

Application Guidance Notes: Technical Information from Cummins Generator Technologies

## AGN 020 – Combined Heat and Power (CHP) Applications

### **OBJECTIVES**

Combined Heat and Power (CHP) applications have two main objectives:

- 1) To offer the best possible efficiency for turning the available engine power [kWm] into electrical power [kWe].
- 2) To operate the Generating Set at temperatures and conditions, which will offer the best realistic life expectancy against commercial considerations.

### **RATINGS**

Achieving both objectives is effectively done by offering an alternator rated at its Class 'F' temperature rise rating. Typically, a Class 'F' rating is at some 91% of the Class 'H' industrial rating.

By operating at this Class 'F' level, the alternator's operating efficiency is as near the optimum as the commercial considerations will allow. By operating the insulation system within a Class 'F' temperature rise, the life expectancy of the insulation system is increased by some SIX times.

The life expectancy of insulation systems is based on the American U.L. [Underwriters Laboratories] classification for the materials and process used for the total insulation system, for each wound component, within the electrical machine.

In fact the U.L. 'rating' for an insulation system is based on calculated 'half-life' expectancy. This 'half life' is the electric strength of the insulation system after it has been subjected to a *time period* at the *stated maximum operating temperature* and therefore, aged and this has

resulted in the electric strength being reduced to half of what it was when the insulation system materials were new.

Low Voltage (LV) alternators manufactured by Cummins Generator Technologies are all wound and impregnated with Class 'H' insulation materials.

If operated at full Class 'H' temperatures, half life expectancy is stated as 20,000 hours.  
If operated at full Class 'F' temperatures, half life expectancy is stated as 120,000 hours.  
If operated at full Class 'B' temperatures, half life expectancy is stated as 640,000 hours.

It has to be said that it not just the operating temperature that will cause an electrical insulation system to fail and a burnout to occur. A multitude of factors affect the real life expectancy of wound components, from contamination of the insulation by dirty air being pulled through the alternator, to the prevailing ambient conditions with respect to such factors as humidity, vibration and care during the stationary standby situation.

When operating, the risks are related to the nature of the load equipment being supported and the possibility of voltage spikes being created, which could rupture the insulation system.

In fact, it is worth remembering that half life expectancy is in fact only half the complete story.