

**NOVELL**  **CUSTOM**  
HEATING AND AIR CONDITIONING CO



*It's Hard To Stop A Trane.®*



## The Trane Difference.

- ≡ Innovation
- ≡ Quality
- ≡ Reliability
- ≡ Durability
- ≡ Efficiency
- ≡ Leadership

## A Century of Innovation.

Trane, a leading global provider of indoor comfort systems and comprehensive facility solutions, began as a family-owned business more than a century ago. In 1885, James Trane opened his plumbing company in La Crosse, Wisconsin, and in 1913 was joined by his engineer son, Reuben. Their small company gradually evolved from plumbing into manufacturing heating products. Their first innovation was a low-pressure steam heating system called Trane Vapor Heating, and by 1925 their lightweight, highly efficient convector radiator could replace the heavy cast-iron radiators of their day. Their first air conditioner, the Trane Unit Cooler, was designed in 1931. Trane acquired the central air conditioning department of General Electric in 1982, forging an even stronger future for Trane in the manufacturing of residential comfort systems.

Today, Trane continues to apply leading-edge technology to the design and manufacturing of air conditioning and heating systems with a revolutionary whole-house air filtration system. TRANE CleanEffects™ with iFD technology removes up to 99.98% of allergens from the filtered indoor air, making your entire home a clean air comfort zone.

Trane commercial products are now sold through a network of nearly 200 sales offices in more than 100 countries throughout the world. Today, just as in 1885, Trane is dedicated to providing unparalleled expertise, quality products and exceptional service to ensure that each building we touch works better—for life.

## Trane: A Brief History.

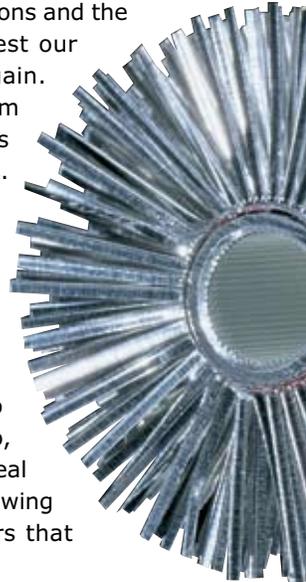
# The Trane Difference.



## We admit it. We do things differently.

We're a different kind of manufacturer. And, we don't mind admitting it. We don't just assemble pieces into parts and parts into air conditioners. Trane engineers spend years researching and developing products based on the analysis of consumer and dealer needs. We design our products and components using the most durable materials and the most innovative technologies available. We manufacture our products with the tightest specifications and the highest industry standards. And we test our products—over, and over, and over again. At Trane, we control product quality from idea to installation. And, that makes us just a little different from the other guys.

Trane builds air conditioners, furnaces, heat pumps, air handlers, coils, air cleaners, comfort controls, boilers, energy recovery ventilators (ERV), humidifiers and packaged units for the residential and light commercial markets—products that are efficient to operate, work when they're supposed to, last for a long time, and provide the ideal home or work environment. On the following pages, you'll discover the many factors that contribute to the Trane difference.



For more information about our home comfort products, please visit [www.trane.com](http://www.trane.com).

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# The Trane Difference. System Superiority.

When designed around a consumer's lifestyle and specific needs, a Trane system is the best long-term solution for providing superior indoor comfort.

A Trane comfort system is just that—a system that is completely integrated into a home's indoor environment, enhancing its livability room by room. In the following chapters, you will learn why Trane components are extremely reliable, durable and efficient. When these components are combined into a system, you can imagine the impact they can make on a home's comfort. At Trane, we also believe your heating and cooling system should clean the air as

well as condition it, and TRANE CleanEffects™ whole-house air filtration system can do that far better than any other system you can buy. It is designed to help deliver what we call Trane Air™—air that is reliably heated and cooled, thoroughly conditioned, and meticulously cleaned for the highest level of comfort inside your home. By working closely with consumers, an independent Trane dealer can provide comfort solutions for a consumer's home and years of worry-free satisfaction.

Trane systems are highly flexible. They are engineered to offer options in terms of capacity, airflow, humidity control, air filtration, energy use and operating efficiency. There are also options in zoning and system controls.

## Only a complete system can provide complete comfort.

The performance and efficiency of an outdoor unit is based on being matched with a similarly engineered indoor unit of like size and capacity. In other words, it is not assigned an efficiency rating independently as a separate component. An air conditioner or heat pump is assigned an efficiency rating as part of a matched system. If a new, high efficiency outdoor unit is installed without replacing the evaporator coil, it is a mismatched system and may not achieve the SEER rating indicated on its EPA hang tag. **Studies have shown that if an old coil is not replaced when a new outdoor unit is installed, the new unit could actually suffer more than a 20% decline in SEER.**

**By the same token, the cooling or heating capacity can also be affected. Studies have shown that if an old coil is not replaced, a system could realize as much as a 10% loss in capacity.**

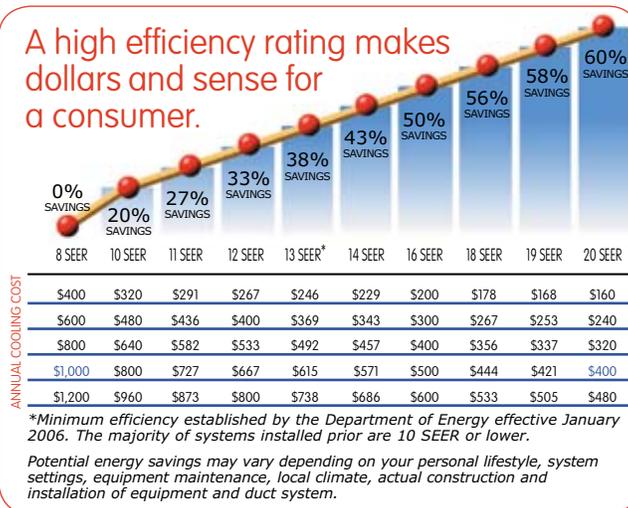
Reliability also becomes an issue with a mismatched system. An older coil is usually a dirty coil. And a dirty coil causes the compressor in the outdoor unit to work harder than it should, which could ultimately shorten its life. A mismatched system is not the best comfort choice for a consumer, particularly if the consumer is purchasing a high efficiency outdoor unit in order to reduce energy use.

## Every Trane system is built with efficiency in mind.

Every Trane comfort system has been designed and engineered to attain the highest level of performance for maximum efficiency and reliability. There is simply no better way to an ideal home environment. For example, Trane furnaces have key furnace control functions integrated into one microelectronic system, which constantly monitors, analyzes and regulates the operation of the gas burner, the induced draft motor and the indoor fan. The multi-port in-shot burner perfectly shapes the flame cone for the maximum heat possible, while using the least amount of fuel. Each burner is fired at 20,000 BTUH, which is significantly less than many other furnaces in the industry. This lower BTUH leads to longer life and reliability. Another efficiency feature is the adaptive hot surface silicon nitride igniter, which starts burners electrically, eliminating a wasteful pilot light.

**Trane's variable speed air handlers are also highly efficient. Equipped with an ECM (Electronically Commutated Motor), these units provide just the right amount of warm or cool air to maintain comfort. A standard motor only has an "off" and "on" speed, which means it runs at maximum capacity when it's on. A variable speed motor can run at lower speeds, to clean, circulate and dehumidify the air more effectively.** It also offers continuous comfort and quiet operation. When matched with the appropriate outdoor unit, you can create a highly efficient system which provides greater comfort and a lower cost of operation.

A high efficiency rating makes dollars and sense for a consumer.



## An experience unlike any other: The XL Comfort System.

While all of Trane's heating and air conditioning systems are highly efficient, durable and reliable, our XL systems provide the ultimate in indoor comfort. These state-of-the-art comfort systems take comfort and efficiency to a new level, offering the consumer a one-of-a-kind comfort experience.

Drawing on Trane's heritage in heat transfer and compressor technology, and marrying it with our highly innovative and tightly integrated cabinet design, these systems offer quiet and efficient operation for years and years. Take a look and see how Trane is raising the bar in home comfort.



### A Complete Line-Up Of Ultra Efficiency Matched Systems.

- ≡ XL air conditioner, variable speed furnace, Comfort™ coil, TRANE CleanEffects™ air cleaner and programmable thermostat
- ≡ XL air conditioner, variable speed air handler, TRANE CleanEffects™ air cleaner and programmable thermostat
- ≡ XL heat pump, variable speed air handler, TRANE CleanEffects™ air cleaner and programmable thermostat
- ≡ XL heat pump, variable speed furnace, Comfort™ coil, TRANE CleanEffects™ air cleaner and programmable thermostat

### Variable Speed Technology.

The variable speed indoor blower motor used in XL systems is programmed to be a constant airflow blower motor. The drive module controls the motor speed and torque to ensure a constant volume of airflow. If the resistance to airflow in the duct system increases (due to dirty filters, closed registers or other reasons), the drive module immediately detects this and increases the rpm of the motor. When the drive module picks up the higher rpm, it will increase the speed and torque to move more air. When the desired airflow is again achieved, the motor settles into the proper speed. This unique feature of speed variability ensures compressor reliability, proper system capacity and airflow distribution throughout the duct system.



### Staged Heating and Cooling.

Instead of operating on a single, full-blast speed, a multiple stage system operates efficiently at a lower speed most of the time. On extremely hot or cold days, it switches to a higher stage to maintain comfort. Because of this, staged heating and cooling puts an end to temperature swings. And, since the system operates at a slower speed much of the time, conditioned air is continuously distributed throughout the home, enhancing comfort and indoor air quality.

### Reduced Operating Sound Levels.

Our systems are designed to be quiet, beginning with the heavy steel insulated cabinets and variable speed blower motors in our high efficiency indoor units. With our quiet Climatuff® compressors and sound insulators in our outdoor units, exterior operating sound is minimized as well. The cabinet design of our outdoor products also leads to reduced operating sound, with rattle-resistant panels and top, and a composite basepan which prevents metal on metal vibration.

### Enhanced Indoor Air Quality.

TRANE CleanEffects™ is the most effective whole-house air filtration system available. This revolutionary technology removes up to 99.98% of unwanted irritants as small as .1 microns from the filtered indoor air, effectively reducing the triggers for asthma and allergies. No other air filtration system can make that claim. TRANE CleanEffects is eight times more effective than a typical HEPA room appliance, and 100 times more effective than a standard 1" throwaway filter, delivering clean air throughout your home.

