



# INDUSTRY AND THE ENVIRONMENT BENEFIT FROM NEW AIR COMPRESSOR TECHNOLOGIES THAT ENABLE ENERGY EFFICIENCY, OPTIMIZED PERFORMANCE AND GREATER RELIABILITY



Faced with increasing competition, high energy costs, increased regulation and more aggressive sustainability goals, facility owners and plant managers are under extraordinary pressure to reduce costs, while achieving greater productivity and energy efficiency. Most industries use some form of air or gas compression to generate power to run equipment, tools and plant processes. It is an extremely convenient source of power, often referred to as the fourth utility. Yet, in many cases it is deployed inefficiently. The U.S. Department of Energy (DOE) estimates 30 to 50 percent of compressed air power is lost during operation. Those losses can be a result of leaks, poor maintenance, bad system design, wasted heat and/or pressure losses.

This is why industries are making commitments to increase energy efficiency. For example, nearly 160 leading manufacturers and industrial-scale organizations have partnered with the DOE on its Better Plant Initiative and signed a voluntary pledge to reduce their energy intensity by 25 percent over a ten-year period.

## EFFICIENCY STANDARDS ARE COMING

In addition to self-regulating efforts, government bodies and industry groups are driving more stringent industry standards to ensure today's air compressor systems meet peak energy efficiency and performance targets. Today, complying with proposed compressor standards is voluntary in the U.S. and Europe, but emerging regulatory developments are likely to change that.

Governing bodies leading the push for implementation of minimum efficiency standards include the European Union, which issued the Ecodesign Preparatory Study on Compressors (ENER Lot 31) in 2009, and the DOE Office of Energy Efficiency and Renewable Energy (EERE).

Industry groups, such as the European Association of Manufacturers of Compressors (Pneurop), Vacuum Pumps, Pneumatic Tools and Allied Equipment (PNEUROP) and the Compressed Air & Gas Institute (CAGI) drive the adoption of uniform, voluntary standards and provide many services, including research, education, information gathering and distribution and training to end users. These efforts are designed to increase the overall energy efficiency of compressed air products on the market while promoting cooperation, awareness and compliance with industry standardization.

Although the scope of U.S. standards for air compressors has only begun to take shape, industry groups agree that the end result of this energy standardization will likely be the promotion of minimum efficiency standards, product testing procedures, certification and enforcement of standards and energy efficiency labeling for air compressors. These anticipated changes will drive research and development teams to push the boundaries of efficiency with innovations in compressor technology as well as systems improvements, proactive service strategies and maintenance offerings for compression systems.

New compression solutions are already coming to market to help manufacturers significantly reduce their energy costs. For example, Ingersoll Rand recently introduced their Next Generation R-Series line of rotary screw compressors that improve energy efficiency by up to 16 percent.

## ENERGY EFFICIENT PRODUCTS ARE GOOD FOR BUSINESS

Manufacturers are motivated to gain a competitive edge by delivering greater performance and energy efficiency. However, when it comes to compressed air, energy efficiency cannot come at the cost of reliability because plants rely on a reliable source of power to maintain their productivity. This evolution within the industry leads to numerous queries: What can manufacturers and customers anticipate? When will they be required to comply with new energy standards and future regulations? And how can facility manager's benefit from using high efficiency air compressors to lower costs, improve energy savings and improve performance?

There are advanced compressed air technologies available that are capable of providing improved performance, while reducing the customers' energy footprint. What's important to note is these improvements can be achieved while maintaining reliable compressed air that is required for highly effective operations. Ingersoll Rand has added the Next Generation R-Series 200-250kW to its portfolio, allowing customers who run their operations 24/7 and rely on large amounts of compressed air to have equipment that is as reliable as their demand. According to internal testing, efficiency and design improvements on some of the high-capacity compressors deliver up to a \$60,000 energy cost savings over a two-year period per compressor compared to previous models<sup>1</sup>. The RS200 to RS250 models are the third introduction to the Next Generation R-Series line of compressors, following the Next Generation R-Series 30 to 37kW fixed-speed and variable speed drive introductions in 2015 and 2016.

At the core of every Ingersoll Rand Next Generation R-Series compressor is an airend that is specifically designed to improve overall system efficiency. In addition to the enhanced singlestage airend, the RS200 to RS250 models are also available with the new two-stage airend. This two-stage airend is the most efficient airend available today.

