



TRANE®

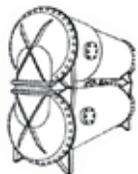


Trane® CenTraVac™ Chillers

The most efficient and reliable centrifugal chillers on the planet

IR Ingersoll Rand.

CenTraVac meets today's efficiency and sustainability challenges



Right from the start, Trane fundamentally changed the way large buildings are air-conditioned with the 1938 introduction of Turbovac™ — the world's first direct drive, hermetic, multi-stage centrifugal water chiller.

Buildings account for nearly 40 percent of the total energy consumption in the United States, and 38 percent of carbon dioxide emissions.¹ As much as 50 percent of energy used by commercial buildings is attributable to HVAC systems.² Globally, there is a focus on changing heating and cooling practices to improve efficiency, optimize the use of natural resources and protect the environment we live in.

Building owners, engineers and architects are searching to minimize both immediate and long-term environmental impact. Trane® is committed to helping achieve this through cooling systems that are highly efficient and

offer environmental advantages. That is good news for the environment and your business.

Trane CenTraVac™ centrifugal chillers provide the lowest possible cooling costs, while delivering environmental benefits that are so significant they have earned awards from the Environmental Protection Agency — three times.

A leader from the start

Trane has been the leader in chiller innovation since 1938. Decade after decade, CenTraVac technology has advanced to meet a variety of challenges, and we will continue to lead the industry into the next generation of cooling.

Most efficient

Today's CenTraVac delivers the industry's highest full- and part-load efficiency, as low as 0.478 kW/ton full-load and 0.296 kW/ton IPLV at standard AHRI conditions.

CenTraVac is ideally suited for a wide range of cooling applications, and is the only chiller capable of sustaining operating temperatures down to 34°F, without energy-robbing anti-freeze.

Performance

Studies clearly show that positive bottom lines for large tonnage chiller plants focus on the use of full-load efficiency ratings, not IPLV/NPLV.³ Optimum system performance can only be determined through analysis that considers a wide range of variables from hour-by-hour analysis to chiller plant performance characteristics.⁴ Simple tools such as the myPLV™ are available to help quickly estimate future chiller performance based on project-specific conditions that include location and building type, building load, number and size of the chillers in the plant, chiller condenser control strategy and more.

Based on Trane calculations, CenTraVac efficiency levels can produce energy-related cost savings equivalent to an investment that provides an annual ROI of better than 30 percent.

Most reliable

Through simplicity in design, Trane centrifugal compressors achieve the industry's highest design reliability rating of 99.7 percent.⁵ CenTraVac is capable of sustaining the precise temperatures at extremely tight tolerances that are key to occupant comfort and crucial to many demanding mission-critical processes. Built to last for decades — with some chillers operating for more than 50 years — and with the industry's fewest moving components, CenTraVac excels even in the most challenging cooling applications.

And because CenTraVac chillers require only simplified maintenance to achieve years of consistent, peak productivity, they will deliver greater financial benefits.

Environmentally considerate

As part of the EcoWise portfolio of products, CenTraVac chillers are capable of utilizing next-generation refrigerants with a Global Warming Potential (GWP) value of less than 2 — among the lowest in the industry. In addition, semi-hermetic compressors, along with low-pressure refrigerant, produce the ultra-low refrigerant emission rate of less than 0.5 percent annually.

And if every chiller could operate at CenTraVac's 0.45 kW/ton efficiency, power plant-generated greenhouse gas emissions would be reduced by more than 19 billion pounds of CO₂, 72 billion grams of SO₂ and 30 billion grams of NO_x over the life of the chiller.



The entire CenTraVac chiller portfolio has earned third-party verification with a product-specific Type III Environmental Product Declaration (EPD), confirming that its environmental impacts are the lowest in the water-cooled chiller industry.



Balanced approach

CenTraVac chillers take a balanced approach to multifaceted cooling challenges. Design simplicity, thoughtful refrigerant selection and innovation driven by time-tested engineering principles make CenTraVac the most reliable, cost-effective, energy-efficient and sustainable chillers on the market today.

1. U.S. Environmental Protection Agency, "Why Build Green?" <http://www.epa.gov/greenbuilding/pubs/whybuild.htm> (accessed August 23, 2010).

