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The Importance of a Compressed Air Solution In Your Automotive Manufacturing Plant

Ingersoll Rand®

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Introduction

During the last century, we have evolved from the third Industrial Revolution to one of science and mass production and now to the digital revolution.

The digital revolution has upended nearly every industry, and the automotive industry is no exception. Today, cars are heavily reliant on computers and electronic chips to operate, making cars more complex to manufacture, maintain and service.

Over the last few years, the automotive market has fluctuated, mired by supply chain shortages of electronic chips and volatile consumer demand.

Despite those challenges, the automobile industry will continue to be a massive driver in the global marketplace because car manufacturers are making bold advancements toward electrification, autonomous navigation technology and sustainability. The industry is also expanding as new automotive manufacturers emerge in the U.S. and China.

Compressed air has proven to be an indispensable utility on assembly lines to help automotive companies keep production moving, even as technologies change.

In This White Paper, You Will Learn:

- The typical uses of compressed air in the automotive industry
- How to use compressed air to keep production moving
- How to achieve the quality and reliability of compressed air required by the automotive industry
- What kind of compressed air system configurations automotive manufacturers can use
- The service and maintenance programs available to protect your investment

Compressed air is used in every step of the car manufacturing process.

Typical Uses of Compressed Air

Compressed air was introduced in automotive manufacturing to increase worker safety and the overall efficiency of the manufacturing plant. Today, it's an essential utility in the manufacturing process. In most plants, compressed air is used in every step of the car manufacturing process— from painting and cleaning to engine and car assembly.

The typical uses of compressed air in automotive manufacturing include:

- Air-operated robots such as paint and welding robots
- Air tools
- Automobile finishing
- Breathing air filters
- Plasma cutting and welding
- Tire inflation
- Painting and coating – application, mixing, and spraying
- Sandblasters and polishers – to prepare and finish parts
- Electrophoresis tank (drive stirrer)
- Pneumatic conveyors, lifts and hoists

Air Powers Applications from Start to Finish in Automotive Manufacturing

Compressors power pneumatic tools used for various processes, including inflating tires, painting and fastening. They also filter the air that auto workers breathe on the assembly line. Simply put, air compressors are used from start to finish in the automotive manufacturing process.

Conveyance and Material Handling

Many components are brought together either from the manufacturer or from partnering suppliers to produce a car. Engines and transmissions, metal forms for hoods, roofs and deck lids, as well as body sides and fenders, are just some of the many components that come together to produce a car.

Today, cars are made of durable yet light materials—polymers like polypropylene, polyurethane and polyamides—compressed air can power the lifting, positioning and moving of all these components as they move through the automotive manufacturing process and assembly line.

Air-powered lifts and conveyors do the heavy lifting—and that's not just a figure of speech. Material handling equipment moves and positions the pieces of the car where they need to go so people don't have to, increasing safety for workers and improving ergonomics and efficiency.

A compressed air solution is vital in this application, not only to power the equipment but also because, during conveyance, there is a pressure difference between the beginning and the end of the pipeline or assembly line that moves the goods. This required pressure difference makes perfecting the power and flow rates of your equipment essential to avoid equipment breakdowns or damage. The best way to check that everything is at its optimum level is through a comprehensive air audit that will allow for a complete assessment of your equipment. This allows you to gauge where your equipment is at and identify areas of inefficiency or potential improvement.

As mentioned above, consistent air power is vital to keep these automotive manufacturing processes moving, but if contaminated air touches the product, it can have catastrophic effects on the final product. Therefore, it's also vital to implement a high-quality filtration system into your compressed air set-up that will act efficiently to remove any contaminants such as oil, dust or moisture.

Stamping

The automotive assembly process starts with the parts and components. In the stamping department, technicians work with coiled steel and other advanced metals, stamping them into shapes, contours and sizes that will form the car. The car body and sides, engine compartments, hoods, roofs, deck lids, floors, doors, fenders and more are all created in the stamping room.

Operators load the coils into "blanking machines," which straighten and clean the metal, and then the machines cut the metal into blank sheets of metal known as "blanks." The blanks are stacked in preparation for stamping. After they are stacked, workers use compressed air to slightly separate the flat steel sheets from each other to be fed into the stamping presses.

