INGERSOLL RAND WHITE PAPER | NOVEMBER 2023

Iron and Steel - A Market that Continues to Grow

Ingersoll Rand®

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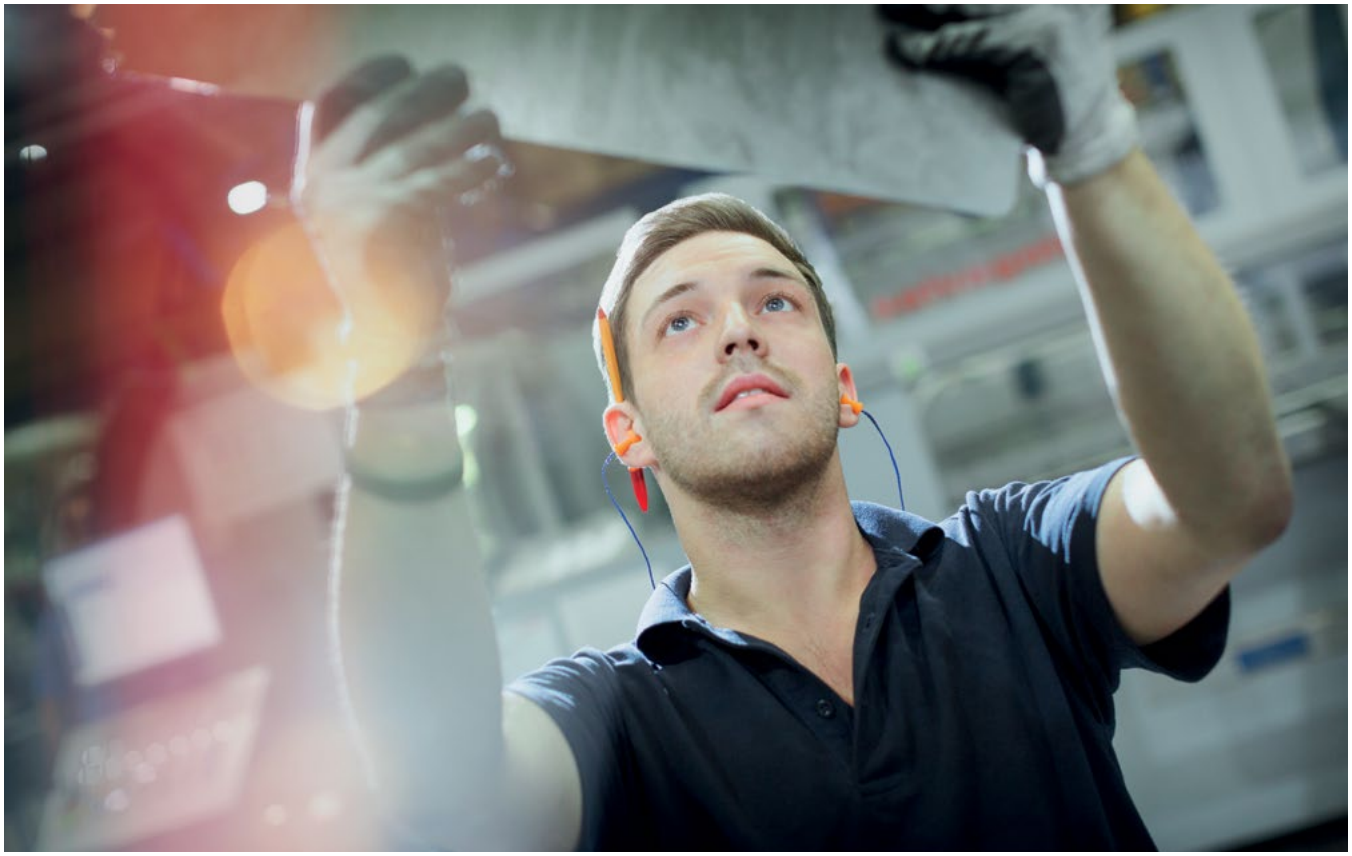


Introduction: A Constantly Growing Market

The iron and steel market is a highly competitive industry that continues to expand and develop, and despite a reasonably static few years, steel production continues to grow year-over-year.