2. U.S. Department of Energy.

3. W. Ryan Geister and Mike Thompson, "A Closer Look At Chiller Ratings," *ASHRAE Journal*, (December 2009).

4. W. Ryan Geister, Mike Thompson and Justin Wieman, "Chiller Plant Ratings: Why the Proper Evaluation Method Matters," *District Energy* magazine, (Fourth Quarter 2010).

5. Calculated according to the ASHRAE Applications Handbook "Operations and Maintenance Management."

Built for a long and quiet chiller life

CenTraVac™ chillers are a lesson in rugged simplicity. Direct-drive, centrifugal chillers by Trane® are built without speed-increasing gears and shaft seals, which are both prone to failure and require constant attention to maintain.

Technology inspires continuous innovation, and hundreds of patents have been registered under the Trane name. Still, “reliability by design” remains the core philosophy behind every CenTraVac chiller.



Each CenTraVac chiller is custom-built individually, following rigorous quality control processes. Before a CenTraVac leaves our manufacturing facility, you as a Trane customer can take advantage of our fully customizable portfolio of myTest™ chiller test packages and proof-of-performance options. We invite you to witness all testing before your chiller ships — either in person at our La Crosse, Wisconsin, factory or remotely from the comfort of your office.



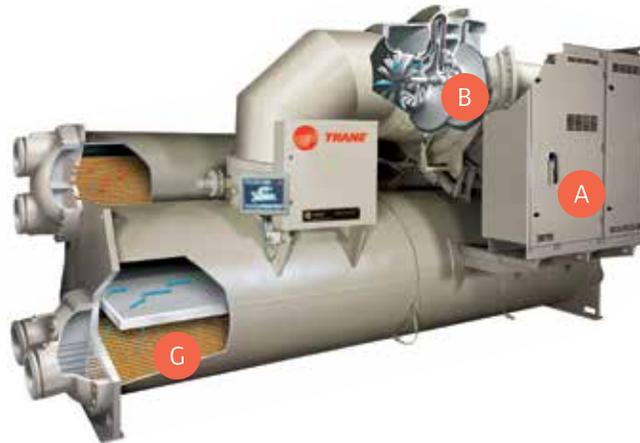
CenTraVac chillers stand up to rigorous industrial and commercial requirements



- Robust design reduces downtime for manufacturing operations, where minutes of lost production time cost dollars in lost revenue. In addition, uninterruptable power can be fed to the controller and the purge, so that critical monitoring functions can continue despite a loss of main power.
- Superior HVAC system efficiency (made possible by an unequalled 34°F sustainable operating temperature without glycol) reduces energy costs for district cooling applications such as office campuses, airports and universities.
- Integrated controls deliver precision cooling and humidity management for applications that demand uncompromising conditions for manufacturing and research, such as pharmaceuticals, biotechnology, genomes and medical devices.
- A selection of options fortify the CenTraVac design with additional electrical and construction features: wiring in seal-tight conduit, enclosed junction boxes, NEMA 4 protection, industrial-grade starters, special paint and coatings.