Stamping involves huge presses that use precision-manufactured dies to form the flat steel into contoured pieces. The stamping presses require compressed air to cushion and control the heavy dies as they press together to stamp the sheet metal. Large stamping presses usually also have air receivers nearby to smooth out the drawdown on the system.

Welding

Next, the stamped parts of the car are welded together. Most of the welding is done by robots that are powered by compressed air. Robots also apply sealants to the joints where the stamped pieces fit together.

Painting

Painting car bodies is an essential step in automobile manufacturing. It's a multi-stage process that includes dipping and drying different parts of the car's body, frame and other structural components repeatedly in different primers, sealants and anti-chip coatings. Base and topcoat paints are applied by air-power robots or by operators using pneumatic sprayers or spray guns.

The robotic paint process and pneumatic paint equipment require constant air pressure of quality, highly filtered air. The compressed air should have a dew point of -40° Fahrenheit or drier to ensure no bubbling or fisheye effect in the final paint job. To ensure your compressed air is clean and dry, it's important to consider an effective downstream system, with either a desiccant or refrigerated dryer to remove moisture from your air and a filtration system to remove any contaminants such as oil, dust and, as mentioned below, silicone. For this particular application, we'd recommend a desiccant dryer, as they are able to produce ultra-dry air with a lower dew point!

The air also must be silicone-free. No silicone or silicone sealants should be used in the compressor and dryer system that power painting robots or pneumatic painting equipment.

Assembly

Lastly, workers on the manufacturing line finish off the assembly of the car using handheld assembly power tools. Using a variety of different tools, technicians install pieces like the dashboard and other interior components in compact areas that robots can't easily reach.

Assembly tools are getting more sophisticated and more economical. Many assembly tools are electric, connected to each other and to the cloud, and gather and record fastening data such as torque control, angle and number of fastenings.

Technicians use pneumatic and hydraulic pulse tools to complete fastenings that require high torque output, speed and durability Pneumatic screwdrivers or nut runners deliver high torque output with minimal exertion from the operator. Pulse tools are similar, but rather than delivering constant torque, they apply controlled torque in consistent increments. Hydraulic and air-powered pulse tools deliver short bursts of torque to tighten a fastener and control the torque limit, ensuring that fasteners aren't over-tightened, which can cause the joint or the fastener to break under too much force.

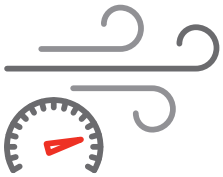
Compressed air is vital to power pneumatic tools and equipment! However, no matter which pneumatic tool you use during your automotive assembly process, moisture will always be the enemy. By using air that isn't dry, with a high particulate count to power your point-of-use equipment, you risk diminishing the performance and longevity of your tools, resulting in potentially costly damage. But how do you get dry air to power your equipment? It all comes down to an effective downstream system. For powering pneumatic equipment and tools, we'd recommend beginning by implementing a desiccant dryer, which uses absorbent material to remove any moisture from your equipment. To accompany this, a high-performance, efficient filtration system will help to remove moisture, as well as any other contaminants, such as oil or dust, from your air! This way, you will have consistent, high-quality compressed air to power your pneumatic tools without compromising the performance and longevity of your equipment!

Removing the Pain Points

How to Achieve the Quality and Reliability of Compressed Air Required by the Automotive Industry

The quality and reliability of compressed air are essential to automotive manufacturers who are well- known for their zero-defect goals. In an operating environment driven by Six Sigma, Lean, and Kaizen approaches, compressed air must be constantly available, reliable and high-quality at all times.

There are five things to know when assessing whether a compressed air system will help you achieve the production goals and quality at your automotive plant:



1. AIR CONSUMPTION

Assess the amount of compressed air your automotive assembly plant needs for its large-scale and highly automated processes. A compressed air expert can help you quantify the capacity your operation requires through a comprehensive air audit, which will analyze your existing system. From here, enhancements can be made to your existing system or a new one can be designed and installed that better suits your air requirements. All stages of your automotive manufacturing processes would benefit from this assessment, as it will ensure that your entire facility is operating at its most efficient, without the risk of unexpected breakdowns or downtime!