### Comfort-R™ and Dehumidification.

This technology is called Comfort-R™ and it's set by the installer. During cooling, the motor ramps up slowly—the slow movement of air allows the Comfort™ coil to cool quickly, which means moisture is extracted from the air. This dehumidification feature removes four times the amount of moisture that a standard system can. It also provides more immediate comfort, allowing a home to get cooler or warmer faster.

# Clean Air

## Quality is in the air

At Trane, we believe that a heating and cooling system should clean as well as condition the air. And TRANE CleanEffects™ will help do that far better than any other

air filtration system on the market today. **It is the new industry benchmark verified by experts who make it their business to know about clean air.**



## TRANE CleanEffects

- ≡ Removes up to 99.98% of allergens from the filtered air
- ≡ Traps particles down to .1 microns in size
- ≡ Up to 100 times more effective than a standard 1" filter
- ≡ Delivers cleaner air, and more of it
- ≡ Performance verified by leading experts at the Harvard School of Public Health

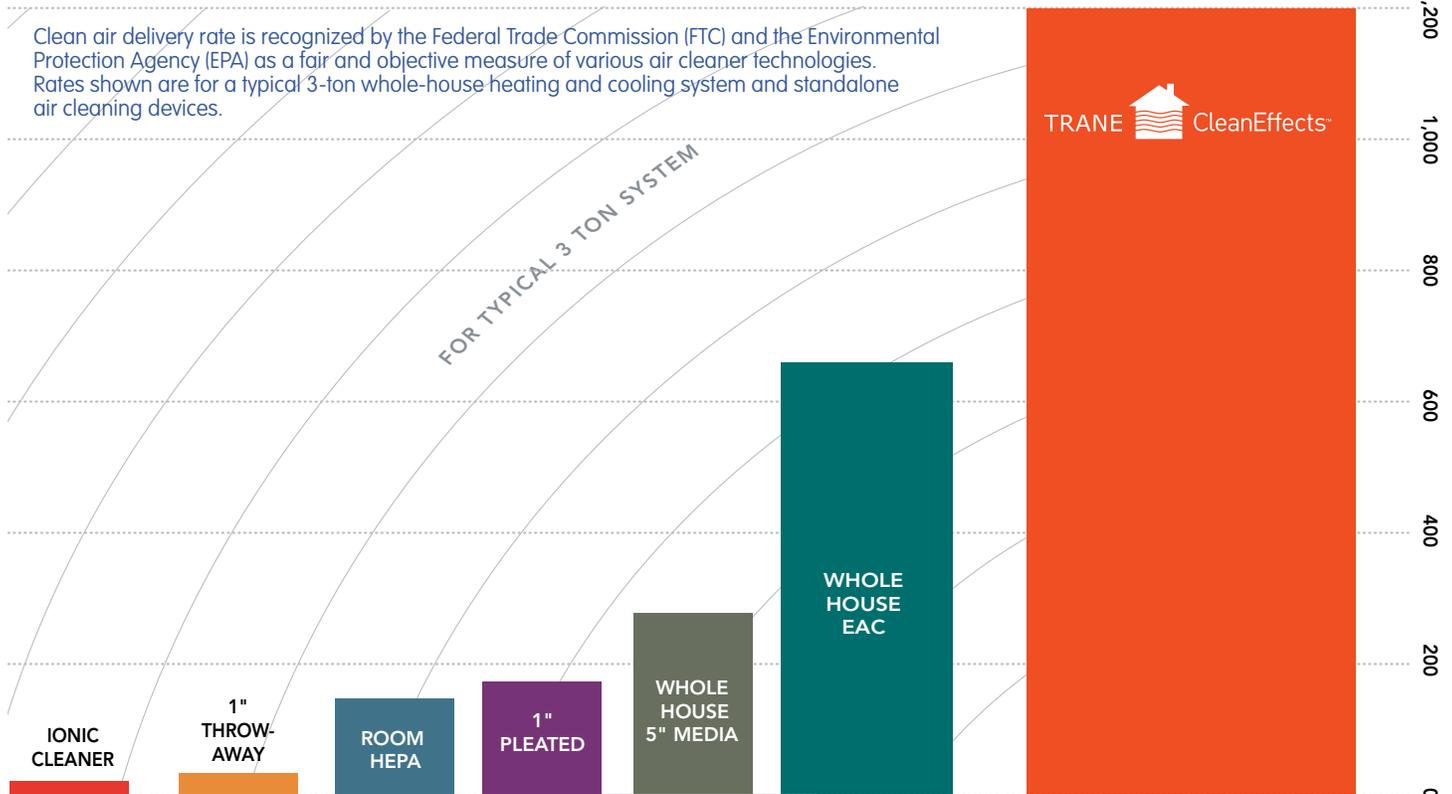


## TRANE CleanEffects changes everything

So what makes TRANE CleanEffects so different? In short, it's light-years ahead of anything else out there. In fact, it's up to 100 times more effective than conventional 1" filters, and nearly twice as effective as current electronic air cleaning systems. As a result, the clean air delivery rate is quite impressive. **For example, a 3-ton unit using standard**

**5" media can only produce a clean air delivery rate of 240, at only 20% efficiency. By contrast, a 3-ton CleanEffects system produces a clean air delivery rate of 1,200, cleaning up to an astonishing 99.98% of the particles from the filter air, down to .1 microns.**

**Clean air delivery rates for typical whole-house air cleaning devices.**



## A REVOLUTION IN CLEAN AIR TECHNOLOGY



TRANE CleanEffects™  
whole house air filtration system

### 1 Pre Filter

Traps large airborne particles and extends the time between cleaning the collection cells

### 2 Field Charger

Facilitates up to 99.98% cleaning effectiveness by charging harmful airborne contaminants so they are attracted to an oppositely charged collection cell

### 3 Reusable Collection Cells

Precision engineered to trap particles down to .1 microns in size. Vacuum is all it takes to make the collection cells like new again.

### 4 Painted Sheet Metal Cabinet

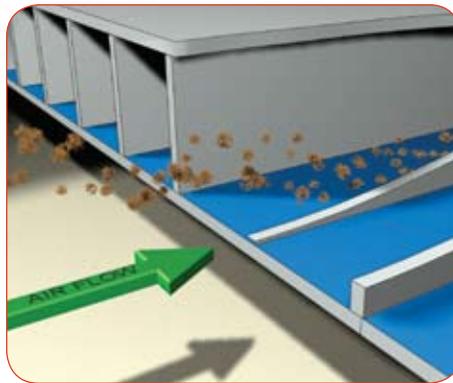
Constructed of heavy 18-gauge metal to protect the filter and internal electronics.

### 5 Power Door

Provides easy access to internal components. Features a filter status display as well as safety interlocks that automatically shut down the power when the door is opened for maintenance or cleaning.

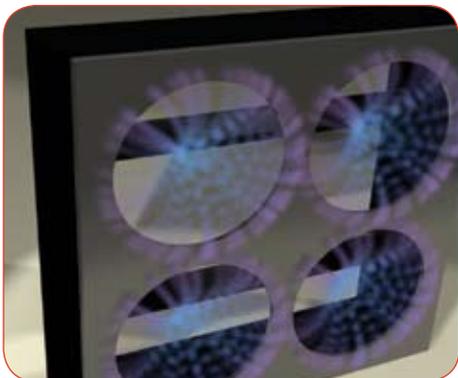
## Superior technology

TRANE CleanEffects is built using patented technology called iFD or Intense Field Dielectric which charges particles moving through the air stream far better than the electronic air cleaners of the past. Drawing from the system transformer, the system creates a very high-voltage corona field over holes through which incoming air must pass. Since the air passes through many small, strong electrical fields, rather than over a single charged metal wire or plate, more airborne particles are charged and more particles are collected. As a result, TRANE CleanEffects can remove particles from the air that would normally pass right through traditional electronic air cleaners.



The collection cell traps microscopic particles down to .1 microns.

Even the collection element is ground-breaking. Each layer is only 0.08 inches apart, with alternating charges, which makes for a stronger, more effective collection field. The CleanEffects element generates this field without the arcing and popping of a traditional electronic air cleaner. What's more, the CleanEffects element has 8 times the collection surface of a standard electronic air cleaner.



The high-voltage corona field charges harmful airborne contaminants so they are attracted to an oppositely charged collection cell.

TRANE CleanEffects™ upgrade kits are easy to install and in most cases can be installed in less than an hour.



# Gas Furnaces

## Efficient, precise and intelligent for superior comfort.

Trane's family of variable speed and multi-stage gas furnaces represents the perfect combination of efficient fuel usage, precise temperature control and intelligent design. They also offer an undeniably higher comfort experience to discerning consumers who demand the same level of comfort in every room of their home, every season of the year.

Variable speed systems can be incredibly efficient to operate. In continuous fan mode, the operating costs for a variable speed motor can be 90% less than a standard motor. Variable speed blower operation is less than that of a 100 Watt light bulb.

## First things first: multi-stage heating will take care of your customers.

Trane's multi-stage furnaces put an end to two of the biggest complaints consumers have about single-stage systems. As you know, single-stage furnaces are notorious for short-cycling, the frequent starting and stopping, which leads to inefficient fuel usage and noisy operation. They're also less responsive, sometimes allowing a temperature swing of as much as 5°F before turning on or off. Trane's multi-stage models run on first stage at 65% of full capacity—more than 80% of the time. With such a long run time in first stage several things occur. Heat stratification is eliminated because of a more constant flow of air. And, energy is more efficiently used because running longer at a lower speed requires less fuel than frequent start ups at full capacity. An added benefit is first stage is the quietest stage—so the consumer enjoys a quieter comfort experience overall.



Application flexibility: The variable speed upflow model can be installed horizontally on its left side for attic and crawl space applications. Or it can be vertically installed in closets and basements.

## Variable speed will make a house feel like a home.

A back bedroom that is always too hot. A kitchen with a western exposure. A family room that never seems to get enough air. These are common situations in many homes—situations that can be remedied with a variable speed furnace. Trane variable speed furnaces automatically and continuously deliver the correct amount of airflow during heating or cooling. The ECM motor used in our variable speed furnaces automatically varies its speed between zero and maximum, starting slowly and then ramping up to the speed the installer has selected.

When the Comfort-R™ mode of operation is also selected, even greater comfort can be delivered to the home. That's because Comfort-R™ applies advanced electronics, controls and motor technology to overcome system inertia so a home can be heated or cooled and dehumidified faster.