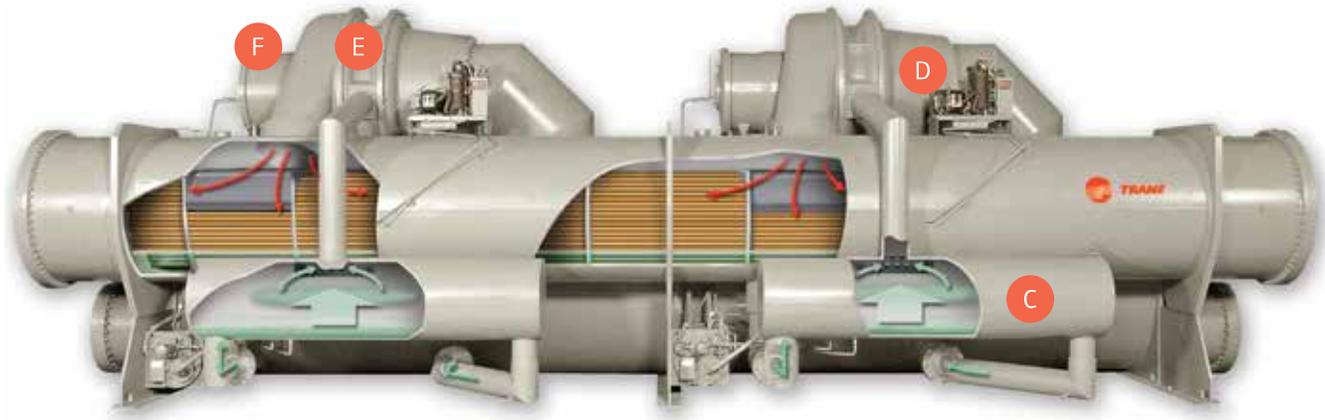
Simplex

120–2,000 ton at 50Hz
120–2,000 ton at 60Hz



Duplex™

1200–4,000+ ton at 50Hz
1400–4,000+ ton at 60Hz

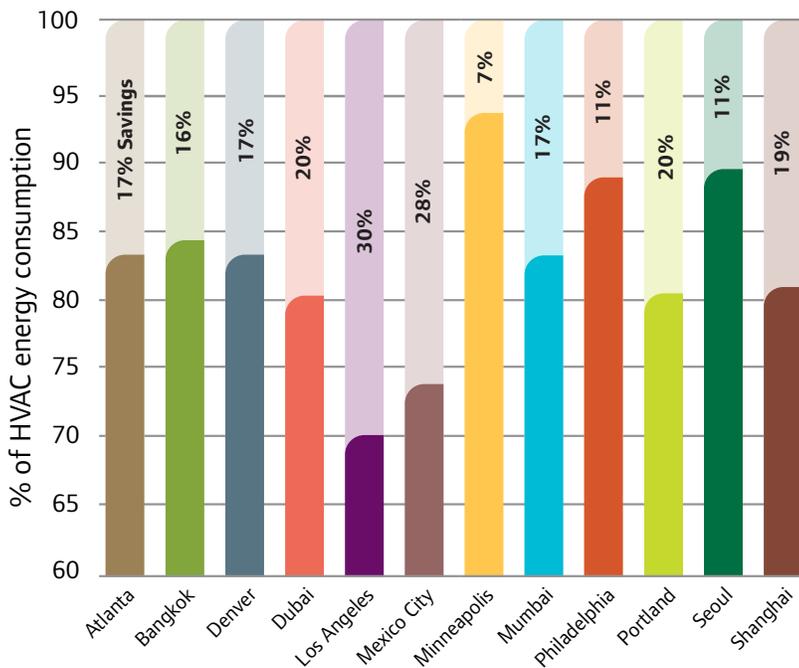


- A** Drive performance: Adaptive Frequency™ drives are the industry's most capable variable speed drives, optimizing compressor speed control to reduce energy usage.
- B** Surge resistance: Multiple stages of compression provide surge resistance and overcome high head-pressure conditions, assuring more consistent comfort levels.
- C** Better cycle efficiency: An integrated flash economizer improves cycle efficiency by 5 to 7 percent, further reducing energy use.
- D** One moving part: Exclusive centrifugal compressor design is built with only one moving part that needs just two bearings for support, resulting in the most reliable chiller available.
- E** Quiet, vibration-free operation: Low-speed, direct-drive design gives CenTraVac the industry's lowest sound and vibration levels. It eliminates the need for costly jacketing and energy-wasting liquid-refrigerant sound attenuation, too.
- F** Improved motor efficiency: Semi-hermetic motor design, along with low-pressure refrigerant, provides the lowest refrigerant leak rates and assures clean and cool motor operation for maximum performance.
- G** Reduced refrigerant charge: Trane evaporator technology reduces the refrigerant charge to nearly half that of most competitors. Lower charge means the chiller requires less refrigerant to operate, and when it comes to refrigerant, less is definitely better in terms of both cost and environmental impact.

A range of options ... and a CenTraVac to meet your needs

CenTraVac™ chillers are available in a wide range of cooling capacities and with features that can be optimized to suit the building's size and function. Specialized chillers fulfill specific needs for large-space cooling and lowest environmental impact. Your Trane sales engineer can help you select the right CenTraVac chiller based on your specific performance criteria.

