Chiller Performance Testing Program

Proven performance under your watchful eye

TRANE TECHNOLOGIES

The Proof Is in the Testing

Ensuring performance

Computer selection programs predict chiller performance based on laboratory testing. Testing your chiller in the factory confirms that the actual chiller performance matches the predicted performance, and the results serve as a benchmark during the commissioning process. Factory testing also verifies the pre-installation quality of the chiller, helping ensure a trouble-free startup.

AHRI Certified™

The Air-Conditioning, Heating and Refrigeration Institute (AHRI) developed Standard 550/590 to govern the certification and testing of continuous loading and unloading of chillers. AHRI defines the range and type of chillers covered by Standard 550/590, but chillers outside of this scope may still be tested in our facility using the same procedure. Several times a year, AHRI tests random production chillers to verify that the predicted performance falls within the defined tolerances.

Both the air-cooled and water-cooled test stands in our Pueblo, Colorado chiller manufacturing facility have been approved by AHRI for certification testing. In fact, Trane was the first chiller manufacturer to have an AHRI-approved air-cooled test facility.

AHRI Standard 550/590

Chiller efficiency is measured under full load and part load operation, and tests are conducted in accordance with AHRI Standard 550/590. This Standard defines the temperatures and flow rates for loads of 100, 75, 50 and 25 percent. Each point is tested, and then the Integrated Part Load Value (IPLV) can be calculated.

However, a chiller's performance depends not only on these standard AHRI points, but on many factors ranging from chilled water temperature to outside weather.

Simulating your jobsite's unique conditions in the factory provides valuable insights into how you can expect your chiller to perform once installed.

Although some manufacturers focus on IPLV only, high efficiency at full load determines the ability of the chiller to minimize the electrical infrastructure required, and reduces the impact of demand-based charges and real-time pricing during peak periods. The full load efficiency rating is required for buildings to comply with most local codes. Both full load and IPLV ratings are required for LEED® Energy and Atmosphere (EA) credits.

More meaningful part load test data should be based on the specific building type, location and plant design, providing accurate part load condenser temperatures based on the local weather data. Understanding the ton-hours at each of the part load points allows the customer to more accurately estimate annualized energy use.

Adherence to AHRI tolerances

AHRI Standard 550/590 also defines the allowable tolerances for performance tests including:

- Flow rates ± 5 percent
- Leaving evaporator and entering condenser water temperatures ± 0.5°F of target
- Air temperature +/- 1°F
- Voltage ± 10 percent of nameplate
- Frequency ± 1 percent of nameplate
- Water pressure drop — maximum of 1.15 times rated pressure drop at rated flow rate OR rated pressure drop plus 2 feet of H_2O, whichever is greater.
- Tolerances for capacity and efficiency vary depending on the full load evaporator temperature difference and the load point

These tolerances apply to all standard AHRI tests.

"Our primary focus in new HVAC systems is energy management, and it is critical to ensure that our systems will perform as designed. Using a witness performance test gives us the documentation to prove that we can operate as designed."

– Larry Hood, senior construction manager for Volusia County Schools, Florida

"A witness performance test confirms to our customers what we say about our energy efficiency and performance. It is one great step towards earning their trust."

– Kelly Carlson, LEED accredited professional, Trane sales engineer

Air-Cooled Chiller Testing

Our AHRI-approved test facility provides unmatched air-cooled chiller testing capabilities, with the ability to test 20-500 ton air-cooled chillers over a wide range of conditions:

- Test a 20 ton air-cooled chiller at full load under 110°F ambient test conditions even during the sub-freezing temperatures of our winter months.
- Or, test a 500 ton chiller at minimum load under 55°F ambient test conditions during our warmest summer months when outdoor temperatures can exceed 100°F.
- Or, simulate glycol by testing the saturated evaporator temperature from the glycol selection as long as the saturated temperature is 37°F or higher.

We are able to replicate your jobsite conditions by matching the leaving chilled water temperature, flow rates and ambient temperatures.

The test facility is located 4,700 feet above sea level, so test conditions may be submitted based on either:

- Predicted performance at this elevation, or
- Sea level, with the test results adjusted per AHRI Standard 550/590, Appendix F according to the barometric pressure of the test facility on the day of the test.

Water-Cooled Chiller Testing

We can test water-cooled chillers over a wide range of operating conditions:

- Leaving evaporator temperatures down to 38°F or up to 50°F
- Simulated for glycol with saturated evaporator temperatures down to 37°F
- Entering condenser temperatures from 60°F to 130°F

With the growing number of geothermal applications, we can also accommodate chillers running in the heating mode, as our facility is designed to test units with leaving condenser water temperatures up to 140°F.

Rapid restart

For many mission-critical applications, bringing a chiller back online rapidly after a power loss is crucial. When every second counts, having this rapid restart capability proven on the test stand will demonstrate the chiller's ability to adapt to power-loss situations.

Testing You Can Count On

Testing at more difficult operating conditions to account for clean tubes

Tubes in the chiller serve as the heat transfer surface. A certain amount of fouling will occur on the walls of the tubes after the chiller is operating. Fouling impedes heat transfer and makes the chiller work harder. The predicted chiller performance anticipates slightly reduced heat transfer performance due to the fouling factor specified. The test conditions will be adjusted so that the chiller works as hard during the test as it will after fouling has occurred.

The evaporator leaving water temperature is adjusted slightly lower. For water-cooled chillers, the condenser entering water temperature is adjusted slightly higher.

Recording of test data

The computer data acquisition system records four sets of data at five minute intervals. It displays the result of each data set. Following the fourth set, the results are averaged and a report is generated. We will review this report with you to confirm that your chiller meets the test requirements.

Test instrument calibration

To ensure our chiller testing meets or exceeds the accuracy requirements of AHRI Standard 550/590, testing equipment is calibrated and validated by the National Institute of Standards and Technology (NIST). A copy of the latest calibration report is available on request.

Redundant measurements

Redundant measuring devices are designed into test loops to verify test data. Redundant sensors measure water flow rates, temperatures and unit power consumption. Agreement between the calibrated sensors confirms the data taken is accurate. Continuous real-time monitoring of these measurements is done for all performance and witness tests.

Heat balance calculation

To confirm that the water-cooled test data is valid, a heat balance is calculated to verify that the energy entering the system (at the evaporator and the motor) equals the energy leaving the system (at the condenser). The heat balance calculation does not verify if the performance is good or bad; rather, it validates that the quality of the data is good. Trane typically calculates a 100 percent load heat balance of ± 1.5 percent, which is tighter than the AHRI-defined heat balance tolerance.

Test chiller, Trane Laboratory

Research and development

The testing process starts in research and development. We look at environmental performance, acoustic characteristics, operating longevity, and overall operating efficiency. After the chiller goes into production, we keep looking for ways to make it better, quieter, more reliable and more efficient.

TRANE

Trane – by Trane Technologies (NYSE: TT), a global climate innovator – creates comfortable, energy efficient indoor environments through a broad portfolio of heating, ventilating and air conditioning systems and controls, services, parts and supply. For more information, please visit *trane.com* or *tranetechnologies.com*.

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