Trane's new 3 row secondary heat exchanger is used on all 95% furnaces. The XV95 provides up to 96.7 AFUE, the highest in the industry.

## THE DISTINCTIVE DIFFERENCES OF A TRANE GAS FURNACE.



Integrated Variable Speed Gas Furnace



### 1 Built-in TRANE CleanEffects™ Technology (select models)

The most advanced clean-air system integrated into the furnace cabinet for easy, all-in-one installation and a cleaner, more comfortable home. Removes up to 99% of particles down to .3 microns from the air that is heated or cooled.



### 2 Variable speed blower motor with Comfort-R™

Operates quietly and efficiently at lower speeds than conventional blowers, gently warming your home. Trane's exclusive Comfort-R feature provides greater humidity control during cooling.



### 3 Primary heat exchanger

Trane manufactures one of the most reliable heat exchangers in the industry, using highly durable, heavy duty aluminized steel. We also employ a patented serpentine-shaped design, which maximizes heat exchange. Crimping allows the material to expand and contract without squeaking or popping, which are common problems with welded designs.



### 4 Multi-port in-shot burner

Featured in all Trane furnaces, the multi-port in-shot burner doesn't require any air adjustment. The multi-port burner insert perfectly shapes the flame cone to provide maximum heat with minimal fuel usage.



### 5 Adaptive hot surface silicon nitride igniter and self diagnostic ignition controls

The igniter is an electric heater that ignites the gas by temperature. It is "adaptive" because it learns the lowest igniter temperature that will ignite the burners—a routine which significantly lengthens the life of the igniter. Self diagnostic ignition controls perform a safety check prior to every heat cycle. This feature orchestrates ignition sequence and monitors all components.



### 6 Multi-stage gas valve

Our multi-stage gas valve works in tandem with the variable speed blower by providing the correct amount of fuel required by each stage.

# Air Handlers

## Superior dehumidification and technology.

Available with either single or variable speed motors, Trane air handlers make a significant contribution to the overall efficiency of a Trane home comfort system. And, our air

handlers also provide a significant increase in comfort to the consumer, with advanced airflow systems and variable CFM settings, as well as unrivaled dehumidification features.

## Trane's air handler family.

Consumers can choose from two-speed to high efficiency variable speed models with built-in TRANE CleanEffects™ iFD technology, perfect for limited space applications. Regardless of the climate or season, a Trane air handler provides consistent, reliable comfort.

## Putting an end to temperature swings.

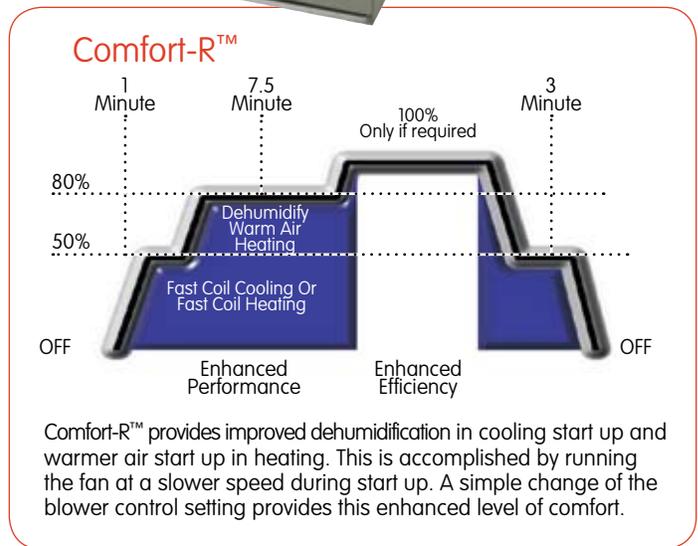
Many standard indoor units have only three fan speeds. But Trane units have 12 different selectable CFM settings, which means greater airflow flexibility and more customization opportunities on the part of a dealer. This kind of flexibility allows a dealer to design a home comfort system based on the specific airflow requirements of a home and on the specific comfort requirements of the homeowner. Once a homeowner's "comfort zone" has been established, temperatures will vary much less than a standard system, which leads to greater comfort and long-term satisfaction.

## Trane Comfort-R™ removes moisture and adds comfort.

In many regions of the country humidity can make the summer a miserable experience for homeowners. But, Trane can make summer a pleasant experience with a variable speed blower motor and the Comfort-R™ enhanced mode of operation. This feature is available on all air handlers, furnaces and packaged units.

The secret of Comfort-R™ is the managed ramping system of the ECM variable speed motor. During cooling, the ECM motor ramps up slowly, moving air slowly across the coil and giving it a chance to cool. The motor then ramps up to 80% where it stays for 7.5 minutes. By ramping up slowly and running longer at a lower speed, the variable speed system is able to remove more moisture from indoor air. After the thermostat is satisfied, the motor then ramps down to 50% where it operates for three additional minutes.

By managing the ramp up and ramp down of the variable speed motor, Comfort-R™ assures humidity control and quieter operation with the greatest level of comfort for the consumer.



## Exclusive Technology Vortica™ Advanced Airflow System

The Vortica™ Advanced Airflow System is an example of Trane's ongoing leadership in technology and design. Trane has developed an innovative blower technology that improves airflow while reducing sound. And, because of its enhanced performance capabilities, this new system allows for a smaller cabinet size.



Trane's exclusive Vortica blower design provides a reliable, consistent level of quiet comfort and energy savings.

XL Packaged Unit  
featuring the Vortica™  
Advanced Airflow System



### ≡ Quieter operation

The quietest unit at every tonnage with sound levels as low as 68 dB

### ≡ Easy service

Vortica slides out from the cabinet for optimal servicing and accessibility

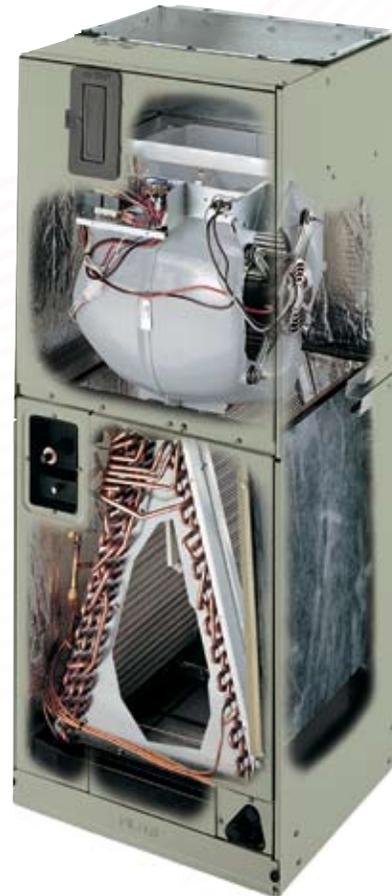
The Vortica Advanced Airflow System in Trane's XL packaged units and high-efficiency air handlers feature:

### ≡ Durable composite construction

Made of highly durable, composite materials that won't crack, corrode or rust

### ≡ Higher system efficiency

Requires lower fan power resulting in higher system efficiency and lower energy use



Air-Tite™  
Air Handler  
featuring the  
Vortica™ Advanced  
Airflow System

### ≡ Quieter operation

3 dB quieter than existing four and five ton air handlers

### ≡ Modular design

The unique two-piece cabinet fits better in tight places, allowing the installer more flexibility while offering the consumer high efficiency

### ≡ Reduced cabinet size

26" cabinet reduced to 23.5" wide  
5-ton height reduced 5"  
5-ton cabinet is 3 cubic feet smaller  
and 50 lbs lighter

# Packaged Systems

## The total comfort experience continues.

Trane's family tree of comfort extends to our broad offering of Total Comfort packaged heating and cooling systems which include heat pump, gas/electric, dual fuel and air conditioning models. Building on a strong

heritage of efficiency, these units offer state-of-the-art electronics and control systems, along with an updated appearance, serviceability and quiet performance that is uniquely Trane.

## Our packaged products set us apart.

Trane's leadership role as a technology innovator that meets the needs of both dealer and consumer continues in the packaged unit arena. Available in both single- and three-phase models, these systems meet both residential and commercial needs. They offer the quietest performance on the market, with state-of-the-art fan system, composite Vortica™ blower, and well-insulated cabinet.

Trane packaged systems not only serve as the centerpiece of your home-comfort system, they also offer amazing architectural flexibility, easily accommodating both rooftop and ground-level placement. Whether installed on the ground, or positioned on a flat or sloped roof, Trane packaged units are designed to adapt seamlessly to your needs.

We test our packaged units in our Seasonal Extreme Environmental Test Facility (SEET), exposing them to an array of harsh testing before we put them into production. You can be confident that they'll provide consistent comfort for years to come.



Another reality that sets Trane packaged units apart from the rest of the industry is our unrelenting attention to cabinet design. Trane's high efficiency packaged systems feature an appearance package that includes attractive contrasting louvers and corner guards, and full-sided powder painted panels that allow units to withstand inclement weather, pollution and other outdoor hazards. Trane's famous fit and finish is built into our packaged units just as it is in all of our other product lines.



The cabinet is designed with a dealer in mind. Embossed labels on each access panel make it easy for the technician to locate critical components. The compressor is easily accessible in the left corner compartment, which includes a convenient liquid line service port. The Vortica blower is mounted by a single fastener and slides out for quick and easy service. These features contribute to Trane's industry leading serviceability and system superiority.

## A LOOK INSIDE A TRANE XL PACKAGED SYSTEM



XL Packaged  
Dual Fuel

Trane's family of packaged dual fuel and gas/electric systems, which range in SEER from 13 to 16 and have 80 AFUE ratings, includes some of the highest efficiencies in the industry.



XL Packaged  
Heat Pump

Our packaged heat pump and air conditioning systems are also highly efficient. They range from 13 to 16 SEER and offer some of the quietest performance available in the industry.

### Easy adaptability to light commercial applications

Trane packaged systems come with a line of accessories that make them easily adaptable to light commercial applications. Unicurbs, filter kits and economizer controls are examples of accessories that allow Trane dealers to take advantage of light commercial opportunities efficiently and cost-effectively. And with dedicated downflow or horizontal designs, Trane packaged units are also faster to install at the jobsite.

