



“the higher availability and reliability is the real premium with the UMD system”

Said Sten-Inge Lundgren, senior electrical and control systems engineer, Siemens.



*This is a reprint of an article originally published by **Compressor Tech Two**, January/February 2006 issue.*

KRAFT

Kraftelektronik AB

www.kraftelektronik.se



■ The recently inaugurated Ciechanow compressor plant in Poland has three SGT-600 compressor units installed. In Poland, there are 16 SGT-600 compressor units installed.

NEW BACKUP SYSTEM KEEPS LUBE OIL FLOWING

Uninterruptible Motor Drive, Variable Frequency AC Motors and Battery Pack Designed to Replace Traditional DC Motor-based Systems

By Bo Svensson

Kraftelektronik AB, Sweden, is building a list of references for its Uninterruptible Motor Drive (UMD), a system that in the event of an AC power loss, converts the DC-supply from its battery to AC thereby feeding the system without a voltage dip. The UMD system is designed to provide the motors and systems connected to it with a seamless AC power supply during changing of the main power source, for example at loss of main grid power pending a diesel emergency plant start-up.

The UMD system provides uninterrupted AC and battery backup power via variable frequency drive (VFD) to AC-driven lubrication oil pumps and oil system ventilation fans. In addition, a safe area can be achieved with the UMD guaranteeing continuous supply to ventilation fans.

The UMD system eliminates the need for separate DC-driven back-up motors and significantly increases availability and reliability of lubrication oil supply to the turbine. A system with proper redundancy for capacity pumps and static frequency

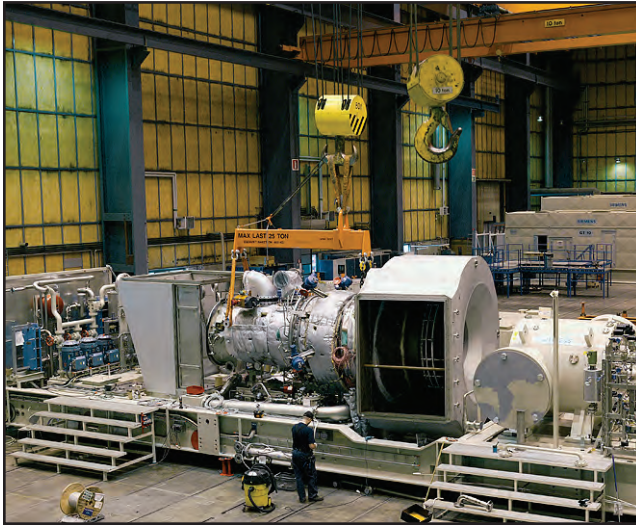
converters ensures a high availability and reliability of the system. In battery mode, the motor speeds can be reduced to conserve the battery power.

While the system primarily focuses on the power supply to the motors for lubrication and ventilation in the gas turbine plant, it can also supply Uninterruptible Power Supply (UPS) to essential functions, such as control systems, within the plant.

“Our UMD system sets a new standard in safeguarding drive function for turbine auxiliary systems,” said Marcus Samuelsson, UMD product manager, Kraftelektronik AB. “UMD is offering several advantages over the traditional DC motor-based systems, one being the increased availability resulting from the continuous supply of AC power to the motors and other essential systems of a gas turbine plant.”



■ Testing is completed before shipment of the SGT600 turbine instrument and control panels (left) and UMD and UPS system (right).



■ Pictured is an SGT-600 core engine being lifted into its position on the skid between the lube oil module and the pipeline compressor.

“Siemens in Finspong, Sweden, has for more than 10 years used the UMD system principle for their SGT-600, SGT-700 and the SGT-800 gas turbines,” said Sten-Inge Lundgren, senior electrical and control systems engineer/product manager marine power plants, Siemens. “We first started to use the system from Krafelektronik for our SGT-600 gas turbine and have today more than 135 systems in use. The system provides for a continuous supply of AC power for the lubrication pump motors, the lubrication oil tank ventilation and the turbine control system. For the SGT-600, SGT-700 and SGT-800 the bearing design requires a close to continuous oil supply, without dips in pressure, and with Krafelektronik’s design and equipment this is guaranteed.”

The UMD and UPS systems are built up in modules, contained within a freestanding panel arrangement and utilize a common battery bank for backup emergency operation on DC power when external AC power is lost. The system must pass a complete factory test before delivery. It is compact and requires a minimum of space.

A complete system consists of an input transformer for voltage matching, AC/DC distribution boards, VFDs for lubrication oil pumps, lubrication oil system ventilation fan and a VFD for UPS load (instruments and control equipment). Also included in the UMD and UPS board is the battery charger with online battery diagnostics for the batteries, which can be either valve-regulated lead-acid or, optionally, Ni-Cd batteries.

