Genset Technology

Recent developments

The new developments in liquid fuel-based power generation technology are geared towards high speed engines, prefabricated gensets, smooth transfer and switching, dual-fuel options, easy operations and maintenance, and lower emissions – products that can be integrated with others and have flexibility to be packaged to suit customer needs. Here are few products that have recently been launched by leading engine generator manufacturers across the world or are in the pipeline…

High speed diesel genset: A new 2-4 MW high speed diesel engine generator set has been developed for operation in the prime power, continuous or standby modes. It has significant improvements in six areas as compared with traditional gensets, claims the manufacturer. These areas are the fuel system, the cooling system, air management, the blue system, core engine components and the engine management system.

The fuel system has full control of fuel delivery as well as fuel pressure at any load or speed. It is more compact with simpler injection design and requires no pumping. It has an improved cold start capability where it uses higher pressures at low speeds and produces less smoke. The system is such that the high pressure line and rail provide out concentric low pressure containment, which drains back any leak in the high pressure section through the outer low pressure section. Since the fuel system design does not require excess fuel to cool the injector, the need for a fuel cooler is eliminated. The fuel filters also have an improved design. Fuel pumping has engine control module (ECM) controls.

The cooling system has been designed to minimize heat rejection by cooling only those parts that require cooling. Temperature sensing at the inlet and control of output, regulation of the inlet temperature of the coolant allowing easier troubleshooting, integrated water supply and return module, and two-stage after-cooler are some features of the cooling system. The system can be packaged either in horizontal or vertical mode. Radiators are sized for the generator ratings and optimized for low air-flow and small size.

The air management system provides for separation between the intake and exhaust ports and manifolds, a taller head accommodating larger ports for new improved port performance and new generation turbochargers providing a high pressure ratio in a single stage and increasing efficiency by 5 per cent. The lube and core engine systems have been designed to increase durability, provide stronger support, improve alignment and give better seizure resistance.

The manufacturers claim that these engine generators have lower maintenance costs due to increased oil exchange intervals; lower operating costs due to lower break-specific fuel consumption; and can integrate well with uninterrupted power supplies, automatic transfer switches, switchgear, remote monitoring and SCADA systems. The new generator sets are expected to be available by early 2007.

Compact portable power plant: this product has been developed to cater to the small and medium enterprise user segment with power demand of 1-3 MW. It is essentially an HFO-based medium speed engine with prefabricated auxiliary modules, all skid mounted for ease of installing and running.

The manufacturers claim that the new product has considerably lower life-cycle costs as compared with the conventional HFO-based engines, which provide fuel economy but have a high cost per MW of installation as compared with other liquid fuel-based plants. The design has been tested and genset production started in late 2004.

The compact prefabricated auxiliary-skid combines the fuel oil, lube oil, cooling and electrical systems on one skid right next to the engine and requires far fewer components than the traditional HFO plant design. It is intended for use in one-or two-engine low voltage applications or for 11 kV systems. The design requirements are a skid solution with the possibility of adding a sound canopy and the maximum skid size is one 20 foot container. It has no standby equipment. Noise requirements are to be handled by the building design. Black-start possibility is optional. There is no provision for heat recovery in the standard module. It has electric heating of fuel and a single-circuit cooling system.

The key design changes as compared with the conventional system are in the fuel oil system, lube oil system, cooling system, control system, and building and civil works. In the fuel system, the skid includes one HFO separator (from grid or another back-up fuel) per engine. The PLC in the control panel adjusts the engine load, thereby reducing the HFO day tank size.

No separate electrical heater is required in the day tank. Oil from the lube oil (LO) separator is used to heat fuel in the day tank before starting the engine and in standby mode. The final heating of HFO takes place in the combined heating and mixing tank, which has an electric heater. The close proximity of the engine to the day tank eliminates the need for a separate return fuel tank and return fuel pump.

In the lube oil system, the skid has an LO separator, a provision for filling and emptying as well as connection for a separate lube oil cooler. In the cooling system, cooling pipes from the engine pass through the skid to radiators or heat exchangers. Cooling water preheater and pressure boosting pumps can also be mounted on the skid.

A skid-mounted control panel makes a separate control room redundant. Apart from PLC controls for the HFO separator, fuel heating, engine speed control and engine monitoring, the control panel includes synchronizing equipment, generator protection, electrical measuring equipment, electrical starters for the skid-mounted equipment and the DC equipment. The control panel can be factory-tested before start-up.

Other significant developments: the other significant technology developments in recent times have been in automatic transfer switches, fuel sharing, digital controls and emission reduction.

Transfer switches in conventional gensets are normally hard transfer switches, which cause momentary power disruption when power is switched from the utility operate in parallel for about 5 seconds while power is gradually transferred from one to the other. This transfer also prevents severe voltage and frequency dips.

Other improvements in transfer switches are in terms of actuation and protection, programmed transition to prevent “hang-up”, easy operations and security.

The dual-fuel technology has allowed the use of gas along with diesel for more economic and cleaner engine generator operation. The latest development in the dual-fuel system is that of fuel sharing. It allows the engine to run on gas and liquid fuel in different proportion as against the fixed proportion system available earlier. In the fuel-sharing system, the operator can freely change the set point for fuel share and the control systems ensure that the actual operating point is within the specified range. The fuel-sharing option is available typically within 35-100 per cent of the rated load. If at any time, the engine load is too low fro reaching the selected set point, the control system ensures that the set point is automatically readjusted according to the minimum / maximum limit.

Developments in control systems have provided a shift from analog systems to digital controls. Analog systems have discrete components, perform rudimentary functions and have interconnected modules for operation. With the increasing complexity of modern generators, there may be more than 200 typical alarm conditions, which an analog system is unable to handle. A digital control system uses microprocessor-controlled functions, allows for operational adjustments through simple software changes and provides for integration of several analog functions so that one digital control can perform for several analog controls.

The selective catalytic reduction (SCR) technology is fairly established for nitrogen oxide reduction in diesel engines. It has been adapted to gensets also after considerable testing of optimized SCR systems for engine generators with different fuel options. In gensets with earlier SCR systems, poor fuel oil could lead to reduced availability of the SCR system due to rapid fouling of the catalyst. A new high-dust SCR method allows more reliable performance. The high-dust system differs from the traditional one in terms of structure and material of the catalyst and a more effective soot-blowing system to keep the catalyst layers dust free.

Note: the product profiles above have been taken from corporate papers published by leading manufacturers of diesel/liquid fuel gensets.

Reference Book:

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