



Chiller performance testing program

Proven performance under your watchful eye



The proof is in the testing



“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 Strokes, LEED accredited professional, Trane sales engineer

Ensure chiller performance

Businesses around the world are being challenged to improve energy efficiency. According to the World Business Council for Sustainable Development, buildings worldwide account for 40% of global energy consumption. Of that amount, between 45% to 65% is used by the HVAC systems that keep building environments comfortable and healthy. The slightest inefficiencies in cooling and heating equipment create a huge energy drain and the financial impact is significant.

The first step in meeting your energy management goals is a Trane performance test. This verifies that your chiller will perform as specified under job site conditions.

Trane is the global chiller leader

Trane has manufactured centrifugal chillers in La Crosse since 1938. Much more than a chiller manufacturing location, La Crosse is the birthplace of Trane and the site of the world’s leading building comfort research location. Equipment and systems developed and tested in La Crosse are found in hundreds of thousands of buildings around the world.

In 1987 a new manufacturing facility was constructed in Pueblo, Colorado to produce Series R screw compressor water chillers. Since then, the Pueblo facility has doubled in size and produces both air-cooled and water-cooled chillers. Visitors come to La Crosse and Pueblo from all over the globe to see our world class manufacturing and testing facilities first hand.

La Crosse, Wisconsin is located on the Mississippi River, the second largest river in the world, with scenic landscapes of limestone and bluffs that soar high above both sides of the river. The drive along the upper Mississippi is one of the most beautiful in the United States.

Pueblo, Colorado is located at the base of the Rocky Mountains. The mountains create a beautiful backdrop and provide many exciting activities for every season.

Performance testing to match your specifications

Computer selection programs predict chiller performance based on laboratory testing. Factory performance tests confirm that the actual chiller performance matches the predicted performance, and the results serve as a benchmark during the commissioning process.

We are committed to the highest level of design and manufacturing accuracy to make sure your chiller performs as expected.

AHRI 550/590 certification

AHRI Standard 550/590 requires specific types of instrumentation and specifies chiller testing procedures and tolerances.

Trane chillers are AHRI certified. AHRI requires a copy of the computer selection program used to predict the chiller performance. Several times a year, AHRI tests random production chillers to verify that the predicted performance falls within the defined tolerance.

All Trane test stands in La Crosse and Pueblo are approved by AHRI for certification testing. Trane Pueblo is the first chiller manufacturer to have an AHRI approved air-cooled test facility. Each test facility undergoes an extensive and rigorous inspection process conducted by AHRI to gain approval for conducting AHRI certification tests.

AHRI 575 factory sound test

If the sound pressure test per AHRI Standard 575 is specified, we will discuss the procedure with you.



Testing is our way of life



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.

Measurement that counts

Accurate measurement is an integral part of performance testing. All the following instrumentation is calibrated and traceable to NIST, the National Institute of Standards and Technology: wattmeter, temperature sensors, flow meters, and pressure transmitters. This ensures the instrumentation meets or exceeds the accuracy requirements of AHRI Standard 550/590. A copy of the latest calibration report is available upon request.

A poly-phase wattmeter measures the volts and amps per phase and the kW. Two platinum resistance temperature detectors (RTDs) measure temperature at each location (entering and leaving evaporator water, entering and leaving condenser water for water-cooled, ambient air for air-cooled). Magnetic flow meters measure the evaporator and condenser water flow, where applicable. For air-cooled units, the ambient temperature system averages multiple readings from sensors throughout the controlled test environment. Differential pressure transmitters measure the water pressure drop.

Redundant measurements: Per industry practices, redundant measurement devices are designed into test loops to verify test data. Redundant sensors are used to measure evaporator water flow, evaporator water 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.

Part load conditions per AHRI standard, or at your specified conditions

Large chillers are tested at full load to determine the capability and efficiency of the unit at design duty. The full load performance often affects demand charges. For part-load measurements, AHRI 550/590 defines the entering condenser water temperatures or ambient air temperature for 75 percent, 50 percent, and 25 percent load. If you prefer to have your chiller tested at other part load conditions the measurements are taken using the same methods.