### Exclusive features

- 1 Variable speed blower motor with Comfort-R™**  
Trane exclusive dehumidification feature that removes 4 times the amount of moisture that a standard system can.
- 2 Composite Vortica™ blower**  
Advanced design uses less energy to produce more airflow with minimal sound. Slides out for easy service.
- 3 Ultra-quiet operation**  
An ultra-quiet, state of the art ducted fan delivers sound ratings as low as 68 dB allowing Trane packaged products to offer the quietest products in the marketplace.
- 4 Climatuff compressor**  
Designed to handle the extreme conditions of heat pump applications, including higher operating temperatures, liquid refrigerant flooding, adverse electrical stresses and the stress of long operating hours.
- 5 Stainless steel heat exchanger and burners**  
Featuring a new ultra-safe tubular design for reliable performance and peace of mind.
- 6 All-aluminum Spine Fin coils**  
Aluminum tubes and fins deliver greater corrosion resistance and a longer lasting OD coil that stands up to hail, sun, rain, snow, salt, dirt, ice and temperature extremes. Manufactured joint free in continuous lengths (90% fewer brazed joints) means no end turns and a dramatic reduction in potential refrigerant leaks. Larger air to fin surface insures higher efficiency and lower energy usage. Thousands of tiny spines resist clogging by sand, salt, leaves and ice unlike regular coils.
- 7 Reversible louvers**  
Louvers are easily reversed for either rooftop or ground level installation creating a polished appearance for even the most discriminating customer.
- 8 Rotolock fittings**  
Unique design makes compressor service quick and easy should it ever be required.
- 9 Industry leading serviceability**  
Labeled access panels, slide out blower, easy access to compressor and convenient liquid line port are few features that save time on service calls and deliver industry leading serviceability.

# The Trane Difference. Reliability.

Trane and reliability go hand in hand. Every day we stake our reputation on the fact that our products work when they need to, year in and year out.

The heart of a reliable Trane system is the Climatuff® compressor. Since 1938 when the industry's first hermetic centrifugal refrigeration machine was introduced by Trane, we've lead the way in defining the standards in compressor technology. Our reciprocating compressor was the first successful heat pump compressor and is well known for its superior durability, its low noise levels, and its ability

to provide high operating efficiencies. The Climatuff® scroll compressor uses a similar design and the same testing standards to continue the Trane tradition of excellence in compressor technology. Trane uses either a reciprocating or scroll compressor in all outdoor products, depending on the level of efficiency and reliability required for a specific application.



An all-aluminum frame, motor housing, piston and connecting rod help to reduce thermal stress and help the compressor run cooler by dissipating heat away from the bearing surfaces.

## Reciprocating Technology

### The Climatuff® difference.

What makes a Trane Climatuff® compressor the talk of the industry? For starters, it was the world's first successful heat pump compressor. Over the years, its reputation has been built on the fact that it handles the extreme operating conditions of heat pump applications with ease. For example, a compressor's reliability is directly related to its ability to handle stress. The Climatuff's all-aluminum frame not only dissipates heat, but its light weight reduces stress on its mounting springs as well. Valves are another critical factor because they experience more stress than any other component. For that reason, Trane manufactures compressor valves to extremely tight design specifications.

A large shell volume is another Trane difference. Climatuff® reciprocating compressors have more volume inside the shell than other compressors, which gives it an additional safety margin against slugging, often caused by overcharging or low indoor airflow.

The differences add up to the most durable compressor manufactured in the industry today.

### Designed to handle thermal stress.

The Climatuff® compressor's stress-handling ability begins with its aluminum frame, and its aluminum pistons and connecting rods. An aluminum frame reduces thermal stress and allows the compressor to run cooler than compressors with cast-iron frames, which tend to retain heat, resulting in higher operating temperatures.

The frame is designed with a very large intake area to minimize the pressure drop of suction gas. Suction gas flow to the valve is virtually unrestricted.

The lightweight aluminum pistons and connecting rods provide for easy starts and relieve stress on the crankshaft. Trane uses an industry-unique pearlitic cast-iron cylinder liner for enhanced durability.

The next phase takes place on the upstroke of the piston. The suction valve closes, holding back the incoming flow of gas until the next intake stroke. This abrupt stop creates a pressure pulse that travels backward along the inlet path at the speed of sound. The pulse of refrigerant vapor hits the bottom of the motor, muffling noise as it cools the bottom windings.



Our lightweight piston and connecting rods allow for easier starts and higher running efficiencies. A pearlitic cast iron cylinder increases durability.



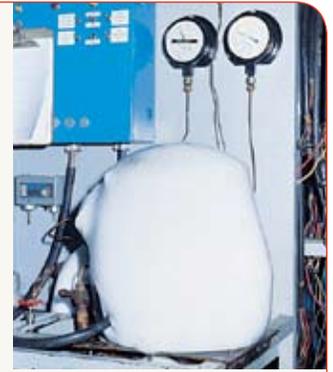
### Why valve design is critical.

Valve design is critical to liquid refrigerant tolerance. On mild days, liquid refrigerant can accumulate in the suction line and flood the compressor on start-up. Because of this, valves must be able to tolerate some slugging. Climatuff's valve assembly has been designed to allow liquid refrigerant to be expelled from the cylinder without damaging the valves.

Valves experience more mechanical, thermal and pressure-related stresses than any other component of the compressor. In heat pumps for example, they spring open and shut 57 times a second, up to 800 million times a year. Because of this wear and tear, an indestructible valve material is required.

Trane manufactures discharge and suction valves using a special Swedish-type valve steel. The steel has a unique microstructure that has a high carbon content and a very low amount of non-metallic inclusions, such as sulfides and silicates. This composition makes Climatuff® valves highly impact and distortion-resistant. They're also resistant to metal fatigue and are not affected by excessive heat.

Climatuff® compressors are designed to handle the extreme conditions of heat pump applications, including higher operating temperatures, liquid refrigerant flooding, adverse electrical stresses, and the stress of long operating hours. To maintain this level of superior performance, Trane adheres to a strict compressor testing philosophy, which yields continuous application and design improvements.



"Snowball" underwent a continuous flood-back test in the Trane compressor life test facility for 27 years, before finally ceasing to operate in 2000. The test demonstrates the reliability of the compressor under conditions like low indoor airflow or system overcharge.

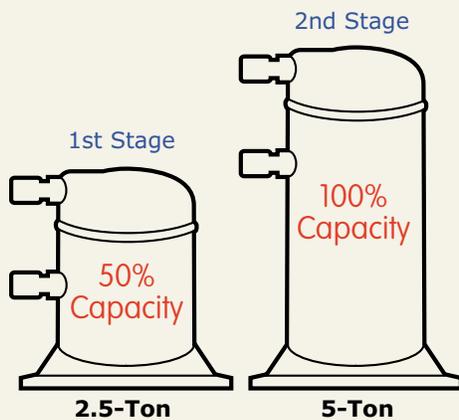


The rugged valve assembly is the most critical component of the Climatuff® compressor.

All Climatuff® compressors feature highly reliable Rotolock mechanical fittings. These fittings make service and replacement much easier because there is no brazing or cutting required. Enhanced safety is another benefit.

### Dual Compressor Operation

**5-ton model has 2.5- and 5-ton compressors. It's like having two systems in one!**

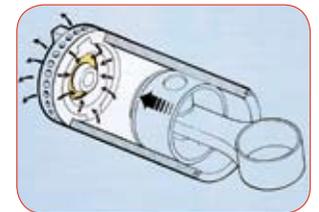
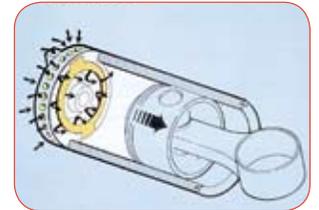


- ≡ 1st stage compressor operates at 50% capacity and runs independently
- ≡ 2nd stage compressor operates at 100% capacity and runs independently

### How reciprocating compression works.

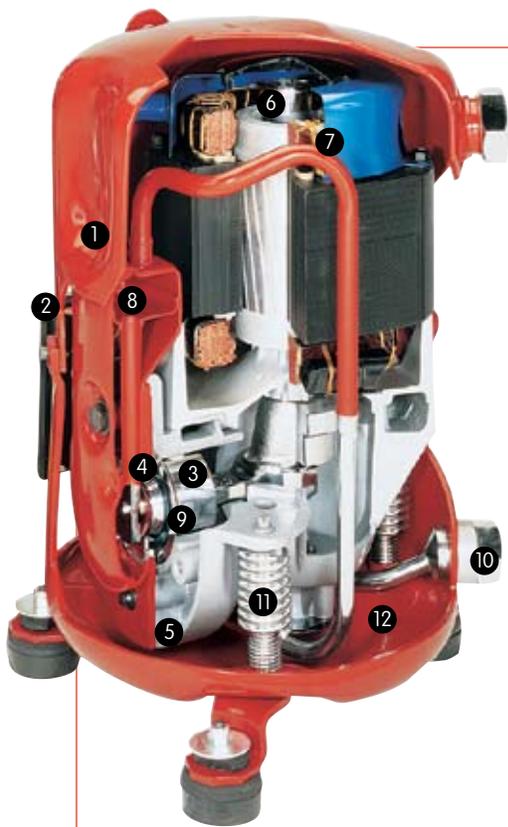
On the downstroke of the piston, when pressure in the cylinder is less than suction pressure, the suction valve is pushed off its seat allowing refrigerant into the cylinder. The gas enters efficiently in a cylindrical pattern around the circumference of the valve.

On the upstroke, the suction valve closes preventing refrigerant from leaving the cylinder. When cylinder pressure exceeds discharge pressure, the large round discharge valve lifts completely off its seat allowing gas to efficiently exit the cylinder. If there is liquid present, flow dynamics resulting from tapered surfaces and valve proximity will allow the liquid to be purged from the cylinder without damaging the valves. Besides being gas flow efficient, Trane's valving is engineered to tolerate some liquid slugging.



Valves are made of the highest quality steel to handle extreme heat and the stress of opening and closing 57 times a second.





