High speed electric drive systems

Gas and steam turbine replacement.

Increase energy efficiency and reduce emissions and maintenance across compressor drive trains

INNOMOTICS

High speed compressor applications.

Turbine replacement: tackling new challenges.

Oil & gas operations are under increasing pressure from multiple directions including stricter emission regulations, carbon taxes, rising OPEX costs, and industry-specific climate protection agreements like the Oil and Gas Climate Initiative (OGCI). When existing equipment reach their limits, it is time to think about alternative ways to modernize your gas and steam turbine fleet.

Operators of turbine-driven systems today have to cope with various costs:

- Investment and reserves for purchasing
- Maintenance and operational expenses
- Carbon (CO_2) taxes
- Downtime caused by conventional turbine start-up phases

Innomotics electric drive trains could significantly cut down or eliminate all these costs, allowing operations to invest in more proactive monitoring system upgrades like Inspire IQ.

Digitalized electric drive systems allow train analytics which includes data acquisition, processing, and visualization tools that support condition monitoring, operations, and maintenance planning. Inspire IQ includes continuous data collection and connection with a secure cloud platform. It records operational and historical data that can optionally be evaluated and interpreted by an Innomotics expert.

Innomotics is experienced in supporting continuous operations for up to six years with an electric drive train availability of up to 99.9 percent!

Drive Train Analytics and Digital Drive Train Services can greatly accelerate troubleshooting and issue resolution. In practical business terms, this means:

- Avoided downtime due to early detection of abnormal situations and trends by customer crews and/or an Innomotics service expert.
- Improved and faster root cause analysis in case of an incident due to immediate access to all data, anytime, anywhere.
- Optimized planning and execution of maintenance activities due to up-to-date asset health status as well as aggregated and historical KPIs, events and measurements.

How we meet unique application and operational challenges.

Reliability.

In many cases, turbines are not redundant in a production facility. It is critical that a replacement project run smoothly, and the electrical drive proves to be just as, or even more, reliable than the existing turbine system.

- The reliability of Innomotics, advanced high speed rotor technology is unrivaled in the field.
- Innomotics, industry-leading VFD technology includes extended redundancy measures for maximum uptime.

This high reliability comes from a proven and pre-tested plug-and-play electrical system including motors, VFDs, and transformers. Advanced high-speed motors ensure a trouble-free operation without any need for field balancing at initial start-up or throughout its service life.

Interchangeability.

Each compressor and foundation design is unique. That is why a turbine replacement solution should be specially engineered to meet all speed, space, weight, stiffness, and vibration requirements. Innomotics works with compressor manufacturers, EPCs, and operators to develop electrical solutions that will fit applications in all cases, whether the driven compressor is untouched, refurbished or replaced. Our feasibility studies and designs will ensure the electrical replacement will be smoothly integrated into the compressor train.

Torsional integration.