“We use three AC motor-driven lubrication oil motors today, i.e., triple safety. With only one DC motor-driven pump, as in the past, the risk for loss of lubrication oil was higher,” said Lundgren. “We no longer need the DC

motors, the starting and control systems for them or the DC driven pump with its piping and filtration system. Of course the UMD system equipment is added, but the higher availability and reliability is the real premium with the UMD system as used by us. The UMD and UPS systems are vital systems for the operation of the gas turbines’ motors, instrument and control systems, and besides some early teething problems, the system has performed to 100%.”

The battery capacity is enough for a complete post-lubrication run and one hour’s operation of instruments and control via the UPS. The battery is maintenance free and with online supervision from the charger it requires no testing during operation. If required, a capacity test is normally performed during a scheduled turbine inspection or overhaul.

The UMD and UPS system is now also available in KEMA type approved version, EEx(p) for installation in a hazardous area environment, which is essential for many applications within the oil and gas industry. This ensures uninterrupted operation of the lubrication system in case of explosive gas in the equipment room. The design is according to ATEX zone 2 and the dimensions of the standard system are just increased by 40% in cabinet length.

Krafelektronik has done this development in close cooperation with Siemens and received certification. The solution was to keep the enclosure for the UMD equipment pressurized with air. The first Siemens installation using the explosion-proof version was the Agip Kachagan plant in Kazakhstan.

“I consider the economic gain with the UMD to be substantial compared to investing in a separate DC motor-driven emergency and standby system. The UMD ensures continuous opera-

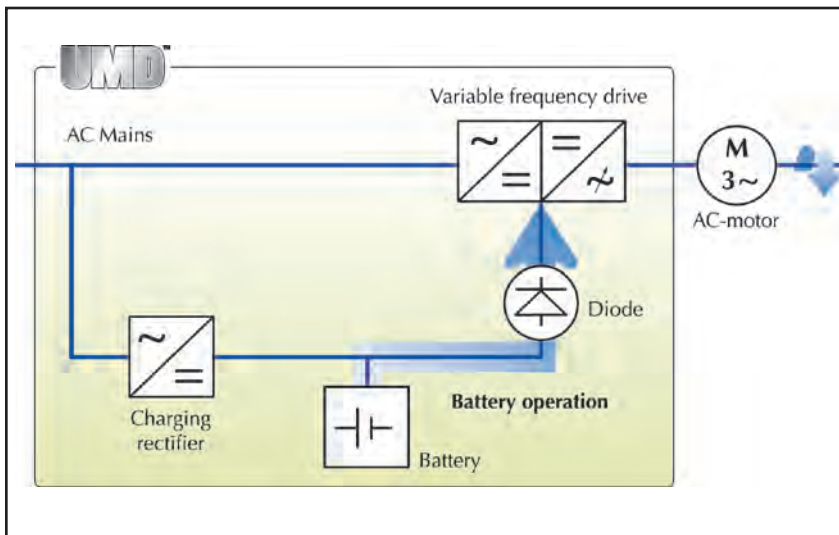
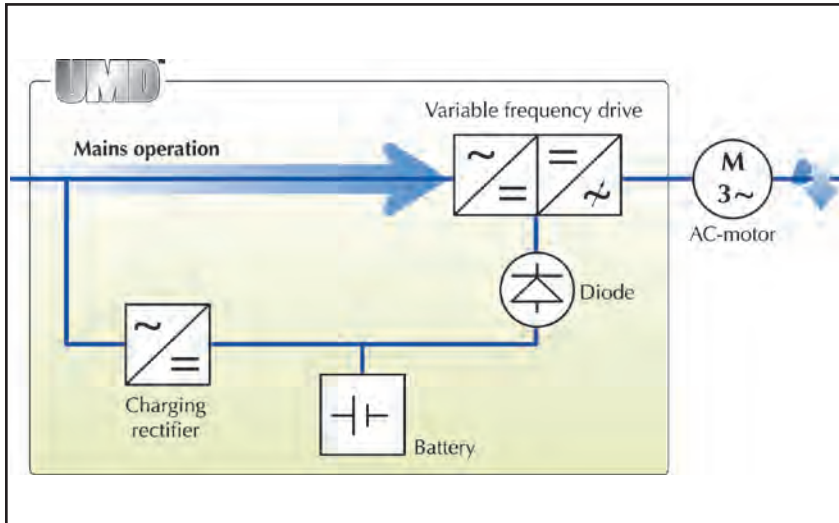
tion of the ordinary drive system and eliminates the need for a separate DC system,” said Samuelsson. “The UMD is a complete unit that provides uninterrupted power for AC motors, a system continuously providing the pump system with a full power supply, without a drop in lubrication oil pressure in the event of a main outage.”

For the Siemens gas turbine plants, the total rated UMD power is about 100 kW split over five motors — three for lubrication and two for the oil mist fans — and two UPS outlets. The physical dimensions of the UMD/UPS system are 86.6 in. wide by 23.7 in. deep by 82.7 in. high (2.2 m by 0.6 m by 2.1 m).

