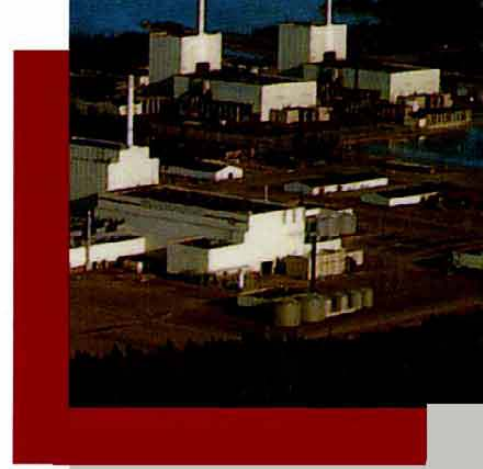


**POWER**



## MUNTERS DEHUMIDIFIERS REDUCE COSTS & IMPROVE SAFETY IN POWER PLANTS

Munters Cargocaire desiccant dehumidifiers are helping power plant owners throughout the world reduce costs by solving corrosion problems, by speeding maintenance procedures and by reducing the use of hazardous chemicals and gases. The benefits provided by dry air are appreciated by all departments in the plant.

The maintenance group appreciates the accessibility of all components made possible when dry air is used instead of nitrogen for corrosion protection.

The safety staff knows the benefits of using dry air rather than toxic corrosion inhibitors to protect components.

Operations personnel appreciate the reliability improvement when dry air reduces corrosion in the boiler and condenser tubes and in the flue gas passages.

Corrosion engineers appreciate the predictable coating operations made possible by dehumidifiers.

And start-up crews appreciate the predictable operation that follows an outage where equipment, motors and controls have been kept free of moisture damage by controlling humidity.

Munters Cargocaire desiccant dehumidifiers can save money in every phase of operation. For example:

### **Cold Standby—Dry Air Provides A Safe Method And A Fast Start**

As established by layup guidelines published by the Electric Power Research Institute (EPRI), dry air corrosion protection allows fast plant shutdown and reactivation. The technology provides a comprehensive solution free from the hazards of inert gas and the expense of toxic, or carcinogenic chemical alternatives. The dry air solution, proven in over 300 installations throughout the world, has been documented as effective and economical not only by EPRI, but also by more than 60 installations across North America.

### **Scheduled Outage Timetable Stays Predictable & Reliable**

When the plant goes into scheduled outage for maintenance, repowering or life extension, turbines can corrode and the windings of the generator and auxiliary motors can absorb moisture, which can degrade insulation performance by six orders of magnitude (106 OHM). Munters dehumidifiers keep moisture out of the windings, avoiding the cost and delay of bake-out or rewinding. Dry air also protects turbine components, reducing the potential for the extreme expense and delay of turbine repair.

### **High-Quality Coatings Delivered On-Schedule**

Munters portable dehumidifiers allow blasting and coating to proceed smoothly—in spite of humid weather. This predictability saves tens of thousands of dollars in coating costs. And the quality of the coating applied under dry air protection helps avoid unscheduled outages caused by coating failure.

### **Water Quality & Plant Availability Improves By Reducing Corrosion**

When dry air protects steam side components during shutdown, water quality improves considerably. With better water and with the tube thickness intact, there is less risk of unpleasant surprises caused by corroded tubes that come under high pressures during reactivation.

### **Mothballing & Protecting Spares With The Low-Cost, Proven Solution**

When the time comes to lay up the plant or to mothball specific components, Munters Cargocaire desiccant dehumidifiers allow you to get the job done at minimal cost in time and equipment. The dry air technique, proven in naval and marine boiler layup since 1947, has been used in power plant layups both when new plants come on line and old plants are taken out of service. Blanketing with dry air eliminates the need for greases and the constant replacement of corrosion inhibitors, reducing the initial cost and ongoing maintenance costs of mothballed equipment. And the same holds true for stored parts. Protecting storage areas with dry air is not only more effective than other methods—it saves money because there is no need to heat or air condition the warehouse.

