Electronics Manufacturers Can Increase Reliability and Production With 100% Oil-free Compressed Air

Save energy and help ensure product quality, reduce the number of quality rejects

Ingersoll Rand

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Introduction

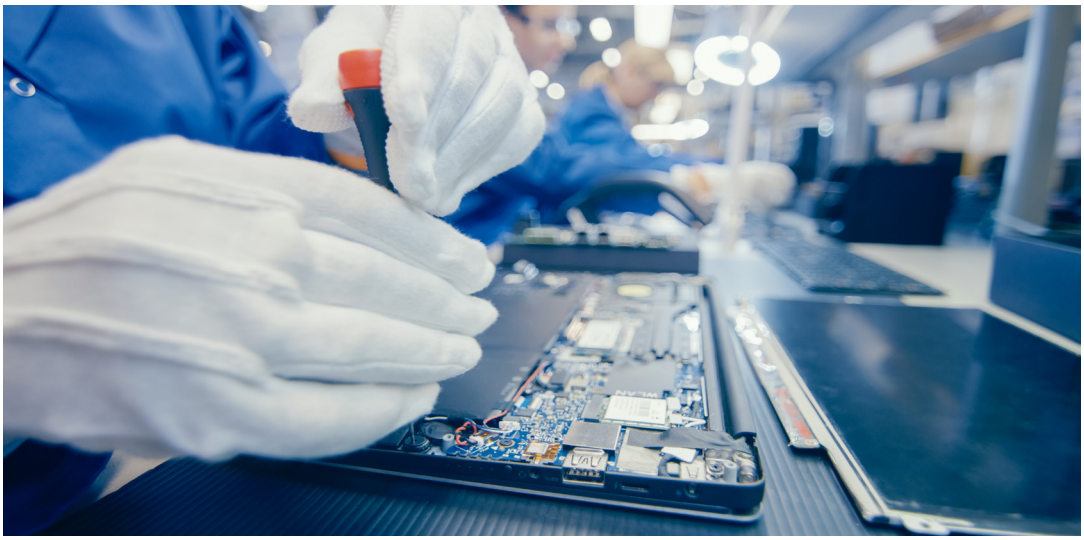
It will come as no surprise that the adoption of smartphones has changed the way we communicate. In 1994, IBM released a phone named Simon that paved the way for manufacturers to develop chips for a new generation of electronics. Simon featured a touchscreen, email capability, and a handful of apps, such as a calculator and a sketch pad. It was revolutionary and introduced what later became known as Industry 4.0.

Printed circuit boards, sensors, and control systems are used in smartphones, medical equipment, automotive, and other machinery. The electrification of vehicles, smart home devices in developing nations, and medical device manufacturing in North America and Europe have created a highly competitive market and pressure to remove costs from the manufacturing process and drive down product costs.

The future of the electronics manufacturing industry is bright, but it's not without its challenges, particularly when it comes to moisture inside the components.

In this white paper, you will learn:

- How product defects and returns can indicate a bigger issue inside your components;
- The role of 100% clean and dry compressed air in reducing moisture;
- Why an energy efficiency audit can help you determine what's going on in places you can't see; and
- How to avoid unplanned downtime and consequent production loss.



The Electronic Manufacturing Future Is Bright

Lagging computer deliveries, the inability to buy new video game consoles, and quarries filled with newly built cars and trucks awaiting electronic parts are just a few of the most visible signs of the global chip shortage. That shortage was caused by pandemic-induced work stoppages at semiconductor factories and supply chain disruption. At the same time, demand increased for computers and the other devices needed to work from home or provide entertainment to stave off quarantine boredom[1].

Even when current demand is satisfied, the future is bright for the electronic manufacturing market. According to Global Market Insights, that market exceeded $500 billion in 2019, and it is predicted to grow at a compound annual growth rate of more than 5% between now and 2026.

As more everyday items are connected through the Internet of Things, high-quality and reliable compressed air can help manufacturers ramp up production to meet the demand of a world population hungry for all things tech. At the same time, product defects and returns can foil even the best laid revenue-generating plans.

Defects and returns may be your first indication that there is a problem with moisture in your electronic product, which can result in shorting, loss of signal strength between connections (attenuation), mirror and lens fogging, intermittent functionality/disfunction, or complete failure.