2. AIR QUALITY

Generally, the requirement for air quality in automotive plants is stringent. The painting process needs extremely high-quality air without the introduction of water, oil or dust. If the air quality isn't high enough, contaminants can travel through the paint gun and onto the car part. These contaminants, when heated, will cause issues in the final finish, typically referred to as "fisheyes." These flaws trigger defect alerts and re-works at the end of the line, which costs manufacturers precious time and money. That's why your compressed air must meet the suitable ISO rating.

But how can you ensure your air meets the suitable ISO rating? There is a proactive and reactive solution for this. Proactively, you can request an oil sampling assessment to be done at your automotive manufacturing facility. This will provide you detailed insights into your air quality, the presence of oil, and both internal and external contaminants that may impact your air system, including factors that may impact the usability and effectiveness of your oil or lubricant. By identifying any issues or abnormalities, steps and precautionary measures can be taken to fix these issues and maximize the quality of your compressed air. This is a useful solution for applications such as conveyance and material handling, painting and assembly where high-quality air is uncompromisable.

Another solution here, which is more reactive, is implementing an effective downstream system into your compressed air set-up. This will need to include a dryer, either a desiccant or refrigerated, which will help to remove moisture from your system, producing dry air for your applications. Alongside this, filtration systems are ideal for removing moisture, as well as other contaminants such as oil or dust, by filtering out and preventing these substances from entering compression assemblies. This is especially important for painting and assembly to ensure a high-quality, aesthetic finish. Here, there is also the opportunity for a condensate treatment and management system which

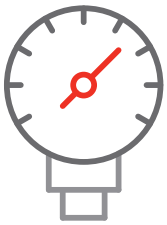
helps to remove the water condensate that is a natural by-product of compressing air. This condensate can cause costly equipment damage, so it's the job of a condensate or zero-loss drain to drain away this condensate so that it can be disposed of in a way that adheres to strict industry regulations. The condensate is drained into an oil water separator to separate out the oil from the water. The drain often then has timers which will open and close when condensate needs to be removed, allowing it to leave your compressed air system. The presence of condensate can massively impact the finish of your paint, so this is particularly important to consider for that stage of your manufacturing process.

3. DRY AIR

Moisture is the enemy of all pneumatic tools and equipment. When the compressed air is appropriately dry, it helps maintain the performance and long life of pneumatic equipment used on the assembly line.

Dry air can be achieved through downstream equipment, including dryers, filters and condensate management systems, as mentioned above. For ultra-dry air, desiccant dryers are the best option as they produce much dryer air than other systems due to their lower dew point. This is important, particularly for painting or powering pneumatic tools and equipment. However, refrigerant dryers are another option available for more general automotive manufacturing processes and applications.

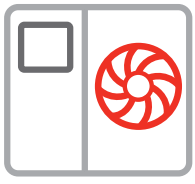
Both of these systems will help to eliminate moisture from your air to ensure you're using only clean, dry, high-quality compressed air for your operations!



4. PRESSURE

The pressure levels needed are dependent on several variables, including whether the air is used continuously or intermittently, as well as the ratings of the pneumatic tools. The air pressure must match the specifications of the equipment to keep everything running at peak performance.

How can you ensure that your air pressure is at its optimum level? We'd recommend a thorough air audit of your existing system. This will assess things such as pressure levels, potential leaks, inefficiencies and other abnormalities. From here, enhancements and improvements can be made to your existing system or a new one can be designed and installed to better suit the pressure requirements of your particular automotive manufacturing process or application needs.



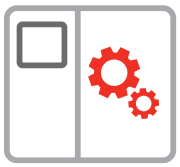
5. COMPRESSOR TYPE

Oil-flooded rotary screw air compressors are commonly used on assembly lines due to their flexibility and energy efficiency. Centrifugal compressors are also used for their ability to generate very high- quality air and their reputation for reliability and long service life. Deciding which compressor is right for your particular automobile manufacturing operations and applications is paramount! Otherwise, you could end up wasting time and energy on machines that don't meet your exact requirements, which could lead to bad product finishing or unexpected breakdowns and downtime.

Again, an air audit would be the best solution here to assess your operational needs and tailor a compressed air system to their exact requirements.

Air System Approaches for Today and the Future

The type of compressor you use depends on your plant's needs and your goals for the future.