*Corrosion can be avoided by using Munters dehumidifiers to circulate dry air through the unit during shutdown.*

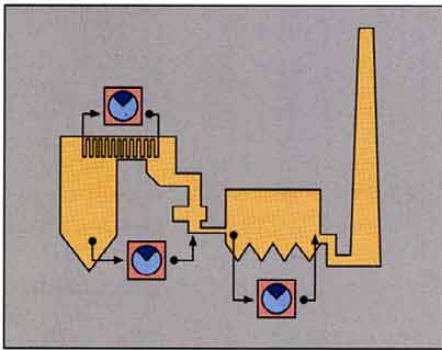




## RELIABLE PROCEDURES FOR COLD STANDBY

In 1987, the Electric Power Research Institute (EPRI) published guidelines for the layup of power plants. (Report # CS-5112). These guidelines describe how Munters desiccant dehumidifiers are used to protect components during cold standby. In October, 1992, EPRI also published the proceedings of the Plant Layup and Reactivation Conference (EPRI TR 101250), which describes installation details and operating experiences of six different plants which use Munters dehumidifiers. Power plant operators considering options for component protection during cold standby can benefit from these detailed reports based on field experience.

Munters equipment is used to reduce costs and reduce the risk of humidity damage in a wide variety of applications during cold standby.



*Dry air protects boiler and flue gas components.*

### Fire Side & Flue Gas Components

Circulating dry air through the fire side of the unit prevents the damage to the exterior of the boiler tubes, which can occur in the humid, sulfur-laden atmosphere of the cold plant. Further down stream, that same dry air protects costly heater components. For example, plates in rotary air heaters can cost as much as \$2,400 each, and replacement of dozens of corroded plates in each heater is not only expensive in terms of material, but can be difficult to accomplish without a major overhaul and costly outage time. Recirculating dry air through the fire side after wash-down avoids these costs.

De-NO<sub>x</sub> equipment includes catalysts that can be damaged by humidity above 50% rh. Dry air protection extends the life of the catalyst, which can cost millions of dollars to replace.

Desulfurization systems sometimes include rotary reheaters, which need protection from acidic condensation. Dry air circulation reduces the risk of premature replacement of heater plates.

Electrostatic precipitators are also subject to corrosion of electrodes and clogging of rapping mechanisms due to moisture absorbed into hygroscopic residual dust. With dry air protection, these problems are eliminated.

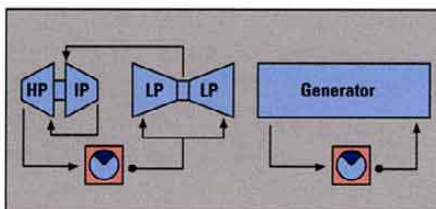
### Steam Side Protection

Munters dehumidifiers protect the steam side from the tubes through the turbine and condenser. When the boiler is flash-drained at 250 PSIG during shut down, the superheater tubes are purged of residual water. The dry air forced through the tubes carries off the remainder, protecting the internal surfaces from corrosion and reducing the potential for tube fracture on reactivation. This protection is especially useful for the reheat superheaters with their thinner tube walls.

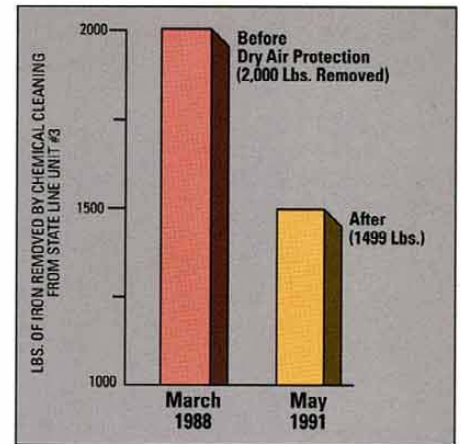
Steam turbine components can also corrode during shutdown because of excessive humidity. For example, uneven spot corrosion in certain parts of the turbine can be caused by condensation collecting in the low points of the rotor assembly. Dry air circulated through the turbines counter to normal steam flow is recommended by the EPRI guidelines as a means of protecting the costly assembly.



