

INGERSOLL RAND WHITE PAPER | JULY 2024

Compressed Air for the Oil & Gas Industry



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Introduction: A Constantly Changing Market

The oil and gas industry, a market in constant flux, is being shaped by environmental concerns, geopolitical factors, and high costs. The industry's transformation, driven by climate change and global warming, is marked by the anticipated long-term decline in oil demand and the subsequent rise in natural gas demand. As the need for power plants, offshore production, LNG terminals, waste-to-energy plants, and other forms of oil and gas production escalates, the ability to adapt becomes crucial. One element of vital importance here is your compressed air, a fundamental component in most, if not all, oil and gas processes. That's where we come in!

In This White Paper, You Will Learn:

- The uses of compressed air in the oil and gas industry
- How to keep up with market changes whilst still producing cost-effective compressed air
- How to select the right air compressor and the solutions we have available to you
- How to find service and maintenance programs that optimise the total cost of ownership

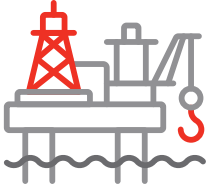


Compressed Air In The Oil And Gas Industry

From exploration, drilling and transportation to nitrogen generation, purging and blanketing, as well as the powering of pneumatic equipment, compressed air is vital for an extensive range of onshore and offshore oil and gas applications. This makes having a continuous supply of clean, reliable, cost-effective air essential to keep up with the large range of processes and operations that need it.

Air quality across the industry varies by application, but across the board, clean air is mandatory. Typically, most applications will require Class 1-2-1 air, as per ISO 8573-1 certification, but for some, if not for most applications, Class 0 oil-free air is vital! This is because, whilst some oil and gas processes may tolerate a small amount of oil, others, such as drilling with sensitive downhole tools, will require higher-quality, oil-free air. This makes understanding your air quality vital, not only for your finished product but also because substandard air can lead to accelerated equipment degradation and increased safety risks! Let's take a look at the applications and their desired air quality in more detail...

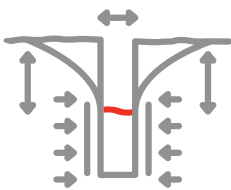
Applications That Rely On Compressed Air In The Oil And Gas Industry



Exploration:

Compressed air powers a variety of material handling and man-riding solutions on offshore platforms, land rigs, and underwater, allowing for the safe movement of people and assets. In particular, it plays a vital role in exploration. From seismic exploration to production, drilling, and treatment, a continuous supply is required every step of the way. A compressed air system is vital onshore to recover crude oil and prepare it for transportation. This may be in a small rig as part of much larger drilling operations. On an offshore oil platform, it is equally as important as it is essential for sandblasting, cleaning, painting and blowing out pipelines. However, as they are larger than land-based drilling rigs, offshore facilities will require bigger, more powerful equipment and more compressed air, as sometimes they need to go through hundreds or thousands of feet of water before drilling can even begin.

Due to the heavy-duty machinery used for exploration and drilling, ensuring your compressed air is clean and dry is of fundamental importance. This is because the presence of moisture in your system can lead to accelerated equipment degradation which will increase safety risks and your maintenance costs. Considering the dangerous conditions and environments faced in the oil and gas industry, this issue is one that cannot be left unmanaged. Here, we'd recommend an effective downstream and air treatment system, including a high-performance compressed air dryer, which will work to eliminate any moisture from your system. A filtration system and condensate management unit are also essential here to maximise air quality!



Well Testing:

Well testing is a highly intensive, demanding offshore application that requires compressed air to power its equipment. Due to the sensitive downhole tools used, a very high quality of oil-free compressed air is required. Here, like with exploration, the presence of moisture or contaminants will impact the longevity and safety of your equipment, making an effective downstream system essential!



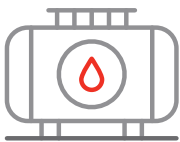
Transportation:

Air compressors help to move the raw materials from the source at which they were extracted to the refineries and facilities where they are processed. The transportation of oil and gas requires large vehicles, which are significant contributors to climate change and global warming. Whilst this is inevitable, there are other ways that you can reduce your carbon footprint. One is ensuring that your compressed air system is operating at its most energy-efficient! This can be gauged through an air audit, which is a comprehensive analysis of your system that checks for leaks, inefficiencies, and any areas for improvement. From here, changes can be implemented, such as compressor controls, monitoring systems, heat recovery systems, or a complete oil-free setup revamp to get you operating more sustainably.



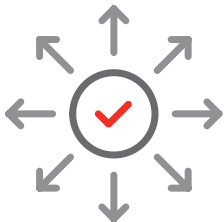
Processing & Refining:

Compressed air plays an integral role in the processing and refining of oil and gas. From catalyst regeneration, purification, sulfur removal and recovery to process heating and hydrogen recovery, it is essential to ensure optimal results!



