



Air Conditioning & Heating

THE **FUTURE** OF
AIR CONDITIONING...

**SMALLER
IS SMARTER!**



Thank goodness for Goodman.™

THE **FUTURE** BEGINS TODAY.

SMALLER IS SMARTER

Long ago the HVAC industry determined that the combination of copper tubing and aluminum fins provided the most efficient transfer of thermal heat available. Today, the Goodman brand has improved upon this industry standard by making the copper tubing smaller and smarter. The result is an air conditioner or heat pump unit that can offer high efficiency, use less refrigerant, and deliver money-saving and energy-saving comfort to homeowners for years and years. Goodman's SmartCoil™ coil is our most advanced and most efficient that is manufactured in North America. And, several patent applications are pending on this coil as a result of the technology required to engineer and manufacture it.

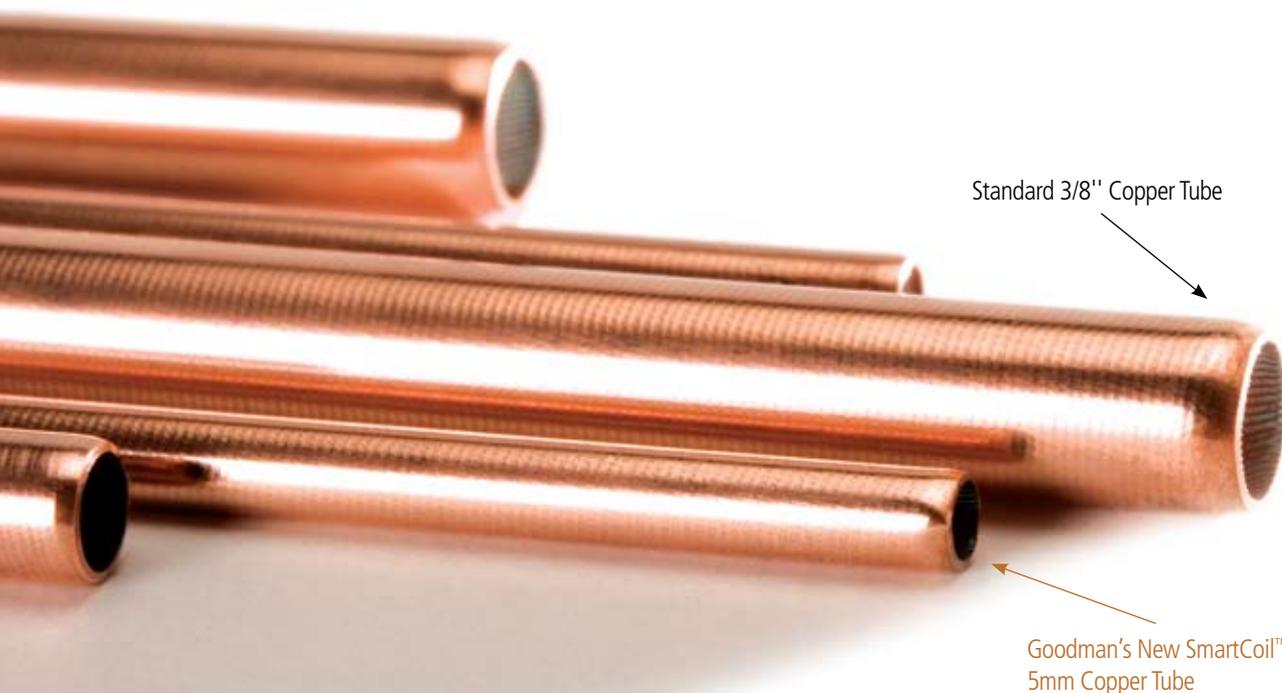
Beyond the excellent thermal transfer properties of R-410A refrigerant when it's coupled with 5mm copper tubing, the smaller diameter tubing requires less refrigerant to achieve the same efficiency rating. Although the 5mm copper tubing has a smaller diameter, the tubing's wall strength is as strong as the old 3/8 inch tubing.



SIZE MATTERS

The smallest amount of heat transfer occurs in the center of the tubing. The larger the tubing size, the larger the area where minimal heat transfer increases.

Images enlarged to show detail.



R-410A IS THE FUTURE.

In a few months, R-410A refrigerant will become the sole refrigerant used by the HVAC industry in the manufacture of new equipment. R-410A refrigerant does not contain chlorine. This makes it an environmentally friendly refrigerant compared to its predecessor R-22.