The last few years have brought many new challenges to sustainable operations. Despite this, APAC, Europe, and North America have continued to pursue new levels of maturity and advanced technology appropriation in the iron and steel industry. Demand grew by 5.8% in 2021 to reach 1.874 billion megatons in the steel industry. These developments occurred despite a more than 115% increase in the import price for energy between December 2020 and December 2021.

In such a growth-oriented and fast-paced industry, being out of step can happen very easily. To stay on top in the marketplace and to keep providing the best services possible, manufacturers and professionals have set their sights on equipping their facilities with efficient and highly reliable compressors.

In This White Paper, You Will Learn:

- The uses of compressed air in the iron and steel industry
- How to build a reliable compressed air system that promises clean, dry air at a stable pressure at the lowest cost possible
- How to select the right air compressor and the solutions we have available to you
- How to find service and maintenance programs that optimize the total cost of ownership

Compressed Air for Iron and Steel

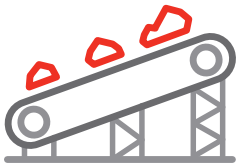
Overall, the main goal of a compressed air system is to provide a reliable supply of clean, dry, compressed air at a stable pressure at the lowest cost possible. Designing a compressed air system that ensures efficiency, reliability, and safety requires thorough consideration and extensive technological knowledge about iron and steel applications.

Air-Powered Dock Levelers

Whilst hydraulic levelers use a hydraulic cylinder to position the leveler platform, dock levelers are powered by compressed air and use an airbag to raise and lower the deck. This innovative technology uses air as the working media instead of fluid. The airbag is inflated with a high-volume, low-pressure compressor, which eliminates the problem of messy hydraulic fluids and leaky seals whilst also offering improved simplicity.

Due to the need for a high-volume, low-pressure compressor, it may be beneficial to your iron and steel operations to have a thorough air audit. This will assess your current system and analyze whether it is the right match for these demands. Enhancements can be made, or a new compressed air system that better suits these volume and pressure requirements can be designed and built.

Another issue to consider here is moisture; if not managed properly, air-powered tools can suffer degradation due to the presence of moisture. This is also important to ensure all heavy equipment is operating safely and efficiently, as any weakness caused by rusting or corrosion could have dangerous consequences. To deal with moisture, we'd recommend implementing a downstream system into your facility, including a compressed air dryer. For this particular application, a desiccant dryer may work better, as it uses absorbent material to eliminate moisture and achieve ultra-dry compressed air at a lower pressure dew point. You can also ensure optimum safety levels by having a predictive, proactive maintenance plan in place to make sure equipment is regularly checked and serviced. As mentioned, this is particularly important in the iron and steel industry to ensure workplace safety and efficiency!



Pneumatic Conveyors

Pneumatic, also known as air-operated conveyors, are used for transferring a wide variety of lightweight products, including sugar, salt, plastic pellets, and fly ash, to name a few, within processing or manufacturing machinery. The process starts with creating a vacuum within a hopper, which enables suctioning of the material to further discharge it to the point of destination, for example, a container or packaging machine. As opposed to mechanical transfer, pneumatic transfer guarantees minimal contact with external factors and, hence, a clean operation, which is essential.

As mentioned before, when powering any air or pneumatic tool, moisture is the enemy! This is because the presence of moisture in your compressed air system can have detrimental impacts on the performance and longevity of your equipment. Therefore, using clean, dry air is essential to power your pneumatic conveyors.

But how do you achieve this standard of compressed air? The secret is an efficient, reliable downstream system that takes out the guesswork surrounding your air's quality and usability. As for powering dock levelers, we'd recommend a desiccant dryer here, predominantly because of its effectiveness at producing ultra-dry air. To accompany it, an effective filtration system and condensate management unit are essential to maximize the quality of your compressed air! We discuss more about why this is so critical in the next section of this whitepaper.

