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Bulletin 751

HOW TO GET FREE HEAT AND PRODUCE DRY AIR WITHOUT A DRYER.

You can eliminate high energy costs
and forget the maintenance problems
of a traditional dryer by using
this proven, durable and trouble-free
system in your manufacturing operation

GET FREE HEAT WITH ADAMS.

R.P. Adams Company Inc.
Quality and innovation for over 60 years

THE STORY OF REHEATING

THIS IS THE SYSTEM THAT TRULY SUPPLIES FREE HEAT.

Saving energy is an important goal in every business and the search for proven methods of energy conservation has focused new attention on Adams Reheat Systems. Warm, dry air is an essential ingredient in many manufacturing processes and the R.P. Adams Company Inc. can provide it with an innovative and durable system that eliminates the high energy cost associated with other drying systems.

This packaged system cools the process air using your existing cooling source so that moisture can be removed and then reheats the air — without using an external energy source — eliminating the possibility of condensation in the manufacturing process.

The Reheat System was originally embraced by the glass industry because of the need for hot, dry, compressed air in the glass-making process. Today, industries using this system include textile, automotive, food processing, pharmaceutical and those requiring a volume of warm, dry, clean, compressed air.

The established facts are that a Reheat System removes the moisture in the process air, reduces coolant consumption, and reheats the air without an external energy source. This is the system that truly supplies free heat.

HOW DOES IT WORK?

Compressed air is both hot and laden with moisture coming from the air compressor. It needs to be cooled and dried, and then reheated so it can be used in the manufacturing process. One traditional method of performing this job calls for the use of an aftercooler and refrigerated dryer. That arrangement, although effective, is both expensive to operate and difficult to maintain.

Moisture in any compressed air system represents a major problem. One reason is a compressor uses ambient air that contains man-made pollutants. Contaminates such as carbon dioxide, sulfur dioxide, chlorine, etc. combine with moisture to form weak acids that are concentrated and corrosive in the compressed state. Cooling the process air is the first critical step toward the removal of this moisture. More moisture is condensed as the air temperature drops.

However, during the cooling process as much as 30% of the total compressed air system energy (air volume) is lost. The Adams Reheat system provides the necessary cooling and at the same time restores this lost energy (air volume) back into the compressed air system. The system is so efficient that it can actually take the place of a refrigerated dryer. In other cases, it enhances a desiccant dryer's performance.

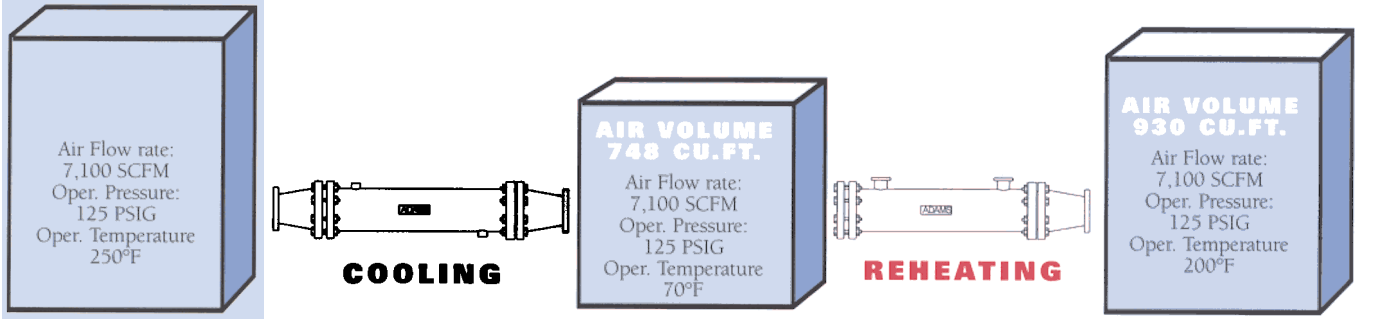
Work available from the compressed air is dependent upon the volume and pressure at the point of use. Hot air has a greater volume than cold air. Therefore, hot air will do more work at the same cost than cold air.

Figure 1 illustrates what happens when air is compressed, cooled, and reheated. The example involves 7,100 standard cubic feet per minute (SCFM) of atmospheric air at 14.7 PSIA and 70°F entering a two-stage air compressor and discharging at 125 PSIG. The resulting physical volume represents 1,000 cubic feet per minute (CFM) of air at 125 PSIG and 250°F. It takes 1,200 horsepower to compress the air. When this air is cooled to 70°F, its volume shrinks to 748 cubic feet per minute resulting in a 25% reduction. This represents a loss of 302 horsepower of work that could have been performed if the air temperature was at 250°F. By reheating the compressed air to 200°F, using the waste heat of compression from the compressor, there will be a gain in air volume of 182 cubic feet per minute. This translates into a 24% increase in air volume and 291 horsepower of work has been reclaimed using the Adams Reheat System. In addition, by reheating the air the chance for additional condensation in the air distribution system is eliminated.