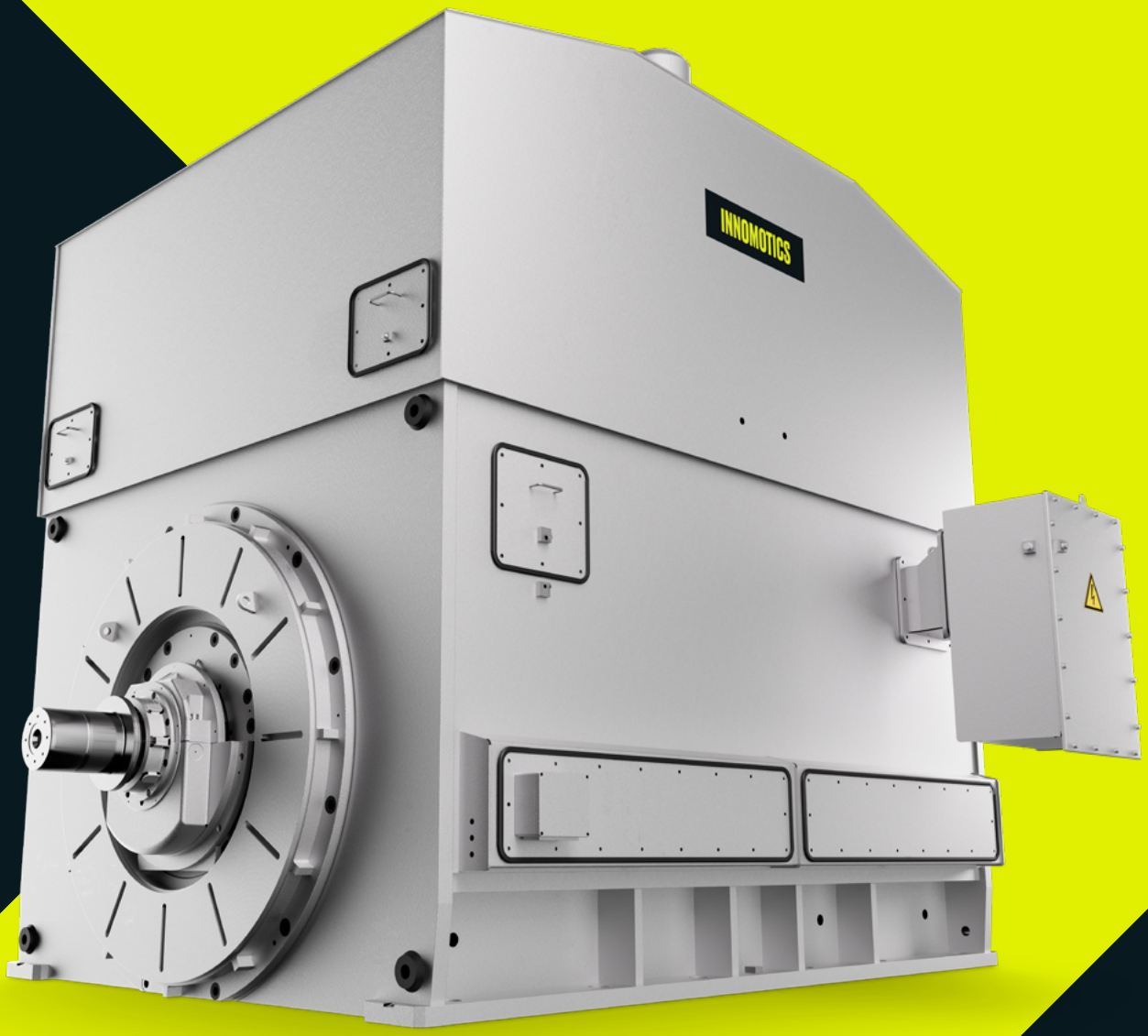
Drive trains exhibit complex torsional behavior affected by multiple component inertias and stiffness. Innomotics works with compressor manufacturers to examine existing torsional analysis to make sure the same results are achieved according to API requirements. We also help to ensure any compressor couplings meet slip/break/withstand requirements and are safety-checked for short circuit excitation, while keeping its hub or dynamics the same.

Construction and start-up.

A change from a mechanical to an electrical solution will require gas or steam pipe removal, and installation of a high voltage infrastructure to support the new equipment. This involves a substantial construction and start-up effort requiring many moving parts and multiple disciplines to execute smoothly. Experience in these projects is critical for a replacement limited to a normal scheduled plant service downtime (maximum 4 weeks).

As part of a firm site study conducted with an experienced EPC, Innomotics inventories the power and speed combinations of all effected turbines, the expected exchange dates, and foundation information. The entire connection and commissioning process typically falls within a standard plant maintenance shutdown period.

- Turbines are removed from their raised table foundations.
- Motors are installed with a custom base plate to meet the shaft height of the compressor.
- The system is tested decoupled (and coupled if necessary) for vibration and temperature to ensure smooth operation.



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Electric drive benefit summary.

System turnaround	Shortest possible with plug and play concept
Commissioning time	One day for VFD's possible and without a need for onsite motor balancing
Reliability and availability	Maximum delivered with electric drives and digitalization
Speed range capability	Flexible 70% – 105% is typical and can be extended if required
System efficiency	95% across the entire drive train
Energy savings	Significant while meeting exact power demands at any time
Starting time	< 1 minute – much faster than steam turbines
Running noise	Lower at ~ 85 dBA
System emissions	Completely emission-free system once connected to renewable power sources
Footprint	Fits easily within existing turbine system footprint
Maintenance requirements	Minimal in full alignment with scheduled plant turnarounds (typically 5 years)
Cooling requirements	Fully flexible design to meet application needs
Ambient limit	Temperature independent operation

reliable motion for a better tomorrow

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