



TECHNICAL PERSPECTIVE

Designing Generator Systems for Reliability and Long Life

INTRODUCTION

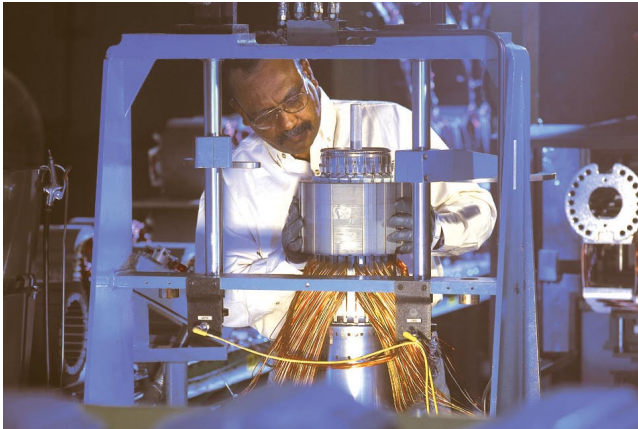
In the world of standby power generation, the truest test of generator design is time. Through years of service, generator sets endure a host of trials including the elements. Because of their relatively low number of run hours, standby gensets typically don't wear out, but they can rust out. That's why attention to environmental concerns and proper design engineering are essential to ensure that backup systems provide decades of reliable service when properly maintained.

Generac Power Systems has set the standard for longevity. We are the specialists of both gaseous and diesel standby generators. Generac remains at the forefront in the industry for a reason. We combine the highest protective features with the most durable materials. We make certain that our individual components and our integrated systems withstand a rigorous and comprehensive testing process. We build quality, durability and reliability into all our products.

KEY POINTS

- Reliability Through Design
- Proven Examples of Durability and Long Life





Reliability Through Design

At Generac, product reliability is always a high priority. We stay focused on reliability throughout the design, engineering, testing and manufacturing process.

All Generac products must pass rigorous laboratory performance, reliability and endurance tests before being released to production. Existing equipment is also evaluated on a continuing basis. We also look at engineering design reviews, end user feedback, dealer suggestions and warranty information to focus on quality improvement and refinement of the products.

After installation, Generac stands behind its dealers to provide you with 100% of your parts and service requirements. To maximize the reliability and longevity of your Generac equipment, a regularly scheduled maintenance program is important. Consult with your dealer for a maintenance contract that will help keep your unit operating reliably every year.

Engine Selection:

- Top quality prime movers – Unlike many other manufacturers who are limited to a particular line of engines (their own), Generac evaluates and selects top quality, prime movers from an array of world class

manufacturers. These reliable, proven designs are well suited for power generation. Through advanced engineering and the use of Generac-designed components, we optimize performance with an emphasis on durability and long life. Each engine is tested, up to 1000 hours, at its standby rating to ensure performance capabilities.

Engine Cooling System:

- Closed cooling system – To prevent corrosion, cooling systems feature pressure caps with expansion tanks to keep air from entering the system.
- Low coolant shutdown – To guard against the effect of a slow leak, sensors shut down the generator if coolant levels drop below safe margins.
- High coolant temperature shutdown – To prevent overheating of the system, high coolant temperatures will cause the generator to shut down.
- UV resistant hoses – Coolant and oil hoses are made of compounds that resist the degrading effects of ultraviolet light.
- Top quality block heaters – Low watt density electrical block heaters are designed for increased starting reliability and extended life.

Engine – Electrical Interface:

- Corrosion protected terminals – All exposed electrical terminals on the engine are coated for corrosion protection and enclosed within a boot for mechanical protection.
- Dual wire sensors – All engine sensors have been changed from industry standard single wire to dual wire types. This reduces circuit failure due to unreliable ground return circuits.

Wiring:

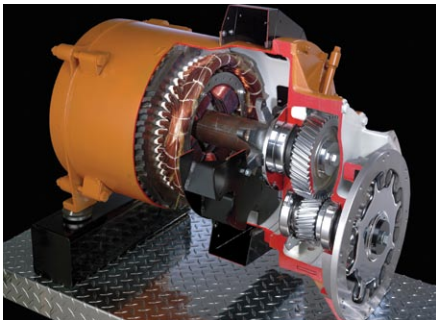
- Fully enclosed wiring system – All wiring is enclosed in flexible plastic conduit to prevent damage to harnesses and connectors.
- Waterproof and airtight connectors – Generac has led the industry in establishing an even higher reliability standard through its standardization of automotive / aircraft type waterproof and airtight electrical cable connectors.

