Ask the Expert:

Maintaining a Healthy Diesel Generator Engine at Your Facility

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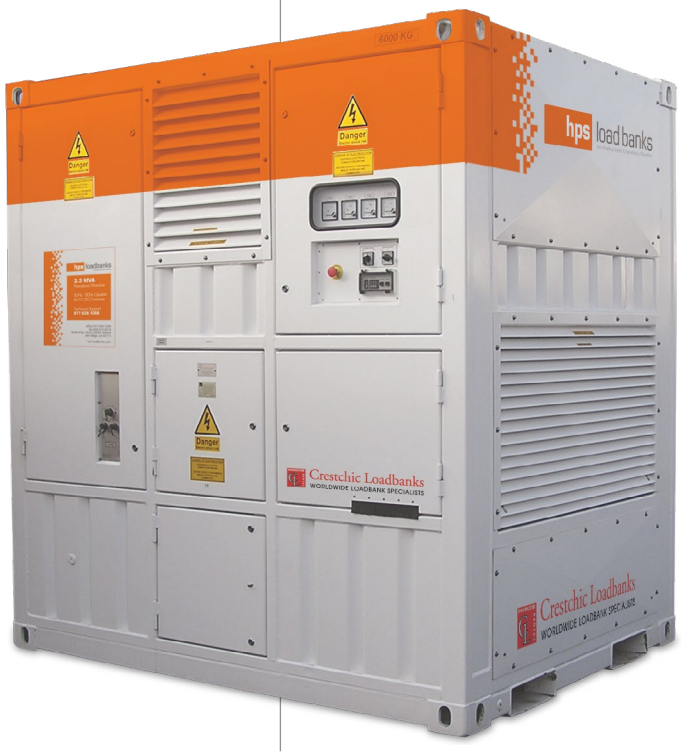
All diesel powered generators when exercised should be loaded to at least 60 - 70% of their standby nameplate rating at least once a month in order to be a reliable sources of power. Exercising generators at less than 50% will ultimately result in “wet stacking” or “slobbering”. In order for a diesel engine to operate at peak efficiency it must be able to provide fuel and air in the proper ratio and at a high enough engine temperature for the engine to completely burn all of the fuel.

> NFPA 110, Emergency and Standby Power Systems makes specific reference to this issue in the Appendix of the 2013 edition at A.8.4.2: *Light loading creates a condition termed wet stacking, indicating the presence of unburned fuel or carbon, or both, in the exhaust system. Its presence is readily indicated by the presence of continuous black smoke during engine-run operation…*

If the connected load will not provide sufficient engine loading to mitigate the problem, there are two solutions: (1) connecting a portable loadbank or (2) increasing the connected loads served by the generator. If a generator set is paralleled with other generator sets, or if loads from other generator sets can be safely transferred to the under-loaded set, then simply switching the other sets to the off position might suffice.

A portable loadbank is the simplest solution in that the loadbank can be rented from a generator service company and trailered to the site for connection to the generator or paralleling switchgear. Most loadbanks are manufactured with incremental switching that allows the generators to be “ramped-up” so as not to damage the engine by unintentional “block-loading”.



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NFPA 110, 8.4.2.3, 2013 edition, states: *Diesel-powered EPS installations that do not meet the requirements of 8.4.2 shall be exercised monthly with the available EPSS load and shall be exercised annually with supplemental loads at not less than 50 percent of the EPS nameplate kW rating for 30 continuous minutes and at not less than 75 percent of the EPS nameplate kW rating for 1 continuous hour for a total test duration of not less than 1.5 continuous hours.*

Using a resistive and reactive loadbank should be considered when conducting tests in lieu of just a resistive loadbank. Most generator sets are rated at 0.8 PF with the generator (alternator) having a kVA rating of 125% of the kW rating. The resistive and reactive loadbank will allow you to test both the engine and the generator to its maximum rating.

Procedures for connecting a portable loadbank should be well thought out to mitigate problems in case of a failure of the normal/utility source during a loadbank exercise.

If possible, output cables from the generator or breaker(s) should never be disconnected during a test. If an outage should occur there is no way the cables could be reconnected in order for the generator to provide power to required loads within the 10 seconds required for life safety or other critical loads.

> NFPA 110, 8.4.2.2 states: *Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.*

In order to perform the loadbank test safely the loadbank can be "paralleled" with the building load if possible so that a reconnection of generator cables is not necessary. The proper way to connect the loadbank is to a dedicated bus or breaker downstream from an overcurrent protection device inside a switchboard or to a bus inside a NEMA 3R connection box mounted at a convenient place outside the generator building.

Another method is to have an additional switchboard installed so a loadbank or portable generator can be connected to the bus. The switchboard would consist of three breakers with kirk-key interlocks that allow only two breakers to be closed at once. The first breaker would be connected to the permanent generator, the second breaker connected to the building load, and the third for connection to the loadbank (or portable generator). In the event that utility power fails during the test, generator power could be reconnected to load quickly. If there was a failure of the permanent generator, the third breaker could be used to quickly connect a portable generator to the facility. In some critical cases a facility would be wise to have both the loadbank and a portable generator on-site during the exercise in case the permanent generator fails.

Increasing connected building load can be problematic and sometimes not feasible from an investment standpoint because of the location of switchboards, transfer switches and generators. However, there is some economic benefit when switching non-essential load onto the generator in that the electric utility bill is decreased during the test (this benefit has to be offset, however, by the cost of the diesel fuel used during the exercise). Additionally, testing may cause interruption to normal business activity.

Adding a permanent pad-mounted loadbank mounted outside the generator building is another alternative. One major advantage is that the loadbank can be hard wired into a switchboard and, through proper control wiring, be automatically disconnected in case of a utility failure.