THE SYSTEM IS SO EFFICIENT THAT IT CAN ACTUALLY TAKE THE PLACE OF A REFRIGERATED DRYER.

.While there are cases where the manufacturing process does not require 200°F process air, the operating principles are the same. R.P. Adams can work closely with you to design a Reheat System that is suited to your needs.

FIGURE 1
HOW AIR VOLUME IS RECOVERED BY AN ADAMS REHEAT SYSTEM



,200 HP of Work

302 HP of Work Lost
25% decrease in air volume

291 HP of Work Reclaimed
24% increase in air volume

THE REHEAT SYSTEM IS DESIGNED TO PERFORM THREE MAIN FUNCTIONS:

1. **COOLING THE AIR** The Reheat System cools process air in two steps using a regenerative heat exchanger and an aftercooler, as shown in Figure 2. The regenerative heat exchanger is unique in the system because it accomplishes two functions simultaneously through a process known as regeneration. Regeneration is a method of exchanging heat between the same fluid at different stages in the process. For example, compressed air must be cooled to remove moisture then reheated for use within the manufacturing plant. Instead of performing the entire cooling requirement in an aftercooler, the Adams Reheat System uses a regenerative heat exchanger upstream of the aftercooler to handle part of the cooling duty. The regenerative heat exchanger's cooling source is the same process air that has already been cooled by the system's aftercooler. Final cooling then takes place in an aftercooler. This precooling arrangement can reduce the aftercooler cooling water consumption by as much as sixty (60%) percent.

2. **MOISTURE REMOVAL** Once the air is cooled, the condensed moisture can be effectively removed. Using a cyclone separator, the Reheat System removes up to 99% of the condensed moisture from the process air.

   Figure 3 shows the moisture content of compressed air at various pressure dew points. Moisture is significantly reduced by getting the air as cold as possible. The exact amount of moisture removed depends upon the cooling sources available. Pressure dew point temperatures range from 35°F to 90°F using a Reheat System.

3. **REHEATING THE AIR** Once the air is dried, it needs to be reheated for use in the manufacturing process. Reheating is accomplished using the regenerative heat exchanger as described above, with no external energy source required to heat the air. Instead the "free" heat of compression from the air compressor increases the air temperature well above the pressure dew point at the aftercooler. Process air can be reheated to temperatures ranging from 90°F to 300°F, depending upon the incoming air temperature to the Reheat System.

