

THE W-SERIES GENERATORS GIVE YOU REAL WORLD 300% CAPABILITY.

Auxiliary winding for AVR.

The new W-Series generators are a major step forward in our constant quest to give you the best generator set on the market.

W-Series generators feature an auxiliary rotor winding that supplies separate and stable power to the Automatic Voltage Regulator (AVR). The results are impressive:

- Classification society compliance.
- Real 300% short circuit capability
- Improved AC circuit breaker performance.
- No increase in size.

Basic generator set operation

It's important to understand how most generator sets make power to fully appreciate the advantages of the new W-Series sets.

An engine turns the AC generator's rotor inside of a stationary stator at a given RPM. The rotating magnetic fields between the rotor and stator produce AC electricity. Some of this electricity is used to power the set's automatic voltage regulator (AVR). The regulator senses load changes as you turn electrical appliances on and off. It then sends DC electrical power to the generator's exciter windings. The exciter increases or decreases the field of the main rotor to make the power needed by the load.

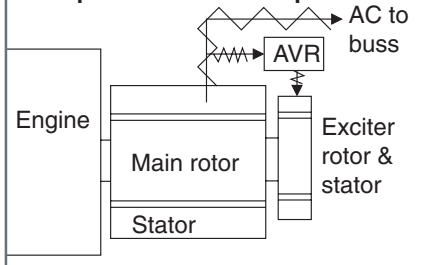
Clean power requirements.

The AVR needs stable power from the main rotor to do its job well.

Some components, such as battery chargers, variable frequency drives and other nonlinear loads can actually corrupt the generator's output waveform.

Starting large electric motors can also cause problems. When turned off, a motor is in a dead rotor condition. The current needed to overcome the inertia of the dead rotor and start the motor is called "inrush". Inrush can often be many times the power needed to run

Ordinary generator AVR powered by corruptable main AC output.



the motor after it is started. This is why some generator sets slow and the lights dim when a motor is turned on. This is called voltage dip.

An AVR being powered by corrupted power or voltage that "dips, surges and sags" can become part of a cascade of problems. Weakened by a bad power supply the AVR doesn't react well to new load demands. It's

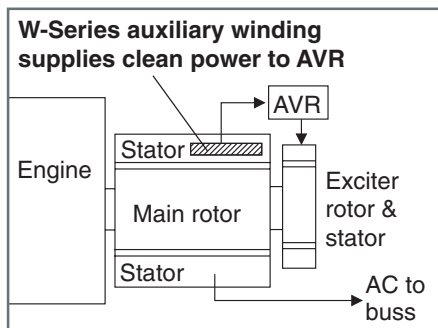
power to the exciter degrades. Less excitation means less power from the main output further degrading the power supply to the AVR...a cascade or loop effect is created.

A main line short circuit is the ultimate power supply problem for the AVR. The power drawn by the short leaves no electricity to power the AVR so it stops powering the exciter windings. In milliseconds the magnetic field between the stator and rotor collapses. No electricity is being made. You are now standing in the dark while the generator set is still running and the mainline circuit breaker has not tripped.

Why didn't the circuit breaker trip?

If you have a mild short circuit, the breaker may have time to respond and it may trip. However, when a dead short occurs, the field collapses so fast that there isn't time for the circuit breaker to respond. That is why the circuit breaker on your generator set has probably never tripped.

Why do some generator manufacturers put circuit breakers on their sets? Because industry councils recommend they do it. The manufacturer follows the guidelines even though they know it is of little practical use.



W Series sends clean power to the AVR

To solve these problems the W-Series generators have a special auxiliary winding to power the AVR. The winding is completely separate from the main stator windings and is not affected by load changes and power corruption. It's only job is to provide stable power to the AVR. This greatly enhances its ability to regulate the main output power. The AVR is always ready to respond to the large load increase needed to start motors. Even under a direct short circuit condition the AVR will continue to provide excitation support until the circuit breaker trips breaking the connection. This is true, real world 300% capability.

No size increase.

W-Series generators are the same compact size as the K-Series they replace. Boatbuilders will not need to modify their engine rooms to accommodate the new sets.

Classification Requirements

Marine classification societies set standards for equipment used on vessels. Only the largest vessels are built to "Class", having been built, inspected and approved to have met the classification standards. Many owners of vessels do not need this level of quality assurance. They do, however, want the best equipment, so they specify generator sets that have a society Type Approval. This increases the value of their vessel and their peace of mind. Northern Lights generator sets from 4.5 to 33 kW have proudly held a Lloyds' Type Approval since 1999.

"8.4.5 Generators and their voltage regulation systems are to be capable of maintaining, without damage, under steady state short circuit conditions a current of at least three times the full load rated current for a duration of at least two seconds..."

Lloyd's Register of Shipping

Rules and regulations for the classification of special service craft, July 2002

300% short circuit capability

Marine classification societies including Lloyds, ABS, DNV, BV, and the USCG require that the generator on a boat built to "class" have 300% short circuit capability. This means the generator end can withstand a short circuit that increases its amperage output three times its rated capacity for a specified period of seconds without the magnetic field collapsing and without sustaining damage.

Want true 300% capability?

