Total Energy Systems, LLC

KOHLER

Your Reliable Guide for Power Solutions

Information Sheet # 135

To fulfill our commitment to be the leading supplier in the power generation industry, the Total Energy Systems, LLC. team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

The Importance of a Sizing Calculator When Applying a Generator

1.0 Introduction:

Standby generator systems are frequently applied to critical power applications, both life, and economic. Examples of applications include medical facilities, water treatment plants, data-centers, and air traffic control centers. When determining the appropriate standby generator system, it is not just a case of calculating the correct size of generator to manage the load, but also to ensure the power plant meets all codes and standards. Specifying system engineers increasingly use the resources of major generator system manufacturers to determine that the generator meets all criteria. As such, the principal manufacturers of generator systems have developed sizing software.

This information sheet explains the importance and advantages of using the correct sizing software in not only the size of the generator, but also meets all applicable codes and standards.

Sizing Program Drop Down Menu & Sample Load Types

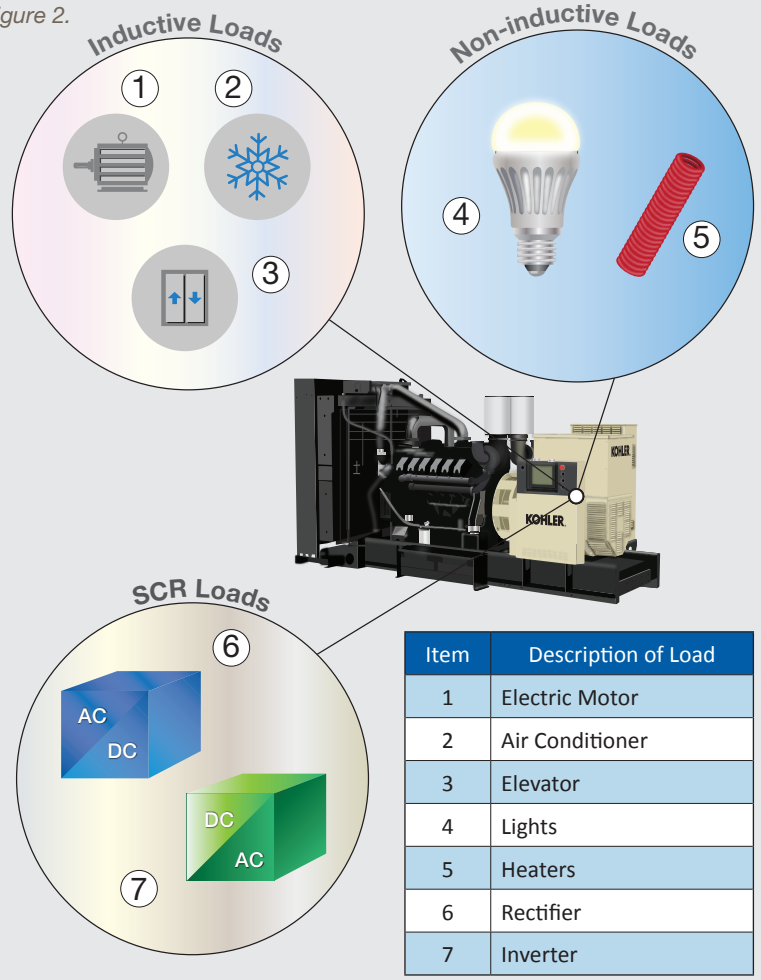
Figure 1.

Typical Sizing Drop Down Menu

Emission Requirements	STATIONARY EMERGENCY
Application	Construction
Voltage	380/220
Phase	3
Frequency	60
Alt. Temp. Rise/Duty	130C Standby
Quantity	1
Altitude	5000’
Max Ambient Temp. (Fahrenheit)	78
ISO 8528	User Defined
Voltage Dip (%)	30 %
Frequency Dip (%)	10 %
Harmonic Distortion (%)	10 %
Fuel Type	DIESEL
Quantity	1
Min Load %	30 %
Max Load %	80 %

Seismic — UL2200 — CSA

Figure 2.



Item	Description of Load
1	Electric Motor
2	Air Conditioner
3	Elevator
4	Lights
5	Heaters
6	Rectifier
7	Inverter

2.0 Types of Sizing Programs:

Individual manufacturers use a variety of sizing systems for users to determine the size of their generator systems when an array of required data is entered by the user. Typical of the two types are:

- Access through the manufacturer's website portal.
- Application software that can be downloaded to the users computer.