FIGURE 2
TYPICAL ARRANGEMENT OF A REHEAT SYSTEM

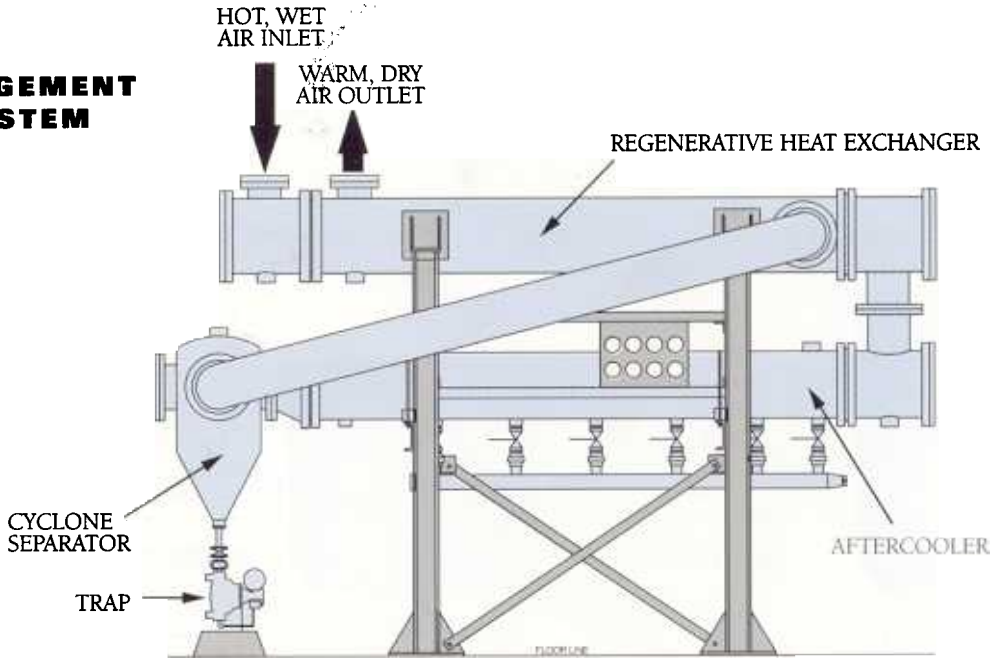
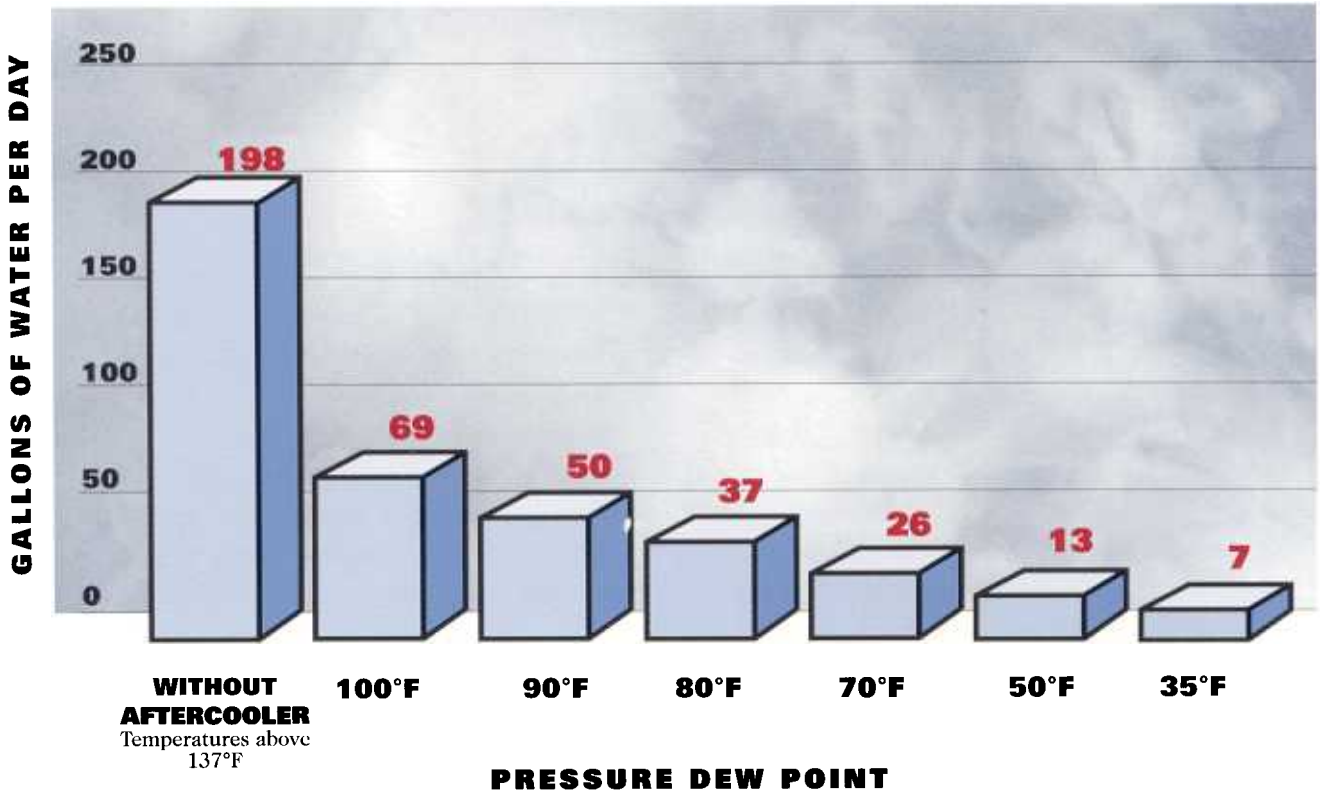


FIGURE 3 MOISTURE CONTENT OF COMPRESSED AIR



Based on 1,000 SCFM of air at 100 PSIG operating pressure.
Ambient conditions being 84°F, 14.7 PSIA, & 60% Relative Humidity

THE BENEFITS OF A REHEAT SYSTEM

- Provides warm, dry air for your manufacturing process.
- Saves electric cost because it does not require external power to cool or reheat the process air. In addition, no electrical wiring is needed for installation.
- The compact design requires minimal space for installation.
- With no moving parts or sensitive controls, it is virtually maintenance-free.
- Supplies increased air volume; by heating the air and keeping pressure constant, the volume increases.
- Conserves cooling water because the Reheat System pre-cools the air prior to the after-cooler thereby reducing the amount of cooling water needed in the aftercooler.
- Assures low pressure dew points for the process air, ranging from 35°F to 90°F, depending upon the coolant available.
- More economical than a typical refrigerated dryer.
- Eliminates condensate and external line sweat in the air distribution system.

