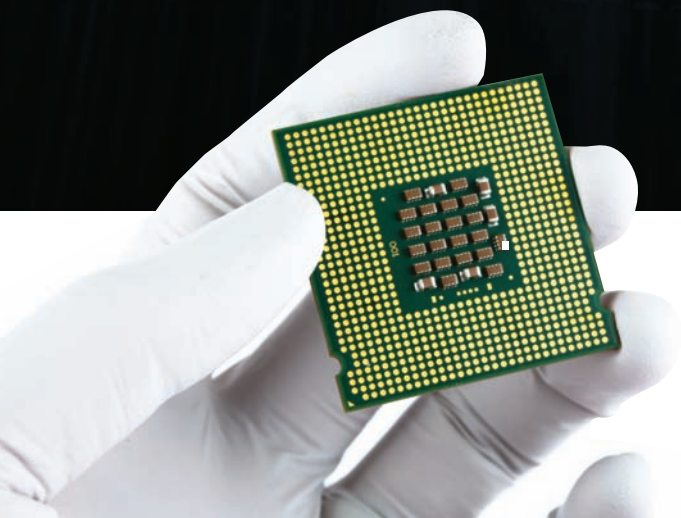


Semiconductor Fabrication

Creating the Heart of the Digital Age

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Atlas Copco pioneered oil-free air technology, which has become a critical technology for advanced manufacturing operations worldwide.

A digital core that interacts with its power sources, with other digital systems, with people, and with the physical world is at the heart of practically every electronic product. Texas Instruments (TI) is a worldwide leader in the design, development and manufacture of the analog, digital signal processing and semiconductor technologies that enable these key interactions. At its North Campus in Dallas, Texas, TI manufactures the building block of the digital age: semiconductors.

Masoud Saber, Facilities Engineer at North Campus, leads a group that provides utilities for the plant's highly specialized operations. "We're a support organization for TI," Saber explains. "We provide the necessary utilities including natural gas, electricity, chilled water, hot water, and compressed air."

Managing Risk with Oil-Free Air

Compressed air plays a critical role in the manufacture of semiconductors, and TI's specification for the quality of its compressed air is extremely high. The air is so clean, measured particulate is less than 100 parts per *billion*. The air is so dry, the dew point is -100°F .

All of the air compressors at work at TI are oil-free, with no lubricating oil injected into the process airstream. Oil-free air is crucial because, in the manufacture of semiconductors, hydrocarbons are the enemy.

Simply put, hydrocarbons on a wafer ruin the wafer. The risk of hydrocarbon contamination from compressed air is effectively eliminated when the air compressors are oil-free.

Improving Energy Efficiency

"TI requires a large volume and continuous supply of high quality oil-free compressed air," according to Mike Rotondo, Key Account Manager for Atlas Copco Compressors LLC in Coppell, Texas. "TI has several centrifugal compressors in their Dallas operation, including one of ours. They do their own compressor monitoring using sophisticated technology, and it was through their own monitoring systems that they identified a problem related to running all of their centrifugals efficiently. In short, they couldn't get all the compressors trimmed precisely."

"We were looking at different options," Saber explains. "In particular we wanted a solution that would eliminate venting." Venting is the release of compressed air into the atmosphere due to unutilized full load operation. Since it costs money to compress air, any air vented is waste. Especially when large volumes of air are being produced, venting can become very costly as a means of regulating system pressure.

According to Saber, TI had 15 compressors on site, 11 of them centrifugals. "The design of centrifugal





Energy Savings with Variable Speed Drive

Because energy accounts for about three-fourths of the total cost of compressed air, most compressed air applications are candidates for the energy savings provided by a Variable Speed Drive compressor.

compressors results in low turn down capability, so we wanted a way to fully load the centrifugals and then adjust output to meet demand. We use 19,000 to 20,000 standard cubic feet of compressed air per minute so we needed a big adjustment range to work with, close to 1200 scfm, in order to trim that volume within the demand fluctuation range.”

TI considered a number of different options, such as a screw compressor with a tank that could be used as storage to release air into the system as needed to keep the pressure constant. As the various options were considered, one alternative – a Variable Speed Drive compressor – was found to be ideal for this application.

“There are a few choices for a screw compressor with VSD in the size we needed,” says Saber. “Atlas Copco has a good reputation and we did an evaluation between different suppliers.”

Adding an Atlas Copco VSD Compressor

Following its evaluation, TI selected an Atlas Copco VSD compressor. This unit was integrated into the air production system and controlled by TI’s central controller, enabling each centrifugal compressor to be base loaded while the VSD compressor provides trim.

“This is one customer who really did his homework,” says Rotondo. “Mr. Saber conducted his own analysis of several Atlas Copco units. Using our engineering data, he narrowed it down to three compressors that could do the job: the ZR315VSD, ZR400VSD and ZR500VSD. Based on his projections of what the loads would be, he concluded the 400 would run closest to its ‘sweet spot’ and be most energy efficient.”



The Oil-Free Advantage

In addition to electronics manufacturing, industries such as food and beverage processing, pharmaceutical manufacturing and packaging, automotive paint spraying, powder coating, and textile manufacturing improve their quality and guarantee peace of mind by eliminating hydrocarbons in compressed air.

Adding the VSD compressor cut 200 kW out of the compressed air system, so energy savings for the project were substantial:

**200 kW savings x 8760 hour per year =
1,752,000 kWh saved per year**

This project saves about \$158,000 per year at \$0.09/kwh power rate, but the saving did not stop there.

“Now we fully load the centrifugals and let the new Atlas Copco compressor take care of the fluctuation of demand,” says Saber. “Because there is no more need to vent to the atmosphere, we made some other adjustments to the system and kW usage dropped by another 200 kW. So overall, we’re down about 400 kW. We were using close to 4,200 kW to make compressed air for the site and now it’s down around 3,800.”

Rapid Return on Investment

“VSD compressors are engineered specifically to maximize energy savings,” according to Rotondo. “The energy savings provided to Texas Instruments by the upgrade to an oil-free Atlas Copco VSD compressor are huge. Energy savings alone will make this compressor upgrade pay for itself quickly.”

Saber concurs. “When we went for the capital request, we were looking at something close to 1.5 years for payback,” Saber explains. “By the end of the project, we were able to complete the project for less money than expected, so the payback may be a bit sooner.”

As innovative businesses seek new ways to cut production costs, they are discovering that investing in VSD compressor technology from Atlas Copco pays off.

Texas Instruments

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