3.0 The Advantages of Using a Sizing Program:

A generator system is a complex network of many key components including:

- **Engine -** fuel, diesel or gaseous. Site conditions (altitude, ambient, and humidity). EPA requirements.
- **Generator End -** windings, frequency, phase, voltage, kVA capacity, power factor, environment.
- **Arrangement -** open, enclosed, sound attenuated, fuel tanks, UL, non-UL, exhaust aftertreatment.
- **Starting -** electric, mechanical, DC voltage, charging requirements, battery.
- **Generator Controls -** auto, manual, annunciation.
- **Switch Gear -** bi-pass switches, automatic transfer switch (ATS), paralleling.
- **Stationary/Mobile -** mounting requirements and trailers.

In sizing a generator system to the appropriate codes and customer specifications, all the combination of above components, by an internal matrix, can be determined by the sizing program. For an end user to undertake this individually would be time consuming and not necessarily arrive at the correct bill of materials.

In addition to determining the combination of components that meet the site specifications, the user is also able to input the various loads to be applied. Sizing programs will give the user a range of generator models that meet the specification and site requirements. The advantage of multiple solutions enables the system designer to determine:

- **Frequency Dip -** Does generator "A" recommendation show less dip than generator "B".
- **Generator Size -** Does generator "A" signify greater durability over generator "C".
- **Oversized Generator -** Does generator "A" indicate improved motor-starting over generator "C", and room for expansion.
- **Temperature Rise -** Does generator "B" heat rise fall more in line with NEMA than generator "A".

4.0 Determining Different Scenarios:

Many applications are not just considering the immediate power requirements, but also looking to future load demands as the facility expands. Sizing programs enable the system designer to run multiple simulations to determine the optimum generator for today and the ones that can be built on to best meet future power requirements. For example, is it more practical to consider paralleling as a solution over a larger generator system.

5.0 Meeting the Requirements of Specifying Engineers:

Frequently, the designers of standby generator systems applied to critical power requirements are contractors, government departments, architects, or engineering consultants. They have overall responsibility to ensure the final generator system meets all specifications and codes.

Sizing software/programs designed by the major generator set manufacturers, not only determine the size of the unit but also provide detailed specification, and of applicable codes. This is a valuable service to those having final approval and selection of the generator for a given application. Generator distributors frequently rely on the sizing program tool to complete a bid with all the supporting technical data necessary to confirm compliance with applicable codes and specifications.

6.0 Sizing Program Inputs:

The sizing programs follow similar input requirements from the user to determine the range of generator options that address the data inputted into the system. In addition to the inputs requested by the manufacturer, it is advisable for an existing installation to provide the prior years utility electrical load report.

Figure 1 details a typical website sizing program drop down menu for the user to enter the required fields. The following factors will change the generator selection from region to region, and application to application.

6.1 Site Location:

Site location impacts the engine component the most. Engine hp is reduced as altitude, ambient temperature, and humidity increase. Selection of enclosures can be influenced by location; for example, if installed outside in areas subject to snow and cold, motorized louvers, heated batteries and engine heaters are recommended.

6.2 Connected Electrical Load:

The connected load will determine the engine size (hp) required at a location and the kVA capacity and voltage/phase configuration of the generator. The following types of connected electrical load will determine generator size. ***See Figure 2***.

- **Inductive Loads -** Inductive loads and electromechanical loads include electric motors, transformers, solenoids, etc. These types of load determine the kVA capacity of a generator. On start an electric motor will have a much higher starting kVA than running kVA, also as the load is applied there will be a dip in voltage. The system specification normally advised permissible percentage voltage drop; the sizing software takes this into account in recommending generator kVA.
- **Non-Inductive Loads -** Non-inductive loads are purely resistive loads such as heaters and some lights.
- **SCR Loads -** Silicon Controlled Rectifiers (SCR) are found in electrical equipment such as inverters and rectifiers. SCRs can lower the Power Factor and change generator wave form and harmonic distortion. The sizing will take this into account.

6.3 Applicable Codes:

Where the generator is located will have to take into account applicable codes. EPA standard changes from prime to standby and stationary to mobile. Seismic defined areas will dictate mechanical specifications. Specifying engineers can ask for UL2200 or CSA compliance.

MEMBER EGSA Electrical Generating Systems Association

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