



COMMERCIAL SYSTEMS & SERVICES

Predictive Maintenance



REDUCE BUILDING OPERATING COSTS AND AVOID UNEXPECTED DOWNTIME

A Full Range of Testing Keeps You Informed

Building Survey & Analysis

Start with our comprehensive inspection and analysis of the condition of your building's envelope, cooling and heating systems, ventilation systems, air distribution systems, controls, and more. This expert service can help you improve operating efficiency, ensure performance, and avoid maintenance problems and breakdowns.



Predictive maintenance is the key to solving problems before they become serious.

We'll check for hidden air or water infiltration that could cause building system deterioration or air quality problems.

We'll evaluate the current performance of your HVAC system, and compare this to the original design conditions. Then we'll make recommendations to improve the operating efficiency of the system based upon current operating needs and conditions.

We'll measure air system discharge quantities and static pressures, verify damper control operation, check heating and cooling valves for proper sequencing, and calculate actual coil tonnages. We'll make sure your air

system is properly balanced and delivering the right airflow to every area. If changes in area use, occupancy or partitioning have occurred, we'll recommend updated control settings. We'll inspect all electronic and pneumatic controls for proper calibration.

Our energy audit will include all major energy-consuming systems, such as HVAC, lighting systems and elevators, as we look for additional opportunities to save you money. Moreover, we can audit your mechanical equipment rooms to ensure compliance with the latest ASHRAE Standards and Guidelines.

Our detailed, written report is a great starting point on the road to savings. We'll include plain-language recommendations — a road map to more efficient building management, energy savings, more satisfied occupants, and fewer breakdowns.



Photo courtesy of CSI

Vibration Analysis



Even in the smoothest-running machinery, there's some vibration. For any machine, vibration characteristics are distinct and identifiable. Even "identical" machines will have slightly different, readily identifiable vibration "signatures." When problems develop, those signatures change — and the ways in which they change provide an accurate means of identifying potential problems.

Analyzing the vibration in rotating components of any machine can provide a remarkably detailed picture of many different mechanical problems, even at early stages in their development. And vibration signatures are extremely valuable for future comparison and analysis. If the signature changes over time, it can reveal wear or impending failure. Our full report includes what we tested, how we conducted the tests, complete results including representative vibration signatures, and any recommendations for corrective action.

Photo courtesy of CSI

Thermographic Testing



Photos courtesy of CSI

With heat-sensing scanners and imaging equipment, we'll detect any abnormal temperatures or heat build up in your mechanical systems. If present, they're signs that a system has problems. For example, many building systems have electric motors which are costly to repair or replace. Our thermographic analysis will quickly spot the overly high operating temperatures that are the principal cause of costly motor winding failure.

Thermographic testing also pinpoints such problems as loose or corroded electrical connections, deteriorating wire insulation, and inadequately lubricated bearings. This testing is a powerful tool for early problem identification and avoidance of potential breakdowns. Our written report will include specific recommendations for correcting any detected problems.



Eddy Current Testing

Your chillers' heat exchanger tubes are exposed to chemical, mechanical, and thermal stress. As a result, they can develop a number of harmful conditions that can lead to tube failure with the potential of causing widespread damage to the chiller. Even if heat exchanger tubes could be examined visually, many problems would be difficult to see.

Fortunately, we can spot virtually any kind of tube problem with eddy current testing. An inspection probe, inserted in a heat exchanger tube, creates a magnetic field which causes electrical disturbances in the tube — eddy currents. Expert computer analysis of those currents

can reveal and identify pits, cracks, gouges, bulges, worn areas and other tube defects. We'll provide a printed test record with full-color tube bundle layouts and color-coded defect reports.

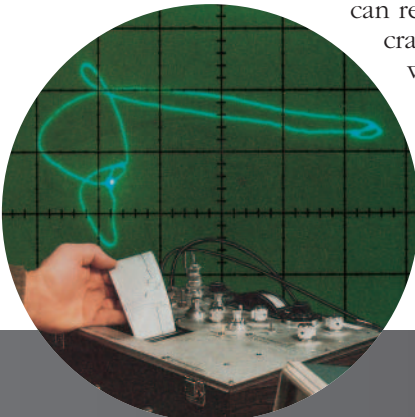


Photo courtesy of MQS Inspection, Inc.

Chiller Tube and Chemical Analysis



Photo courtesy of CSI

Just as you need physical exams to catch any developing health problems, the working fluids and internal components of your chiller need an occasional “physical” for the same reason. Improper lubricant viscosity can cause premature bearing wear. In addition, moisture can infiltrate the system, reducing lubricant performance and forming corrosive acids when mixing with refrigerants. These acids can attack tubes, motor windings and other internal components.

We'll remove tubes to take precise interior and exterior measurements, sample tube scale, and conduct a corrosion evaluation. Our metallurgical analysis will spot and identify any metal deterioration. Our laboratory chemical analysis will determine the condition of all fluids in the chiller: refrigerant, oil, water, or lithium bromide.

These test results can pinpoint a wide range of specific problems. Your detailed report will include any appropriate service, repair, and cost-saving recommendations.