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 operational. 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 condensers the condensing entering water temperature is adjusted slight higher.

We meet AHRI tolerances

When you select a Trane chiller, a product report is provided from the computer selection program that predicts performance. The purpose of a factory test is to verify the chiller operates at this performance level, plus or minus a tolerance as defined by AHRI.

This tolerance is applicable to all manufacturers. The following AHRI tolerances are consistent for all tests:

- Flow rates $\pm 5\%$
- Water pressure drop $< 115\%$
- Leaving evaporator and entering condenser water temperatures $\pm 0.5^{\circ}\text{F}$ of target
- Voltage $\pm 10\%$ of nameplate
- Frequency $\pm 1\%$ of nameplate



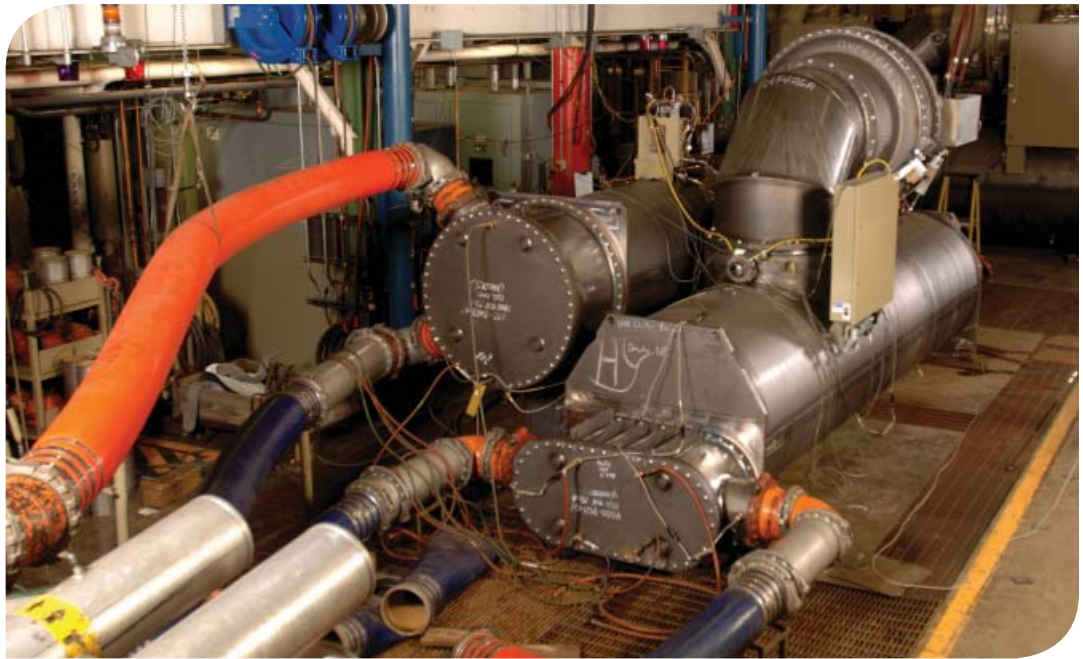
The tolerance for tons, kW/ton, and heat balance varies based on the chiller load and the operating conditions of the system. The specific tolerances for the test are listed on the test target sheet.

Recording of test data for your review

The computer data acquisition system records three sets of data at five minute intervals. It displays the result of each data set. Following the third set, the results are averaged and a report is printed showing this data.

We will review this report with you to confirm that your chiller meets the test requirements.

Proven performance and quality workmanship



Full-load vibration test available

Trane performs a vibration test on the assembled centrifugal chiller compressor at the time of the 100 percent load test. Advise us if you would like to see the vibration test results.

A nickel can be balanced on the edge of the main compressor-motor assembly, demonstrating the extremely low vibrations generated by the unit while operating. We can arrange for the famous “nickel test.”