Point-of-Use Compressors

Some manufacturers are decentralizing compressors and using smaller compressors to create point-of-use air that generates air near its use. These rotary-screw compressors are often situated next to the line, or "line side," reducing the need for building extensive piping networks throughout the plant.

No matter how good the piping is, it inevitably leaks, which is a waste of high-value air.

As automotive manufacturers focus on increasing energy efficiency, the point-of-use approach is attractive because it mitigates compressed air waste.

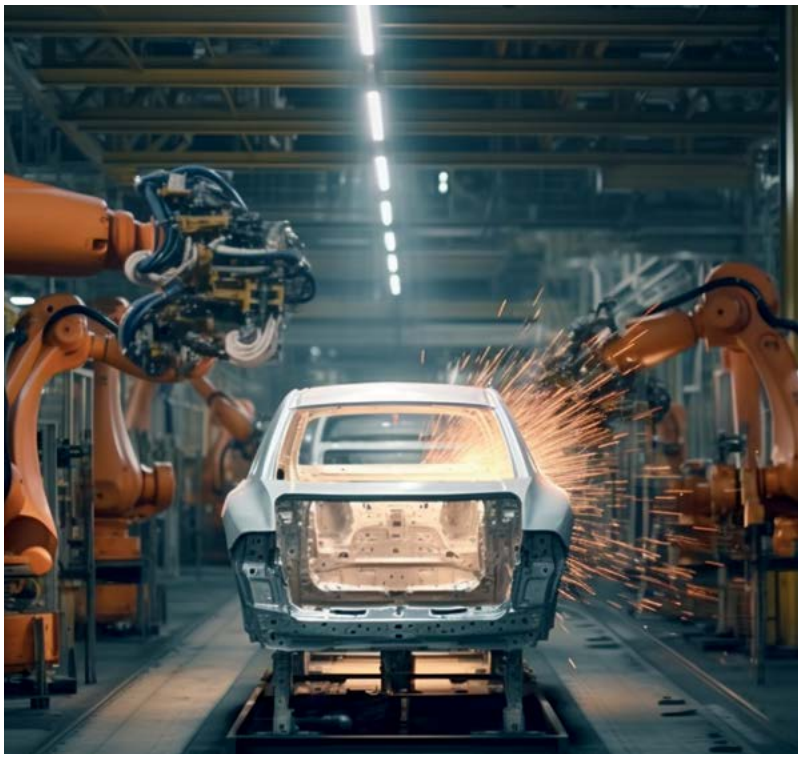
Contract Air

Large manufacturers are more often embracing "contract air." Contract air is a method of purchasing air as a service, wherein the customer pays a fee to a third party to maintain the in-house compressors, oversee the maintenance and service, and take on all the responsibility of the air compression process. This worry-free approach is advantageous when companies have limited maintenance personnel or if they want to move the air utility to their operational expense column versus their capital expense column.

As preventative maintenance services increase built on the IIoT infrastructure, more manufacturers may embrace air as a service.

Total System Solutions

Another approach manufacturers can take is to work with an original equipment manufacturer to design a purpose-built compressed air system solution. These solutions include all the customer needs to generate air for its operations – the compressor or multiple compressors, integrated or standalone dryers, air storage, digital control options, as well as a maintenance and service program. The OEM works with the customer to design, install and test the whole system to ensure it operates at 100% specification on day one of operation.



Compressed Air Plays a Vital Role in Your Automotive Facility

Compressed air plays a vital role in your automotive facility; however, maximizing the value of your compressed air systems can be complex and overwhelming. As your compressed air solutions partner, Ingersoll Rand can take the burden off you, collaborating to design, deliver and install compressed air systems that are a perfect match for your operations.

We work with you to identify the compressed air needs for your applications. Then, we design a compressed air system that delivers the right level of quality, quantity and power that your process requires. We can also oversee the installation and recommend service and maintenance programs that optimize the total ownership cost.

With various configuration options available, including fixed or variable speed drives, single- or two-stage airends, as well as Total Air System packages, our team collaborates with you to design a complete, integrated solution that maximizes efficiency and airflow.

We can also provide a range of service options and preventative maintenance programs that optimize your total cost of ownership and extend the life of your compressed air equipment.

