

## SERVICE CALLS

## Understanding Lyophilizers: Function, Diagnostics, & Maintenance Needs



MSC was called in when temperatures in an office wouldn't come down below 80°F. Upon arrival, airflow inside the building measured low and DP at the rooftop AHU was high. Our tech shut down the unit and opened the door; everything checked out fine. Puzzled, he turned the unit back on and immediately observed a large flap of loose insulation being sucked up against the fan inlet. The insulation was fastened back down and airflow and temperatures returned to normal.



MSC responded to an emergency call regarding compressed air units that were repeatedly shutting down on high temperature. The maintenance worker who led our service technician to the air compressors mentioned that the problems started right around the time concrete floors in the mechanical room were being resurfaced. Our tech immediately checked the air compressor filters and found them caked with concrete dust. The filters were changed and the problem was solved.

The lyophilizer, or freeze dryer, is one of the most essential pieces of equipment in pharmaceutical manufacturing. Lyophilization is a low-temperature dehydration process in which water is removed from a product or sample in three interdependent phases: freezing, primary drying (sublimation), and secondary drying (desorption). In pharmaceuticals and biotechnology, it is primarily used to maximize sample stability and shelf life while maintaining product characteristics, and to enable easier storage and transport.

During the freezing phase of lyophilization, product is cooled below the triple point of water, a point at which

solid, liquid, and gas can coexist and are equally stable. This ensures that sublimation, or conversion to vapor, will occur during the primary drying phase rather than melting. Next, for the primary drying phase, the product is placed under a deep vacuum, and a small amount of heat energy is applied, energizing the ice crystals to sublime. About 95% of the water is removed in the sublimation phase. Finally, in the secondary drying phase, any remaining unfrozen water molecules adsorbed to the product are removed by slightly increasing the temperature to disrupt their interaction with the frozen material, then lowering or increasing pressure to encourage desorption.

Lyophilizers come in many types, but most contain a similar set of main components. These are the refrigeration system, vacuum system, instrumentation and controls, product chamber or manifold, and condenser. As with any process cooling system, lyophilizer maintenance, diagnostics, and repair require a knowledgeable service contractor that understands the lyophilizer process and inherent problems and failure points, particularly in screw-type machines.

*Continued on page 2*



*Photo by MSC: complex inner workings of a pharmaceutical lyophilizer taken during full system overhaul including refrigerant conversion*

## Capital Improvements 2022

**HVAC equipment purchases should be decided ASAP to meet fiscal year delivery deadlines**

It has long been a common practice for companies to examine annual budgets during the latter half of the fiscal year to determine whether funds are available for much-needed capital improvements.

In 2022, however, pandemic-related supply chain shortages and delays have upended this norm as far as HVAC equipment purchases are concerned.

With lead times on new HVAC equipment still pushing 16-20 weeks or longer, businesses considering these and other long-lead purchases don't have the luxury of putting off evaluating capital budgets and waiting until Q3 or Q4 to place equipment orders.

**Facility managers and engineers are strongly urged to start this process as soon as possible in order to ensure delivery before the end of the current fiscal year.**

Please contact MSC at (973) 884-5000 for HVAC system assessment, equipment selection, and lead-time assistance.

## MSC CASE STUDY



### Tripping Pumps in Research Lab Traced to Motor Starter Issues

When two large condensate pumps providing mission critical cooling for walk-in boxes, freezers, environmental rooms, air compressors and other critical equipment kept tripping on startup, MSC was called in to investigate. These pumps were the life blood of the facility, and intermittent operation was not an option. After ruling out electrical problems, we zeroed in on the controls side. The source of the problem was traced to dip switch settings on reduced-voltage motor starters and the control module.

View our extensive [Technical Note](#), which includes charts, graphs, tables, wiring diagrams, photographs, and other data detailing how we arrived at our conclusions and provided successful solutions.

## Understanding Lyophilizers: Maintenance, Diagnostics & Service Needs

*Continued from page 1*

Many lyophilizers have built-in function testing systems that should be run semi-annually or quarterly (annually at minimum) by trained technicians, and some facilities may require testing as often monthly depending on standard operating procedures. The function test verifies proper operation of refrigeration and mechanical systems and components including compressors, refrigerant charge, valves, heat transfer systems, etc. Common lyophilizer problems include refrigerant leaks, electrical relay failures, and valve failures.



Preventive maintenance should be performed on lyophilizers at prescribed intervals. PM checklist items should include (at minimum): verify UPS and emergency power through the ATS; check computer and VFD alarm history to diagnose anomalies; verify and calibrate temperature, pressure, and level instruments per SOP; check wet vacuum pump oil and change every 2,000-3,000 hours, especially when using solvents other than water. Oil-free vacuum pumps are not as common as wet and may require periodic rebuilding due to lack of lubrication. Finally, it is essential to keep critical spare parts on hand in case of an emergency.



## MSC: Investing More in Advanced Diagnostic Tools & Training Since 1976



Mechanical Service Corporation continually and substantially invests in the most sophisticated, up-to-date diagnostic tools available, from megohmmeters and micromanometers to multimeters and ultrasonic flow meters, and more, to ensure that our elite roster of service technicians is the best equipped in our industry. We spare no expense in making sure all of our technicians receive in-depth training on how to use these instruments properly and effectively.

MSC service technicians receive continuous in-house and off-site technical training including vendor seminars and monthly, collaborative workshops led by on-staff engineers where they share problems and solutions and stay updated on the latest equipment, controls, and technology. MSC certifications include MSCA STAR, UA STAR, NEBB Air and Hydronic Balancing, NEBB Building Commissioning, and CFC Refrigeration. We are fully licensed in electrical, plumbing, and HVAC, and our service technicians are supported by on-staff licensed professional engineers to ensure that customers consistently receive the highest level of expertise, quality, service, and professionalism possible.

## *“No thanks, we’ll buy our own equipment...” Are you sure about that?*

MSC has heard it time and time again. A business opts to handle a commercial HVAC equipment purchase on their own, but has little idea what they’re buying.

There are so many questions that need to be answered. Are the access doors on the correct side of the unit? Was hot gas reheat selected, and if not, why not? Did you purchase start-up? Can your roof hold the weight of the new unit? Are there sufficient service clearances surrounding the unit? What about a first-year warranty, and what are the maintenance requirements during year one? It can all get very confusing, and mistakes are easily made.

Thrifter business owners tend to choose this route because they think they’ll save money, but very often this is not the case. “Simple” errors can result in future expenses, inadequate performance, and worse. Sometimes, the consequences are immediate; needless to say, it’s never a good thing when a realization that the wrong equipment was purchased only occurs after the unit has been rigged onto a high rooftop and the crane is long gone.

Equipment selection on larger construction projects can be a thorny business, as well. It’s not uncommon for disreputable mechanical contractors to “go in tight” when bidding a project in order to secure the award, then source the equipment from the lowest-allowable bidder to recoup the heavy discounts taken in the estimate.

These contractors do this in their own best interest, not their clients’. Owners are usually completely unaware that equipment substitutions have occurred and they won’t be getting what was specified in the project plans. A cheaper unit is almost certain to be a downgrade, and important options like DDC interface controls are likely to be sacrificed.

A far better avenue in any case would be to either have an experienced, licensed professional engineer handle the specifications before the project is bid, or hire a reputable service contractor like MSC to be responsible for the project from start to finish, including ensuring that the correct equipment is shipped and arrives undamaged. Make no mistake, the “savings” that result when owners handle their own equipment purchases often wind up looking like chump change compared to the costs that pile up in the end when mistakes are made.



*By Pete McGrath*