## PRODUCT INNOVATION KEEPS ENERGY EFFICIENCY AHEAD OF THE CURVE

Only 10 to 20 percent of the energy input to a compressed air system reaches the point of end use. The rest is converted to heat or is lost through leaks. The costs from lost energy can run into the millions of dollars for a large operation.

To lower energy use and costs, the Ingersoll Rand Next Generation R-Series air compressor has been engineered to require less energy input and more capacity for typical applications, regardless of load. At the core of this model is an innovative airend, which is the most vital component of every air compressor. The high capacity Next Generation R-Series 200-250kW models from Ingersoll Rand are available with the new, state-of-the-art single-stage airend, or the two-stage airend that increases airflow by up to 21 percent.

Rotary screw compressors use rotating, meshing male and female helical rotors to compress air. These rotors and their housing contain the airend, which requires complex engineering to improve, because a change to one factor can have a major impact on another. For example, changing the pressure ratio can increase internal air leakage, desired rotor speed and exhaust temperature. This is where expert engineering is critical and Ingersoll Rand accomplished this by applying highly sophisticated modeling to re-design the convex and concave rotor profiles for optimized airflow.

Today's compressors with advanced airennds enable facilities to meet their demand with reliable systems that consume less energy. Our analytics show that we can reduce energy use, and by using more efficient

<sup>1</sup> Energy calculation based on 6,000 hours of annual operation and energy costs of 0.075 dollars/kwh

compressors and applying a comprehensive service program, we can reduce the total cost of ownership of the compressor by up to 20 percent.

**Variable Speed Drive** – Rather than controlling a compressor by running the motor at full speed then stopping when the air has been compressed to the desired pressure, a variable speed drive (VSD) regulates the delivery capacity based on actual need, thus avoiding wasteful energy loss associated with load/no-load operation.

The Ingersoll Rand Next Generation R-Series with VSD can save up to 35 percent in energy use over a fixed speed compressor. Operating a machine as variable speed allows the compressor to deliver compressed air at constant pressure over a wide range of capacity, up to 75 percent turn down depending on model and pressure rating

With a fixed speed air compressor, starting up the drive motor creates a huge energy draw which can be as much as 800 percent of the full load running current. Ingersoll Rand's motor and drive system limits the in-rush current to less than 100 percent. This significant decrease in the starting load minimizes peak power charges – thus lowering energy use.

**Intelligent Control** – Advanced air compressors provide additional opportunities to enhance energy efficiencies via remote monitoring. This allows users to control, manage and identify maintenance needs on air compressor systems through their desktop or laptop computers. Users can adjust compressor settings and program compressors according to specific events through real-time schedules. With remote monitoring users can make better decisions, in a more timely manner so that downtime can be minimized or eliminated.

Air compressors that use controllers can automatically adjust settings to minimize downtime and energy consumption. The compressor automatically reacts to key parameters, like airflow pressure rating, operating cycle and energy consumption and then notifies users of the activity.

In addition, air compressors with adaptive controllers continuously monitor key performance parameters and automatically adjust settings to meet a specific application's needs. Adaptive controllers use advanced control algorithms that automatically adapt to the environment. This delivers better performance, reduced downtime risks and energy conservation – providing built-in performance analysis for a wide range of load requirements.

## ORGANIZATIONS DEVELOPING STANDARDS AND MANUFACTURERS SHARE MUTUAL INTERESTS

As energy costs increase, facility managers in virtually every industry look for new ways to improve efficiencies. Compressed air systems are vital to these industries, yet billions of dollars in the U.S. alone are wasted each year due to inefficient systems. In addition to lowering energy costs and achieving greater uptime, all facilities can benefit from reducing negative impact on the environment by reducing energy consumption. Industry standards will increase energy efficiency and ultimately help manufacturers and industrial users increase their competitiveness – without compromising safety and reliability.

While today's energy standards are voluntary, at some future date, they may become mandated by the U.S. Congress or the DOE which is authorized to enact legislation. Air compressor manufacturers are already achieving energy efficiency and performance improvements through sophisticated engineering and advanced technologies. Working hand-in-hand, industry standardization and manufacturers will pave the way toward greater future improvements in energy efficiency, optimized performance, reliability and decreasing environmental impact.



**Rolf Paepen**

Vice President, Product Management  
Compression Technologies and Services, Ingersoll Rand