*Failure of an austenitic steel heater tube caused by moisture condensing on the surface during shutdown.*



*EPRI guidelines recommend dry air protection.*



*Results of chemical cleaning of State Line Unit #3 of Commonwealth Edison of Indiana. Beginning in 1990, Munters dehumidifiers were used to protect boilers and turbine components. Note the 25% reduction in corrosion products removed in 1988. Commonwealth Edison engineers attribute this improvement to dehumidification.*

### Generator & Motor Windings

During operation, windings are cooled by dry gas, but during standby, the rotor and stator insulation can absorb moisture from the atmosphere. Removing this moisture can take days, when each day of equipment out of service means tens of thousands of dollars in lost revenue. Keeping the wire insulation dry by using Munters dehumidifiers helps avoid this lost revenue. And dry air eliminates absorption without using costly and hazardous inert gas, which means that the generating equipment can be open and accessible for maintenance during standby.

Motors also benefit from dry air protection. Munters dehumidifiers are used to circulate dry air through the cooling passages in boiler feed pump motors and the induced draft and forced draft fan motors. In some cases, these components can be connected to the same dehumidifiers that protect the turbines and boilers, providing valuable motor protection at virtually no additional cost.



## PLANTS ON LINE

Munters dehumidifiers have been used to deliver useful benefits to power plants even when they are operational. For example:

### Phase Isolation Bus Bars

Dry air from dehumidifiers is used to protect bus bars from corrosion and from the potential costly problems of flashover. The dielectric constant of dry air is many orders of magnitude greater than humid air, so isolation is improved and corrosion is reduced.

### Peaking Generators

Because it is easy to connect and disconnect dehumidifiers to critical standby units, Munters units have been used to improve reliability and speed the process of bringing these units on line. As described on previous pages, dry air can protect the turbine from corrosive attack and prevent moisture from reducing effectiveness of motor wire insulation. Avoiding problems with peaking generators also avoids the tremendous expense of purchased power when such equipment is slow to come on line.

### Switchgear & Control Rooms

While switch gear and control rooms are always kept dry and are often air conditioned to reduce contact corrosion, humidity can float upwards during summer months. This happens because in summer, sensible heat loads are so high that cooling equipment no longer has adequate dehumidification capacity. Munters desiccant dehumidifiers can supplement existing cooling equipment, ensuring stable humidity control even in hot, sultry weather.

## PLANTS AND EQUIPMENT IN MOTHBALLS

When plants and equipment are no longer needed, mothballing them with dry air may be far less costly than complete decommissioning and demolition.

Dry air protects equipment from deteriorating during the winter seasons without the need to heat either the equipment or the buildings which contain it. And during the summer months, dry air will prevent corrosion without the need to air condition large buildings and equipment.

Dry air is especially useful for mothballing plants and equipment which must be inspected regularly, since there is no need to remove greases, drain chemicals or ventilate inert gases. Safe, dry air is not only inexpensive, it is easy to apply and the equipment is built to power plant standards of reliability for operation over decades with minimal maintenance.

Long-term success in mothballing equipment with dehumidifiers is well-established. Since 1947, tens of thousands of our units have been protecting the entire U.S. Navy reserve fleet, as well as dozens of power plants. This application experience can be put to use for your benefit when you plan for mothballing plants and equipment that are at the end of their useful life.



*This nuclear power plant has been mothballed using 15 Munters dehumidifiers—a very cost-effective, long-term solution.*



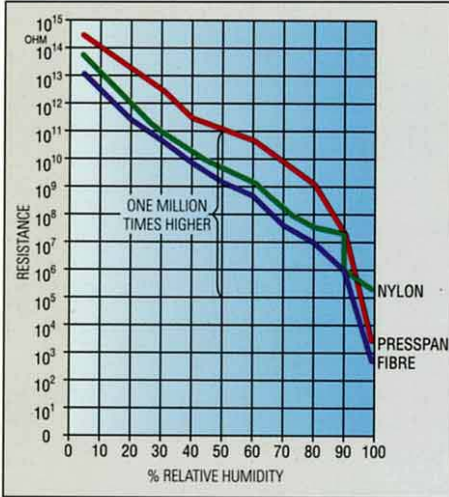
*At its capacity of 3750 MW, the Drax power station is the largest in Europe. Seven Munters dehumidifiers are in continuous use on bus bars.*



## SCHEDULED OUTAGES STAY ON SCHEDULE

The number and complexity of maintenance projects accomplished during scheduled outages can be a major management challenge. Munters can help eliminate problems and keep your projects on-track, which earns hundreds of thousands of dollars in power revenue when the unit comes back on-line on schedule.