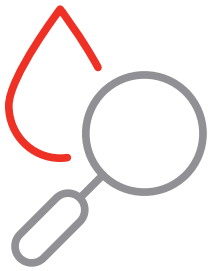
Removing the Pain Points

Building A Reliable Compressed Air System That Promises Clean, Dry Air At A Stable Pressure At The Lowest Cost Possible

Particularly in the iron and steel industry, air quality is uncompromisable to ensure optimum safety and efficiency levels, as well as high-quality finished products. Therefore, it's vital to design and build a system that guarantees consistent, clean, dry air at a stable pressure at the lowest cost possible! By making sure that your compressed air meets Class 0 ISO specifications, you can meet industry requirements and ensure a safe working environment. But how can you ensure it meets this standard?

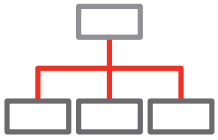
1. AIR AUDITS

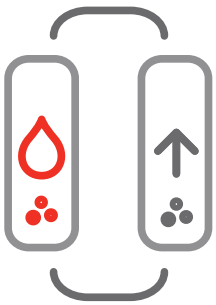
The best place to start when building a reliable compressed air system is with a comprehensive air audit. This analyzes where your system is at, checking for any leaks, inefficiencies or areas of potential improvement. The insights gained from this assessment can be used to enhance your existing system to ensure it better meets the demands of the iron and steel industry. Alternatively, we can build you a bespoke system that aligns perfectly with your exact application needs and requirements. We'd recommend air audits for a range of industrial applications, especially powering pneumatic conveyors and dock levelers, due to their specific pressure and air flow demands. These thorough assessments can also analyze the quality of your compressed air and provide valuable insights into how you can maximize its quality for your iron and steel processes.



2. OIL SAMPLING

Another assessment available, which is more focused on air quality, is oil sampling. This will provide you with a comprehensive report about any internal or external contamination that may be impacting your compressed air system. It assesses the inner workings of your air compressor and its ambient conditions to provide you with vital insights into factors that may be affecting the quality of the oil or lubricant in your system, as well as the current condition of all of its components. Identifying these issues will allow for any necessary changes to be made, as well as the creation of a solid maintenance plan based on the typical degradation of your oil. By ensuring you are frequently changing the lubricant in your system, you can prevent equipment damage and optimize air quality! Again, this is particularly important for the safe and efficient powering of pneumatic conveyors and dock levelers.



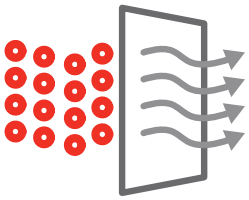


3. AN EFFECTIVE DOWNSTREAM SYSTEM

To ensure optimum air quality, an effective and reliable downstream system is essential! This consists of 3 key components:

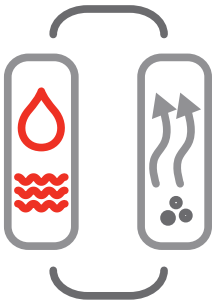
Dryers:

The first key component is a dryer, whose role is to eliminate moisture from your compressed air and ensure you are only using clean, dry air for your industry applications. As mentioned before, this is vital to ensure the safe and efficient powering of pneumatic conveyors and dock levelers, making it essential to your iron and steel facility! There are a range of dryers on the market, including refrigerant, which are better suited to general applications, and desiccant, which guarantee ultra-dry, high-quality air at a lower pressure dew point. If you wanted to reduce your costs, there are also heat of compression dryers available for utilizing wasted compression heat. For powering pneumatic tools, we would typically recommend a desiccant dryer, as these are arguably the most effective for removing moisture and producing ultra-dry compressed air that complies with Class 0 ISO standards!



Filtration System:

To accompany your dryer, a reliable filtration system is vital to remove any contaminants and impurities, such as oil, dust, and particulates, from your compressed air. Again, this is particularly important for powering pneumatic machinery, as clean, high-quality compressed air is essential!



Condensate Management & Treatment:

Often overlooked, condensate management and treatment is vital to maximize your air quality! Condensate is another natural by-product of the compression process and can have detrimental impacts on the quality of your compressed air, as well as on the performance and longevity of your equipment. The most effective way to deal with it is by implementing a condensate management unit that uses zero-loss or condensate drains to remove it from your system. Accompanying this unit is an oil water separator, which will separate the condensate from the oil before relying on the drains to remove it. An oil water separator is an essential part of this process, as it ensures that condensate is correctly disposed of in a way that adheres to strict industry regulations. Removing condensate is necessary for a variety of applications, but particularly for powering pneumatic tools, as ISO Class 0 standard air is essential!

