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Pressure and Vacuum Solutions in the Aircraft Building Industry

Ingersoll Rand®

What's Inside

Introduction: The Air That Lets Them Fly

Defined by the ongoing global Covid-19 pandemic, the last two years have arguably been a difficult time for the aircraft building industry. Travel restrictions imposed by most countries following the outbreak and spread of coronavirus negatively affected air passenger travel around the world, causing cash flow problems for numerous airlines. This, in turn, resulted in many carriers canceling or delaying their previously planned aircraft purchases and major manufacturers scaling back production as the demand for new jets fell.

However, despite the pandemic still raging on, the prospects for the sector's growth in both the short and the long term look very promising. Air passenger travel is expected to recover and return to pre-pandemic levels by 2024; and order backlogs should keep market leaders, like Airbus and Boeing, very busy. Once the market sees the much anticipated rebound, fleet modernization and destination expansion plans will likely help keep the momentum going for years to come.

According to a 2021 report by Mordor Intelligence, a market research and advisory firm, the total value of the commercial aircraft building industry will reach almost $173.1 billion in 2026 (compared to the almost $85.5 billion recorded in 2020), registering a CAGR (Compound Annual Growth Rate) of over 12.3% spanning the 2021-2026 period. The growth is forecasted to continue beyond 2026, with Boeing expecting up to $9 trillion to be spent over the next decade in the global aerospace industry if defense and services industries are included.

The US giant predicts the world's fleet of commercial airplanes to increase from 25,900 planes in 2019 to over 49,400 planes in 2040. By then, most of the fleet will be new plane models that have not entered service yet. Company representatives point out that until now, between 15% and 20% of the total fleet has been retired every five years, and that market trends now indicate this figure will soon reach close to 25%, translating into more and more new orders in the coming years.

Pressed for Air

The predicted expansion of production activities will mean the need for a substantial outlay of capital on aircraft building infrastructure. Aircraft manufacturers already are (and will continue to be) upgrading existing factories and constructing new facilities to be able to meet the growing demand. With pressure and vacuum solutions playing a key role in the aircraft building process, significant investments will be going into the addition of new compressed air systems, as well as the replacement of aging compressors that are currently in operation.

Compressed air is a critical utility for a wide variety of aircraft manufacturing and testing operations.

Compressed air is used for a broad spectrum of aircraft building applications and is a primary utility at airplane manufacturing plants. It is utilized in autoclaves - large pressure vessels where components are processed and treated through exposure to elevated pressure and temperatures. It also supports numerous assembly processes by powering various conveyance, fastening, lifting, riveting and rigging devices, as well as pneumatic equipment.

To ensure a clean environment with the desired air humidity and temperature levels, a large amount of compressed air is used during massive aircraft coating and painting operations, which create significant heating, cooling, exhaust and ventilation requirements. Compressed air is also needed to help fill the hydraulic systems of an airplane, which help move elements such as flaps, doors and landing gear. Vacuums are used in composite materials assembly and bonding, as well as in debris collection and other clean-up activities.

Compressed air supports the numerous test requirements typical for aircraft manufacturing. A significant amount of air is needed to test aircraft engines (the so-called compression testing procedures) and the various airplane systems. Large compressors with air storage tanks are utilized to repeatedly pressurize aircraft bodies to simulate take-off, elevation and landing scenarios. Compressed air is also used in several types of wind tunnel tests.

Top-Flight Designs

The exact amount of compressed air needed by aircraft manufacturers varies, depending on the size and type of facility, with some producing smaller or larger airplane components and others working on final aircraft assembly. Every facility is different, but the majority have both a production site and a testing site; each with its own compressed air requirements. While in some plants the sites may share air, most manufacturers use two separate compressed air systems for their manufacturing and testing functions.

A large plant's air system may include several compressors, including one that is on standby. It also includes a number of additional elements like air dryers. The air system should be equipped with an ASM (Air System Manager), which matches compressor operation to system demand, helps start back-up machines when they are needed and provides remote access to operating data, system alarms and shutdowns.

A test site's air system often features a high-pressure centrifugal design, with regulated air used to handle a variety of test applications.

Just like all other industrial processes, aircraft manufacturing depends heavily on the reliability of existing equipment to achieve the desired levels of productivity and efficiency, while ensuring quality and optimizing production costs. Maximizing uptime is of the utmost importance, so the technological solutions used in an airplane plant must guarantee optimal system redundancy, while giving you backup whenever an emergency occurs. Of equal importance, the system needs to be flexible in the way it is laid out to provide sufficient access.

Because of the size and complexity of airplane manufacturing facilities, designing compressed air systems poses major logistical challenges. The distribution of air across a large factory needs to be carefully planned to make sure that the utility is delivered to all the individual assembly locations in an efficient manner without impacting other crucial equipment. For example, when choosing the overhead or in-floor distribution option, it is necessary to ensure that the piping does not obstruct the work of cranes or rolling material-handling systems.

Cleared for Takeoff

With the aircraft building industry being defined by very rigorous quality and performance standards that are a result of safety considerations, the compressed air used in airplane factories must be dry and clean. Most aircraft manufacturing applications require strict contamination control. In many cases, especially regarding the autoclave and painting processes, this rules out the use of lubricated compressors that could compromise purity by allowing fluids to mix with air. This makes oil-free, ISO Class 0 compliant compressor technologies a natural choice for airplane manufacturers.

Compressor types common in aircraft manufacturing, include rotary screw air compressors (for continuous, large and high-pressure flows) and reciprocating air compressors (for intermittent-use applications). However, due to the large scale of airplane building processes and their considerable compressed air demand, centrifugal compressors are often the most logical fit to support the needs of an aircraft manufacturer. Such compressors deliver reliable, oil-free air while taking up the smallest footprint related to the required system flow capacity.

With Flying Colors

As a global provider of pressure and vacuum solutions for numerous industries, Ingersoll Rand is well established within the aircraft manufacturing community. We have hundreds of machines operating at airplane factories located across the globe. For decades, aircraft manufacturers have been operating Ingersoll Rand supplied compressed air systems ranging from small dedicated systems to large scale, centralized plant air compressors.

Ingersoll Rand meets the exacting equipment quality and reliability requirements of the aircraft building industry. Our portfolio, which includes 'silicone-free' rated products that provide the highest-quality air, features a range of compressors designed to suit the various process needs of aircraft manufacturing companies. Our centrifugal compressors, including the recently introduced MSG® TURBO-AIR® NX Series machines that deliver market-leading efficiency and are ISO-certified to produce 100% oil-free air, are the perfect fit for large centralized systems.

For systems requiring flows of less than 2,000 cfm, we offer both centrifugal and oil-free rotary compressors that ensure state-of-the-art efficiency and Class 0 oil-free air.
For less stringent applications, Ingersoll Rand provides a full line of oil-flooded rotary screw compressors with capacities of between 5 hp to 450 hp.
Our compressors can be supplied with heat-of-compression dryers and a heat recovery option to help maximize energy savings for aircraft building facilities' operators.

Ingersoll Rand has the unique ability to provide, in cooperation with engineering companies, a total customized compressed air system design to best address the specific application requirements of a given manufacturer. Our engineers help customers identify their compressed air needs, and then design, deliver and install solutions that are the right match for their operations. We also offer a broad spectrum of service options and maintenance programs that optimize your total cost of ownership and extend the life of your compressed air equipment.

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

Learn More

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