Preventing moisture during the manufacturing and assembly process is important to support product quality and minimize product loss. If the ambient air in the manufacturing space and process air used in the manufacturing process can be controlled for humidity, it can decrease moisture exposure to the electronic components. The most effective way to prevent moisture from harming your electronic products is to use dry process air.

Electronics manufacturers can improve their throughput and production by leveraging Ingersoll Rand's decades of experience as a solutions provider as a designer and supplier to manufacturers of semiconductors, PCBs, electronic components, flat screens, and displays.

[1] Fortune, "PC sales have surged for at-home workers and learners during the pandemic" January 11, 2021

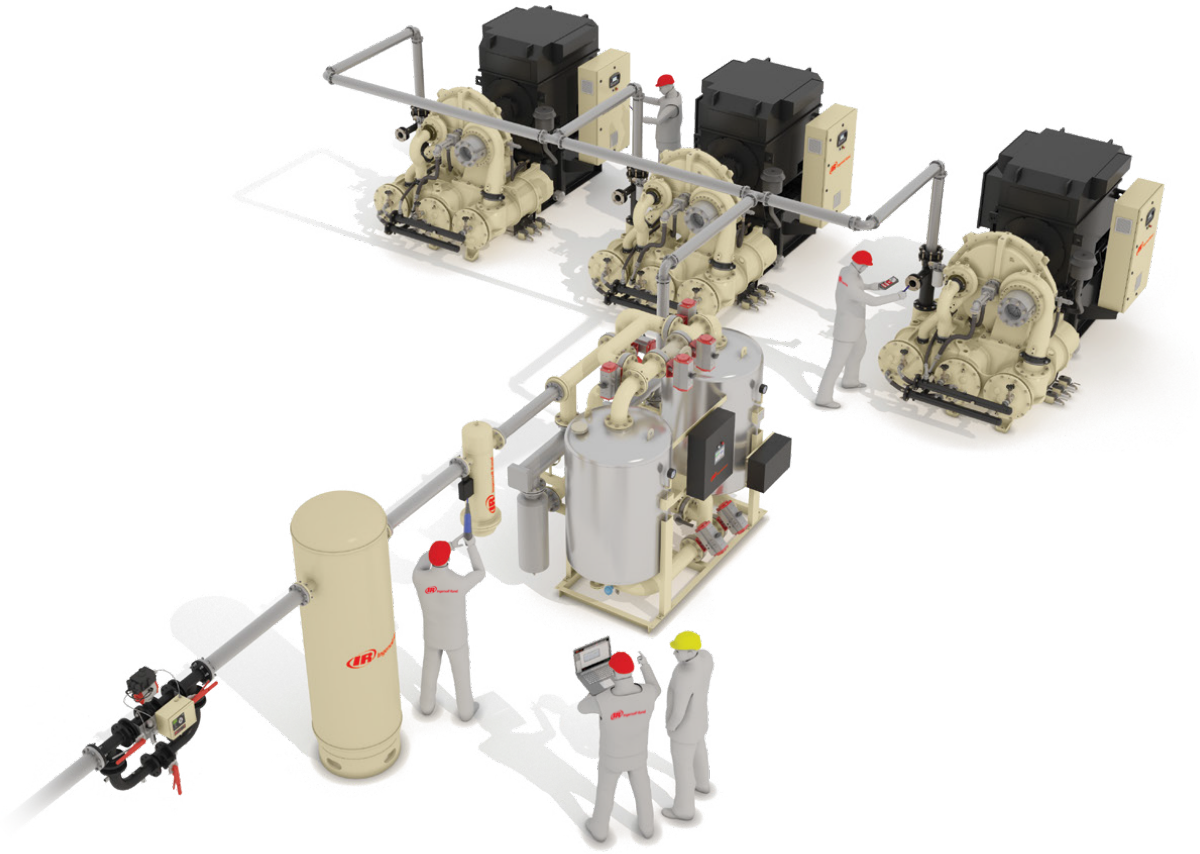
Gain Reliability, Purity, and Uptime from 100% Oil-free Compressed Air

PCB and chip manufacturing's 24/7 continuous process places exceptionally high requirements on compressed air quality. If the air does not meet the required quality, the product defect rate can rise, which of course, increases business costs, directly affecting the company's bottom line. Additionally, air that is inconsistent or of lower quality can damage production equipment, such as electronic testing equipment, exposure machines, drilling machines, and optical testing equipment.

