

# Systems Extreme Environmental Test Laboratory (SEET)

## Trane's reliability testing facility

In the SEET lab, Trane technicians will put a heat pump system through 2,688 hours of continuous testing, watching for signs of weakness or unusual wear. Why do we only test heat pumps? Because if a Climatuff® compressor can withstand SEET as a heat pump, it will

easily handle any stress it may encounter as an air conditioner. During the 16-week testing period, heat pump systems undergo two-week cycles of torture, eight consecutive times, allowing engineers to measure and manage a system's quality and performance. Only the strong survive.

## Round 1: Heating defrost with snow

Outside temp: 23° with snow and ice

Inside temp: 90°

Objective: The heat pump's challenge is to heat and maintain an inside room at 105° while operating in sub-freezing conditions. The coil must be free of ice build-up in order to perform under these conditions. This test will require the compressor to work very hard and run almost continuously.

## Round 2: Cooling

Outside temp: 100° with fan shut off

Inside temp: 75°

Objective: To cause the unit to cycle on overload by simulating outdoor fan failure. This test will also determine if the unit will restart after it cools down.

Note: When pressure builds too high, the internal pressure relief valve will open and discharge hot gases over the internal motor overload device, which in turn will open and shut down the compressor. The internal overload device is designed to take the compressor off-line on any combination of temperature and current that exceeds motor winding tolerances.

## Round 3: Minimum load heating

Outside temp: 0°

Inside temp: 90°

Objective: With minimum refrigerant flow, compressor bearings could seize because there's not enough oil to lube the bearings to keep them from burning. The Climatuff® compressor has the velocity necessary to pull oil back through the lines and into the compressor to lubricate all bearing surfaces.



## Systems Extreme Environmental Test Laboratory (SEET)

### What it is:

A controlled testing environment that simulates extreme weather conditions.

### What it tests:

Heat pump systems.

### Length of test:

16 weeks of high stress, accelerated conditions simulating five years of wear and tear.

### Why it exists:

SEET supports Trane's manufacturing philosophy of testing in the lab, not in a consumer's home. All of Trane's testing procedures are conducted at much higher extremes and in more stressful conditions than the rest of the industry.

After each test period, each unit is disassembled and its compressor is cut apart and analyzed to locate signs of stress.

## Round 4: Power shut off

Objective: After 12 hours of power outage, oil can drain or be washed off bearing surfaces by refrigerant migration. The oil reservoir at the bottom of the sump has been floated above the oil pump opening by the heavier liquid refrigerant. On start-up, Trane's unique bearing plating will serve as a boundary lubricant until oil flow is established. This test simulates the effects of a power outage, giving engineers the opportunity to see if the compressor can withstand starting conditions with little or no oil pressure.

## Round 5: Cooling maximum load #2

Outside temp: 125°

Inside temp: 90°

Objective: To remove excessive indoor heat, getting rid of it outdoors. System is cycled and must restart and run without tripping off.

## Round 6: Cooling flood

Outside temp: 85°

Inside temp: 80° with indoor blower off

Objective: To subject the compressor to the mechanical stresses of liquid refrigerant flood back or TXV shutoff. Gross system overcharge or blocked indoor airflow could cause this condition.

## Round 7: Cooling maximum load

Outside temp: 125°

Inside temp: 80°

Objective: To attempt to force the compressor to shut down under the stress of high load conditions, and load voltage.

## Round 8: Power shut off

Objective: To produce a start-up situation that could seize most compressors due to low oil pressure across the bearings.



XL Heat Pump



Variable Speed Gas Furnace

## Outdoor Unit Testing Procedures:

### Psychrometric lab tests

Run tests according to ARI Standard 210/240. Indoor rooms capable of simulating temps of 40°F to 100°F. Outdoor rooms simulate -20°F to 120°F.

### Compressor motor tests

Compressor motors are tested at five to six times the rated current and at twice normal temperatures. Compressor is turned on and off at cycling rates ten times faster than normal for weeks at a time.

### Compressor calorimeter testing

Capacity and development tests are conducted in a thermally controlled environment, unmanned and collecting data continuously.

### Compressor life test room

Tests mechanical loadings, high-pressure refrigerant charge, bearing stresses, fatigue stress, chips contamination in the refrigerant and more.

### Rain room tests

Underwriters Laboratory (UL) rain tests conducted at 6-inches per hour to detect any risk of shock from electrical components.

### Materials and processes lab tests

Ongoing testing on alternate refrigerants, metallurgy, oils, powder paint processes and more.

### Rain/fog/low temperature room tests

Tests demand defrost controls, ice build-up, oil migration and cold start-ups for motors and compressors.

Trane reliability is the result of a long history of comprehensive component and system testing—testing that not only meets industry standards, but exceeds them. That's because at Trane, we set industry-leading standards.

## Why We Test:

### Performance

Prescribed by ARI and carried out with tests in accordance with ASHRAE standards.

### Reliability

Trane's reliability tests exceed industry standards. For example, a 2,000-hour salt spray test is run on fin-type coil samples to check corrosion levels. Industry standards require 1,000 hours of testing. Trane also field-tests units in real-world environments to monitor the harmful effects of salt spray on painted surfaces, Spine Fin coils and electrical components.

### Safety

Required by UL, safety tests consist of electrical component temperature and pressure testing. Trane's safety tests are conducted at extremes higher than required by industry standards.

### Simulation of data

Airflow and sound tests are conducted in order to simulate product performance.

## Gas Furnace Testing Procedures:

### Heat exchanger thermal stress test

ANSI.Z21.47 residential gas furnace design standards require all furnace heat exchangers to pass a 10,000-cycle stress test without failure. Trane's patented heat exchanger design successfully passed this test five times.

### Heat exchanger corrosion test

Trane's heat exchangers are tested with "chlorine-spiked fuel" to simulate operation with contaminated combustion air. The corrosion test is operated for a minimum of 100 days and 12,000 cycles and provides the assurance of long-term reliability.

### Heat exchanger pressure decay test

Each individual heat exchanger is pressure tested to comply with the ANSI.Z21.47 test standards. Trane goes one step further and stamps the test station number into the corner of each heat exchanger that passes the test. This stamp of approval provides a visual confirmation of a gas-tight heat exchanger and approval for use in a Trane furnace.

### Combustion testing

There is an extensive set of combustion and emission tests required for design certification. Trane not only meets these industry standards,

but also routinely conducts more stringent tests in order to produce a more robust design.

### Electronic verification of parts

Key furnace components are electronically verified for each individual furnace model by scanning the bar code label. The end-of-line run test requires all critical parts to be verified before the test can begin.

### End-of-line run test

Trane fires each furnace and cycles all of the components. The computer controlled run test automatically sequences the furnace through a series of tests and will only print a shipping label for furnaces that pass. The test data for each furnace is permanently stored for use by Trane's field support personnel.

### Daily audits

Compliance audits are required in order to maintain agency approval. Trane exceeds these requirements by performing a daily audit of furnaces built on each assembly line.