LEROY – SOMER EXCITATION SYSTEM

REGULATORS AND EXCITATION SYSTEMS ARE AT THE HEART OF INDUSTRIAL ALTERNATORS PERFORMANCE AND RELIABILITY.

TEKSAN's UL2200 listed generators are coupled with a well-known topmost quality Leroy-Somer alternator ends. Leroy-Somer design, test and qualify its electronic products to meet the challenges of power generation systems. Using its experience and field expertise, Leroy-Somer provide regulation features that help protect installations from outage and failures, and the excitation systems are optimized to provide the best performance levels for any situation.

Excitation System is a vital component of Alternators. It provides necessary excitation current to the rotor winding. Without the excitation system, alternator shall have no way of building its voltage as it starts to rotate. Also, while alternator is running at rated speed it would not be able to regulate its voltage to the preset nominal level.

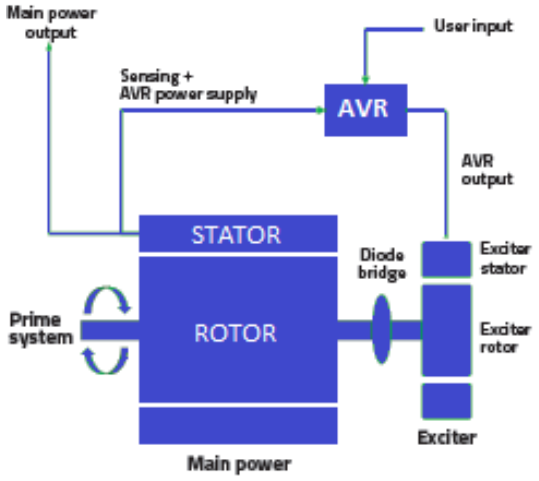
Components of Excitation System:

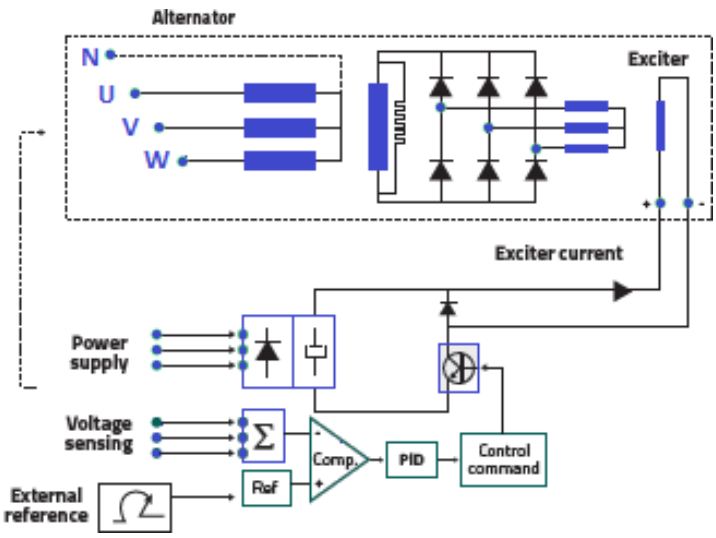
A typical Excitation System consists of following components:

1. Automatic Voltage Regulator
2. Exciter Field (Exciter Stator)
3. Exciter Armature (Exciter Rotor)
4. AREP or PMG (if not shunt system)

To build excitation current, a regulator needs both a supply voltage to provide power, and a measured reference voltage at output terminals to pilot the excitation.

The supply voltage to AVR can be provided through Shunt System, AREP or PMG.





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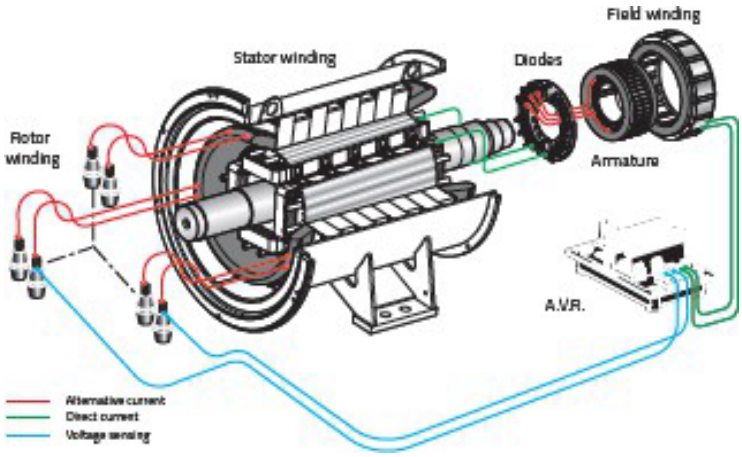
SHUNT

In SHUNT excitation systems, the AVR power supply and voltage reference are picked on the same output terminals. The AVR generates and regulates the excitation current as a function of the alternator output voltage.

The SHUNT system is extremely simple in its design and is ideal for standard applications. AREP or PMG systems are more relevant for demanding situations where short circuit currents are anticipated (for example for motor start-up).

The SHUNT excitation system can also be completed by a booster system for larger installations to allow for short circuit capability. In this situation, current transformers are added in the terminal box to increase supply voltage range. This solution is not always possible and adds an extra cost due to the transformers purchase & installation.