EarthWise Systems¹ savings as compared to Conventional Systems² operating at 100% energy consumption



EarthWise Systems¹

Waterside: 12°F ΔT across evaporator, 15°F ΔT across condenser, high-efficiency chiller.
 Airside: 48°F design supply-air temperature, 76°F zone cooling setpoint (due to lower indoor RH driven by lower supply air-temperatures, per ASHRAE Cold Air System Design Guide defining indoor comfort), supply-air-temperature reset (from 48°F up to 60°F) at mild outdoor conditions, comparative enthalpy economizer, parallel fan-powered VAV terminals, optimized supply duct static pressure control (fan-pressure optimization).

Conventional Systems²

Waterside: 10°F ΔT across evaporator, 10°F ΔT across condenser, minimum ASHRAE 90.1 chiller efficiency.
 Airside: 55°F design supply-air temperature, 75°F zone cooling setpoint, fixed dry-bulb economizer, VAV with reheat terminals, fixed supply duct static pressure control.

EarthWise Systems

Good for the environment, great for the bottom line

A comprehensive approach to HVAC system design makes it easy to do what is best for your building, right for the environment and good for your bottom line. A central plant system built around a CenTraVac centrifugal chiller drives emissions of all kinds to their lowest levels while raising energy efficiency to new heights. Through the integration of superior services and optimized controls, EarthWise™ systems drive sustainable outcomes throughout the entire life cycle of the system.

Additionally, the unique EarthWise capabilities are incorporated into low-temperature, low-flow systems to produce the highest levels of efficiency and lowest cost of operation as compared to conventional systems. Overall, EarthWise Systems use smaller fans and ductwork, fewer pumps and less piping, reducing both initial materials costs and long-term operational costs.



Duplex CenTraVac Chiller

High capacity, low complexity

For larger cooling capacities, the Duplex™ centrifugal chiller extends the proven Trane CenTraVac design to more than 4,000 tons.

Duplex chillers with a series-counterflow design and dual independent refrigerant circuits leverage thermodynamic staging to deliver unmatched efficiency. Duplex designs reduce energy consumption by 13 percent over a single compressor unit; and when paired in a series configuration, they increase the energy savings to 19 percent.

Duplex chiller features include the following:

- Series counterflow for highest efficiency
 - Very low water-pressure drop
- Multiple compressors with multiple stages for unloading stability and efficiency
 - Versatile for ambient applications
- Proven CenTraVac compressors and ancillaries
- 380–13,800 volts



Add options to enhance energy management

Chiller options conserve energy and save money. Your CenTraVac™ chiller can be configured in hundreds of different ways to deliver the performance you need. Energy management features are designed, factory-installed and tested to provide seamless integration with chiller operation.



Adaptive Frequency Drives (AFD)

Adaptive Frequency™ Drives control the operating speed of the chiller compressor motor by regulating output voltage in proportion to output frequency. Varying the speed to optimize the performance of the compressor can take advantage of part load conditions that translate into significant energy savings.



Heat recovery

Use of the heat recovery CenTraVac can significantly reduce the energy operating costs of many buildings by using heat that normally is rejected to the cooling tower. Heat recovery enables you to reduce your need for boilers — thus lowering your overall system energy use. Any building with a simultaneous heating and cooling load is a potential candidate.



Free cooling options

A refrigerant migration feature can provide up to 45 percent of the nominal chiller capacity, without running the compressor. Under the right conditions, it can produce significant cost savings. Examples include climates with cooler wetbulb temperatures where a cooling load is present, applications with elevated leaving chiller water temperatures, and settings where heat is rejected into a river, lake or pond.



Thermal energy/ ice storage

A thermal storage system uses a dual-duty chiller to make ice at night when utilities charge less for electricity. The ice supplements or even replaces mechanical cooling during the day when utility rates are at their peak. Reducing mechanical cooling results in big utility cost savings.



High efficiency tubing

Enhanced tubes have greater surface area where heat can be transferred from one side of the tube to the other, and they provide more fluid turbulence. External enhancements suit the refrigerant properties and the application (boiling or condensing), while internal enhancements improve fluid flow.