Motor Insulation Testing

Motor failures and resulting downtime are usually caused by motor winding insulation breakdown. Regular motor insulation testing identifies insulation deterioration before failure occurs, permitting budgeted, scheduled repair. We use meg-ohm testing to evaluate the condition of electric motors in your systems without labor-intensive disassembly. Our testing will reveal any weak spots in motor windings or the presence of potentially damaging moisture. Both indicate winding insulation deterioration. We'll also evaluate starters and connecting wire insulation.

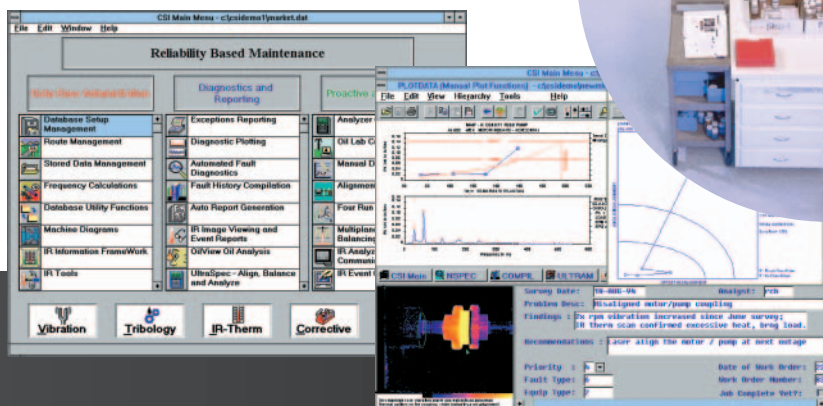
Again, you'll receive a complete written evaluation, with problem-solving recommendations.

An Invaluable Database on Your Facility

Just as a doctor keeps a comprehensive record of a patient's health history and care, we maintain a complete database of all tests and results performed on your building's systems. This record is an essential tool to help optimize operation and identify any developing problems — a key component of predictive maintenance.



Photos courtesy of CSI





Hidden Problems Can Increase Operating Costs. Here's How to Catch and Cure Them.

Your building's systems seem to be running fine. There aren't too many complaints about lack of comfort. Energy costs keep inching up, but that's not unexpected. There are no clear signs of problems.

Perhaps your systems are sound. But are they operating with maximum efficiency to minimize energy costs? Are there hidden problems that could lead to costly repairs and downtime? Could there be indoor air quality problems? Have changes in the building configuration made system modifications necessary?

The longer your building's systems have been in service, the greater the probability your costs are higher than they should be. Fortunately, there's an easy, cost-effective solution: predictive maintenance by Carrier Commercial Systems and Services.

Welcome to Carrier Predictive Maintenance

If equipment fails unexpectedly, you face downtime and, potentially, inconvenienced occupants. With predictive maintenance, you'll know about potential problems before breakdowns occur. That brings you the luxury to schedule repairs before they become more costly — and at times when they won't inconvenience you or your building's occupants.

Using today's best testing tools and technologies, we can discover or rule out virtually any kind of hidden building system problem. As a result, we can help you:

- find, identify, and correct minor problems inexpensively, before they lead to more complex and expensive repairs
- avoid needless downtime and inconvenience or discomfort to occupants
- ensure continued production when equipment is used in process application
- control energy costs
- prolong equipment life, deferring replacement expense
- prevent overtime costs for unscheduled repairs.

In short, Carrier predictive maintenance is the key to optimal building systems management. With it, you can make the most informed decisions and achieve the lowest overall operating costs.

The Best Hardware and Software

With our comprehensive, international experience, we identify and invest in the best tools for complete, accurate building system evaluation. When you turn to Carrier Commercial Systems and Services for system evaluation, you do so knowing you can trust the results.

The Best-Trained Experts

Carrier maintains the largest training organization, and creates the broadest range of advanced training materials, in our industry. We use the best educational technology and proven educational design to assure that we have the most highly trained personnel. We keep our technicians current on the latest systems testing technology — and ensure they have the most up-to-date testing tools.

Carrier Predictive Maintenance: Part of the Most Complete Range of Building Systems Support

Carrier Commercial Systems and Services offers the best support for your vital building systems available anywhere. In addition to sophisticated testing, we're your expert source for any repair or maintenance service. We also have the unique ability to upgrade older Carrier chiller installations to new technologies. That means we can offer advanced refrigerant containment; conversion to environmentally friendly HFC-134a refrigerant; electronic control retrofit... and much more.

All of our services are backed by a depth of HVAC knowledge you won't find anywhere else. It goes back to Dr. Willis Carrier's discovery of the principles of modern air conditioning in 1902 — and his invention of the centrifugal chiller twenty years later. It reflects more than a half-century of Carrier training. And it includes a record of accomplishment servicing every kind of system in every kind of building.

To learn more about how Carrier Commercial Systems and Services can help you control costs and ensure system performance, call your local Carrier service office today.



Cover inset photos courtesy of MQS Inspection, Inc. and CSI.



As the world leader in Heating, Ventilation and Air Conditioning, Carrier is committed to continually improving the quality of comfort we provide to our customers.

But our level of responsibility extends well beyond...

Carrier Corporation has identified six specific areas which directly impact how we, as a world manufacturer, balance our customers' needs for comfort with the environment's needs for responsible consumption.

These symbols graphically represent our six areas of concentration and will serve as visual reminders of the importance of managing our finite resources.

Each one of us at Carrier Corporation believes that, for generations to come, success will not only be measured by the quality of our products and systems, but also by how we have improved the quality of life.



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