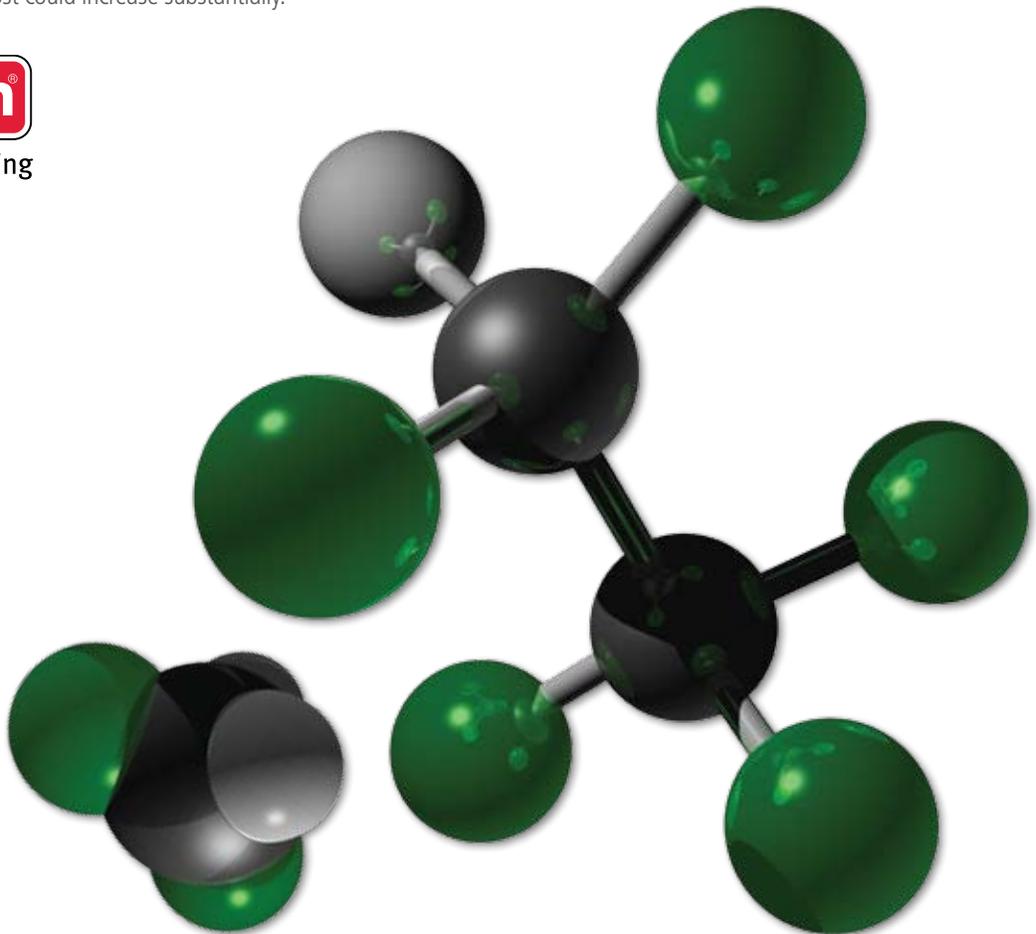
Over a decade ago, the federal Clean Air Act was amended to begin a mandatory phase out of the production and use of many ozone depleting substances, including a commonly used air conditioning refrigerant known as R-22. By 2010 air conditioning and heat pump manufacturers in most countries will no longer be using refrigerant R-22 in new equipment because it is being banned around the world as part of the global phase out of ozone-depleting CFCs (chlorofluorocarbons) and HCFCs (hydrochlorofluorocarbons). In addition, at that time R-22 refrigerant cannot be manufactured or imported into the country, except for use to repair or maintain HVAC equipment manufactured prior to that year. As R-22 refrigerant is phased out of production, its cost could increase substantially.

Several years ago, the automotive industry migrated from the use of R-12 refrigerant to an environmentally-friendly refrigerant known as R-134. During this transition, the cost of R-12 refrigerant skyrocketed. Given the history of refrigerant prices when a phase out of a product is mandated, one can presume that future repairs and maintenance needs of HVAC units that use R-22 refrigerant will likely cost more and more as R-22 refrigerant is phased out of production.