Energy that comes into our system must equal the energy that comes out

Energy comes into the system at the evaporator and the motor. The energy leaves the system at the condenser. For a hermetic chiller, the energy absorbed from, or given to, the equipment room or ambient air is ignored.

Heat balance calculation: While it is collecting data for water-cooled performance tests, the computer calculates a heat balance to confirm that the test data is valid.

Energy In = Energy Out: A good heat balance does not verify that the chiller performance is good or bad. Instead, it verifies that the quality of the data is good.

We typically expect that the 100% load heat balance will be $\pm 1.5\%$. The allowed tolerance for your test's heat balance is listed on the test target sheets.

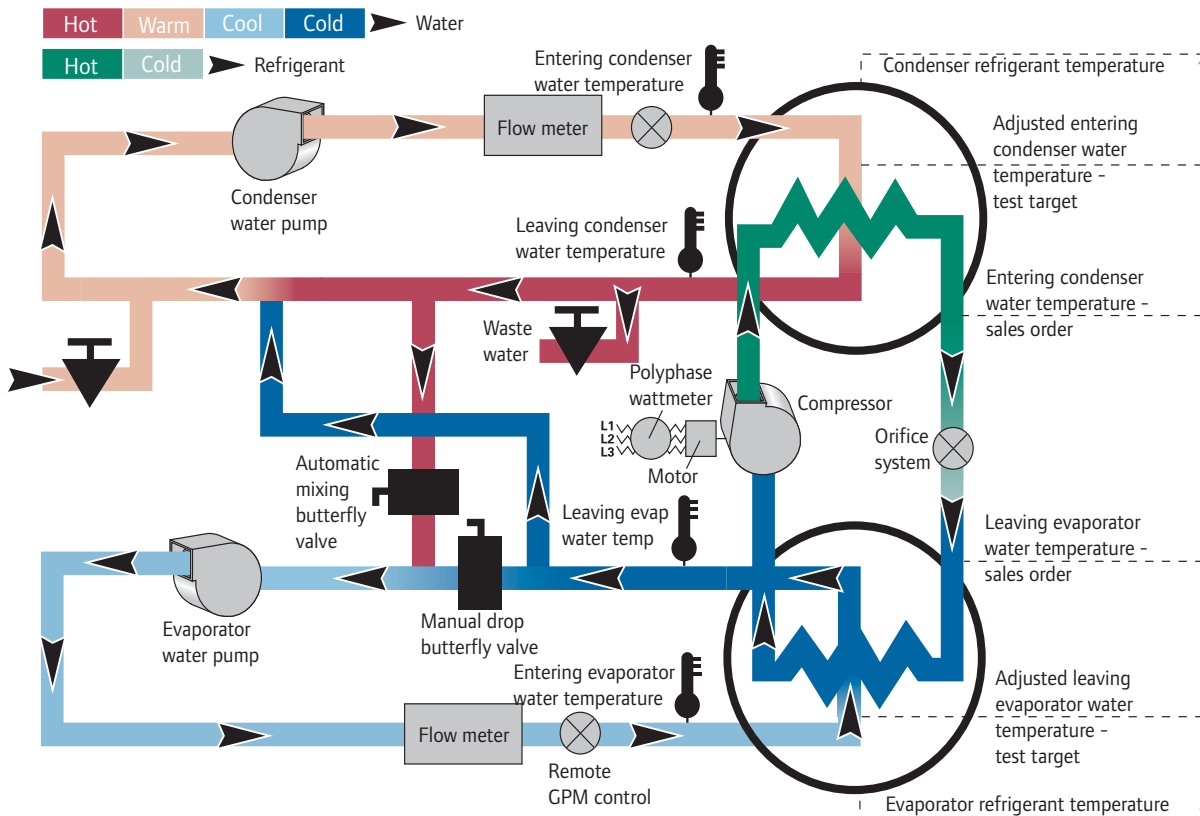
How does the water-cooled test loop work?

