

How to choose an Alternator and PMU for a variable speed system

In general, there are three parts to an alternator system or a starter-alternator system. There is the alternator, there are regulation electronics, and there is mounting hardware.

The alternator is chosen either for a power @ RPM point, the wattage required to crank an engine (if to be used as a starter-alternator) or for physical fit to the engine or driving mechanism. The faster an alternator turns, the more power it can make. Put another way, the faster it spins the smaller it can be for a given wattage. Most alternator data sheets show an output wattage vs. RPM curve.

If the alternator is to mount to the front of an engine, the prop bolts must pass through the alternator hub. Thus the alternator hub must be large enough for the bolt pattern. If the engine is equipped with a rear shaft, a smaller alternator hub may fit on the shaft. This can allow a wider range of alternator sizes.

It is possible to drive the alternator with a coupling or belt. In this case the alternator is chosen for power vs. RPM. This requires an alternator style that includes a shaft and dual ball bearings.

For production programs it often makes sense to optimize the alternator for size, weight and cost.

These alternators produce three phase AC voltage that varies with RPM and load. Most programs need a DC voltage output. The regulator (PMU) uses rectification and switching regulation to supply one or more DC voltages from the variable input.

The PMU is chosen for the required output voltages, the wattage needed at each voltage, the features required (such as back up battery management, starting capability or data output) and any special requirements such as sealing, multiple inputs or an unusual input range.

In a hybrid or generator (APU) system, the engine runs at a nominal (constant) RPM. The PMU controls engine speed to maintain voltage as the load varies. Constant speed PMUs are usually smaller and less expensive for a given wattage.

Regulators for wind or water power are different from engine types.

In the case of a starter-alternator, the PMU contains a module for running the alternator as a motor for cranking and a module for interface. The alternator must be large enough for the engine's required cranking wattage.

The mounting hardware depends on the alternator frame size and whatever fixed support it is to mount to. If it is to mount to an engine, this usually involves machined brackets designed for its crankcase. Advanced programs add mounting bosses to the engine for stator mounting, eliminating the bracket and eliminating the centering bearing.