



The Freus – An Overview

The Freus is a unique, but proven concept in refrigerated air conditioning condensers. The patented system uses water to cool and condense the refrigerant, enabling the Freus to provide more consistent, quieter cooling performance, often at only half the energy costs of conventional “air-cooled” condensing units. Condensing temperatures achieved by the Freus can be over 20 degrees cooler than air cooled equipment, reducing compressor power usage, and extending the life of mechanical components within the Freus. The Freus uses reliable, time-tested Copeland Scroll compressors and a simple, durable design to provide unsurpassed efficiency and long life. The Freus can be used in conjunction with most major manufacturers’ air handling equipment, in retrofit or in new construction.

Frequently Asked Questions

1. How Does the Freus System Work?

The Freus uses water instead of air to cool and condense the refrigerant. An equal volume of water can absorb 3,500 times more heat than air. The water is sprayed over the condensing coils and moving air cools the water. The lower condensing temperature allows a smaller compressor to provide more cooling than in air-cooled units. Looking at any manufacturer’s compressor chart, you can see that all compressors are more efficient at lower condensing temperatures.

2. Why should a homeowner install a Freus?

The number one reason is to save money. By reducing air conditioning costs by 40 to 65 percent versus air cooled equipment, the Freus can save a homeowner hundreds of dollars a year, and thousands of dollars in operating costs over the life of the unit. In new construction, the buyer who finances his home and installs a Freus will create more spending money every month (the finance cost increase is small compared to the energy savings). In most cases, a homeowner can purchase the Freus for the same price as an air-cooled 14 SEER. With electric power deregulation, a Freus unit is a great safeguard against big residential electric rate increases. In addition, the level efficiency performance of the Freus at high and low outdoor temperatures creates more even cycle times, providing for better household dehumidification in humid climates.

3. How easy is the Freus to install?

The Freus is installed in much the same manner as an air-cooled condenser, on a ground pad or as a roof-mounted unit. The only difference in installation is the requirement to connect the ¼” copper tube supply water (tubing and hose bib provided). The water connection can be installed outside on a water bib (faucet) or connected to the cold water plumbing indoors. An automatic flush system is provided to help keep your Freus unit clean. The Freus installation time is close to the install of an air cooled unit.

4. **What about price?**

The average cost of a Freus unit costs about the same as a conventional 14 SEER unit. Due to the steady capacity, the condenser can be sized flat, not sized larger for hot climates like air-cooled units generally are. This savings in tonnage can offset some of the cost difference between the Freus and air-cooled condensers.

5. **How do I determine condenser size when using a Freus?**

Freus sizing is somewhat more forgiving than with air-cooled units, as they do not diminish in cooling performance as outdoor temperatures like air-cooled units (4% versus up to 20% @ 115°F.). Freus, as with any other HVAC system, requires proper sizing be done based on the Btu/h of cooling needed at design conditions for each application and installation. Refer to Freus capacity tables and compare them to air-cooled unit capacity tables to make comparisons for your local area.

6. **My City Code says I can only use an Evaporative Cooler that is a "Water Conservation Device". Does the Freus Qualify?**

Yes. The Freus is not an "Evaporative Cooler" it is a water-cooled condenser. Many restrictive codes, (i.e. Fresno CA Section 14-201) limit water consumption. In many installations the condensate line can be returned to the Freus unit cutting water consumption up to half and saving more electricity. The Freus use of water can be less than the water needed to generate the electricity saved by Freus! At any rate, the water consumption is small and water is recycled giving **Freus** the designation of a "**WATER CONSERVATION DEVICE**".

7. **The Freus uses water to cool the condenser, so what about the cost of water?**

Freus water cost is approximately \$15 dollars per year. In most markets this cost can vary from \$0.00 to \$39.00 per year depending on your water company.

8. **Where does the water run off go?**

To keep the cabinet clean of mineral deposits, the Freus includes a flush pump. This can be run into the garden near the home (generally drain at least 5 feet away from the foundation) into a French drain, or suitable drain as may be required by local codes.

9. **How does the Freus perform in a hot and humid environment?**

It performs very well since neither outside temperature nor does high humidity have much effect on the efficiency of the Freus. Even on the hottest, most humid days, the water temperature in the condenser stays relatively constant, and even a large change in humidity creates only a small temperature difference in the

evaporatively cooled water. This principle is demonstrated by the widespread use of cooling towers in humid climates.

