

## Semiconductor Manufacturing

### Dehumidification Application

*A Cargocaire dehumidification system provides a simple, cost effective way to insure a stable humidity control level in all seasons. It supplements rather than replaces standard clean room air handling systems, which preserves your investment and increases the reliability of your process.*

When the humidity level fluctuates in a wafer fab area, a host of problems can occur. Resist characteristics change, bake-out times increase and generally the entire process becomes more random and less predictable.

The Cargocaire system is based on industrial desiccant technology, designed specifically for humidity control. It gives you a solid 35% RH control level in all seasons, even during the muggy, rainy summer weather that causes air conditioning systems to fail.

#### Why 35% RH?

- **Photomask Protection**

The ultrafine geometry of today's photomasks makes them very vulnerable to corrosion when the humidity exceeds 35% RH. Cargocaire insures that your control level can be exactly where you need it to eliminate humidity-related photomask corrosion and reduce circuit corrosion following plasma etch.



- **Reduce Resist Swelling**

As your spinners spray developer onto the wafer surface, the solvents evaporate rapidly, cooling the wafer low enough to condense moisture from the air. This extra water on the resists can change the developer characteristics and also be absorbed into the resist itself, causing the polymer to swell. The 35% control level largely eliminates these problems because the solvent evaporation cannot cool the surface temperature below the air dewpoint.

- **Improve Resist Adhesion**

At high moisture levels, the silicon will behave as a desiccant, attracting moisture to its surface which interferes with photoresist adhesion. The 35% RH control level reduces this problem significantly.

- **Faster Vacuum Pumpdown**

Water vapor is the largest load on your cryopumps and other vacuum equipment. When you control at 35% RH rather than 45%, you have removed over 25% of the total moisture load from your pumps. This means faster pumpdown and improved batch processing speed.

- **Protect EPI Equipment**

Chilled surfaces in your epitaxial equipment can condense moisture from the air, leading to corrosion and slowing batch processing time. Controlling at 35% RH eliminates that condensation.

In short, the Cargocaire dehumidification system and its stable 35% control level contributes to solving many process problems.



## Conventional Systems

Clean room air treatment systems are optimized to closely control particulate and temperature levels.

To remove particles the system circulates a great deal of air, creating laminar flow and sweeping the particles into the filters.

They control temperature by operating with a very small difference between the temperature of the air entering and leaving the room. This, together with the fact that they process large air volumes, gives them the ability to provide a very even thermal condition across the room. While this is the ideal system for