Adams Reheat Systems come in a variety of configurations. The Economat® Reheat System is used with a single or multiple cooling water source. When a refrigerant is available at the plant, such as ammonia refrigeration in a food processing facility, then the AKU Reheat System is recommended. Listed below are further details about each of these systems.

THE ECONOMAT® REHEAT SYSTEM

Whether making glass, steel, paper, textiles, beer, paint, or a whole range of other products, many manufacturers have come to depend upon the Economat as a reliable and economical source of warm, dry, process air. When the presence of moisture can adversely impact the quality of the end product, the Economat is an important and reliable ally to ensure its removal.

The Economat system can be arranged in two typical configurations. One incorporates a single aftercooler, as shown in Figure 4, using one cooling source such as tower, lake, river, city or chilled water. The other, as seen in Figure 5, uses a second aftercooler when another water source is available in the plant. For example, the primary aftercooler uses less expensive tower water to handle part of the cooling; the secondary aftercooler — using chilled water — is responsible for the final cooling. This arrangement reduces chilled water use and the expense associated with it.

FIGURE 4 THE ECONOMAT SYSTEM, USING ONE COOLING SOURCE

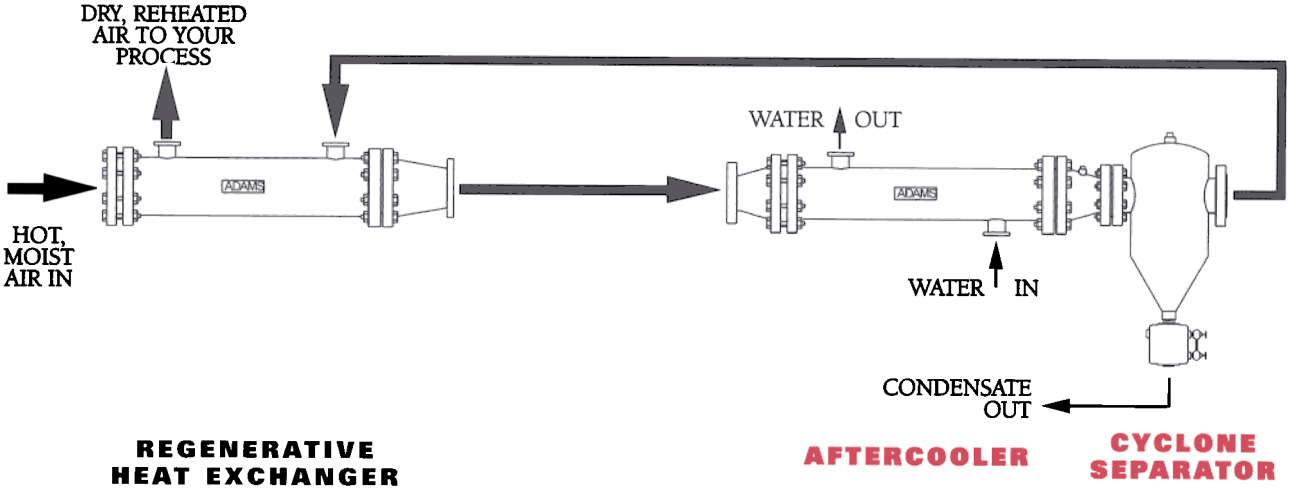
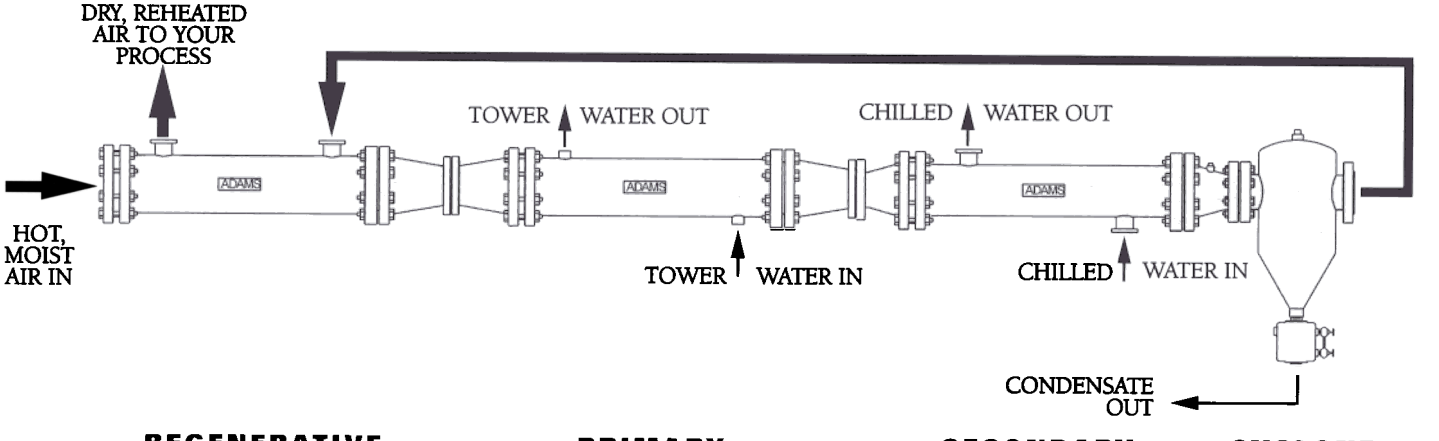


