

WINPOWER ALTERNATOR/GENERATOR BASICS

There are many ways to build Alternating Current (AC) generators. Winpower is one of the few manufacturers of generators and generator sets that build nearly all of the possible types. Each type is selected for certain benefits and features. Several factors are considered when making that selection: Performance, power, weight, size, durability, motor starting ability, user preference, application, environment, and of course cost. The most common generator types are listed below. All the types with an asterisk (*) at the left margin are manufactured for use on Winpower or Winpower supplied private label products.

Generator Types

RFL(P) - Rotating Field BrushLess -Permanent Magnet type

- * RAB - Rotating Armature Brush-type
- * RFB - Rotating Field Brush-type
- * RFL(C) - Rotating Field BrushLess -Capacitor Excitation
- * RFL(I) - Rotating Field BrushLess Exciter - Int. Regulation
- * RFL(X) - Rotating Field BrushLess Exciter - EXt. Regulation

* - Winpower Manufactured types

All generators, AC and DC, operate due to very basic physics principles - A Conductor Moving in close proximity to a Magnet will induce voltage in the conductor. The reverse is also true: A Magnet Moving in close proximity to a Conductor will also induce voltage in the conductor.

When the conductor (armature) is moving, the generator type is generally referred to as a Rotating Armature generator. Since the conductor is rotating, slip rings and Brushes are needed to collect the power output from the conductor for the receptacles. Winpower classifies this type of generator **RAB** for Rotating Armature, Brush type. **RAB** is a rugged design with very high residual voltage for reliable voltage build-up every time. The heavy shell will absorb normal construction environment abuse. **RAB** units are simple and easy to trouble shoot and repair.

When the magnet is moving, the generator type is generally referred to as a Rotating Field (magnet) generator. Since the conductor is stationary, No Brushes or slip rings are needed to collect the power output from the conductor for the receptacles. If the field (rotor) is a permanent magnet, no brushes are needed for the generator set (RFL-P). If the rotor is wound, Brushes will still be required to power the field with Direct Current (DC). Since the DC field current is much lower amperage than the AC output current, the brushes can be smaller. The DC field only requires two slip rings (+ and -), at lower DC voltages, so the brush rigging is simpler. Winpower classifies this type of generator **RFB** for Rotating Field, Brush type.

Rotating Field type generators have a significant advantage when the output current or voltage is high, three

phase, complex or the output needs to be re-connectable. When the current and voltage levels increase, the brush rigging on a RAB design becomes too large or even impractical. A 10 amp, 120 Volt AC generator output is not difficult to handle with a Rotating Armature Brush type unit, but a 100 amp, three phase, 480 volt AC brush rigging becomes much larger and more difficult to insure reliable operation, especially for prime power applications.

Units requiring higher power and voltage are built as RFL(I) or RFL(E) type generators. These two brushless generator designs are very similar. Both use a separate brushless exciter and identical rotating rectifier assemblies. They differ primarily in their excitation methods. The RFL(I) type generator has a single bridge rectifier to power the exciter field (stator). The RFL(X) type generator uses an AVR (Automatic Voltage Regulator) to power the exciter field and maintain very close output voltage regulation.

Both types of units, RFL(I) and RFL(X), are made up of a RFB type main generator and a RAB type exciter generator. Instead of the slip rings and brushes on the rotor connections, a rotating rectifier assembly is electrically installed between the two generators.

The main generator portion of the RFL(I) and RFL(X) units operate like a the RFB type units, where the main rotating field (magnet) is revolving inside the main stator. The DC power for the rotating field winding is supplied by the exciter assembly.

The exciter assembly consists of a three phase RAB type exciter generator and a rotating rectifier generator assembly. The rotating rectifier assembly takes the three phase AC output from the exciter Rotating Armature of the RFB type exciter, rectifies it to DC and passes it on to the main Rotating Field winding.

The exciter field (magnet) is powered by DC voltage. The DC is made by taking a little AC voltage from the main stator output. The AC output is connected to either a rectifier on the RFL(I) type units or an AVR on the RFL(X) type units.

Since the stator (conductor) is stationary, No Brushes or slip rings are needed to collect the power output from the conductor for the receptacles.

Basic Alternator/Generator Theory

Generator Basics

Three elements

Conductor

- Produces AC Output (Armature -RAB) or (Stator -RF_⊥)

Magnet [Electromagnet]

- DC Input Field (Stator -RAB) or (Rotor -RF_⊥)

Motion

- Rotation (Engine, Pulley, Propeller, Wheel, Etc.)
- Proximity, speed, power (engine)
- 60 Hz -> 3600 RPM (2 Pole) or 1800 RPM (4 Pole)
(50 Hz -> 3000 RPM or 1500 RPM)

<u>Design Type</u>	<u>Conductor (Arm)</u>	<u>Magnet (Field)</u>	<u>Comments</u>
RFL(P)	Stator	Permanent Magnet Rotor	No brushes
RAB	Rotor	Stator	AC Brushes
RFB	Stator	Rotor	DC Brushes
RFL(C)	Stator	Rotor	No Brushes Cap Excit.
RFL(I) Main Gen Exciter	Stator Rotor	Rotor Stator	Int. Rect. Exct. + Rot. Rectifiers
RFL(X) Main Gen Exciter	Stator Rotor	Rotor Stator	AVR + Ext. Exct. + Rot. Rectifiers