## Climatuff® Reciprocating Compressor

- 1 Internal Pressure Relief Valve (IPR)** High pressure protection for longer life.
- 2 Metal To Glass Hermetic Terminal** Insulates terminal from steel shell, and prevents electrical and refrigerant/oil leakage.
- 3 Pearlitic (Super Hard) Cast Iron Cylinder Liners** Superior wear resistance for long life.
- 4 Aluminum Pistons and Connecting Rods** Lighter weight provides for quicker starts and lower stresses.
- 5 Aluminum Pump Body** Dissipates heat faster and runs cooler.
- 6 Internal Overload** Provides overheating temperature protection caused by (1) low refrigerant pressures or (2) excessive electrical currents resulting from extreme operating conditions. Resets itself, avoiding service calls.
- 7 Motor Winding Insulation** Super strong epoxy locks the windings in place and resists erosion of insulation by refrigerant and oil.
- 8 Internal Muffler** Reduces compressor sound and vibration levels for quieter operation.
- 9 Special Valve Steel** Made from one of the world's finest steels, so impact resistant that valve stress is not a problem for the Climatuff.®
- 10 Rotolock Fittings** Unique design makes compressor service quick and easy should it ever be required.
- 11 Internal Spring Mounting** Double spring mounting reduces motor vibration and noise. The design is so unique it's patented.
- 12 Special Oil** Specially refined and formulated to keep internal parts lubricated and running smooth.

The heavy steel shell of the Climatuff® reciprocating compressor can withstand many times normal operating pressure. It's designed to seal oil and refrigerants in—and keep contaminants out.

### Large shell design is a distinct advantage.

Climatuff® reciprocating compressors have 25 percent more volume inside the shell, which is a distinct advantage over other compressors.

With a large shell design, the need for suction line accumulators on residential systems is eliminated. Because of this, the potential oil traps, system leaks and pressure drops associated with a separate accumulator are no longer a concern.



Large shell volume of a Climatuff® reciprocating compressor.

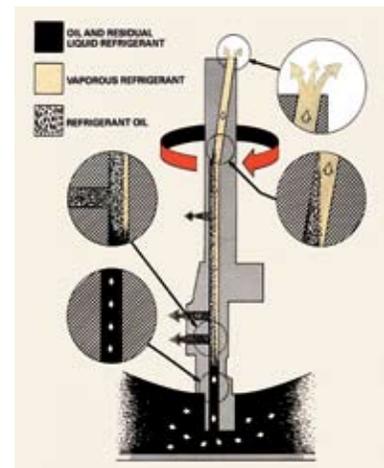
All Climatuff® compressors have the discharge line routed through the compressor sump. With the compressor running, the hot discharge line will vaporize the liquid refrigerant in the sump separating it from the oil. In the off cycle, Trane uses crankcase heat on compressors where needed to vaporize liquid refrigerant and maintain desired oil temperature.

For increased reliability, magnets are installed in the large sump to catch metal particulate and keep it out of the bearings.

The Climatuff® reciprocating compressor doubles as a positive, non-directional, centrifugal oil pump.

### A dual purpose crankshaft.

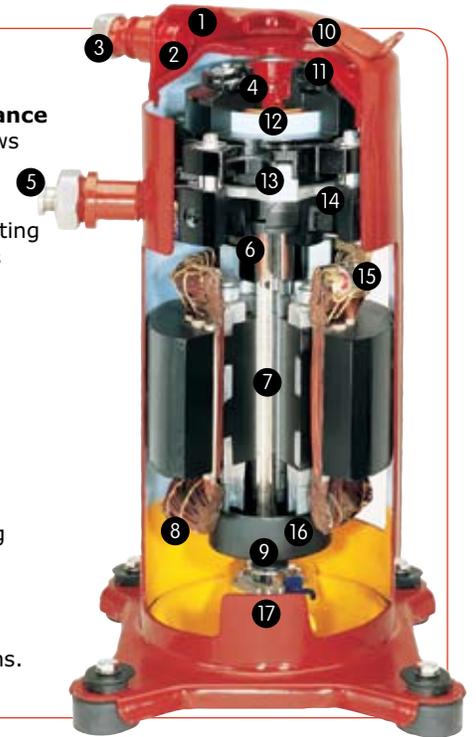
Good lubrication is essential to long compressor life and is one of the keys to its reliability. The Climatuff® compressor's crankshaft doubles as a positive, non-directional, centrifugal oil pump. It provides a constant oil supply to the bearing surfaces when the pump is running. In addition, it helps vaporize liquid refrigerant and cools the motor bearings.



# Scroll Technology

## Climatuff® Scroll Compressor

- 1 **High Pressure Volume**  
Small top cap of shell serves as an internal muffler.
- 2 **Check Valve**  
Internally equalizes shell for easy start ups.
- 3 **Discharge Rotolock**  
Allows for ease of installation and removal.
- 4 **Bi-Metallic (TOD) Thermal Disc**  
Bypasses discharge gas.
- 5 **Suction Rotolock**  
Allows for ease of installation and removal.
- 6 **Rotor Counterweights**  
Allows for smooth operation.
- 7 **Crankshaft**  
Feeds oil centrifugally through center bore to bearings.
- 8 **Yellow Shows Oil Level**
- 9 **Lower Bearing**  
Supports crankshaft.
- 10 **Discharge Deflector**
- 11 **Floating Seal For Axial Conformance**  
Seals high to low pressure and allows axial conformance.
- 12 **Lower Orbiting Scroll Set**  
Rotating crankshaft converts to orbiting motion of lower scroll, which produces compressed gas.
- 13 **Orbit Coupling**
- 14 **Positive Shutdown Device**  
Separates scrolls at shutdown to eliminate noise or reversal.
- 15 **Internal Overload**  
Protects motor from overheating.
- 16 **Oil Baffle**  
Separates oil in sump from churning counterweights.
- 17 **Oil Pick-up (Underneath)**
- 18 **Terminal Plug (Not Shown)**  
Assures correct electrical connections.



## Conformance is key.

Trane's Climatuff® scroll compressor features an innovative method, referred to as "conformance," for assuring a tight compression pocket. The orbiting scroll is self-adjusting. It moves radially in and out to precisely follow the shape of the involute; the fixed scroll moves vertically to maintain optimum contact of the tips. This dual motion is the key to achieving the full benefits of the Climatuff® scroll.

The scroll compressor uses a moving pocket which is produced by the orbiting motion of the four spiral operations described in the box at right.

The orbiting relationship of these two involutes is the key to scroll compression. To perform properly, they have to stay in contact the entire length of the involute.



**Two-Stage Scroll Operation**  
Relief holes allow 70% capacity operation when open, 100% capacity when closed.

## The benefits of conformance.

The benefits of Climatuff® conformance are many, including maximized efficiency, durability, low voltage start-up and quiet operation. Compressor conformance increases efficiency by continuously compressing the refrigerant gas in each rotation with minimal leakage. Low leakage is achieved with minimal efficiency—robbing friction because of the tight manufacturing tolerances of Climatuff® compressors.

Durability is improved because conformance allows the scroll to handle reasonable amounts of liquid flooding and system contamination. Flanks and tips will separate if liquid refrigerant or debris is present allowing the particulate to pass through without harm to the involutes. Conformance allows the flanks and tips to separate when the compressor cycles off and on and unloads the gas from its high-pressure state. This allows for low voltage start-ups. Hard start kits are not required. Quiet operation is achieved because the orbiting motion causes very little vibration.

## How a scroll compressor works: unrestricted gas flow optimizes efficiency



**Cold, Low Pressure—Entering Gas.**  
Compression in the scroll is created by the interaction of the orbiting spiral and a stationary spiral. Gas enters the outer opening as one of the spirals orbits.



**Warmer, Medium Pressure—Interim Gas.**  
The open passage is sealed off as gas is drawn into the spiral.



**Hot, High Pressure—Discharge Gases.** As the spiral continues to orbit, the gas is compressed into an increasingly smaller pocket. By the time the gas arrives at the center port, discharge pressure has been reached.



**All Stages Working Together.** During operation, all six gas passages are in various stages of compression at all times, resulting in nearly continuous suction and discharge.

**FACT:** Trane is the only manufacturer to patent a special anti-reverse control device for scroll compressors. When coupled with a 30-second delay on the defrost control board, this device ensures that power interruptions will never cause heat pumps to run backwards.

# 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.

# The Trane Difference. Durability.

Trane manufactures products using durable materials and time-proven technologies. The end result? Products that withstand the daily demands of living and the constant requirements of comfort. Products that are built to last.

At Trane, we build in durability from the inside out. First we design our indoor and outdoor products with exacting specifications and innovative features that will wear well over time. Then, we make sure they're easy to access and service for better long-term performance and a longer life. Plus, we use only the most durable materials in the manufacturing process—materials that have passed the test for strength and resistance to stress. And, finally, we

finish with protective coatings so our products can stand up to any climate, from coast to coast, for years to come.

From the durable DuraTuff™ basepan, to the galvanized steel louvers, on up to the polycarbonate Weatherguard™ II top, a Trane outdoor unit is built to last. Even the cabinet fasteners are specially treated to resist rust and outlive normal zinc coated screws.

## Durability by design



### Weatherguard™ II Top

- ≡ Withstands 1,440 hours of 194° desert heat
- ≡ Withstands 100 ft/lbs of impact in -35° Arctic cold
- ≡ Withstands a 300-pound load
- ≡ Withstands the impact of a 90 mph fastball

### Weatherguard™ Fasteners

- ≡ Rust resistant
- ≡ Meet 1,500-hour salt spray test
- ≡ Double the thread engagement area
- ≡ 50% improvement over ceramic coated screws



### Seacoast Shield

- ≡ Protects transition joints from salt spray and pollution
- ≡ Eliminates need for corrosion prevention materials
- ≡ An added durability feature for ocean-front environments



### Integrated Steel Cabinet

- ≡ Powder painted louvered panels
- ≡ Full coil protection
- ≡ G90 galvanized steel construction
- ≡ Interlocking seams create a tight fit and finish
- ≡ X-brace construction enhances cabinet stability
- ≡ Recessed screws, rounded edges and integrated panels make our outdoor products safe for any backyard



### Duratuff™ Basepan

- ≡ Molded-in color will not fade
- ≡ Withstands 135° 20-year accelerated heat test
- ≡ Won't crack, warp, corrode or rust
- ≡ Withstands an 800-pound load



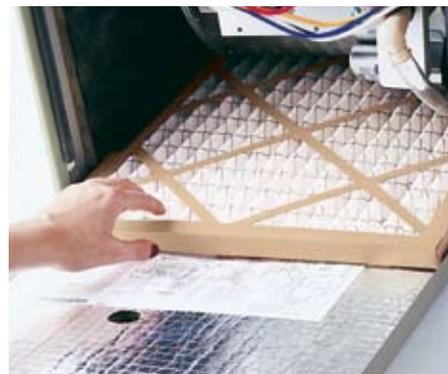
Trane products are easy to service and easy to maintain which means longer life and durability.