FIGURE 5 THE ECONOMAT SYSTEM, USING TWO COOLING SOURCES



THE AKU REHEAT SYSTEM

The AKU Reheat System is particularly suited for food processors who have a large refrigeration capacity to keep the food products cold. It takes advantage of the excess refrigerant and uses it as the coolant in the aftercooler.

For example, at a major chicken processing facility in North Carolina, nearly all the equipment is pneumatic, and the air must be as dry as possible because the slightest moisture can affect the control systems and shut down processing lines. The AKU Reheat System uses the available ammonia refrigerant to chill the air to a dew point of 35°F, removes the condensed water and then reheats the air. The AKU minimizes refrigerant consumption by pre-cooling the air in the regenerative heat exchanger.

After years of trouble-free performance, the operator of the North Carolina chicken plant ordered another AKU system for a similar plant in the Midwest and gave this appraisal of the system's performance:

"Not only is it dependable, it's very cost-efficient because it reduces the amount of horsepower needed to cool the air. There are other methods we could use to dry our air, but I don't believe there is another method that would accomplish our goal as inexpensively as the Adams system. As far as maintenance is concerned, we hardly know the AKU is there."

"...IT'S VERY COST-EFFICIENT BECAUSE IT REDUCES THE AMOUNT OF HORSEPOWER NEEDED TO COOL THE AIR."

THE ADAMS REHEAT SYSTEM SAVES OPERATING EXPENSES IN FOUR DIFFERENT WAYS:

1. Uses no electrical power for cooling or reheating the air.
2. Conserves coolant needed in the aftercooler because it performs part of the cooling work.
3. Reheats the process air using the heat of compression of the air compressor.
4. Restores, by reheating, the energy (air volume) lost during the cooling process.

CHOOSING A SYSTEM

There are a number of critical considerations in the design of a Reheat System. These include the pressure dew point temperature required, final reheated air temperature needed, any requirements for partial cold air bleed, maximum system pressure drop allowed, and types of coolant available.

Every system designed and fabricated by R.P. Adams Company is factory tested before shipment, assuring quality and reliability. In addition, R.P. Adams Company guarantees total system performance for the entire package.

ADAMS REHEAT DESIGN QUESTIONNAIRE

Type of Quotation: ☐ Budget ☐ Firm Date Quote Required _____ Approx. Installation Date _____

CUSTOMER INFORMATION

Company Name _____

Address _____

Contact E-mail _____

Telephone _____ Fax

PROCESS INFORMATION

	VALUE	
Total Air Flow:	_____	SCFM
Will all of the air be reheated?		
If no, then how much air needs to be reheated?	_____	SCFM
Air inlet temperature into the Reheat System	_____	°F
Desired pressure dew point	_____	°F
Desired air temperature out when reheated	_____	°F
Air inlet operating pressure	_____	PSIG
Total air system pressure drop allowed	_____	PSIG

COOLING MEDIUM AVAILABLE

	SOURCE 1	SOURCE 2 (IF AVAILABLE)
Fluid name		
Fluid inlet temperature	_____ °F	_____ °F
Fluid operating pressure	_____ PSIG	_____ PSIG

DESIGN INFORMATION

System Design Pressure	_____	PSIG
System Design Temperature	_____	°F
Design Basis	☐ R.P. Adams Standard	☐ ASME Code
Preferred Materials of Construction	Tubes _____	Tubesheets _____
	Shell _____	Baffles _____

Please photocopy and complete the questionnaire above and fax or mail this information back to us for a proposal.

Your Local Representative

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