4. MANAGEMENT & MONITORING YOUR SYSTEM

Properly managing and monitoring your compressed air system is another way that you can maximize your air quality and cost-efficiency. Compressor controllers are one method of doing this, allowing you to adjust pressure and flow rates to prevent inefficiencies and wasted energy. Powering pneumatic conveyors and dock levelers requires a lot of pressure, and the more pressure you need, the more energy you consume, which contributes to the costs involved in the running of your iron and steel facility. Therefore, by being able to adjust your compressor to suit demand, you are only using what you need when you need it, helping to eliminate any unnecessary costs!

At Ingersoll Rand, we also offer our Helix™ Connected Platform, which uses IIoT technology to remotely monitor your compressed air system. This again can ensure you're operating at your most cost and energy efficient! You can find out more about this solution in the Services and Maintenance section of this Whitepaper.

5. HEAT RECOVERY SYSTEMS

Implementing a heat recovery system into your iron and steel facility is an effective way to maximise your cost-efficiency. Heat is a natural by-product of compressing air, but did you know that 90% of the wasted heat generated by your compressed air system can actually be recovered and used? You can save 1000s of dollars a year whilst also reducing your carbon footprint by simply installing an efficient heat recovery system. This will collect any heat generated by the compression process and will use it for other tasks, such as heating your plant or any process water you need!

6. WARRANTIES, OEM PARTS & MAINTENANCE

Understanding the warranties, OEM parts and accessories, and maintenance plans available to you is vital to prevent any unnecessary costs and to protect your investment! For example, in the Service and Maintenance section of this Whitepaper, you can discover more about our suite of CARE maintenance plans. When discussing the options with our customers, we place special emphasis on discovering more about their exact needs and aligning these requirements with our available options. Whether you are in need of scheduled predictive maintenance, OEM parts and accessories, a warranty, total asset management or remote monitoring, we have all the tools and experience to provide you with the exact service you need! Correctly managing your system is vital to maximize equipment longevity, air quality and the cost and energy efficiency of your operations!

Selecting the Right Air Compressor

Various applications within the iron and steel industry require different types of air compressors. Choosing the right one for your specific application should be done carefully. The key is to make sure the selected unit is able to meet your desired demands while keeping maintenance and operating costs at a minimum.

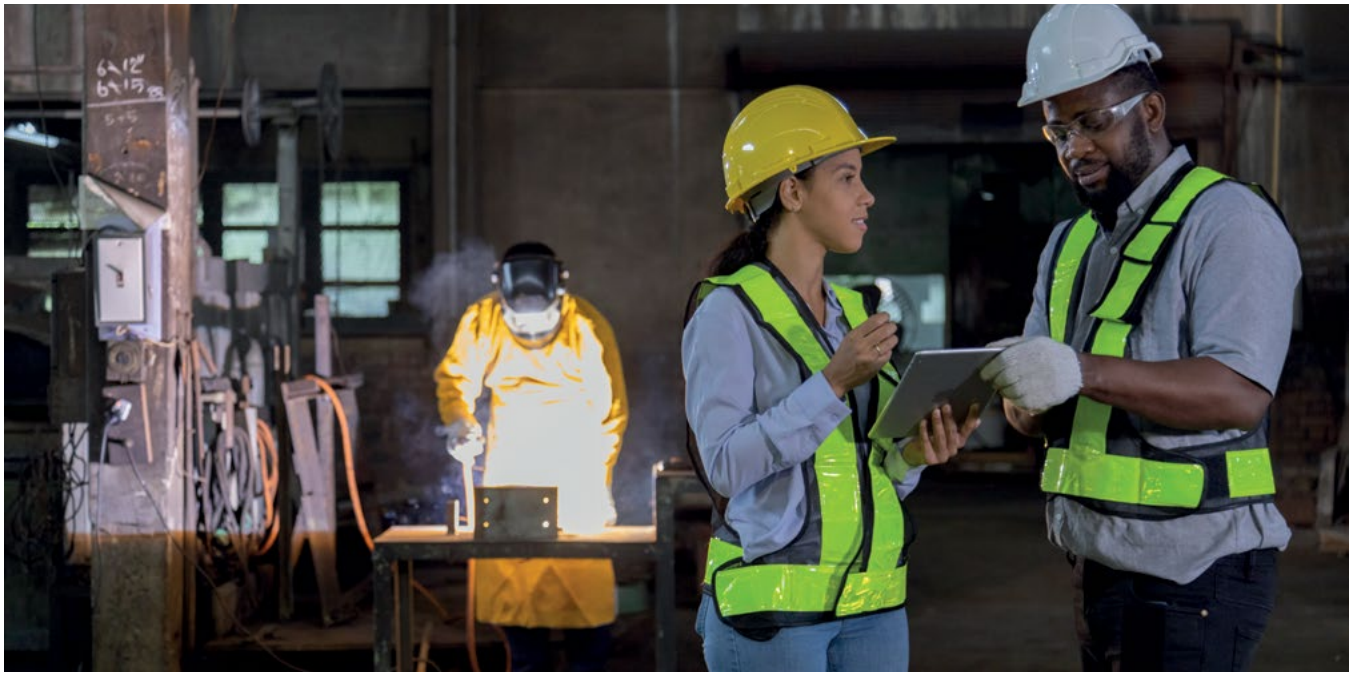
Let's face it - choosing the correct equipment is crucial in ensuring that your facility operates at full capacity. Selecting an air compressor for a given application requires careful consideration of several factors, including the intended use, performance specifications and available resources.