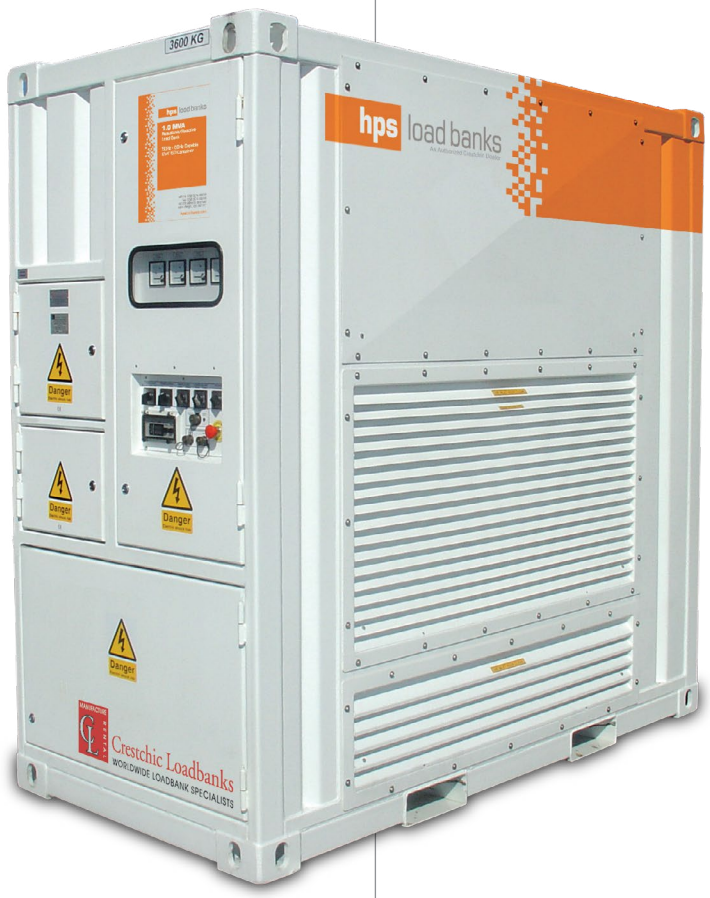
Suggested Methods & Procedures

The recommended procedure to follow for the loadbank test would be to:

1. Start and run the generator until the cooling temperature stabilizes
2. Transfer all manual or automatic transfer switches to the emergency source
3. Step load the generator with the loadbank until the desired load is reached
4. Remove the loadbank load first after the test
5. Transfer all transfer switches back to the normal position, and finally
6. Allow the generator to cool down according to manufacturer's guidelines.

By adding the building load first you will not be in danger of losing power to the building loads in case of a normal power failure: the building will already be on its emergency source.

> NFPA 110, 8.4.2.3, 2013 edition, states. *Diesel generator sets in service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods: (1) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer or (2) Under operating temperature conditions and not less than 30 percent of the EPS standby nameplate kw rating.*



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Engine Testing

While running the generator set under load, operate the set in accordance with the manufacturer's recommendations. Inspections should include the following items recorded several times per hour (every 15 minutes) during the test:

- Generator Power – Record generator KW, AMPS, Power Factor.
- Frequency and Voltage – Check and record frequency and voltage on all phases.
- Oil Pressure Gauge – Check for proper operating oil pressure.
- Fuel Level and Pressure Gauge – Check for proper fuel level and pressure.
- Engine Crankcase – Check the oil level. Maintain the oil level between the "add" and "full" marks on the "engine running" side of the dipstick.
- Generator Louvers (If equipped) – Check for proper operation (able to open and close freely).
- Engine Mounts – Inspect for proper installation and loose fasteners. Check for proper torque.
- Leaks and Noise – Check for leaks and any unusual noises.
- Winding and Bearing Temperature (if equipped) – Check and record winding and bearing temperatures.

When selecting a vendor to perform loadbank testing and maintenance on your generator, it is important to choose a company that has technicians who have been properly trained on both generator systems and operation of the loadbank. This will ensure that tests are conducted properly and any repair/maintenance that needs to be done is performed in accordance with the manufacturer's recommendations.

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Safety Tip

Lockout/tag out and personal protective equipment (PPE) as prescribed by NFPA 70E and OSHA regulations as found in 29 CFR 1910 Subpart S. No person should be exposed to live bus without wearing the proper PPE.

About HPS Loadbanks

HPS Loadbanks is the leading authorized distributor of Crestchic Loadbanks in North America and a recognized premier dealer of Vantran transformers.

Crestchic loadbanks are used to test power supplies every day, all around the world from the coldest, snow-bound to the hottest, desert climates across all seven continents.

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An Authorized Crestchic Dealer

HPS Loadbanks offers the best selection of new and used resistive loadbanks, resistive/reactive loadbanks, transformers, trailers and cables. Our load testing products and services include sales, rental training, parts and service.

Our dedication to listening to our customers has given us insight into what the loadbank industry and customers really want: flexibility, customer service, and only the highest quality products.

HPS Loadbanks is based in San Diego, CA. For more information, visit www.hpsloadbanks.com.

History of HPS Loadbanks

Crestchic UK has specialized in manufacturing the best in-class resistive-reactive loadbanks available since 1983. Crestchic loadbanks are used to test power supplies every day, all around the world from the coldest, snow-bound to the hottest, desert climates across all seven continents.

In 2001, Crestchic UK selected Crestchic USA to be their sole distributor in North America. Crestchic USA has grown the loadbank business into a national distribution channel servicing hundreds of loadbanks in industries ranging from data centers to manufacturers. In the past decade, we have sold more Crestchic loadbanks than any other distributor in the world.

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