Tracer AdaptiView chiller controls: it's how facility managers keep their cool

Tracer AdaptiView™ chiller controls let building operating staff take command of the chiller plant. With a full-color touch screen display and interactive animated graphics, they can view, access and control chiller operations and functions and gain insight into the operating patterns, energy use and system performance.

Algorithms embedded within the controller work with the unique capabilities of the CenTraVac chiller to keep buildings operational, even during the most challenging conditions when other chillers would shut down.



Trane customers directed the design of the Tracer AdaptiView user interface, which provides a practical approach to chiller management.

Manage multiple chillers from any location with the Tracer SC controller

Adding the Tracer™ SC controller to a system provides a flexible, cost-effective solution for managing your HVAC system that can extend to lighting and energy consumption. Its simplified, web-based management tools help improve efficiencies, increase tenant comfort and reduce energy costs.

- Unit controllers can be factory-mounted to ensure easy installation and reliable performance
- Chiller sequencing routines optimize chiller plant energy efficiency by rotating individual chiller operation to equalize runtime, and by matching capacity to the building cooling load
- Coordinates pumps and cooling towers with the chiller operation for greater energy efficiency and reduced costs
- Alarms and diagnostic messages provide easier monitoring and troubleshooting



Tracer SC controller provides an easy-to-use interface via the web to monitor and control a chiller plant from any location.



Tracer SC dashboard uses an easy-to-interpret graphical display to report current operating conditions and energy usage.

Next-generation refrigerants

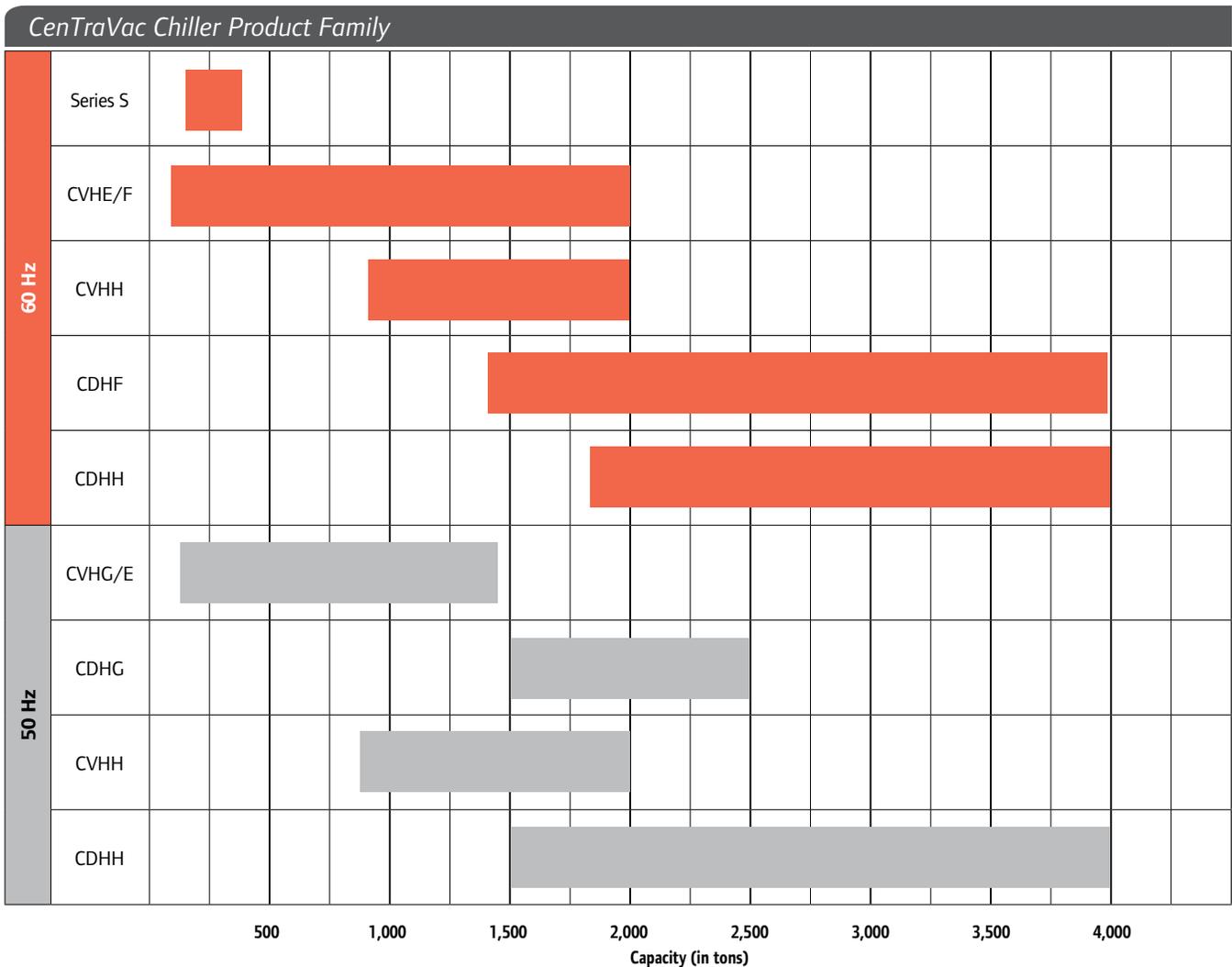
Environmental sustainability is at the heart of CenTraVac™ design. Low pressure refrigerants operate in a vacuum, which virtually eliminates leaks and enables near-zero emissions throughout the operational life of the CenTraVac chiller.