Each test loop has an evaporator section and a condenser section. An interconnecting water distribution system allows us to create a cooling load for the chiller by adding hot leaving condenser water to the leaving evaporator water. At the same time, an equal amount of cold leaving evaporator water is added to the leaving condenser water to create the desired entering condenser water temperature. Usually this does not adequately reduce the water temperature, so some cold water is added to obtain the target entering condenser water temperature. An equal amount of hot water is discharged from the system.



A performance test will ensure your chiller will start up and operate without problems when it reaches the job site. You can confirm your chiller performance at design conditions before it ships to the job site.

Water-cooled test loop





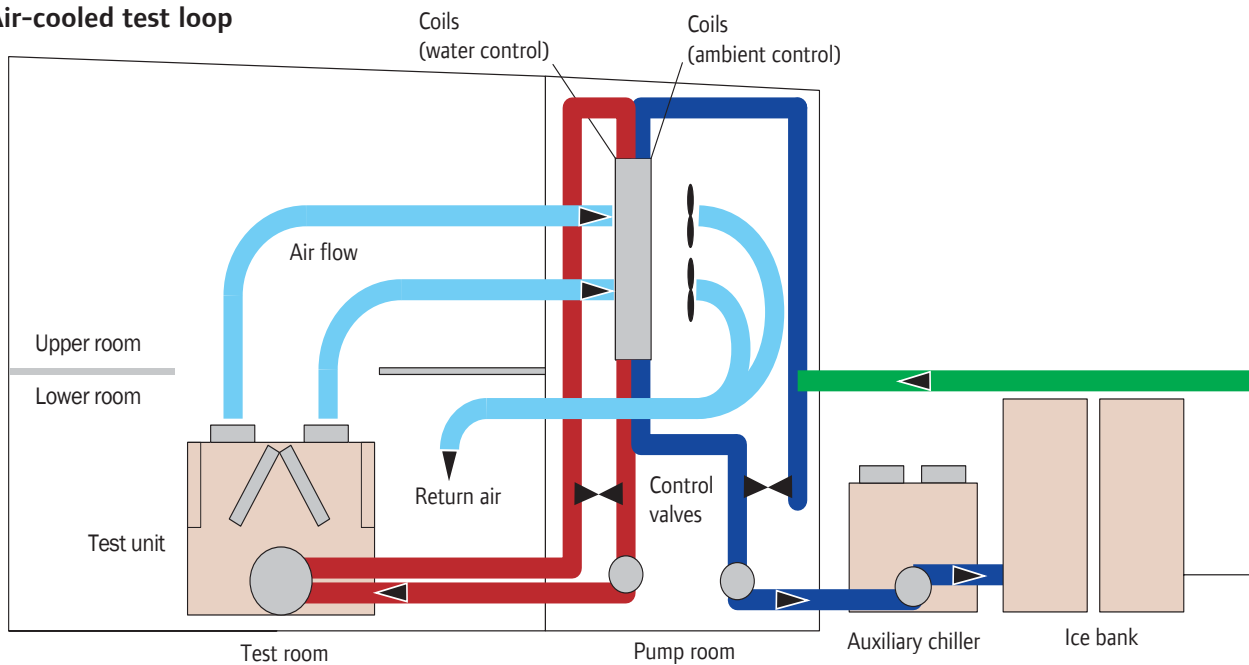
How does the air-cooled test loop work?

The air-cooled test loop has an evaporator section and a condenser section. Inter-connected water and air loops create a cooling load for the chiller by adding heat from the discharge air to the leaving-evaporator water.

Design ambient operating conditions are controlled by pulling the discharge condenser airflow through a set of water-cooled coils. The first coil transfers heat from the discharge air to the leaving-evaporator water. The second coil bank, with water from an auxiliary chiller, further cools the air to the design ambient before returning it to the test environment.

The ambient air temperature within the test facility will be compensated for air density at 4,700 feet above sea level.

Air-cooled test loop



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