With R-410A refrigerant becoming the sole option for new central air conditioners and heat pumps, HVAC manufacturers have already started the process of incorporating the new refrigerant into their product line. Further, the Goodman brand has taken the extra step to maximize the efficiency and performance of its products that use R-410A refrigerant. The Goodman brand enjoys a rich history of providing the perfect blend of energy savings, reliable and dependable operation throughout the entire line of refreshingly affordable heating, air conditioning, and indoor air quality products.



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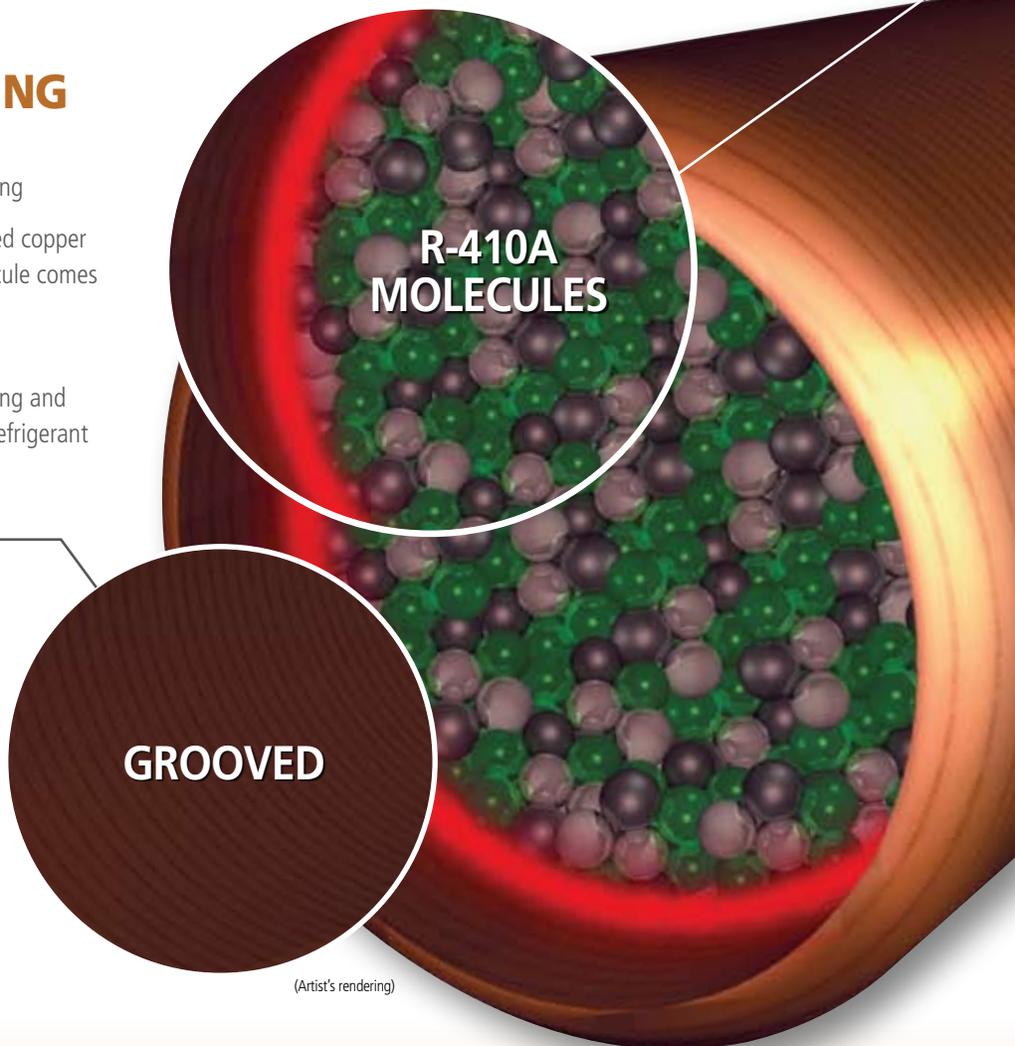
SmartCoil™ GENERATES GREATER PERFORMANCE.

Thermal transfer is a major component in the operation and performance of an air conditioning or heat pump product. One simple job of the refrigerant in an air conditioning or heat pump system is to transfer heat, and, in the process, humidity, from the air. Because the majority of thermal transfer occurs in the condenser and evaporator coils, the Goodman engineers readily accepted the challenge of optimizing thermal transfer in the condenser coils for products that use R-410A refrigerant. After all, the heritage of the Goodman brand involves energy-saving, money-saving, and

resource-saving heating and cooling systems. So the introduction of R-410A refrigerant offered the perfect opportunity to optimize the heat transfer efficiency properties of R-410A refrigerant. In their quest, Goodman's engineers quickly resolved that the thermo-physical properties of R-410A refrigerant are a great match for the heat transfer characteristics of 5mm diameter copper tubing. Scientific theory aside, it's easy to see why smaller tubing in the condenser coil optimizes heat transfer.

