TECH TIPS

Batteries

Before handling batteries, safety is always to be considered. Use rubber gloves and goggles when working on and testing batteries. Keep sodium bicarbonate handy to neutralise acid should a spill occur. When charging batteries Hydrogen gas is produced… as in hydrogen bomb… needless to say, charging batteries must be done in a well ventilated area with no open sparks or flames (don't forget things like space heaters and water heaters may have open flames).

Look for obvious problems such as low electrolyte levels, a dirty or wet battery top, corroded or swollen cables/terminals or a leaking or damaged battery case. A battery with swollen sides (or bulging) is a telltale that the battery will need replacement. Repair or replace such items as required. Terminal brushes are a good thing and make cleaning the terminals fast and effective. When replenishing the battery with water, distilled water is a must.

Use the chart below *as a guide*, when at all possible use the manufacturers' product specifications, and recharge the battery to 100% State-of-Charge. If checking a non-sealed battery using the specific gravity and there is a difference of .030 (sometimes expressed as 30 "points") or more of a difference between the cells, then you should equalize the battery using the battery manufacturer's procedures. On sealed batteries use a digital voltmeter to check the state of charge based on the voltage. Do not load test batteries below a 75% state of charge. Also any battery that does not go over 12.4V when charged must be replaced.

12V System	24V System	Specific Gravity	State of Charge (%)
12.7	25.4	1.265	100
12.64	25.25	1.257	95
12.58	25.16	1.249	90
12.52	25.04	1.241	85
12.46	24.92	1.233	80
12.4	24.8	1.225	* 75
12.36	24.72	1.218	70
12.32	24.64	1.211	65
12.28	24.56	1.204	60
12.24	24.48	1.197	55
12.2	24.4	1.19	50
12.12	24.24	1.176	40
12.04	24.08	1.162	30
11.98	23.96	1.148	20
11.94	23.88	1.134	10

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Follow the battery manufacturers recommended procedures when charging a battery. Simple things like switching off the battery charger before disconnecting or connecting it to prevent sparks, leaving vent caps on when charging or placing a wet cloth over the battery as a spark arrest are pointed out in the 2007 *Exide Technologies* catalogue. There are several other tips, such as charging procedures for gel, orbital and 8V type batteries. Once charged the battery is still not ready for load testing. The surface charge, if not removed, will make a weak battery appear good or a good battery appear bad. Eliminate the surface charge by allowing the battery to sit for between four to twelve hours in a warm room.

To load test a battery 50% of the CCA rating must be applied as a load, typically a carbon pile or series of resistors depending on the tester. After 15 seconds the voltage must be checked with the load still applied. The voltage must be more then 9.6V (if 21° C or warmer), if the voltage is less then that the battery fails the load test. See the chart below to compensate for load testing in colder conditions. For those with a JBT series of tester, they have a battery tester build into them which will perform all of the calculations and load test the battery automatically (pictured to the right and below).

Battery Temperature in °C	Battery Temperature in °F	Minimum Voltage When Load Testing
21	70	9.6
16	60	9.5
10	50	9.4
4	40	9.3
-1	30	9.1
-7	20	8.9
-12	10	8.7
-18	0	8.5

Colder temperatures have an adverse affect on both the battery power that is available for cranking the engine and the amount of power that is required by the starter to turn the engine over. While hotter temperatures allow for more power to be available from the batteries this is far offset by the power required to crank the engine. This is represented graphically in the attached picture.

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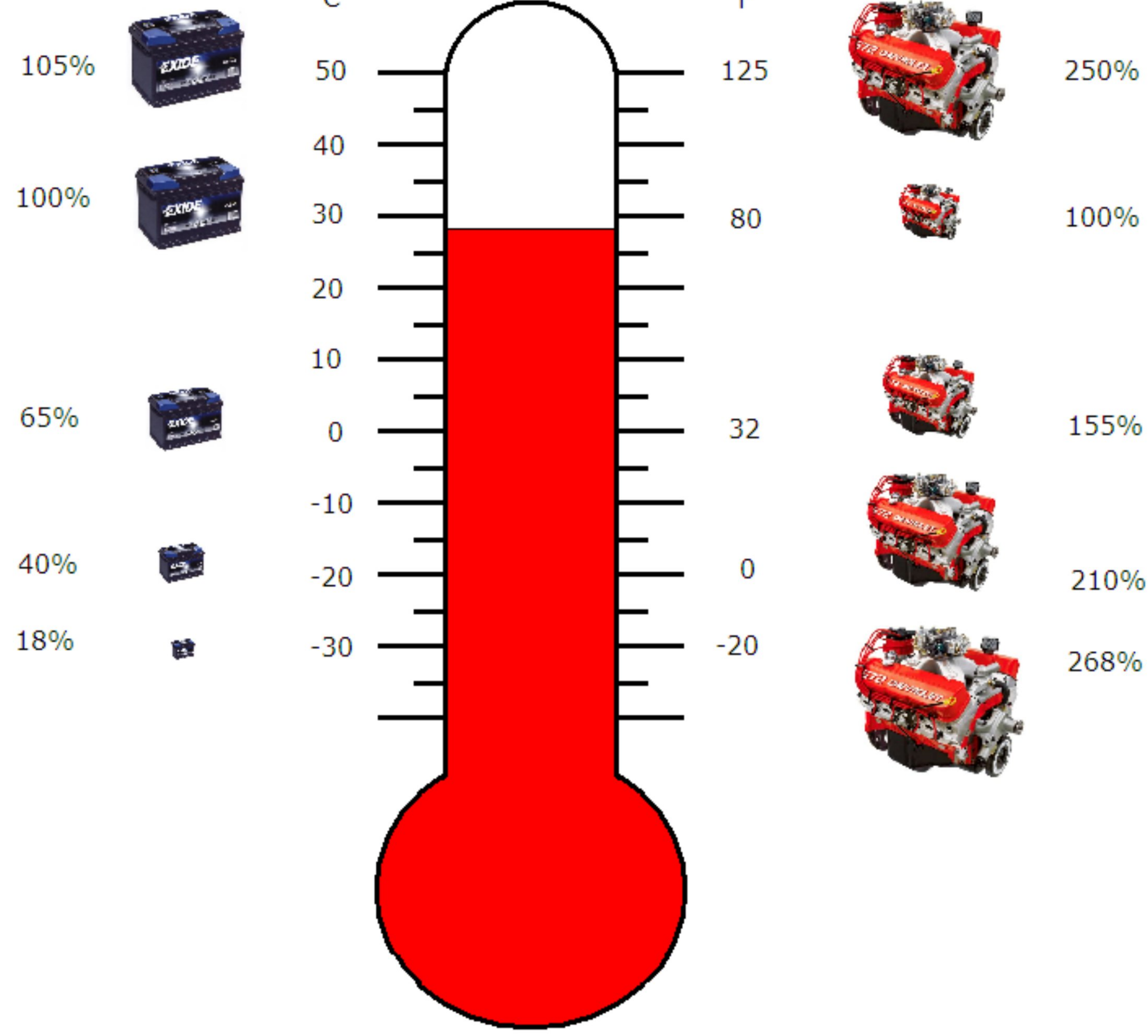

REV20100503: Added Charging tips and graphic showing available battery power and engine consumption requirements.