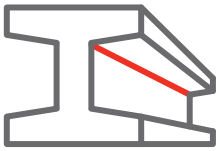
The common misconception regarding powering either pneumatic conveyors or air-powered dock levelers is that more horsepower equals more compressed air output. In fact, modern air compressor technology is highly advanced, so if appropriately sized for the application, an air compressor can produce the same overall power with less horsepower. For example, the Next Generation R Series 11-22 kW, which delivers from 15 to 30 horsepower, can produce 18% more airflow than its predecessor with the same horsepower capacity.

Things to Consider Before Purchasing

It is essential to address key questions before making a purchase:

- How much airflow is required?
- What are the pressure requirements?
- Do you need clean or dry air?
- Which filters or dryers do you need?
- How many hours will the compressor operate per day?
- Will the flow demand fluctuate?
- Are you going to raise the scope of your operations in the near future?

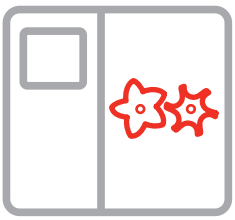




Ingersoll Rand Solutions for Iron and Steel

Ingersoll Rand has long been a leader in providing compressed air solutions for various industries. Known for its high reliability and customer-oriented mindset, the company has an extensive application expertise and product portfolio, which allows it to deliver the high-performance, quality, reliability, and dependability.

Owners of iron and steel plants rely on technologically advanced equipment and do not want to gamble with poor compressed air quality. To help them achieve this goal, Ingersoll Rand oil-flooded rotary screw air compressors offer businesses the very best combination of time-proven designs and technologies with new, advanced features that ensure the highest levels of reliability, productivity and efficiency available.

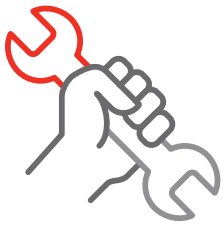


Next Generation R-Series Oil-Flooded Rotary Screw Compressor

The R-Series rotary screw compressor is characterized by a low total cost of ownership because of its industry-leading capacity and reliable components. Its V-Shield™ technology translates to an integrated, leak-free design, with the additional PartsCARE™ service program allowing for longer compressor life.

The R-Series oil-flooded rotary screw compressor family boasts the following features:

- **Improved Efficiency:** State-of-the-art, integrated airend which delivers the efficiency and reliability you need.
- **Decreased Energy Use:** A premium efficiency IP55 motor which delivers significant energy savings, and an optional integrated variable speed drive (VSD), which further reduces energy consumption.
- **Enhanced Serviceability:** Easy access to all user-maintainable components and Ingersoll Rand's extended life, premium grade coolant both help to increase uptime.
- **Remote Intelligent Control:** Xe-Series controllers deliver increased functionality through an intuitive user interface, as well as remote access with any standard web browser.
- **Optional Total Air System (TAS):** Clean, dry air in a single package that minimizes installation costs and space and features improved ISO air quality.
- **IES2 Advantage:** Meets or exceeds IES2 standards for power drive efficiency.