GROOVED COPPER TUBING

- Grooves increase thermal transfer of R-410A refrigerant in conjunction with 5mm copper tubing
- The refrigerant molecules swirl inside the grooved copper tubing, increasing the time the refrigerant molecule comes into contact with the inside of the tubing
- 'Slots' increase the total surface area of the tubing and increase the amount of space available for the refrigerant molecules to touch the inside of the tubing, optimizing heat transfer



(Artist's rendering)

THE HEAT TRANSFER PROCESS

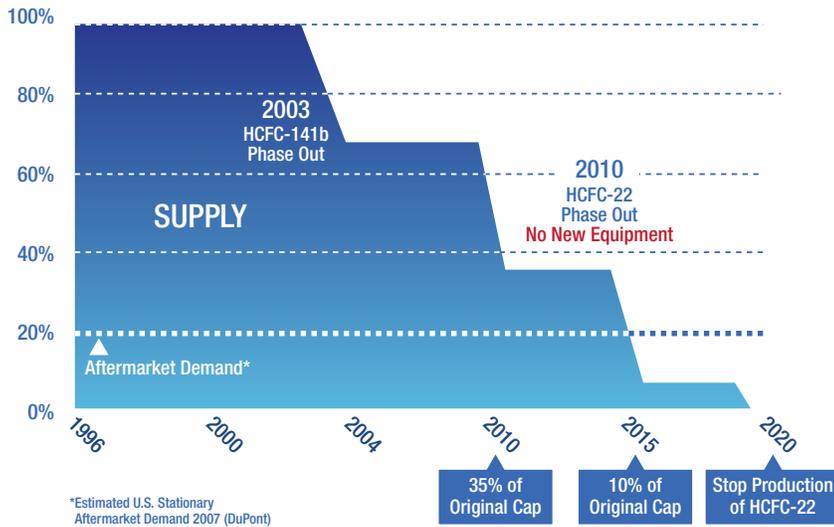
- Maximum heat transfer between the refrigerant molecules occurs highest at the outside edge of the tubing
- Through osmosis, additional heat transfer occurs when the molecules in the center of the tubing touch the molecules at the outer edge of the tubing, releasing heat and becoming cooler
- The smallest amount of heat transfer occurs in the center region of the tubing. The larger the tubing size, the area where minimal heat transfer occurs increases in size.
- Using the Second Law of Thermodynamics, heat can be transferred into cold during the transfer of energy such as the R-410A refrigerant molecule touching the side of the 5mm copper tubing
- The physical size of the area that comes into contact and the length of time the contact occurs helps optimize the heat transfer. And that's specifically what makes the R-410A refrigerant and the 5mm copper tube combination work so well together.

SAVING SPACE

Goodman units with SmartCoil™ and R-410A refrigerant use 25% less refrigerant and the overall unit requires 15% less volume.



U.S. CLEAN AIR ACT PHASE-OUT SCHEDULE FOR HCHFSs



GOOD NEIGHBOR MANUFACTURING



The SmartCoil™ copper tube, aluminum fin condenser coil is designed from two metals widely known for their ability to be recycled. It's just one more example of good neighbor manufacturing endorsed by the Goodman Manufacturing Company. Our manufacturing facilities, all located in the United

States, constantly strive to implement procedures and processes that help to reinforce our environmental stewardship. Here are just a few examples of our manufacturing procedures that have helped to make the manufacture of our products 'green.'

The painting process at our manufacturing plants does not emit any volatile organic compounds (VOC's). This has been achieved by employing powder paint and a baking process for all painted components of our heating and cooling products. Manufacturing processes that utilize oil as a lubricant or coating have been improved so that our consumption of these chemicals has been greatly reduced. Further, we work with our suppliers to capture the most environmentally friendly pallet building materials to assist in the reduction of emissions. These are just a few of the manufacturing initiatives and processes that support Goodman's environmental stewardship.

Many of the components used in the manufacturing process are recycled, such as scrap steel, aluminum, copper, cardboard and oil. Cogent environmental procedures and policies are implemented on a continuous basis throughout our manufacturing operations.



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CB-5MM