Every Trane air conditioner and heat pump model is quick to install and service. All electrical and refrigerant controls are always in the same place under one easy to remove corner panel.



The front panel of our Comfort™ coils is removable for easy cleaning access. A clean coil is more efficient and supports a long system life.



The dual door latch design of our upflow furnaces makes the filter door easy to open so filter changing is a breeze for homeowners. This helps maintain system performance over the long haul.

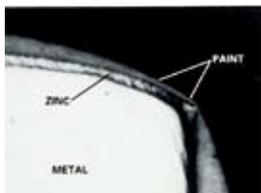
Accessibility is an important design feature of all Trane products. That's because a product that is easy to access for service or regular maintenance is a product that will age well over time.

### Premium products require a premium finish.

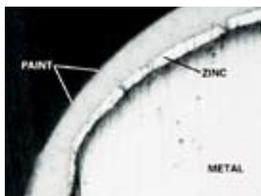
One of the most recognizable attributes of a Trane outdoor product is its powder paint finish. Not only is this high gloss finish a consistent winner with consumers, but it is also a tried and true durability feature. Ultraviolet light from the sun breaks down the chemical bonds in most paints and results in chalking and fading. Powder paint resists the effects of ultraviolet light, so a unit that is installed today will still look good ten years from now.

The electrostatic application of powder paint also provides an excellent coating for sharp metal edges. Unlike liquid paint processes where the paint recedes from the edges, powder paint builds at the edges and forms a protective shield against corrosion and rust.

The combination of corrosion resistance, chalking resistance, and a quality appearance, continue to make powder paint far superior to other paint processes.



A louvered panel has been painted with liquid paint, cut in half, and magnified to show paint coverage. Because of surface tension, liquid paint recedes from the sheared edge.



With our powder paint process, an electrostatic charge builds at the edges of the metal drawing the powder to the sheared edge.

### A perfected process.

An excellent paint finish is only as good as the material underlying it and the pretreatment process. At Trane, we begin with quality untreated galvanized steel. Then we put it through a six-stage pretreatment process, which cleans and etches the steel, applies a corrosion-fighting zinc phosphate layer, and then seals the surface.

The zinc phosphate is present as microscopic crystals that completely cover the untreated steel. This provides additional corrosion resistance and a jagged surface for better paint adhesion.

After the powder paint is applied to the steel, the metal is then baked in a series of ovens where the 390° heat produces a powerful chemical bond.

The final result is an incredibly durable finish that protects the louvers of our outdoor products during the harshest winters and the hottest summers.

### Indoor products durability features

#### Air Handlers

- ≡ Air-Tite™ insulated cabinet
- ≡ "No Leak" drain pan
- ≡ Corrosion-resistant finish

Variable Speed Air Handler



#### Furnaces

- ≡ Heavy steel insulated cabinet
- ≡ Heavy duty aluminized steel primary heat exchanger
- ≡ Durable stainless steel secondary heat exchanger
- ≡ Internal vent pipe of long-lasting CPVC material

Variable Speed Gas Furnace



# Comfort™ Coils

## Corrosion resistant and accessible.

With a strong heritage in aluminum outdoor coils, Trane is now setting a new industry standard with the introduction of all-aluminum indoor evaporator coils. Highly resistant to formicary corrosion, these new Comfort™ coils will meet the widespread champagne leak challenge head on. And, as always, Trane's indoor coils continue to be known for their built-in cleaning access, another industry first.

When put to the test, Trane's all-aluminum coils passed with flying colors, far outranking copper tube coils in a pressurized formicary-testing environment. The results? The aluminum tube never failed. The copper tube failed in 12 days.

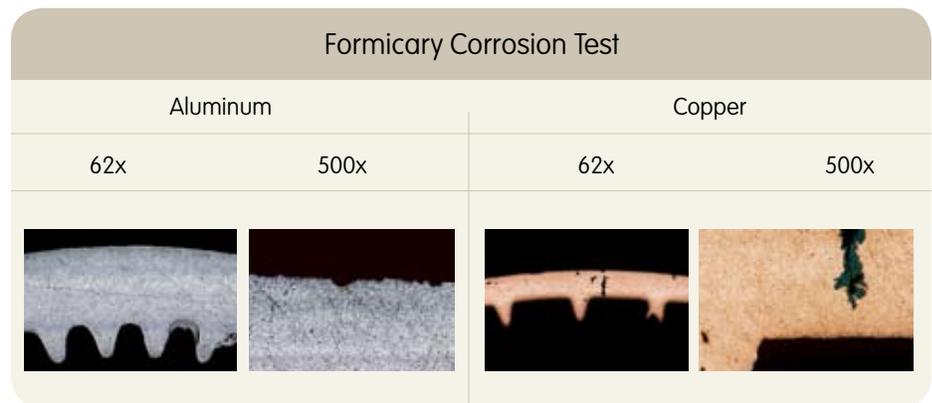
## Testing for success.

A recent independent, third-party test in a laboratory environment proved that aluminum coils are resistant to formicary corrosion while copper tubed coils are not. The results, shown below, indicate the future reliability of an aluminum evaporator coil in an indoor environment.

## Putting the formicary corrosion issue to rest.

It's a long-standing problem that has affected every major heating and air conditioning manufacturer. Indoor coil corrosion is not the result of poor manufacturing processes. It's an environmental issue that directly affects copper tubed coils. As with outdoor condensing coils, indoor evaporator coils are constantly attacked by corrosives in the air and organic acids (formic and acetic) that accumulate over time. With today's tighter residential construction techniques, decreased ventilation can also lead to an increase in contaminants. Known as formicary corrosion, this destructive process leads to tiny pinhole leaks, or "champagne leaks" as the HVAC industry calls them, in the surface of the copper tube.

Trane's answer to this problem is the industry's first production-friendly, reliably manufactured, all-aluminum indoor coil. With aluminum tubes, aluminum fins, aluminum tube sheets and end plates, these new Comfort™ coils are corrosion and rust resistant. Borrowing a page from the Spine Fin™ story, different grades of aluminum alloy are used for the fin and the tube. If the coil is installed in a corrosive environment, the aluminum fin alloy will become the sacrificial element, eliminating the acid attack on the aluminum tube and preventing leaks due to formicary corrosion.



By looking at magnified cross sections of aluminum and copper tubes, the results of an accelerated formicary corrosion test can be seen with the naked eye. After 127 days of exposure in an accelerated environment, aluminum tubes showed only minor surface corrosion. After 12 days of exposure, copper tubes completely failed with through-wall penetration.

Note: The test for formicary susceptibility of Alloys A (Aluminum) and C (Copper) was performed by Corrosion Testing Laboratories, Inc. in August 2004.

## AlumaTuff™ all-aluminum Comfort™ Coils

### A difference you can see.



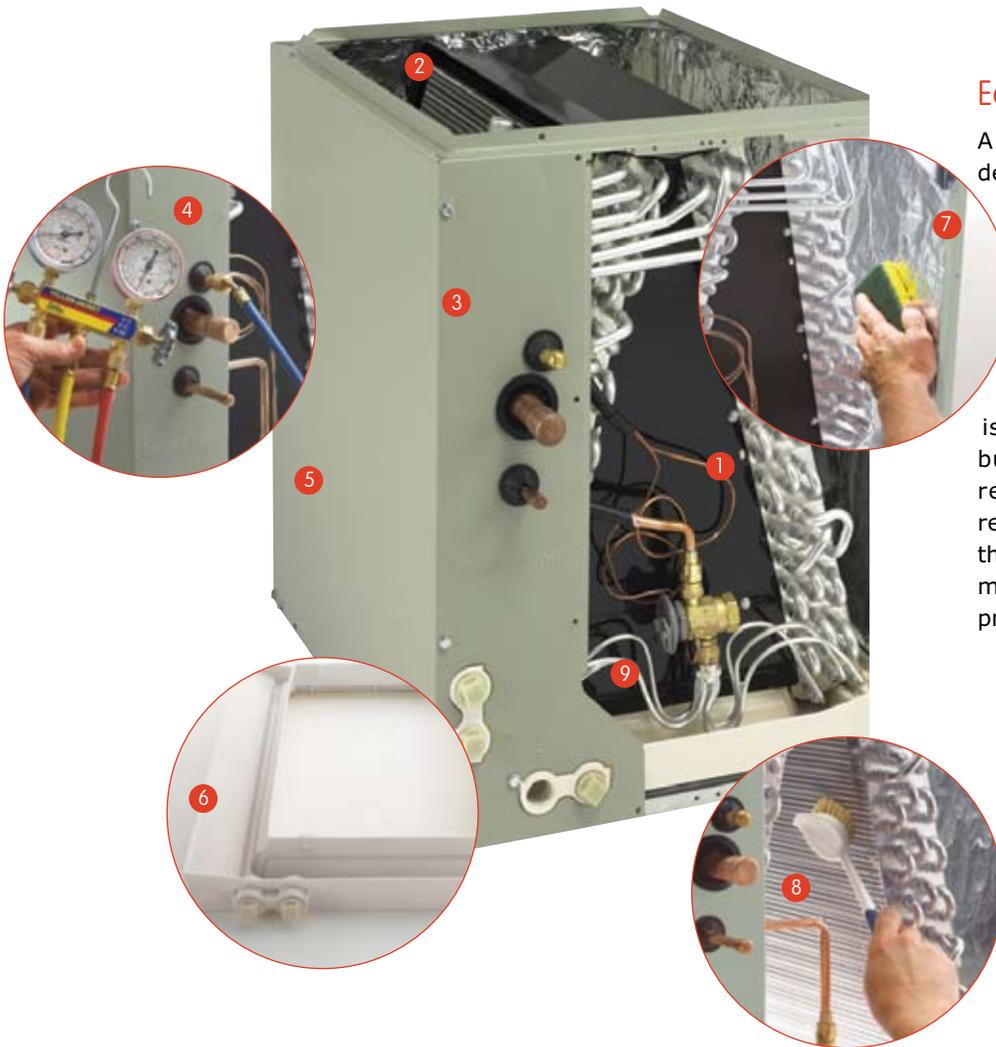
Copper tube and galvanized steel tube sheet after 500 hour salt spray.



Aluminum tube and tube sheet after 500 hour salt spray.