10. Why is the exhaust from the Freus so much cooler than the exhaust from my old air conditioner condenser?

When the air moves across the water, heat is drawn out of the air via evaporation and moisture is added to the air, which will actually lower the air temperature as it crosses the coils. For this reason, the air temperature coming out of a Freus is up to 20 degrees cooler than the outside air, as compared to exhaust air from air-cooled units which can be 30 degrees warmer than the outside air. These cooler temperatures will increase the compressor life, the fan motor life, and the overall life of the Freus.

11. Why does the Freus not have a SEER rating?

Freus units are rated under ARI standard 210/240-94 along with residential air conditioners and classified as either RCU-E-C (Split System: Evaporatively Cooled Condensing unit, Coil Alone) or RCU-E-CB (Split System: Evaporatively Cooled Condensing unit, Coil with Blower). Section 5 of ARI Standard 210/240 specifies that only air cooled units less than 65,000 Btu/h are rated with a SEER rating (which is tested at 82 deg. db/65 deg. wb ambient) and all other units are rated with an EER rating (which is tested at 95 deg. db/75 deg. wb ambient). Both ratings are performed with an indoor condition of 80 deg. db/67 deg. wb, and so the SEER rating performed at a lower ambient condition has a much higher efficiency number.

Ask yourself – Which testing condition is more like the condition that exists when your customer needs air conditioning – EER at 95F or SEER at 82F. ARI has prohibited Freus from publishing an equivalent SEER at 82F, but they have allowed us to make application rating comparisons. Following is a comparison of a Freus, a Carrier, and a Trane unit, all at 95 F ambient, so you can draw your own efficiency conclusions.

Brand	Outdoor Model #	Indoor Model #	Listed SEER	CFM	Mbtub @ 95 Capacity	System Kw @ 95	EER @ 95
Freus	10M0336	FK4CNB006	Prohibited	1,200	37	2.18	17
Carrier	38TDA036-30	CD5BW060	14	1,280	39.07	3.67	10.65
Trane	TTS736A with TUC, TDC080B9V3+TXC736S5		15.45	1,000	36	3.92	9.18

Note: ARI prohibits Freus from publishing a SEER rating.

Indoor Condition is 80 db/ 67 wb and outdoor is 95 db/75 wb for all models.

12. What about freezing temperatures? Will the customer have to do anything to protect the unit?

A flush and fill kit with freeze protection is available, as an option. This kit automatically drains the water at low temperatures, and prevents water from coming into the unit. The customer can winterize by shutting off the water supply, draining the line, and draining the unit, which takes a few minutes.

13. What compressor do you use and why?

Freus units have Copeland Scroll Compressors. These are installed because they are quiet, efficient, and reliable. Copeland Scroll Compressors are widely regarded as the premier compressors on the market today.

14. Since the Freus is water-cooled, how are Algae, Bacteria, and Legionnaires' disease concerns addressed?

Bacteria such as Legion Ella are naturally occurring in virtually all water supplies and so appropriate care should be taken for water from kitchen tap, drinking fountain, bathroom shower, pool, yard sprinkler, and a Freus unit. The primary point of prevention of water-borne disease is the municipal water treatment plant. Most public water supplies are treated with chlorine to control microbiological contaminants and checked regularly by public health officials. After decades of Legion Ella research there has never been a single case of Legionnaires disease linked to an evaporative cooler or a residential water-cooled evaporative condenser like a Freus unit.

Freus engineers have taken care to design the Freus to inhibit the amplification of microorganisms. Some of the main design features for these purposes are:

- a) The Freus unit is a split system air conditioning outdoor condenser; connected to an indoor section therefore the water is completely separate from the indoor components, keeping the water and humidity outdoors.
- b) The sump temperature is kept lower than commercial evaporative condensers to make bacterial growth more dormant (Freus units have a standard cool down cycle).
- c) The Freus sump is shaded to prevent growth of algae.
- d) The condenser coils are designed to drain water down into the sump, dry out, and thereby kill aqueous bacteria on the coils.
- e) The sump water is exchanged once every six to eight hours of operation by a flush pump system. This purges the sump to prevent microbiological concentration.
- f) Freus recommends the unit be cleaned during annual servicing. For these reasons, Freus does not recommend any chemical treatment beyond what the public water authorities perform.

15. How do you make water and electricity in the same environment safe?

Freus housing is fiberglass. Electrical elements are isolated. All Freus designs meet or exceed UL requirements.