Natural Gas Compression:

As mentioned, natural gas is beginning to dominate the global oil and gas market due to its sustainable and renewable nature. Natural gas compression is an integral part of its production process, and compressed air is used to increase the pressure of the gas to enable it to be moved through pipelines and other transportation networks. Air quality is vital here to ensure the quality of the natural gas that reaches consumers, making air treatment equipment vital once again.



Distribution:

Compressed air also plays a role in the distribution of the end products, such as gasoline, jet fuel, fuel oil and kerosene, to power and energy generation facilities and to the end consumer.

Again, the distribution of the end products requires significant transportation, making the sustainability of other areas of your operations vital!



Other Uses Of Compressed Air:

Compressed air also has some other uses within these different stages of the production process, including nitrogen generation, instrument and service air, decocking air, air separation, instrumentation and calibrating test equipment, tank blanketing, purging, and fastening. All of these elements of the production process require clean, oil-free, high-quality compressed air to ensure their efficiency and productivity. Typical compressed air and gas applications can also include:

Production Processes:

- Olefins
- Aromatics
- Fertiliser
- Methanol

Gas Applications:

- Ethylene
- Propylene
- Butylene
- Syngas
- Refrigeration
- Hydrogen

Air Applications:

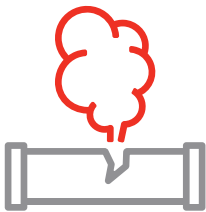
- Main Process
- Utility
- Decocking
- Conveying
- Flare Assist



Removing The Pain Points

How To Keep Up With Market Changes Whilst Still Producing Cost-Effective Compressed Air For Oil And Gas Applications

In communication with some of our oil and gas partners, we discovered that high costs, growing energy consumption, and sustainability concerns dominate your daily operations. This is understandable, particularly in today's uncertain economic and environmental climate, and due to the aforementioned shift towards natural gas. This makes operating in a cost- and energy-efficient manner vital to keeping up with fluctuating industry trends and requirements. But what if there was a way to keep up with these market changes without your costs skyrocketing? That's where we come in!



1. AIR AUDIT

Most inefficiencies that contribute to your costs and downtime all stem back to the foundations of your compressed air system. Whether this may be substandard or inappropriate machinery or gaps in your system, these issues can increase the need for constant costly maintenance, as well as unproductive downtime. This is why, when helping our oil and gas partners, we go back to basics and recommend a comprehensive air audit. Carried out by expert compressed air engineers, this involves checks for leaks, inefficiencies and potential areas for improvement. From here, the next steps can be decided upon. Whether this may be enhancing existing elements, adding new ones, or creating a bespoke setup that aligns with your application needs, a long-term plan will be suggested to benefit your facility. Not only is this essential to get you operating at your most efficient, but it's also important to prevent safety risks or spoiled products due to substandard air.



2. OIL SAMPLING

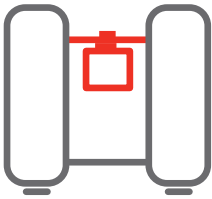
Another assessment available to help ensure air quality is oil sampling! This service analyses any internal or external contamination that may impact your compressed air system. It assesses the inner workings of your system and its ambient conditions, allowing you insight into factors that may affect the quality of your system's oil and lubricant while also giving you an overview of the condition of your compressor's components. Identifying any oil issues is essential, and frequent changing of your lubricant helps to eliminate equipment damage, which can lead to safety breaches. It is also important to make sure that your oil meets industry quality and safety standards.



3. AN EFFECTIVE DOWNSTREAM SYSTEM

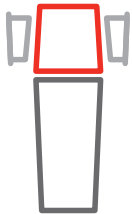
As mentioned, most oil and gas applications will require clean, oil-free, contaminant-free, Class 0 air. To ensure optimum air quality, an effective and reliable downstream system is essential! This consists of 3 key components:

Dryers:



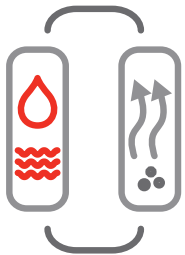
The first key component is a dryer, whose role is to eliminate moisture from your compressed air to ensure that you are only using clean, dry air for your oil and gas operations. This is important as the presence of moisture in your compressed air system can accelerate the degradation of your mission-critical equipment. Left unmanaged, this can increase safety risks and downtime, as well as product spoilage and costly maintenance. Therefore, prevention is better than cure! By implementing a dryer, you can stop the damage before it occurs. There are a variety of dryers on the market, including desiccant, which guarantees ultra-dry, high-quality air at a lower pressure dew point, and refrigerant, which are a good option for a range of general applications. Regarding cost-efficiency, there are also heat of compression dryers, which utilise wasted compression heat. For powering pneumatic tools and machinery, we would recommend a desiccant dryer, as these are arguably the most effective at removing moisture and producing Class 0 oil-free air.