Trane has built an aluminum indoor coil with aluminum tube sheet which allows replacement since the braze oven temperatures are low enough to allow this substitution. Installations will still be copper to copper interface connection with the outdoor unit and refrigerant line set.

**FACT:** The top three corrosion agents for indoor coils are organic acid (formicary corrosion), hydrogen sulfide (sulfur attack) and ammonia or amines (stress corrosion cracking). Aluminum is immune to attack from any of these corrosion agents.



### Easy cleaning means longer life.

A dirty evaporator coil can significantly decrease equipment life and efficiency by impacting airflow. And, as it accumulates mold, dirt and other contaminants, it can contribute to unhealthy indoor air quality. Trane designs its Comfort™ coils to have the best access in the industry, so cleaning an indoor evaporator coil is not just something you should do, but something you can do. An easily removable door is the key, as is a removable inner coil panel. Of course, the use of non-corrosive materials in the manufacturing process also assists by prohibiting rust and other degradation.

**1 All-Aluminum Tubes**

The high efficiency TRANE Comfort™ Coil is the first and only all-aluminum design. It delivers added durability and resists corrosion and rust.

**2 All-Aluminum Fins**

Manufactured from a different grade of aluminum alloy. Lasts longer if installed in a corrosive environment. Helps prevent leaks.

**3 Two-piece door design**

Simplifies door removal so interior of coil is fully accessible.

**4 External service port**

Makes service quicker and easier.

**5 Painted finish**

Matches Trane furnace cabinets for a streamlined installation look. It also adds increased protection from rust and corrosion.

**6 Two-way, sloped, non-corrosive drain pan**

Reduces standing water and positively affects indoor air quality. Non-corrosive material prevents rust.

**7 Foil Insulation**

100% foil-backed insulation reduces operating sound and makes cleaning easy.

**8 Inner coil panel**

Can be removed so cleaning and servicing is easier inside the coil.

**9 Thermal Expansion Valves**

Mechanical fittings make service a breeze.

# The Trane Difference. Efficiency.

Heat transfer is one of the most important factors in achieving heating and cooling efficiencies. Trane's proprietary coil design, Spine Fin™, has proven to be superior to any other technology.

Extensive research and development have led to the innovative heat transfer characteristics of radiating finned, all-aluminum Spine Fin coil heat exchangers. More than 40 years of real-world application experience have confirmed Spine Fin's long-lasting effectiveness and work-horse

durability. Trane continues its tradition of excellence in heat transfer by focusing on the basics of success: always using modern and innovative technologies; only using similar metals and proven materials; and, maintaining our notably high standards in the manufacturing process.

## All-Aluminum Spine Fin™ Coil

### We continue to push the envelope.

Trane began full-scale production of Spine Fin coils for use in outdoor products in 1968. After years of success, Spine Fin has reached a legendary status in the industry. In fact, today it ranks as the most efficient heat exchanger currently being manufactured.

But at Trane, we're not known for resting on our laurels. Our engineers and product specialists continue to push the envelope in heat transfer technology, constantly looking for greater efficiencies and more durable processes. For example, our new woven coil technology has proven to provide ultra levels of efficiency in our high-end air conditioners and heat pumps, clearly paving the way for even greater consumer acceptance and a further reduction in the use of fossil fuels.

### Consumers expect efficiency from Trane.

Why is maintaining long-term efficiency important? When replacing an air conditioning or heat pump system, consumers can significantly save on their cooling bills by purchasing a more efficient system than they currently have. However, the unfortunate reality is the efficiency of their new system will decline over time, as will their savings. That's why Spine Fin's ability to retain a system's efficiency over the course of its lifetime is so significant. Not only is a Trane system efficient to operate today—but it maintains that efficiency during its years of service to the homeowner. And, that's the Spine Fin difference. Consumers have come to expect a higher standard of efficiency and durability from Trane products. Spine Fin helps us fulfill this expectation.



A typical 2-1/2 ton air conditioner or heat pump requires 30 or more brazed joint connections in the coil. A modern Trane unit of the same size requires only 10 with Spine Fin.™



Spine Fin™ coils are fabricated in continuous lengths. Because of the number of leading edges, one row has the ability to transfer the same amount of heat as three rows of plate fin.

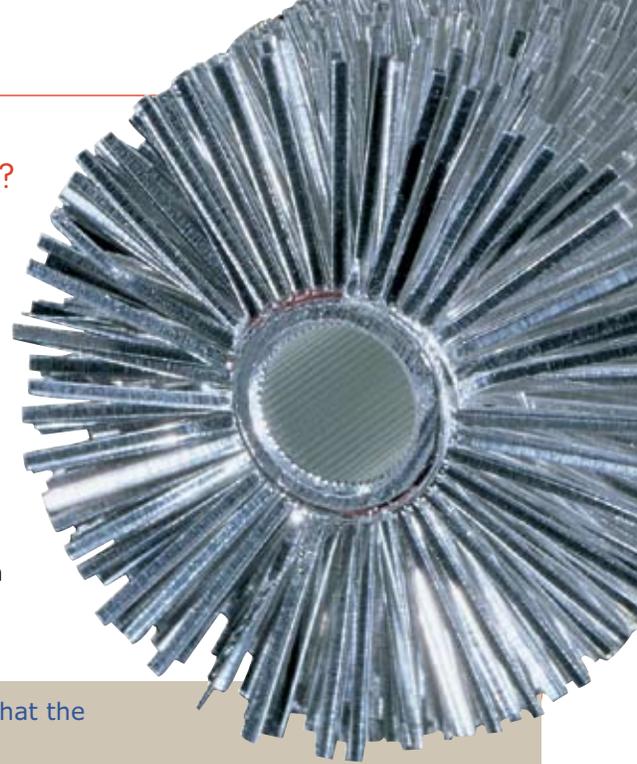
In a typical year, Trane will produce more than 55,000 miles of Spine Fin coil—that's enough Spine Fin™ to go more than twice around the world.

## What causes efficiency loss?

- ≡ A leak in a coil joint.
- ≡ Loss of thermal contact between the fin and tube caused by corrosion.
- ≡ A dirty or damaged coil.
- ≡ Different manufacturing processes. For example, the use of dissimilar metals (copper and aluminum) leads to loss of thermal contact because they expand at different rates.

## How does Spine Fin™ prevent efficiency loss?

- ≡ It's designed for leak resistance.
- ≡ It's made with corrosion resistant materials and innovative construction techniques.
- ≡ It's housed in an enclosed, protective cabinet. And, it's cleanable.
- ≡ On-going research and development keep Spine Fin on the leading edge.



A reliability study by Trane's Field Operations Excellence Team showed that the field leak rate in 12 million coils was only .05% over a one-year period.

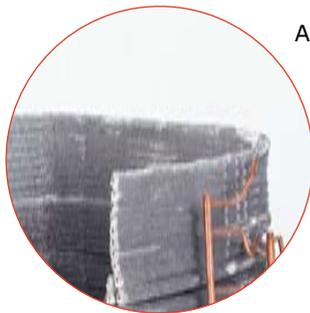
## The Spine Fin™ difference: A leak resistant design.

### One-third the number of brazed joints.

Spine Fin has an extremely low leak potential. Coils are more prone to leaking at joints, and Spine Fin has far fewer joints than plate fin. That's because Spine Fin tubing is manufactured in continuous lengths. Brazed connections are required only at the coil (or circuit) inlet and outlet.

Elimination of end-turns used in copper tube plate fin designs permits a dramatic reduction in brazed joints and potential leaks in this design. Of course fewer leaks increases system reliability and durability. This also means a longer compressor life, because the introduction of moisture and contaminants into the sealed system is prevented.

In contrast, plate fin coils are made by stacking flat fins on parallel tubes. Each tube pair requires an end-turn to complete the refrigerant circuit.



The rounded corners of Trane's four-sided coil design eliminates return bends and provides maximum efficiency.

A typical 2 1/2 ton air conditioner or heat pump requires 30 or more brazed joint connections. A modern Trane unit of the same size requires about 10. Plate fin coils have three times the leak potential.

### Trane's unique transition joint.

Like other manufacturers, Trane uses copper tubing in piping the refrigerant circuit. What is unique is Trane's copper aluminum transition joint. This component is ultrasonically pre-tinned with a zinc rich, aluminum solder. As it is assembled into the heated aluminum tubing, it forms a solder fillet at the joint. This solder fillet is sacrificial and protects both of the base metals from corrosion.

A reliability study by Trane's Field Operations Excellence Team showed that the field leak rate in 12 million coil joints was only .05% over a one-year period.



Woven coil technology is the newest generation of Spine Fin™. The woven coil design weaves a continuous roll of Spine Fin™ in a layered configuration, creating an even greater surface area. This greater surface area results in increased efficiency and a reduced cabinet size.



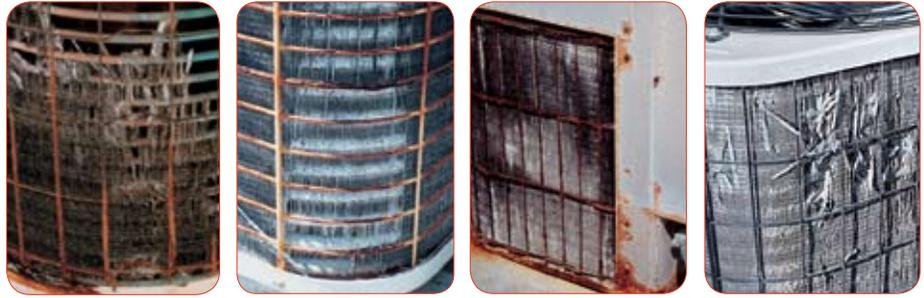
This patented, plated copper tube enables Trane to make a remarkably sound copper/aluminum transition joint.



The integrity of the copper to aluminum connection in the coil is legendary.

## The environment outdoors is a powerful corrosive force.

The outdoor environment is harsh, with dramatic swings in temperature, precipitation, wind and humidity. Near the ocean, the air contains salt-laden moisture. In and around cities, the atmosphere contains oxides of sulfur and nitrogen, acid and alkaline dusts and gases. Most competitors' coils can't stand up to these powerful corrosive forces. However, the carefully selected aluminum alloys in Spine Fin™ provide protection from even the harshest outdoor environments.



Competitive units in Florida show the wear and tear of beachfront living.

