

CQS Innovation, Inc.

# Unmanned cells provide faster, safer, more efficient testing

## New test cells allow automatic operation.

- reduce downtime, test transition time, and maintenance
- allow 24-hour, 7-day-a-week testing
- increase tests run per day by 600%
- permit 95% test repeatability.



◀ The video screen on the left allows the lab technician a live view of the actual unit while it is being tested.

**PROBLEM** — *Could this air conditioner manufacturer get better, faster test results with the same staff by implementing an automated test system?*

### BACKGROUND

New government regulations require more advanced testing cells.

When changing government regulations required higher efficiency levels, a major manufacturer of heat pumps and air conditioners began to develop a testing backlog on new products. Each new product design had to be thoroughly tested using federally specified test procedures to measure efficiency.

If all the new products were tested manually, the hours of testing would require a few more cells. With manual test operations, technicians moved from cell to cell monitoring conditions, recording measurements and changing target humidity and temperature settings to stage the next test. Time was lost if the technician was elsewhere when a cell became “ready” for data recording. Shift changes, meals, breaks and weekends suspended testing and caused further delays. To quickly respond to the market’s needs and meet the regulatory deadline, the company hired CQSI to deliver two, next-generation test cells that can run unattended.

### CHALLENGE

**Automate testing to use existing facilities round-the-clock.**

To execute the customer’s testing backlog, the product testing had to be automated to achieve new levels of asset utilization. The customer also wanted to maintain their current level of technical staffing and minimize the amount of system training. CQSI was contracted to provide the new testing equipment and automation services required to commission the new next generation test cell. The operator interface to the new test cell had to simplify unit setup and allow for the testing of multiple unit configurations without additional time for setup of the unit.

The customer’s requirements for the chiller equipment mandated the equipment be an easy-to-maintain, compact package, with built-in capabilities for remote diagnostics. The chiller package was designed to condition the two individual rooms of the test cell. One of these rooms simulates outdoor environmental conditions while the other room simulates indoor environmental conditions. The outdoor room must provide ambient dry bulb temperatures ranging from -20°F to 120°F and wetbulb temperatures ranging from 10°F to 80°F. The indoor room must provide ambient drybulb temperatures ranging from 40°F to 120°F, and wetbulb temperatures ranging from 40°F to 80°F. Each room requires a  $\pm .2^\circ\text{F}$  tolerance.



## SOLUTION

*After placing a unit in the chamber, the overhead crane and track move out of the way so the door can totally seal the test chamber for optimal test conditions.*

# Quickly pull down to sub-zero temperatures

## SOLUTION

**Integrated system for simpler, 24-hour operation and improved test conditions.**

A tightly sealed chamber and precise condition controls were key to achieving the goals. Each test room has 4" to 5" thick stucco aluminum-insulated walls. Indoor test rooms have insulated concrete floors; the outdoor room features insulated stainless steel floors. An overhead monorail system allows one lab technician to safely, easily and accurately position units in the cell; then move the track completely out of the way for an absolutely tight seal. To prevent door seals from freezing during test and degrading, door frames are heated.

The chiller package consisted of three independent compressor systems used to maintain the environmental conditions inside the test cell. The independent operation of the compressors allowed the test cell to continue operation even when one compressor fails. A direct expansion coil lets the outdoor room pull down to sub-zero temperatures within six hours, for faster component failure tests. Dehumidification coils in each room maintain the humidity, and blowers mounted externally to the conditioned air space prevent miscellaneous heat sources from affecting the controlled room conditions.

To facilitate 24 hour unmanned operation of the test cell, a computer/control system supervises the operation of the test cell. Aerospace grade RTD's, individually calibrated to smart transmitters, help minimize the amount of error involved in the collection of precise temperature readings. Allen Bradley Digital I/O, integrated to a Staco Autotransformer, allow the computer/control system to vary and monitor the voltage of the power connected to the unit on a per phase basis. The computer/control system provides the customer with the flexibility to execute multiple tests on multiple unit configurations and greatly shorten overall test time.

## RESULTS

**24-hour-a-day operation with 95% test repeatability.**

CQSI installed the test cells in the customer's new R&D facility - including wiring installation, hook up of the cooling water source to each chiller package, and facility modifications to house the new chambers. Lab technicians were able to operate the systems within a two-week time frame.

Under actual operation the customer found the new system:

- pulled down to sub-zero temperatures in six hours (at minus 20°F. the test was terminated),
- reduced downtime compared to their existing test cells,
- permitted 24-hours/day, 7 days/week testing, without technician support,
- increased number of possible tests run per day by 600%,
- reduced set-up transition time by 75%,
- reduced preventative maintenance from 10 days to 4 days per month,
- permitted 95% (or more) of all tests to produce repeatable results.

The customer was so pleased with the completed installation that they have purchased more.

## Making your manufacturing world-class.

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