process. 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.