Equipping the Massa test bench
As part of GE’s commitment to drive eLNG solutions, GE’s Power Conversion business developed a new fully electrical solution to equip the Massa test facility in Italy. This 61 MW Variable-Speed Drive System (VSDS) has been specifically designed to test centrifugal gas compressor units at full load and under extreme speed, torque and dynamic response conditions. The aim is twofold: to prove the entire system, with large motor and drive application, works and to ensure the compressors will meet the necessary technical requirements to enable efficient and reliable operation during their normal lifetime. Operational since the first half of 2013, the test bench allows the testing of gas compressors up to 61 MW.

A fully electric compression solution
The 61 MW VSDS is based on advanced and reliable technologies. It is comprised of three step-down transformers connected to the electrical network and linked to three medium-voltage MV7000 converters, VSI type, in parallel (81 MW = 3x27 MW), which feed a 61 MW 2-pole synchronous motor with two shaft ends.

The VSDS supplies the required electric power to start the whole train and operate it to continually maintain the string production capacity at the requested speed range.

Key benefits

**MV7000 converters – VSI technology**
- Low harmonics content (external filter not required)
- Improved network stability and grid integration
- High-performing solution with variable-speed technology
- Reduced torque ripple at shaft level
- No torsional vibration through system integration
- Excellent operation of high-capacity diodes and press-pack IGBT based on water-cooled technology
- Very low noise operation with water-cooling
- Patented technology of interleaving pulses

**2-pole synchronous motor**
- Excellent performance, efficiency and flexibility
- More compact design with MV7000 converter and motor enhancement
- Very good stator behavior with elaborated Roebel bars ends bracing and full VPI treatment
- Good rotor dynamics, based on 3-bearing arrangement and frame design, creating a large speed range
- Torque at zero speed and improved reliability with patented 7-phase induction brushless exciter design
- No spots and homogeneous temperature with very efficient rotor cooling
- Vibration level well below API 546 requirements
- Low noise level
Phase shifted transformers
To reduce harmonic pollution on the network side and comply with the grid owner’s requirements, each transformer’s phase shift is adjusted to create a 36-pulse reaction.

MV7000 converters – VSI type
The medium-voltage converters, with a water-cooled design, are based on the latest generation of powerful press-pack IGBT (PPI) technology. The proven Pulse Width Modulation (PWM) three-level inverter provides high-quality performance. Its adjustable PWM patterns and frequency bring a wide range of flexibility for low switching losses.

Interphase reactors
The three converters are put in a parallel configuration through a new type of filter that is used to decrease torque ripples on the motor. The converter output filter is comprised of interphase reactors with two windings that suppress the first harmonics.

Interleaving pulses
Power Conversion’s patented technology of interleaving pulses is used to control the IGBT firing. This allows a time shift between the three converters that is calculated to interleave the current wave shapes. As a result, a 7-pulse converter is created, and the current supplied to the motor contains very low total harmonic distortion, and has negligible impact on amplitude of torque pulsation at the motor shaft.

2-pole synchronous motor
Manufactured in Power Conversion’s Nancy factory, the 61 MW motor is the most powerful motor driven by a variable-speed converter, VSI type. Because it was painstakingly designed and controlled during construction, the 2-pole synchronous 140-ton motor offers excellent performance, efficiency and flexibility, as well as high reliability.

This machine has a very extended speed range and two shaft ends that adapt it very well to the operating conditions requested by a test bench application.
GE is scaling up its MGV (Moteur Grande Vitesse, High-Speed Motor) direct-drive, well-proven technology, which offers increased performances compared to traditional geared electrical solutions.

As an example, the MGV design features greater overall drive system efficiency, offering customers significant energy savings because there are no losses due to a gearbox, and it has a smaller footprint that enables it to more easily be integrated into diverse environments.

In the coming months, a more powerful solution, including a 80 MW induction motor and larger VSI drives, will equip the Massa test facility.