The robust and high integrity UPS system provides uninterruptible AC and battery backup power to the I&C system via a VFD unit and is identical to converters used for the UMD system. The VFD unit is normally delivered in a single configuration with a manual bypass switch, but is optionally delivered in a full redundant scheme. A VFD mainly consists of two parts, a rectifier bridge converting the AC to a DC voltage and a second part, the inverter bridge that transforms the DC voltage back to an AC voltage, of which the amplitude and frequency can be controlled. As the DC part of the converter is redundantly supplied from a battery, the converter will uninterruptedly provide the AC load with power from the DC battery source.

The frequency converters are designed for heavy-duty applications with constant torque and constant power applications. They provide step-less control and use the latest IGBT transistor technology eliminating the need for de-rating of motors. For UPS supply, a sine filter is used to eliminate any harmonic content to instrument and control equipment. Supervisory information from the VFDs is displayed in the gas turbine operator’s station and extensive diagnostics and protections minimize maintenance and interruptions.

“The UMD system runs continuously and can instantly transfer between mains and battery operation if the regular power supply goes down. Technically, this means a transit of power from the line rectifier in the SFCs to battery power via a blocking diode to the DC section of the converter and the battery power source,” said Lundgren. “Consequently, the UMD supplies full power all the time and there is no start-up phase, as there is for a standby DC motor, which requires additional equipment to compensate for the lack of pressure during start-up. The UMD consists of standardized modules



■ The connection between the battery and VFD goes via the diode, a very fast and highly reliable junction. When the diode feels a lower voltage on the mains than on the battery side, the diodes instantaneously transfer to battery operation.

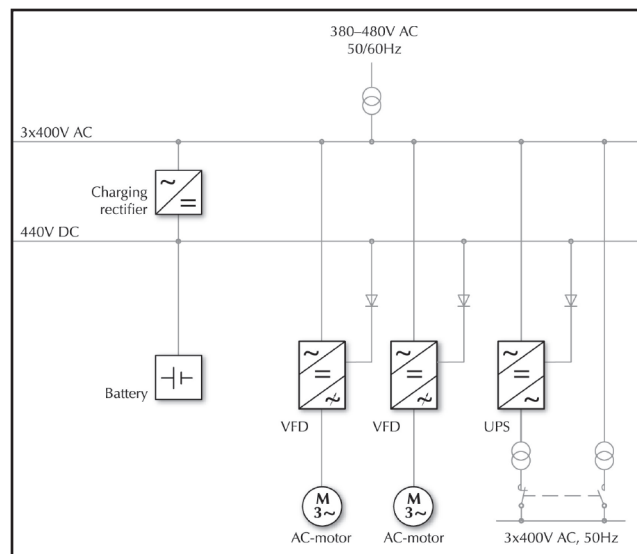
that reduce costs and facilitate engineering and purchasing work. The UMD shortens the lead time for system design, purchasing and installation.”

In some installations, the battery power is used to keep the turbine running even in the event of a network outage, a normal time for operation without main is three minutes and is useful to let backup diesel generators to start.

“The UMD system operates at the same security level as conventional solutions, but gives the user higher availability and increased business benefits,” said Samuelsson. “The components are made by leading international manufacturers such as ABB, Yaskawa, Group Schneider, Exide and Saft. Easy installation by a minimum of connections and only one AC supply reduces the number of feeders in the main switchgear.

“Kraftelektronik focuses on three

■ The UMD and UPS system with VFD and AC-motors, UPS output and battery with charging rectifier. The VFDs, with AC-motors and UPS output, are normally fed from the AC-bus bar and at mains outage through the DC-bus bar.



Kraftelektronik AB Verkstadsgatan 18,
SE-352 46 Växjö Sweden
e-mail: info@kraftelektronik.se

business areas for the UMD, one being the turbine systems, gas and steam applications, where lubrication, cooling and ventilation are the most important areas. In some cases the UMD secures jacking oil, barring and offers black start functions. Beside turbine operation Kraftelektronik also supplies UMD and UPS systems for hot processes and hydroelectric power systems.”

One contract mentioned by Marcus Samuelsson was the supply of nine Siemens compressor stations in the Polish Yamal gas pipeline. The scope was complete UMD and UPS systems for each compressor plant for lubrication pumps with redundant 3 x 50% capacity and additional to this backup for ventilation and cooling of enclosure and compressor. In total for each turbine the UMD supplies eleven drives with backup at mains outage to ensure the high reliability and availability of the turbine and compressor system.

It is the Siemens SGT-600 (former GT10B) gas turbines that drive compressors in the Polish section of the Yamal gas pipeline linking the Yamal peninsula in Siberia with Western Europe. The gas-fired turbines are installed at three successive compressor stations along the gas pipeline. The first six turbines were installed last winter in Szamotuly and Ciechanow, while the remaining three machines for the Zambrow location were installed during the summer of 2005. The orders were placed by the Polish company ABB Zamech Gazpetro Sp. z o.o. with the end customer and operator being STG EuRoPol GAZ s.a. ABB Zamech Gazpetro already operates seven SGT-600 compressor plants in Poland. ■