

## Testing Standby Generator Sets - Resistive Versus Reactive

Information Sheet # 36

### 1.0 Introduction

To ensure a backup generator system will perform as specified, it is necessary to perform a fully witnessed test off-line at the time of initial installation, as part of the commissioning process. It is also important to perform load tests during periodic planned maintenance checks.

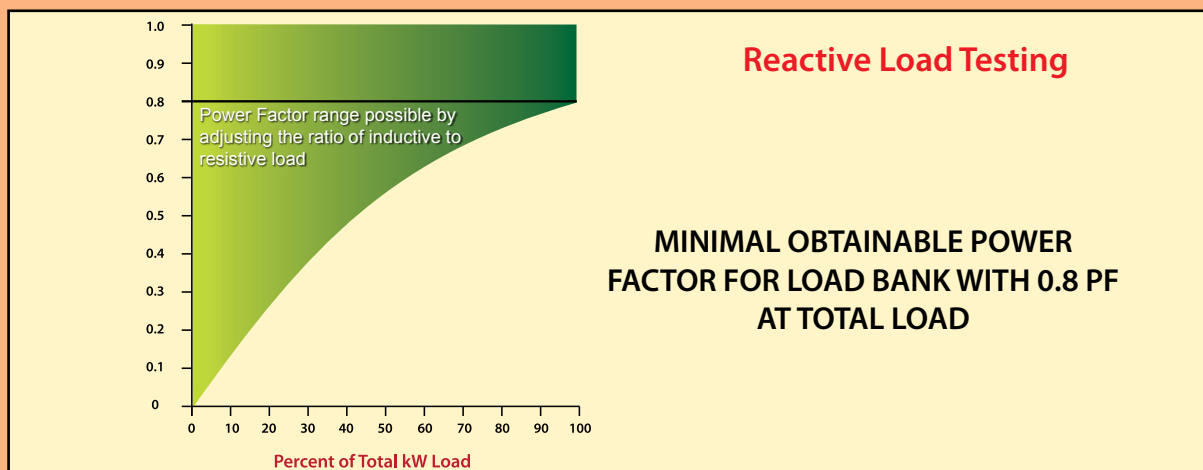
*This information sheet discusses the use of portable load banks used for generator testing and the differences between resistive load bank testing and reactive load bank testing.*

### 2.0 Provision of Test Equipment and Testing

Distributors for the principal generator set manufacturers have the equipment and technicians throughout their dealer networks to perform the required testing. *(Continued over)*

| TOTAL LOAD kW | TYPICAL LOAD STEP kW RESOLUTIONS |                                     |
|---------------|----------------------------------|-------------------------------------|
| 200           | 240/480 VAC                      | 5, 10, 10, 25, 50, 100 kW           |
| 250           | 240/480 VAC                      | 5, 10, 10, 25, 50, 50, 100 kW       |
| 400           | 240/480 VAC                      | 5, 10, 10, 25, 50, 100, 100, 100 kW |
| 400           | 480 VAC                          | 5, 10, 10, 25, 50, 100, 100, 100 kW |

VOLTAGE RATING (3 PHASE, 60 Hz)



To fulfill our commitment to be the leading supplier and preferred service provider in the Power Generation Industry, the Clifford Power Systems, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

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Testing should only be carried out by trained, experienced personnel and conducted as directed by applicable codes and by the manufacturer. This information sheet details some of the testing procedures specified by the National Fire Protection Agency code NFPA 110 for standby generator sets.

### 3.0 Resistive Load Testing

This is the most common means of testing a generator set with its intended load. It will allow the owner to be sure the set produces 100% of its output at 1.0 power factor by connecting full kW loading. This load test measures whether the generator is producing at its full power rating, dissipating the required amount of engine exhaust gases and heat, and producing the required amount of thermal energy into the engine cooling system.

Resistive load testing verifies that the engine and generator system will produce and maintain full load without overheating and shutting down. It also evaluates other critical engine systems such as oil and fuel, assesses whether all components of the standby system will work together as designed and intended, and can identify any potential weaknesses under controlled conditions. Also it can be used to burn out any carbon deposits in the cylinders or exhaust system, thereby reducing any wet stacking problems due to frequent operation with light electrical loads.

Normally, it is sufficient to run a set with an artificial load for a maximum of eight hours. Some government and military specifications require 18- to 24- hour duration tests.

### 4.0 Reactive Load Bank Testing

A reactive load equal to 75% of the resistive rating can be paralleled in combination with the primary resistive load bank to measure the full kVA nameplate rating at 0.8 power factor of the standby generator set. This also allows for proper calibration of load sharing and voltage regulating systems in parallel operation installations. Installations with critical large motor loads might warrant this testing. As this has a higher cost, it is normally only used for new installation start-up, as the generator kVA will not deteriorate or change once tested and proven initially.

### 5.0 Frequency of Load Bank Maintenance Testing

We strongly recommend that the standby generator undergo an off-line load bank test for a minimum of two hours annually.

### 6.0 National Fire Protection Agency (NFPA) 110

NFPA 110 indicates standards for monthly maintenance and operation of standby generator sets and recommends that sets be exercised monthly at 30% of nameplate rating or loaded to achieve the minimum engine exhaust temperature recommended by the engine manufacturer. If the loads to be served cannot endure a brief outage during transfer and retransfer between sources, a load bank can be used to isolate the generator from the electrical distribution during this testing.

Any Emergency Power Supply System (EPSS) must meet NFPA 110 regulations for one of the two levels.

**Level One:** An installation where failure of the EPSS to perform could result in loss of human life, health hazards or serious injuries. These normally include health care facilities or assembly of occupancies greater than 1,000 persons. Level 1 systems are required to test the generator under load for the duration of their class rating **OR** a minimum of four hours, whichever is greater, every 36 months or three years.

**Level Two:** For systems installed where failure of EPSS to perform is less critical to human life and safety.

### 7.0 Web Site Addresses for Reference on Load Testing

The following are useful web sites for suppliers of load banks with details of the equipment available.

|                           |  |
|---------------------------|--|
| Avtron Loadbank Inc.      | <a href="http://www.load-bank.com">www.load-bank.com</a>         |
| ComRent International LLC | <a href="http://www.comrent.net">www.comrent.net</a>             |
| Simplex Inc.              | <a href="http://www.simplexdirect.com">www.simplexdirect.com</a> |



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**Austin Area**  
4918 Burseson Road  
Austin  
TX 78744  
512.477.6937  
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**Tulsa Mailing Address**  
P.O. Box 581807  
Tulsa  
OK 74158-1807  
918.836.0066  
918.836.0094 fax

**Dallas/Ft. Worth Area**  
101 Industrial Boulevard  
Mansfield  
TX 76063  
918.640.5544  
817.477.2938 fax

**Longview Area**  
1913 East US Hwy 80  
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