16. Do mineral deposits accumulate on the condenser copper tubing? What about corrosion?

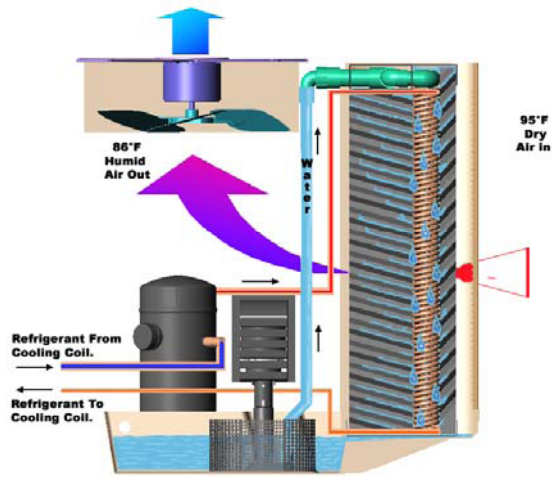
Yes, minerals are left behind as water evaporates and they do get on the condenser coil, however, they do not accumulate to great enough thickness to measurably reduce the performance of the Freus. The Freus has been designed to minimize these deposits and avoid corrosion problems with the following features:

- a) Freus units purge the sump water once every six to eight hours of operation to prevent heavy concentrations of minerals from accumulating. This is done with an automatic flush pump.
- b) The copper condenser coil has a .032 wall thickness which is far thicker (2.6 times thicker) than the common .012 copper wall thickness used on air cooled condensers, reducing the chance of corrosion working through the tubing.
- c) The Freus copper condenser coil has no fins for minerals to lodge in and the coil is coated. This coil coating gives added corrosion resistance to the coil, by reducing the active surface area the anodes protect and extending the life of the anodes.
- d) The intertwined helical copper condenser coil has no fins for minerals to lodge in and the coil naturally expands and contracts with temperature changes at a different rate than mineral deposits do. As a natural consequence, as minerals eventually build up on the coil (to a slight thickness) this expansion and contraction process tends to break loose the minerals and shed them off.
- e) The Freus is shipped with a sacrificial anode to prevent water scaling and corrosion, similar to most water heaters on the market.
- f) Freus recommends annual servicing to clean the Freus unit. This includes spraying out the sump/coil with a water hose to clean out mineral deposits.

For these reasons Freus provides a limited 10 year warranty on the copper condenser coil as part of its standard limited warranty (warranty must be registered).

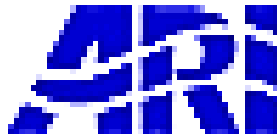
17. What is the background of the manufacturer of the Freus?

The Freus Management and Engineering Team have been involved in the development, sales and servicing of water-cooled air conditioners for nearly 30 years. Freus is a continuous improvement driven company and integrates the latest advances into all currently produced models released.



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Volume 2, Number 1

“The Freus water-cooled A/C unit has a lower operating head pressure.”

Keep these things in mind when selecting metering devices:

- **TXV with “balanced Port”**
- **Upsize the piston or flow rater**
- **Use the proper charging method for your metering device.**
- **Charge One System at a time (only one system operating on multi-system Units).**

Freus water-cooled A/C unit is the most efficient air conditioner available on the market.

The Freus water-cooled unit uses cooling tower technology to provide the highest efficient air conditioner available on the market. Due to this, the freus unit has a lower operating head pressure. To ensure maximum performance installers and start-up technicians need to understand the effect that a lower operating head pressure will have on the evaporator metering device.

Indoor coils with (TXV)

Thermal Expansion Valves

One of the factors limiting a TXV's ability to operate at part load conditions is a variation in pressure drop across the TXV. The low operating head pressure may cause the TXV to have a low pressure drop across the valve body. To counteract this effect, a “balance port” TXV significantly reduces the effects of pressure drop across the valve and is the preferred TXV for the Freus unit.

Generally the TXV needs to be up sized by 25% and the proper charging procedure for the TXV is to charge by sight glass installed in the liquid line close to the TXV, or use the Sub-cool method.

Indoor coils Piston / Flow Rater



Due to the low operating pressure, the piston or flow rater will need to be up-sized to allow proper refrigerant in the coil.

Use the orifice sizing guide to determine the correct orifice for the Freus unit. The proper charging procedure is the superheat method.

A properly installed and correctly charged system will provide maximum performance.