Filtration System:



The next crucial element is a reliable filtration system to remove any impurities and contaminants from your compressed air, such as oil, particulates, and dust. Again, this is important for powering the machinery crucial to your oil and gas operations, as it enables your air to meet Class 0 oil-free standards!

Condensate Management & Treatment:



The final element of an effective downstream and air treatment system is often overlooked but arguably essential to ensure that your air meets stringent oil and gas industry requirements. Condensate is a natural by-product of compressing air, but if left unmanaged, much like moisture, it can have detrimental impacts on your air quality and equipment. Again, this could lead to substandard products and safety concerns. You can completely remove condensate from your system using a condensate management unit that utilises zero-loss or condensate drains. This unit operates alongside an oil-water separator, separating the condensate and eliminating it from your system. An oil-water separator is also an overlooked part of your compressed air system. Still, it is vital to ensure that condensate is disposed of in a sustainable manner that adheres to strict environmental and industry requirements.

3. IMPLEMENTING THE RIGHT COMPRESSED AIR EQUIPMENT

As mentioned, using the wrong equipment can have detrimental impacts on efficiency, thus skyrocketing costs. Understanding your exact oil and gas application requirements is essential to ensure you are operating at your most time, energy, and cost-efficient! Also, adapting your equipment to market changes is important, but it can be costly, so choosing energy-efficient, tried-and-tested designs is the best way to go, as they are more likely to keep up with industry shifts!





4. HEAT RECOVERY

Keeping your costs and energy consumption down, however, isn't just limited to your compressed air equipment! There are other sustainable methods available to help you operate more efficiently, including heat recovery systems. Heat is another natural by-product of the compression process, 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 every year whilst also reducing your carbon footprint by simply installing an efficient, reliable heat recovery system. This works by collecting any heat generated by your oil and gas operation and using it elsewhere in your facility, whether that be for heating your plant or rig or any process water your application requires.



5. MANAGEMENT & MONITORING YOUR SYSTEM

System management and monitoring also play an integral role in operating cost-effectively. Putting off basic maintenance is one of the most significant contributors to costly equipment downtime. Ingersoll Rand makes maintaining your compressed air equipment easy with our suite of CARE™ maintenance plans. From predictive analysis and scheduled maintenance to compressor repair with OEM parts and planned diagnostics, our CARE™ plans have got you covered!

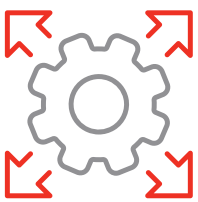
Another method of system management is compressor controllers, which allow you to adjust pressure and flow rates to prevent wasted energy. This is a good method of controlling your energy consumption by only using what you need when you need it, thus helping you reduce your costs!

Regarding system monitoring, Ingersoll Rand offers our innovative Helix Connected Platform, which utilises IIoT technology to offer 24/7 visibility into your compressor. This technologically advanced solution alerts you to any issues or inefficiencies before they become a problem or downtime, allowing you to save on maintenance costs while also reducing the time your system is unproductive. Its customer-facing dashboard also means that you can control and monitor your system and energy consumption whenever and wherever! We also offer Ecoplant, an advanced control platform that uses cloud-based monitoring to increase your energy efficiency and reduce downtime!



6. WARRANTIES, OEM PARTS & MAINTENANCE

Understanding the warranties, OEM parts and accessories, and maintenance plans available to you is vital to preventing unnecessary costs and protecting your investment! For example, in the Service and Maintenance section of this White Paper, you can discover more about our suite of CARE™ maintenance plans. When discussing the options with our customers, we place particular emphasis on discovering more about their exact process requirements in order to better align one of our plans with their industry and application needs. Whether you are in need of total asset management, a warranty, OEM parts and accessories, remote monitoring or scheduled predictive maintenance, we have all the experience and tools to provide you with the services you need! Correctly looking after your compressed air system is essential to maximise your equipment longevity and air quality and keep your costs and energy consumption down!



Sizing Up Your Needs - Ingersoll Rand's Portfolio Of Oil And Gas Solutions

When building your compressed air system, there are a few questions to consider:

- How much air flow is required?
- What are the pressure requirements?
- Do you need clean or dry air?
- What filters or dryers do you need?
- How many hours a day will you need your air compressor to operate for? Will this use be constant or intermittent?
- Will your demand fluctuate?
- Are you going to increase the scope of your operations in the near future?