A defense against corrosion prolongs system life while maintaining system efficiency. The positive attributes of any heat exchanger—high heat transfer efficiency, freedom from leaks, debris tolerance, and compressor protection—are meaningful only if a coil can survive the aggressive environment outdoors.

## The Spine Fin™ difference: Resistance to outdoor corrosion.

### A defense against galvanic corrosion.

Corrosion can prove deadly to a coil. It can cause a loss of thermal contact between the tube and fin and in turn can lead to a significant reduction in efficiency. The resistance of Spine Fin to outdoor corrosion and subsequent deterioration is a substantial benefit. Spine Fin has the lowest corrosion potential of any outdoor heat transfer technology, particularly in seacoast environments and acid rain exposure. In these kinds of damaging exposures, an air conditioning coil experiences two kinds of corrosive actions: galvanic, or two-metal, corrosion, and crevice corrosion.

Galvanic corrosion occurs when two dissimilar metals in close proximity to each other are exposed to a conducting fluid, such as salt spray, acid rain or chemically tainted rainwater. From there, the two metals act as a battery in which one metal sacrifices itself to the other. The more dissimilar the metals (for example, copper and aluminum), the greater the potential for corrosion. This is why a copper tube/aluminum plate fin coil has five times the corrosion potential of an all-aluminum coil such as Trane's.

### Spine Fin is not prone to crevice corrosion.

Crevice corrosion is the second major corrosive force that can undermine the integrity of an outdoor heat exchanger. Crevice corrosion is caused when stagnant solutions are trapped in very small spaces. A few thousandths of an inch is a sufficient enough space to qualify as a crevice and is typical of the space between the tubing and fin stock of plate fin coils.

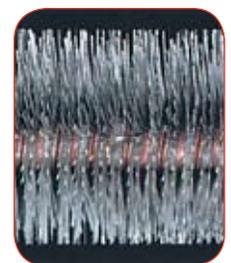
In the construction of plate fin coils, aluminum fin sheets are stacked on parallel rows of copper tubes. The copper tubes are then mechanically expanded to make contact with the fin sheets. After a few months or years of use, a tiny gap develops between the tube and fin sheet because the two metals expand and contract at different rates. Moisture enters this tiny crevice and the coil becomes susceptible to corrosion.

### Acid rain.

The corrosion resistant construction of all aluminum Spine Fin is augmented by the stabilizing characteristics of the aluminum metal itself. Industrial and urban atmospheres are corrosive environments primarily because they are ripe with sulfur gases generated by the burning of fuels. These gases mix with water vapor to form sulfurous and sulfuric acids, which form "acid rain." Aluminum is an active metal, but its behavior is stable because of the protective, tightly adherent invisible oxide film on its surface. In general, aluminum alloys have a high resistance to dilute sulfuric acid and hydrogen sulfide, which are present in outdoor environments.



At left: The patented Spine Fin™ machine wraps aluminum spined ribbon tightly onto adhesive coated tubing. At right: The colored adhesive has extruded out from under the fins, locking them together and sealing out moisture.



**Fact:** The more dissimilar the metals in a coil, the greater the potential for corrosion. Trane uses aluminum for both the fin stock and the tube in the construction of Spine Fin™.

**Corrosion resistance begins with the manufacturing process.**

Trane manufactures Spine Fin on patented high-speed machines that cut, form and wrap aluminum fin stock around aluminum tubing. The tubing rises through a colored adhesive bath in the center of the machine, which coats the tube. Tension rollers wrap the ribbons tightly to the tube using the bonding adhesive. A seam of the adhesive extrudes between the fin wraps, which not only locks the fin stock on the tube, but also forms a protective barrier against moisture and contaminants, minimizing corrosion.

**The Spine Fin™ difference: A protective cabinet and a cleanable design.**

**A protective cabinet prevents damage.**

The outdoor coil in an air conditioner or heat pump can easily get damaged in a backyard environment. Lawn equipment, damaging hail, even baseballs, sticks and tree limbs can all add years of wear and tear to a heat exchanger. Trane's protective cabinet design prevents coil damage by encasing the heat exchanger in heavy gauge steel louvered panels. These panels allow air to pass through the cabinet, but seal out dangerous external elements.

**Ease of cleaning a definite plus.**

One of Spine Fin's strengths is that because of its design, any potential surface loading and clogging—when and if it occurs—is insignificant to its performance. First of all, its large surface area permits more airflow volume at a lower velocity. This lower velocity means that fewer solids, such as dirt, grass clippings or leaves are picked up in the airstream, which reduces the possibility of normal dirt build-up.

If dirt build-up does occur, the thousands of leading edges of Spine Fin distribute the dirt and debris throughout the depth of the coil. Airflow and heat transfer are maintained. When required, Spine Fin coils can be easily cleaned with a reverse flow of low velocity water.

**The Spine Fin™ difference: Continuous research and development.**

**Perfecting the process.**

Spine Fin is the product of extensive research—research that has been conducted over the course of 75 years, dating back to 1927, when the first compilation of the laws and data on heat transfer began. Over the years, third-party testing continues to show that all-aluminum heat exchangers are not only more thermally efficient than all-copper or copper/aluminum heat exchangers, but they're also much more resistant to corrosion.

Most recently, a study conducted at the Ray Herrick Laboratories of Purdue University in 2001, showed that a typical system's efficiency degrades twice as much with enhanced plate fin versus Spine Fin when a three- to four-year buildup of graded dust is present. Even in the event that Spine Fin is loaded with more particulate than enhanced plate fin, more system efficiency is retained with Spine Fin. This study proves the fact that surface loading and clogging are not typical to Spine Fin.

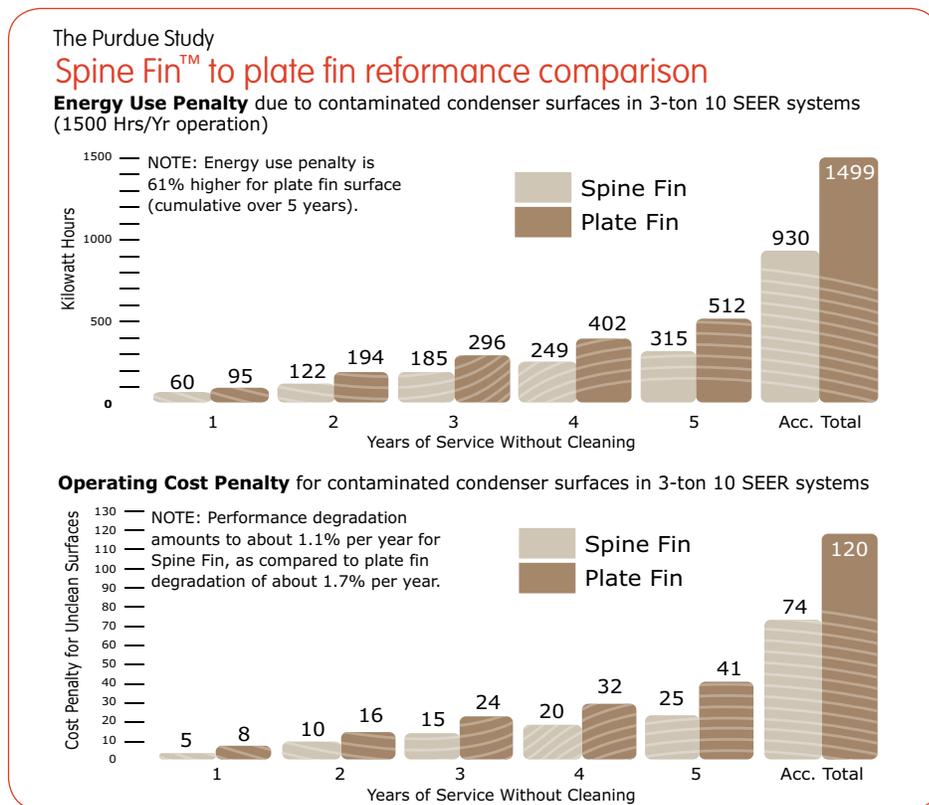
The recent development of Trane's woven coil technology takes the success

**U.S. Navy research testimony**

In a corrosive environment (coastal or urban), heat exchanger performance can degrade quite rapidly. According to an unbiased study performed by the United States Navy Civil Engineering Laboratory, Naval Construction Battalion Center in Port Hueneme, California, evidence of the fact, and support of all-aluminum coils in such environments is presented. Technical Report #N-1560 observes that after 24 months, aluminum tube/aluminum fin, heat exchangers are performing 32% better than copper tube/aluminum fin units.

One conclusion of this research was that "uncoated aluminum tube/aluminum fin heat exchangers are more thermally efficient than either the uncoated copper tube/aluminum fin heat exchangers after two-years of operation in a temperate marine environment."

of Spine Fin one step further. Its increased surface area offers an even greater prevention of dirt build-up, providing superior long-term efficiency and effectiveness against the environment outdoors.



## The Trane Difference.

Since the earliest days of James and Reuben Trane, we've built our reputation on manufacturing reliable, durable and efficient home comfort products for consumers from coast to coast. For over 90 years, we've been making products that deliver years of dependable comfort, applying innovative

thinking and technology that enhance performance, increase efficiency and make the air your family breathes cleaner. We've developed precise processes and stringent quality control measures to support and maintain our on-going standards of excellence, and our component testing procedures

and performance tests are unmatched in the industry. Our competitors may find our fierce attention to detail a bit old-fashioned, but the payoff is in our products. At Trane, it's not just about heating and cooling, it's about making your home a better place for living. You can expect more from Trane.

We design and manufacture our products to be as reliable and durable as possible. In fact, with our top-of-the-line XL products, we ensure further peace of mind with one of the best residential manufacturer's limited warranties in the industry: 10 years on the compressor, 10 years on the outdoor coil, and 10 years on internal functional parts. At Trane, our commitment to excellence continues long after a product leaves the factory.



### It's the end result that counts.

While we may stake our reputation on our state-of-the-art manufacturing processes and our durable products, it's our people who deliver the goods. Trane's Comfort Specialists™ bridge the gap between technology and comfort, providing consumers with the service and satisfaction they need, and the peace of mind they've come to expect from the leader in residential heating and air conditioning. Our Comfort Specialists™ are an extension of the Trane philosophy of providing long term, practical indoor comfort solutions for the way people live today. We know that in our industry, technology is meaningless unless it can be applied to the lives of real people, making them more comfortable today and for years to come.

**Novell Custom HVAC Co.**

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*It's Hard To Stop A Trane.®*