*Loss of electrical resistance.*



The graph shows the relationship between electrical resistance and RH. As the RH increases, so the insulation materials absorb more moisture, as this happens "moisture paths" are created for the electric current and resistance is lost.

### Preventing Moisture Absorption In Motor Windings

In fossil plants, wire insulation in the induced draft fan motors and boiler feed motors can absorb moisture from the humid air. This can reduce performance and even delay reactivation. Plant owners use portable dehumidifiers to temporarily circulate dry air through the internal ventilation channels, which prevents moisture regain and keeps the insulation resistance at a high level for maximum efficiency and full operational readiness.

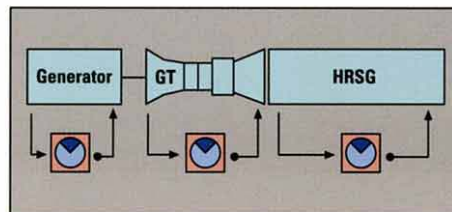


Power companies throughout North America have adopted Munters dry air protection as standard procedure during scheduled outages.

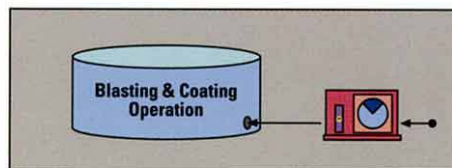
### Protect Gas Turbines and HRSG's

Corrosion can be a problem in gas turbine units and heat recovery steam generators, particularly as this equipment may see more frequent power-up/shutdown cycles than large fossil boilers. Small, portable dehumidifiers can be connected to the exhaust stage of the turbine, circulating dry air through the unit, and returning the air to the dehumidifier via the compressor inlet. Also, a second dehumidifier can protect the exhaust gas side of the steam generator, where acidic condensate can otherwise damage tubing and welds during outages.

Whether you prefer to purchase your dehumidifiers, or rent them along with complete on-site technical support services, Munters can help you make sure your scheduled outage stays on target regardless of weather extremes.



Munters dehumidifiers protect gas turbines and HRSG's.



Munters can hold the blast and keep jobs on schedule.

### Recoating Water Boxes, Fuel Tanks, Coal Handling and Pollution Control Equipment

Munters Moisture Control Services Division provides large portable dehumidifiers when you need humidity control for coating projects — dehumidifiers you may not need in other circumstances, and which you may prefer to rent rather than purchase.

Munters has extensive experience working with coating contractors, making certain that coating operations proceed smoothly in spite of humid weather. By using portable dehumidifiers, the air dew point can always be kept more than 5° F below the surface temperature—an essential requirement for applying high-performance coatings.

And in condensers, where the water box must be thoroughly dried before coatings are applied, Munters dehumidifiers have been used to take two weeks off a three-week drying time. Munters experience in drying large spaces and in drying concrete can benefit your project by shortening completion time and by making the schedule more predictable.

The contractor benefits because he can proceed without costly interruptions, and the plant owner benefits because the coating is applied to spec, and weather variations do not delay reactivating the unit. Savings for all concerned can be hundreds of thousands of dollars—all achieved without capital expense to the plant owner.