Previously, many electronics manufacturers relied on oil-flooded air compressors, which can be a challenge in providing the 100% oil-free air required for the semiconductor manufacturing process. Because Ingersoll Rand offers air compressors that use no lubricating oil in the air circuit, this no longer needs to be a concern.

The new Ingersoll Rand® E-Series® oil-free rotary screw compressors are packaged systems with best-in-class efficiency optimized to deliver reliable 100% oil-free compressed air to electronics manufacturers.

For larger air consumers, Ingersoll Rand's multi-stage MSG® TURBO-AIR® NX 5000 centrifugal compressor offers best-in-class energy efficiency and the lowest total-cost-of-ownership. Like the E-Series, its compressed air quality meets the ISO 8573-1 Class Zero specification to guarantee 100% oil-free air without contamination, and it's designed with ease of maintenance and reliability in mind to offer maximum uptime. Patented long-life consumables ensure peak performance with longer maintenance intervals and contribute to reduced maintenance costs.



Assess the Existing Equipment to Increase Reliability and Efficiency

To plan improvements, the current performance of the plant's existing equipment and air distribution should be assessed:

- Is the equipment reliable?
- What is the cost of current or anticipated maintenance and/or repairs? Newer equipment is often able to offer ease of maintenance at a reduced cost and more uptime.
- Is the current equipment efficient? Advances in air compressors, air treatment, and controls can yield sizable reductions in energy consumption. If the current equipment is also nearing the end of its service life and will require an overhaul or airend replacement, that cost can be weighed against the cost to upgrade to newer, more efficient equipment.

The Performance Services Program, provided by the compressed-air solutions experts at Ingersoll Rand Compression Technologies and Services, is one assessment program available to help electronics manufacturers plan for continuous improvements. The experts identify areas of improvement that will get the most out of a manufacturing plant's existing equipment. The air specialists suggest upgrades to create a total systems solution. At one PCB manufacturer, the solutions providers from Ingersoll Rand were even able to save energy by using the water used to cool the air compressors' heat exchangers, normally disposed of as waste heat, to instead pre-heat boilers used for the workers' shower room.

Reduce Energy Consumption with Efficient Compressors

The PCB industry uses a large amount of air. For most manufacturers, compressed air accounts for 20%-35% of the total electric consumption. And over a 10-year lifespan, energy consumption accounts for 85% of the total investment cost of a compressor system. Ingersoll Rand's variable speed drive (VSD) E-series models provide class-leading efficiency and improvements of as much as 35% in electrical power savings over traditional fixed-speed compressors. Fixed-speed compressors usually require a larger control band, while VSD compressors operate much closer to the target pressure. Every 14.5 psi (1 BAR) over the required pressure costs an additional 7% in power.

Air Treatment and Filtration Selection Can Save Energy

Heat-of-compression (HOC) dryers are one example of the technology from Ingersoll Rand that provides clean, dry air and saves energy. Their dual-tower design uses desiccant as the drying agent. As with all dual-tower designs, the HOC dryer offers a continuous supply of dry compressed air by switching the towers between desorption and cooling cycles to constantly regenerate the desiccant.

Compressed Air System Demands Care in Design and Maintenance

PackageCARE™
We Protect You

PlannedCARE™
We Help You

PartsCARE™
We Enable You

Ingersoll Rand has the capability to design, install and maintain a total compressed air system, which typically includes:

- Redundancy at the source, which ensures ample backup air is available at all times.
- Buffer capacity in the air delivery line, which avoids minor interruptions that can cause production disturbances at the point of use in the process.
- System control capability: sufficient operational flexibility is supported by a combination of fixed-speed compressors that fulfill the base load air demand, supplemented with properly sized variable-speed compressors to absorb any peak loads in the air consumption pattern.
- The load-balancing concept, which enables even utilization of the compressed air equipment, avoids heavier use of one piece of equipment and additional wear than another piece of equipment.
- Fast service response and contingency plans: service partners respond quickly and effectively to any issue and provide 24/7 support with robust maintenance agreements.

In the electronics industry, the cost of unplanned downtime and consequent production loss is enormous. It's crucial to select the right equipment to meet stringent manufacturing process requirements, equipment availability, and MTBF (Mean Time Between Failure), which is where a compressed-air systems expert such as Ingersoll Rand can help an electronics manufacturer meet its goals.

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