ENGINE CRANKING APPLICATIONS

For stationary engine cranking applications, one of three different types of batteries is normally used. Since we offer all three types, we will attempt to fairly report the strengths and weaknesses of each type. They are listed in order of their initial capital equipment cost.

Lead Acid (SLI) Battery (Starting, Lighting and Ignition)

The SLI lead acid battery is commonly referred to as an “automobile battery”. This may be exactly the same battery you have in your family car, or it may be a larger version of the same battery construction, i.e. “4D” or “8D’.

SLI batteries are provided with three different ratings for comparison:

Amp Hour	The (Amps) (Hours) available at the 20-hour discharge rate from a fully charged SLI battery to an end voltage of 1.75 v/c at an ambient temperature of 80°F.
Cold Cranking Amps (CCA)	The maximum discharge current in amperes which a new fully charged battery at 0°F (-17.8°C) can deliver for 30 seconds and maintain a voltage of 1.2 v/c or higher.
Reserve Capacity	The maximum number of minutes a new fully charged battery at 80°F (26.7°C) can be discharged at 25 amperes and maintain a voltage of 1.75 v/c or higher.

As can be seen, none of these ratings relate very directly to the normal needs of cranking a gen set.

The battery was not designed for float service application. In such an application, it has a projected life of 1-3 years (for the better grades of SLI batteries).

10-Year Maintenance Free AGM Battery

The AGM battery is usually designed for 10 years float service and will probably provide this same service life in an engine cranking application assuming its charging and ambient specifications are adhered to. (See section 14.) The AH capacity is normally rated at the 8-hour rate, however, some suppliers rate theirs at the 20-hour rate. The standard temperature and end voltage for rating is 77°F to 1.75 v/c.

25-Year Nickel Cadmium Battery

The nickel cadmium pocket plate battery is the longest life, most rugged and most abuse forgiving of all available engine cranking battery types. It really will have a useful life of over 20 years when connected to a properly sized and applied battery charger.

The AH capacity of the nickel cadmium pocket plate battery is rated at the 8-hour rate to 1.14 v/c at 77°F.

The battery recommendations for engines of various manufacturers are based on the standard generator set specifications of 3 each, 10-second cranks at 77°F, with SAE 30 oil in the crankcase. The electrical connection between the battery and load shall be configured to hold cable resistance to a minimum. A reasonable (total positive and negative) conductor resistance for engine cranking is:

.0015 Ohms for 12 V systems
.002 Ohms for 24 V systems
.0025 Ohms for 32 V systems

For copper cable at 77°F, the resistance is calculated by the formula:

$$R = \frac{10.37L}{A}$$

Where R= Conductor resistance in Ohms
L=` Conductor length in feet (total for both the positive and negative conductors)
A= Conductor area in circular mils

Therefore, to determine the conductor size:

$$R = \frac{10.37L}{R}$$

Example: For a 24 V starter with the battery 8 ft. from the starter;

$$A = \frac{10.37\ (16)}{0.002} = 82960 \text{ circular mils}$$

The minimum copper cable would be AWG 1.

Wire Size AWG	A
22	640
20	1020
18	1620
16	2580
14	4110
12	6530
10	10380
9	13090
8	16510
6	26240
4	41740
3	52620
2	66360
1	83690
1/0	105600
2/0	133100
3/0	167800
4/0	211600

MCM	
250	250000
300	300000
350	350000
400	400000
500	500000
550	550000
600	600000
700	700000
750	750000
900	900000
1000	1000000

To convert engine metric displacement in liters to cubic inches, multiply by 1000 to obtain cubic centimeters, and divide by 16.4.

How to select the right battery size(s) for your diesel engines.

Basic sizing

The basic sizing is very easy. You need to know:

- Total cylinder volume of engine in cubic inches
- System voltage

Use the Battery selection table to find the required battery. Your engine's cylinder volume must be equal to or smaller than the figure stated in the table.

The Nickel Cadmium Cell is nominally a 1.2 V electro-chemical couple. Therefore, use 10 cells for 12 VDC starters and 20 cells for 24 VDC starters.

Note: The battery chargers should be adjusted to float charge the batteries at 1.42 v/c and recharge at 1.6 v/c.

Note: The sizing method is valid only for standard sizing conditions. If your conditions are different, see the correction factors on the next page.

Standard Sizing conditions

The Battery Selection Table is based on the following conditions:

- Cylinder volume in cubic inches (to convert from liters to cubic inches, simply multiply by 61)
- Cranking time: 3 ea. 10 second cranks
- Engine temperature: 77°F
- Battery temperature: 77°F
- Oil: SAE 30 or multi-viscosity oil
- Starting circuit efficiency: 60%
- Minimum cranking voltage: 70% of system voltage
- Fully charged battery

	Engine Cubic Inch Displacement	
CELL	**12 VDC**	**24 VCD**
Type TSP	10 Cell	20 Cell
14	45	100
20	60	150
30	110	300
40	200	550
55	310	840
65	400	1100
80	510	1400
100	720	1950
125	880	2390
150	1220	3300
185	1600	4340
200	1900	5160
235	2420	6550

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