In the past you had to specify a permanent magnet generator (PMG) or a current boost system. These work well on larger sets. Large Northern Lights sets have PMGs as standard or optional equipment. Now, the W-Series offers true 300% short circuit capability to owners of sets from 8 to 33 kW. These sets will meet the requirements for owners who are building "Class" vessels.

Don't be confused by "capability" claims.

If a generator manufacturer claims 300% short circuit "capability" ask what that means. Will their set actually produce 300% of rated current until the breaker responds? Or is it a theoretical "capability" meaning that the generator would not be damaged if it produced 300%, which it can't, because the magnetic field collapses first. This is akin to saying; "Yes, our car would pass a crash test, if we could get it to run long enough to hit the wall"

Northern Lights W-Series

The best just keeps getting better. See your Northern Lights dealer. They have the new W-Series set that is right for your vessel.

Dealer

4420 14th Ave. NW., Seattle WA 98107
Tel: (206) 789-3880 • 1-800-762-0165 • Fax: (206) 782-5455

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www.northern-lights.com

The new Northern Lights W-Series generators

First the K, Now the W.

In 1998 we introduced the K-Series which increased generator performance without increasing size. Six years of duty have shown the K generators to be nearly bullet proof. The new W-Series is based on this proven design and is the next step in the ongoing development of superior generator ends from Northern Lights.

W-Series will be phased into production on all marine and industrial Northern Lights, 60 and 50 Hz sets, 8 to 33 kW.

Auxiliary Winding To Power The AVR.

An auxiliary stator winding makes dedicated power for the new DST-100-2FAK automatic voltage regulator. This gives you several advantages.

- Classification society compliance.
- Real 300% short circuit capability
- Improved AC breaker performance.

See the back of this page for a detailed explanation of this feature.

Automatic Voltage Regulator = 1% RMS.

The solid state AVR produces clean $\pm 1\%$ RMS voltage regulation from no load to full load. This protects electronics and extends motor life. Compare this to $\pm 1.5\%$ or $\pm 5\%$ of competitive generators.

The AVR also allows the generator to produce 50 or 60 hertz power at 100 or 200 class voltage. Boatbuilders: you use one set for domestic and foreign markets.

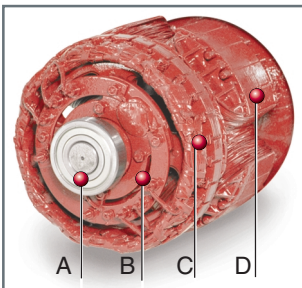
High Copper Content.

One thing we didn't change was the amount of copper in the generator. High copper content gives higher performance.

- Better generator efficiency.
- More motor starting capability.
- Longer life. The PX-300Ws have a conservative 95°C temperature rise rating at 50°C ambient air. Compare this to the 105/40 or even 125/50 ratings used by some manufacturers.

Hot Dripped Rotor.

The rotor is made up of a shaft, large sealed bearing (A), an easily accessible



rotating rectifier (B), a large diameter exciter rotor (C) and main rotor (D). The rotor assembly is slowly hot dripped with high quality, Class "H" epoxy insulation for protection against the marine environment.

The Skewed Stator.

The stator is hand wound by experienced craftsmen. The winder's eyes are a constant quality control check. The skewed design (angled grooves) makes electricity with a clean, symmetrical wave form that electrical equipment needs.



The stator is encased in a strong, rolled steel generator frame which has machined ends to mate with the cast iron bearing housing and SAE housing adapter.

Bearing Housing & Exciter Stator.

The bearing housing is cast iron, not aluminum. Iron is stronger, resists electrolysis and has a thermal expansion rate that more closely matches the bearing on the rotor. This helps to prevent "spun bearing" failures that plague aluminum housings.



We bolt the exciter stator in the removable bearing housing for easy access. Some generators have the exciter welded to the frame making it unreplaceable.



1 Phase Standard – 3 Optional.

Standard PX-300W generators are 1 phase, 4 wire. If you need 3 phase power, order your set with an optional 12 wire generator end.

The Leader Uses Leads.

Some manufacturers use the solid copper magnet wire to connect the set to the load. "Leadless" design is cheaper but prone to failure from vibration. We use multi-strand wire leads with high temperature insulation. These leads go to a terminal strip in the junction box for easy connection to your AC electrical system.

Paralleling the big boys.

The M844LW2, M864W and M984W models have 2/3 winding pitch so they can be easily paralleled with the larger Northern Lights sets. This makes them part of your total power solution.

A look inside the PX-300W generators from 8 to 33 kW.

1. Cast iron bearing housing.
2. Junction box with vibration isolation mounts.
3. 2 amp AVR AC circuit breaker.
4. Circuit breaker for engine's DC system.
5. Cast iron SAE housing.
6. Large diameter exciter rotor.
7. Large diameter main rotor.

8. Cooling fan.
 9. SAE, cast iron drive ring.
 10. Hand wound skewed stator with auxiliary AVR power winding.
 11. Rolled steel generator frame.
 12. Exciter stator bolts into bearing housing.
 13. Bearing carrier.
 14. Mounting foot.
- Mounted in junction box (No 2) and not shown:
Multi-strand generator leads.
Engine DC system relays.
AVR junction block.
DST-100-2-FAK automatic voltage regulator.