Battery Charger:

- Heavy-duty 12 volt DC battery charging alternators – Generators up to 150 kilowatts of output use brushless 12 volt Generac designed DC battery charging alternators with heavy-duty, oversized bearings.

Gearbox:

- Solid design rationale – The gear drive allows an engine to operate within its optimal speed range and peak power band vs. running at just 1800 revolutions per minute (the required speed to produce electricity at 60 hertz with a 4-pole alternator). This enhances durability and extends engine life because the engine is working under less stress with reduced pressure on its critical components.



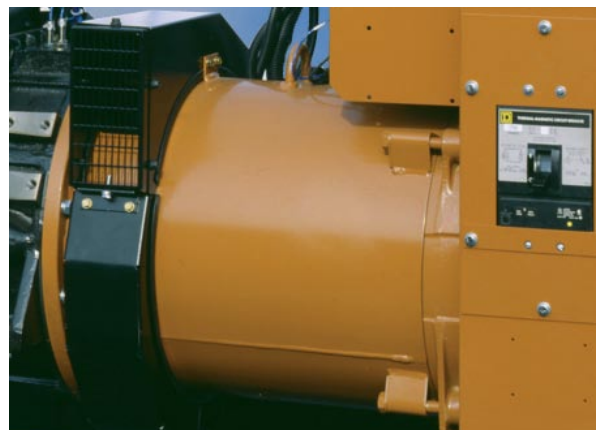
- Durable components – Generac's gearboxes and elastomeric couplings are well proven designs. With thousands of gear driven gensets produced over the past 15 years, this system has demonstrated outstanding durability.

Electronic Control System:

- Coated circuit boards – All printed circuit control boards are conformal-coated or encapsulated to prevent environmental corrosion and mechanical damage.
- Surge protection – Built-in surge suppressors enhance protection from voltage spikes. This increases the reliability of the generator and its controls.
- Magnetic shielding – All units are EMI (electrical magnetic interference) tested and equipped with magnetic shielding to protect the control system from magnetic interference.
- Fuse protection – Control systems have board and system level fuse protection.
- Environmentally sealed – All industrial control printed circuit boards are environmentally sealed in an aluminum case.

Alternator:

- High temperature alternator wiring – All alternators are built with high temperature 190°C NEMA Class H wire and insulation. Maximum operating temperatures do not exceed lower Class F levels per UL2200. This provides an extra margin of thermal capability for standby applications with single phase and non-linear loads.



Enclosure:

- Rhino-Coat™ powder painted surfaces – Our textured, powder coat paint process provides consistent coverage and better bonding to seams and exposed edges for maximum resistance to environmental degradation. All sheet metal is cleaned, rinsed and treated with an iron phosphate to provide superior paint adhesion. TGIC powder paint is electrostatically applied and baked at 375°F to chemically adhere the powder coat finish to the metal.
- Corrosion resistant design – Door hinges, latches and striker plates are made of stainless steel. Corrosion resistant JS500 plated steel fasteners are utilized throughout the enclosure.



- Structural integrity – Integrated stiffeners on the interior walls provide overall compartment strength and rigidity. Sheet metal thickness is 14 gauge for Series 2000 enclosures and 12 gauge for large gensets.

UL2200 Listing:

- Designed and built to high standards – Generac was the first to introduce its complete product line in conformance with UL2200 safety standards. We continue to manufacture our products to these exacting requirements.
- Self-certification – Because of the many tests and requirements needed for UL Listing, Generac invested in its own research and development facilities to self-certify its equipment for UL compliance. For this procedure, we follow stringent UL guidelines in testing our products to UL's uncompromising standards. All such work is subject to UL's oversight and audit procedures however, it speeds up the Listing process.

Proven Examples of Durability and Long Life

In demanding real-world applications, Generac standby generators have compiled an enviable record of durability and long life. To see examples of well-proven Generac equipment, visit the case study library on the Industrial side of the Generac Power Systems Web site (www.generac.com). In particular, see the two case studies entitled "Little Engine, Big Hours" and "Twenty Years On The Job – And Still Going Strong".

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Bulletin 0167860SBY / Printed in USA 06.03, rev. 05.06
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