Available Solutions:

Ingersoll Rand's extensive oil-free portfolio of oil and gas solutions covers everything from offshore exploration, drilling, and production applications to the safety and efficiency of onshore oilfield operations.



Oil-Free Centrifugal Compressors:

Our reliable MSG® Centac® and TURBO-AIR® API oil-free centrifugal systems and engineered rotary solutions are designed to withstand even the most challenging environments and conditions. As ISO-certified Class 0 machines, our API customer oil-free centrifugal air compressor packages offer you complete quality assurance, allowing you to benefit from our expertise and technology. They are simple to install, operate and maintain and offer best-in-class reliability and efficiency at full load, part load and no load. Due to their unmatched efficiency, you can also benefit from low operating cycle costs, as the power savings achieved can significantly speed up payback on your initial investment.

Other oil-free solutions that we offer are our rotary screw technologies, including our E-Series, Nirvana variable speed and Sierra compressors. All three of these technologies guarantee 100% oil-free Class 0 air, as well as reliable, efficient performance even in the harsh conditions faced by the oil and gas industry. Our Nirvana compressors are particularly advisable if you are looking for unparalleled energy efficiency at all speeds to reduce your costs. This is due to their variable speed inverter and hybrid permanent magnet (HPM®) motor. Due to their state-of-the-art design features and rotary technology, our Sierra and E-Series compressors will also enable you to operate at maximum efficiency with unparalleled energy and cost savings. We also offer small reciprocating compressors for smaller oil and gas operations or elements of your processes.



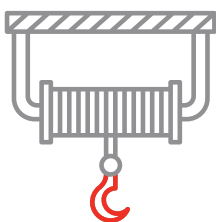
Downstream and Air Treatment Equipment:

We also offer a range of dryers, filtration systems, and condensate management units to ensure your air is oil-free, clean and of optimal quality!



Lifting and Material Handling:

Offshore Lifting Solutions: Regarding offshore exploration, drilling and production applications, Ingersoll Rand manufactures professional material handling equipment to help companies operate safely and efficiently. All of our hoists and winches meet the operational and technical demands of the oil and gas industry, as well as the more challenging requirements of subsea underwater applications. Safe, reliable man riding winches are also available to ensure the safety of your crew. You can rest assured that all of our lifting equipment is designed to the industry's exact applicable regulatory and 3rd party standards, including CE, ABS, ATEX and DNV.



Onshore Lifting Solutions: From land rigs to processing, Ingersoll Rand offers a portfolio of highly efficient lifting solutions to ensure the efficiency and safety of oilfield operations and downstream production systems. Whether you are extracting raw crude, transporting your raw materials to holding tanks or processing plants, or separating oil and gas within the plant, you need to be able to rely on your equipment, especially in more hazardous conditions. You can count on our robust hoists, winches and BOP handling systems to face up to any challenge you face!



Service and Maintenance Programs

There are many applications in which you will require high-quality, oil-free compressed air in your plant. You also now understand how to build a reliable compressed air system that allows you to keep up with market changes whilst still producing cost-effective, oil-free compressed air for your oil and gas applications. 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.

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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 system automation solutions lowers energy costs and stability pressure.



24/7 Remote Monitoring With The Helix™ Connected Platform

Developed to maximise 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.



Increased Energy Efficiency And Reduced Downtime With Ecoplant

Ecoplant is an advanced control platform that integrates with your compressed air system, allowing you to reduce your energy costs with complete cloud-based system monitoring. You can make your assets smarter with live data, dynamic control and a customer dashboard and reporting. This enables you to maximise your efficiency and production reliability as you are provided with actionable analytical insights and alerts of issues before they become downtime, allowing for significant annual savings!



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 minimise 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.

Protect Your Investment With Ongoing Preventative Maintenance

When it comes to oil and gas facilities, original equipment manufacturer (OEM) parts are an operator's best choice to maintain maximum reliability and performance. Non-standard parts can expose equipment to unnecessary wear and tear, leading to downtime and higher operating costs.

If you want to protect your investment and the performance and longevity of your equipment, make sure to invest in quality parts to keep it running. Ingersoll Rand has a complete offering of maintenance and OEM-quality compressor parts, including lubricants, maintenance kits, replacement parts, filtration and condensation management, complimented by the expertise to keep your oil and gas facility running.





Find A Partner You Can Trust...

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 oil and gas facility working at maximum efficiency.

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

Please visit and partner with us!



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

ingersollrand.com



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Ingersoll Rand compressors are not designed, intended or approved for breathing air applications. Ingersoll Rand does not approve specialized equipment for breathing air applications and assumes no responsibility or liability for compressors used for breathing air service.

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