We chose refrigerants based on their overall impact on the environment, taking into consideration ozone depletion potential (ODP), global warming potential (GWP) and energy efficiency. This enables our chillers to be environmentally sustainable without compromising reliability, cost savings or safety.

CenTraVac chillers are part of the Ingersoll Rand EcoWise™ portfolio of products. They operate with either R-123 or next-generation, low global warming potential (GWP) refrigerants R-514A or R-1233zd — both featuring ultra-low GWPs of less than two.

EcoWise™

The EcoWise™ portfolio of products is designed to lower environmental impact with next-generation, low global warming potential (GWP) refrigerants and high efficiency operation.



Trane Building Services: maintain peak HVAC performance year after year

Long-term support

The local Trane team can provide comprehensive support throughout the life of your chiller:

- Available extended service warranties and regular maintenance protect the chiller investment and add value to your CenTraVac purchase by sustaining its peak operating efficiency
- Remote monitoring by Trane is available to safeguard and enhance system performance
- Emergency technical service provides fast resolution to minimize downtime
- A full line of replacement parts is available in local inventory
- Training in proper chiller operation and maintenance is available at several Trane training facilities, or on-site at the chiller location

Local support: we've got your back

Trane fully supports HVAC systems through a network of sales offices located around the world. We have the industry's most knowledgeable engineers, HVAC systems specialists and technical professionals on staff. Currently, over 700 Trane employees have earned LEED® accreditation from the U.S. Green Building Council.

Of course, what's most important to you is that your local Trane sales engineers and technical team will see you through the entire chiller purchase process, from building analysis to equipment specification, through installation and commissioning.



The average life span of a CenTraVac chiller is over thirty years — a full five years longer than competitive chillers.⁷ In many cases chillers have been operating for half a century. Trane offers support to help sustain peak performance throughout the equipment's full life expectancy.

7. "Comparison of Service Life Estimates," ASHRAE HVAC Applications Handbook, (2007 edition): Chapter 36, page 36.3, table 4.

The following are trademarks or registered trademarks of their respective companies: LEED from U.S. Green Building Association.

Ingersoll Rand Climate Commitment



50%

Reduction in the greenhouse gas refrigerant footprint of our products by 2020, and incorporating alternatives with lower GWP across the company's product portfolio by 2030.



35%

Reduction in greenhouse gas footprint of our own operations by 2020.



\$500M

Investment in product-related research and development by 2020 to fund the long-term reduction of GHG emissions.

EcoWise™

The Ingersoll Rand EcoWise™ portfolio of products designed to lower environmental impact with next-generation, low global warming potential (GWP) refrigerants and high-efficiency operation is part of our climate commitment to increase energy efficiency and reduce the greenhouse gas emissions (GHG) related to our operations and products.

Scan the code or visit
Trane.com/CenTraVac
to learn more.



Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands—including Club Car®, Ingersoll Rand®, Thermo King® and Trane®—work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a \$13 billion global business committed to a world of sustainable progress and enduring results.



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