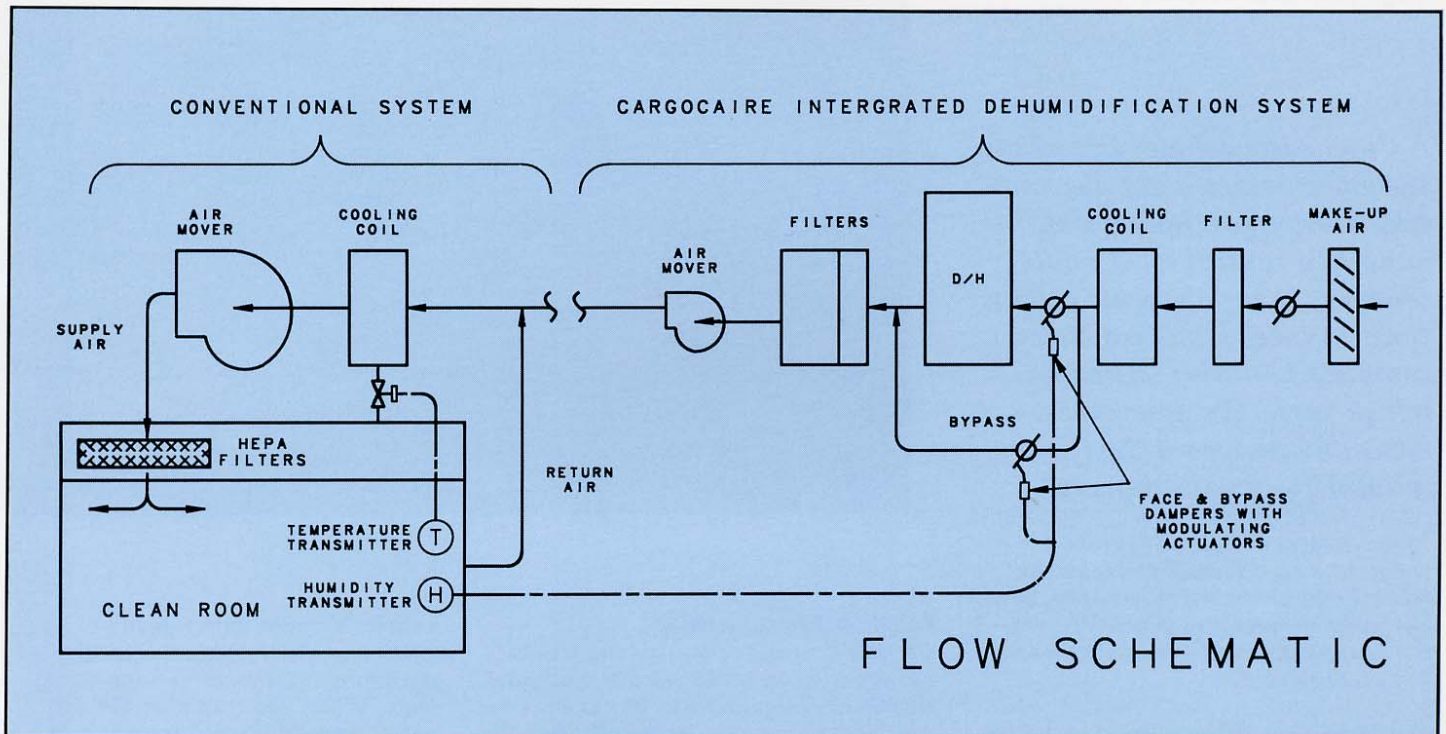
temperature and particulate control, it is not effective in controlling moisture. It does not remove moisture because the temperature differences are so small that no condensation takes place on the cooling coils.

Often a separate system is installed to cool the air deeply, condensing its moisture and reheating the air back to the room condition. In real world operations, however, these cooling-based systems seldom achieve stable humidity control.

Cooling systems are limited in their capacity to dehumidify. They can only cool the air to 40°F before part of the coil surface will be below 32°F and the coil

will freeze. So when the weather conditions are muggy and rainy, these systems have to struggle to keep up with the increasing moisture load. Then the coil freezes as it tries to cool below its natural capacity. The frequent, large swings in the room humidity level are a direct result of this capacity problem.

Straining to keep up with moisture loads also puts a great deal of wear and tear on such cooling-based systems. This leads to high maintenance costs and unscheduled maintenance, which always seem to come at inopportune moments.



## The Cargoaire Improvement

The Cargoaire system is designed to deal with the moisture problem at its source: the outside air brought into the system to provide ventilation and pressurization.

The moisture in that outside air is 85% of the total moisture load in the space, so the Cargoaire system goes to the heart of the problem by removing this water vapor before it gets into the room.

In the first part of a two stage process, much of the moisture is condensed out of the air by conventional cooling coils. In the second stage, the desiccant dehumidifier pulls the balance of the moisture out of the air, delivering it in a very dry condition to the clean room. The Cargoaire desiccant dehumidifier has made the ventilation air far drier than it

could ever be made with cooling coils. It now acts as a "sponge," absorbing the excess moisture generated in the space and allowing steady control at 35% RH.

The system responds to changes in room humidity by varying the amount of air passed through the dehumidifier. When the room condition goes above 35% RH, more air is passed through the dehumidifier. If the moisture level drops below the control point, moist air passes around the dehumidifier into the room, raising the moisture level back to 35%. Filters are included in the system so that particles in the outside air are removed before they can become a load on the HEPA filters of the room ceiling.

Since the system is mounted on the outside air, you can retrofit existing facilities without disturbing mechanical systems already in place. The system comes com-

plete with pre-cooling and controls, and can also be designed to take advantage of any existing utilities.

The key to a stable control level is a system designed for dehumidification rather than just cooling. Your Cargoaire Representative will configure a system to meet the unique needs of your facility.