

Application Guidance Notes: Technical Information from Cummins Generator Technologies

AGN 222 - Onshore Oil and Gas Applications

OVERVIEW

DRPM's (Drilling Rig Power Modules) are described as Generating Sets that are incorporated into onshore mobile drilling rigs. These mobile drilling rigs move from location to location, exploring for underground oil and gas deposits. The Generating Sets typically provide prime electrical power for both the drilling operations, as well as for camp, or hotel, loads for crew accommodation. In most scenarios, the Generating Sets usually incorporate gas burning engines, operating at low running speed, as the prime mover.

TECHNICAL SPECIFICATION

The application described above represents, for an AvK or STAMFORD alternator, one of the most challenging environments, electrically, mechanically and environmentally.

Product challenges

Electrical challenges

- **Hotel loads** – These electrical loads are quite typical of many Generating Set applications. They include lighting, heating and air-conditioning.
- **Drilling operations** – In the majority of cases, the electric motors that provide motive power for the actual drilling operation are dc motors. For these dc motors to accept ac power input, they will have an ac/dc convertor stage on their electrical inputs consisting of Silicon Controlled Rectifiers (SCR's). Typically, in order to get the appropriate dc voltage supply level for the motor, the input ac voltage will be 600Vac or above. As far as the Generating Set power supply is concerned, these represent very harmonically

“dirty” electrical loads, caused by the rapid transient voltage spikes inherent with SCR operation. The combination of high electrical load generated waveform harmonic distortion, superimposed onto a nominal voltage of 600V or above, provides very severe challenges to the alternator’s electrical insulation system.

Mechanical challenges

- **Vibration during operation** – Very often the prime movers are gas engines (usually 1000rpm or 1200rpm) and the quality of the fuel being supplied to these engines is usually not of the highest standard. The consequence of this is that the Generating Set can be exposed to excessive vibration, as a result of the engine misfiring.
- **Vibration during transportation and installation** – When moving around different locations, these DRPM’s will travel across rough terrain. In addition, during installation on site, there are often not the proper lifting facilities available. Consequently, the Generating Sets can be roughly handled during maneuvering into place. In both cases, the alternator needs to be very robust to protect it against harmful damage.

Environmental challenges

- **Air quality** – as the search for oil and gas continues, these drilling rigs and consequently, the DRPM’s, are asked to operate in increasingly severe environments. Typically, the local environment could be very dusty, or at other locations, there could be high levels of moisture, due to inclement weather conditions (snow and rain) and again in other areas there may be high humidity levels. The Generating Set needs to be suitably able to cope with all of these conditions.
- **Ambient temperature** – From the frozen regions of Alaska, or Siberia, to the deserts of the Middle East, to the tropical climates of Central and South America, the alternator needs to accommodate a wide range of operating temperatures.

Specification “watch outs”

Often the customer does not advise, in the Request For Quotation [RFQ], the nature of the application - that the application is actually, “onshore oil and gas”. However, there are a number of easily identifiable characteristics, often appearing in customer specifications, to give us a clue as to the application. These, at least, prompt Application Engineering to ask for more clarity, to enable the determination of an appropriately designed and correctly sized alternator.

The following list contains the most common technical detail that appears in a typical specification for an onshore oil and gas application:

- 600V or 690V output
- Most commonly 50Hz, but sometimes 60Hz frequency.
- 1000rpm or 1200rpm.
- 0.7 p.f. (lagging) operating Power Factor.

ALTERNATOR NOMINATION

Given all of the challenges posed above, there are certain criteria that should be followed during the nomination process in order to provide the customer with a product that will give acceptable durability and life expectancy. Application Engineering will apply the following criteria:

- **Electrical challenges** – A Form (Bar) wound stator winding, incorporating additional coil insulation taping. This offers superior protection against the combination of the high waveform harmonics levels coupled with the 600V or above, nominal voltage.
- **Mechanical challenges** – A sturdy, 2-Bearing alternator design will provide substantial durability.
- **Environmental challenges** – Ideally, an alternator with IP54 enclosure protection would be the most suitable option. However, this will make any nominated alternator expensive, due to the cost of cooler units and associated equipment. Therefore, an alternator with IP44 enclosure protection may be deemed adequate, or even an IP23 alternator with appropriate filtering, will offer a satisfactory compromise.

The most appropriate products within the AvK and STAMFORD ranges, which are best suited to meet the challenges above, would be the AvK DSG range. Versions of the DSG 86 and DSG 99 products have been developed specifically to meet the criteria shown above.

These AvK DSG alternators include:

- Form wound stator winding, incorporating additional coil insulation taping. Designed to minimize the harmful effects of high load harmonic levels of distortion on the stator winding.
- A robust frame design to provide appropriate levels of mechanical strength. A 2-Bearing alternator with re-greasable anti-friction bearings.
- IP23 enclosure protection with filtered air intake, designed to capture both dust and moisture from the air entering the alternator.
- A low profile alternator, with side mounted terminal box, offering unrestricted airflow to the engine, above the Generating Set.

It would always be the recommendation of Applications Engineering to nominate these alternators for onshore oil and gas applications of this nature.

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