COMPACT ECONOMIC



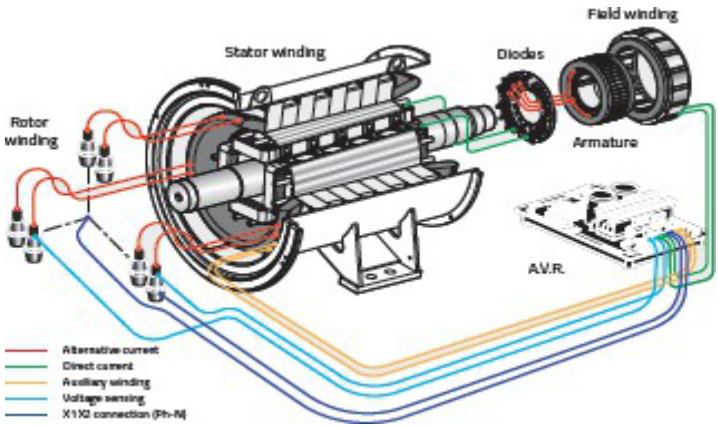
AREP+

The new AREP+ system by Leroy-Somer uses the output voltage of the main stator as supply voltage and a single auxiliary winding inserted in selected slots of the main stator for booster effect. The combination of these two sources is then used to power the regulator, thus combining the power of a traditional SHUNT system with the reliability and control level of an AREP system. Under the same conditions, more power is taken to supply the regulator, which improves the excitation capabilities.

The AREP+ system improves the electrical performance of equipped machines, especially during transient short circuit, load shedding or load impact phases.

As a result, the starting kVA performances are improved by up to 30% depending on generator model (vs a standard AREP system). This level of performance is decisive when generators are used to start electric motors. The AREP+ system gives the alternator a high short circuit capability for LSA range: 300% - 10 s.

TRANSIENT COMPACT SHORT CIRCUIT



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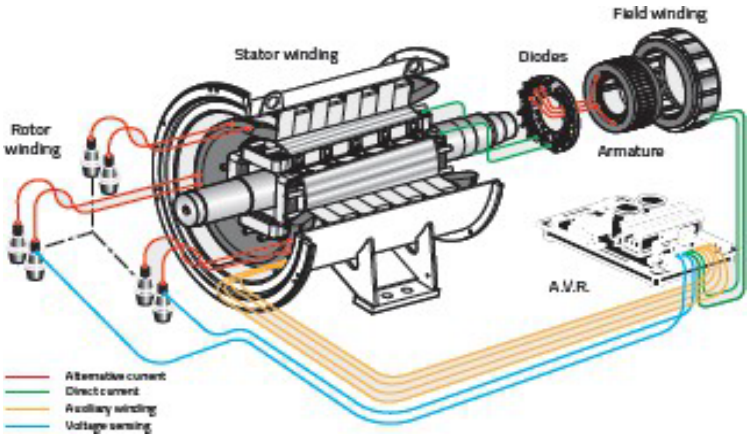
AREP

In AREP excitation systems, the AVR power supply comes from two separate auxiliary windings. The voltage delivered by the first auxiliary winding H1 is proportional to the alternator output voltage (SHUNT characteristic).

The voltage delivered by the second auxiliary winding H3 is proportional to the current drawn by the alternator and is a function of the applied load (booster effect).

The power supply to the AVR power circuit is independent from the voltage sensing measured on the alternator output terminals.

Therefore, the excitation current delivered by the AVR to the alternator exciter is not affected by any voltage distortions (harmonics) due to the load. The AREP system gives the alternator a high short circuit capability for LSA range: 300% - 10 s.

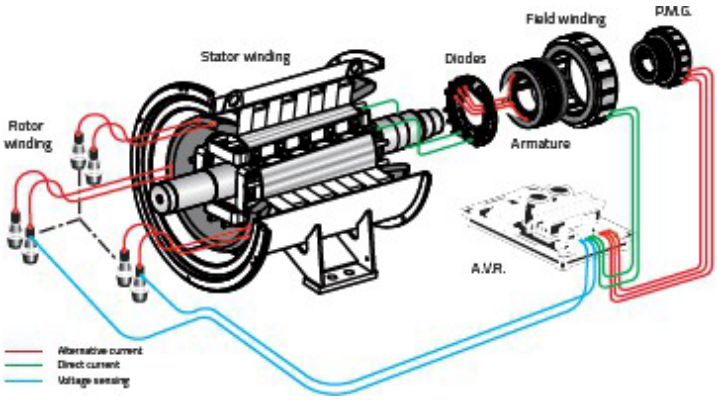


PMG

In PMG excitation systems, the AVR power supply voltage is generated by a permanent magnet generator (PMG) that is mounted on the shaft extension at the non-drive end of the alternator. The PMG delivers a constant voltage, regardless of the main alternator winding. PMG systems have high overload and short circuit (for LSA range: 300% - 10 s) capacities.

The permanent magnets used in the PMG ensure enough remanent magnetism and secure the system startup, even after long shut-down periods. Because it is external to the alternator system, a PMG can be installed on an existing machine (SHUNT or AREP) when required.

As an alternative to PMG, the SHUNT, AREP or AREP+ systems can be completed with permanent magnets inserts (PMI). In this case, permanent magnets are mounted on the exciter stator poles.



EXCITATION SYSTEMS COMPARISON

Both PMG and AREP (AUX Winding) excitation support systems provide power to the AVR independent of the generator output voltage. This allows both systems to continue to provide the excitation necessary to clear the fault.

While both AREP and PMG provide the same performance and characteristics, following factors may be important for the application of Alternator.

EXCITATION SYSTEM COMPARISON	SHUNT	AREP+	AREP	PMG
Transient Performances		~	~	~
Short Circuit Performances		ϟ	ϟ	ϟ
Non-linear Loads		•	•	•
Voltage Built-up	Residual	Residual	Residual	Perm.Magnets
Footprint	Small	Small	Small	Important
Conversion	To PMG	To PMG	To PMG	To Shunt / AREP
Cost	$	$$	$$	$$

EXCITATION SYSTEMS SHORT CIRCUIT PERFORMANCES COMPARISON

The graph below illustrates the compared performance of SHUNT, AREP, AREP+ and PMG excitation systems in short circuit current situations.