Service and Maintenance Programs

There are many applications in which you will require high-quality compressed air in your plant. You also now understand how to build a reliable compressed air system that promises clean, dry air at a stable pressure at the lowest cost possible. Now it's time to look at how to service and maintain your equipment to avoid unplanned, unbudgeted downtime and production interruptions.

Lower cost of ownership, quality results, increased uptime, and efficient energy use all add up to peace of mind.

PackageCARE™: We Protect You

- The greatest value for asset management
- Transfer operational risk for up to 10 years
- Includes all scheduled maintenance
- Predictive and analytical tools prevent production interruptions

PlannedCARE™: We Help You

- Predictive, on-time planned maintenance
- Preventative diagnostics to catch potential problems
- Up to five-year coverage on major airend components in new rotary compressors

Performance Services

Our performance services include electronic, air leak, and system assessments. Whether you need to manage costs, increase reliability, or plan for future growth, our portfolio of assessment tools provides you with detailed diagnostics that give you the proper insights to help lower the total cost of ownership.

System Automation

System assessments often identify waste caused by a lack of adequate controls. Our suite of automation solutions lowers energy costs and stability pressure.

HELIX™

24/7 Remote Monitoring With The Helix™ Connected Platform

Developed to maximize uptime and peace of mind, the Helix™ Connected Platform from Ingersoll Rand gives you real-time monitoring that provides visibility into machine functionality and equips you to operate at maximum efficiency. Your team will have direct access anytime to Helix™ insights and diagnostic reporting that can help prevent lost productivity from unforeseen breakdowns. Maintenance scheduling is simplified thanks to proactive service reminders and automated communications that help to preserve machine health.

There's a lot riding on the quality of your air. Let Ingersoll Rand help you get it right!

Reliability for Life

Generate air in any environment. We offer solutions that operate indoors and outdoors in compact spaces and extreme temperatures.

- Enjoy increased oversight with controls you can access remotely. Regulate your air use with compressor controls that monitor critical operating parameters and adapt the system to prevent downtime.
- Designed for easy serviceability and maintenance, our compressors minimize the total cost of ownership.
- An extensive catalogue of OEM genuine consumable and replacement parts is available to you to make service and maintenance easy and cost-effective. Genuine OEM parts guarantee a perfect fit and function to the highest quality standards.

PartsCARE™

Global Service and Support Network

Renowned for its market-leading reliability, quality, and untroubled performance, Ingersoll Rand brings over 160 years of innovative solutions to the compressed air market. In addition to a comprehensive portfolio of best-in.class air compressors, Ingersoll Rand offers various maintenance programs as well as air compressor repairs that use OEM genuine components.

Depending on your needs, Ingersoll Rand offers a range of service packages, from a comprehensive service program that takes the operational risk away from the customer. We also offer a simple package that includes delivering the right part to you at the right time. Choosing the right package that provides the best, most efficient support to keep your business up and running requires careful consideration. To save our customers' time, our engineers will perform a deep analysis to help determine which maintenance plan is the best for your specific industry and application needs.

Ingersoll Rand's Wide Portfolio of Air Compressors

Ingersoll Rand provides a wide range of high-quality, low-maintenance commercial and industrial air compressors to fit every application. Our engineers can provide you with a bespoke solution and the support you need to keep your facility working at full steam.

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About Ingersoll Rand Inc.

Ingersoll Rand Inc. (NYSE:IR), driven by an entrepreneurial spirit and ownership mindset, is dedicated to helping make life better for our employees, customers and communities. Customers lean on us for our technology-driven excellence in mission-critical flow creation and industrial solutions across 40+ respected brands where our products and services excel in the most complex and harsh conditions. Our employees develop customers for life through their daily commitment to expertise, productivity and efficiency. For more information, visit irco.com

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