Service and Maintenance Programs

There are many applications you will require high-quality compressed air for in your plant. You also now understand how to achieve the quality and reliability of compressed air required by the automotive industry. 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

- Predictable, 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 stabilizes pressure.

HELIX™

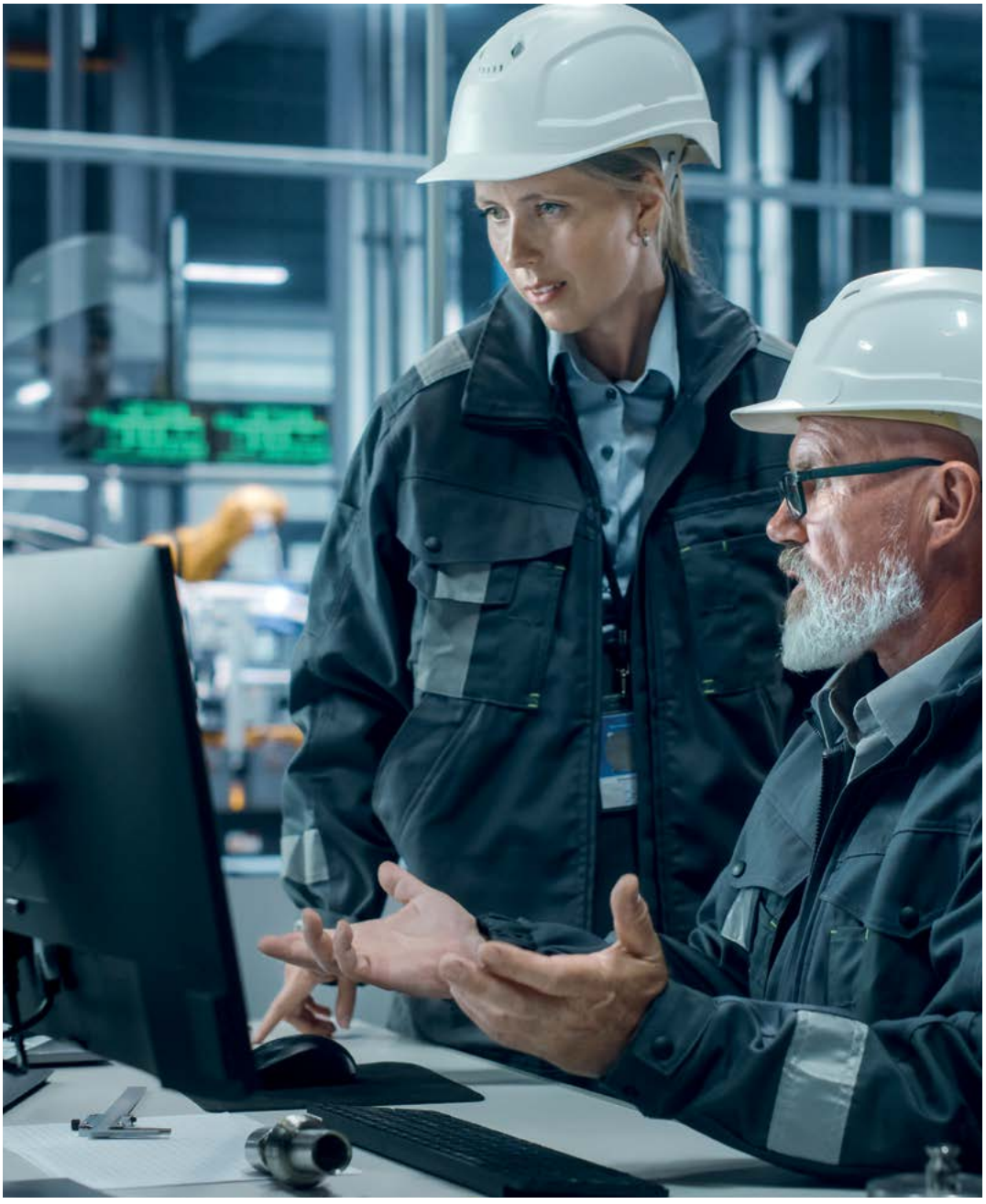
24/7 Remote Monitoring With The Helix™ Connected Platform

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.

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.

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



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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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