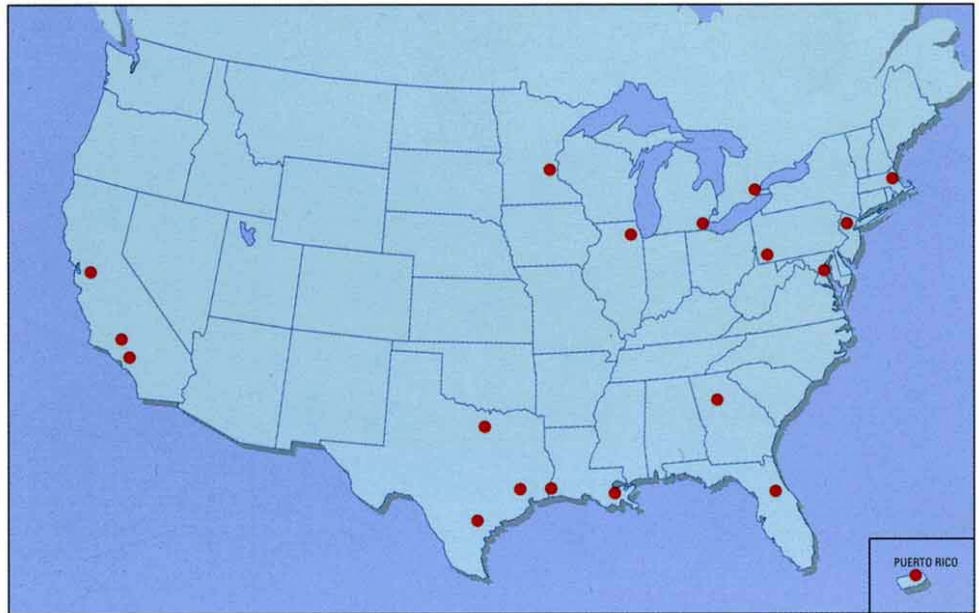


## MUNTERS MOISTURE CONTROL SERVICES PROVIDES RENTAL DEHUMIDIFIERS WITH ON-SITE SERVICES

Call Munters MCS when you need dehumidifiers for shorter projects—dehumidifiers you may not need to own permanently, or when there is a financial advantage to avoiding capital expenditure. For example, when contractors need large, portable dehumidifiers for coating operations, there may be no need to own the equipment for such a one-time use. Similarly, if your outage budget does not include capital expenditure authorization, you can rent dehumidifiers rather than purchase them. When you rent from Munters MCS, you get complete on-site technical services including design of temporary installations, start-up and on-site maintenance.



*Munters Cargocaire provides technical support from service operation centers throughout North America.*



*Munters operation centers—equipment sales, rental and service.*

## MUNTERS CARGOCAIRE SELLS DEHUMIDIFIERS AND DEHUMIDIFICATION SYSTEMS WITH NATIONWIDE SERVICE SUPPORT

Call Munters Cargocaire when you need dehumidifiers that you choose to own rather than rent, or when you would benefit from our application engineering resources. Your installation will be unique in many respects, so we will design and manufacture equipment to your needs cost-effectively because we have experience based on tens of thousands of desiccant dehumidifier installations. Munters Cargocaire can provide desiccant dehumidifiers in sizes from 70 cfm to 40,000 cfm, and we can provide complete, integrated systems including cooling, heating and filtration along with the dehumidifier.

After purchasing our equipment, you benefit from our North American service support network. You can rely on Munters for critical technical backup and fast parts replacement from our domestic manufacturing plants, providing you the same speed of response, corporate continuity and long-term operational reliability you expect from your power-generation equipment.

## THE NEXT STEP

Customers have been able to count on us for over 50 years, and we're looking forward to serving your needs as well. You can contact us through our main offices in Amesbury, MA, just North of Boston. Our phone and fax numbers are listed below. We're looking forward to your call. For the Munters center nearest you, contact:

## DEHUMIDIFIER SALES AND SERVICE

Munters Cargocaire  
79 Monroe Street  
Amesbury, MA 01913  
800-843-5360  
508-388-0600  
Fax: 508-388-4556

## ON-SITE TEMPORARY DRYING SERVICES AND RENTAL EQUIPMENT

Munters Moisture Control Services  
16 Hunt Road  
Amesbury, MA 01913  
800-I-CAN-DRY  
508-388-4900  
Fax: 508-388-4939