

Load Sharing Test



Testing load sharing

- How will the modular switch mode convection cooled battery chargers work together in parallel to source a DC load?
- The charger operates without the need of extra cables, software or any added options.

Test Parameters

- Using two 130Vdc 8-Bay 32A dc battery chargers wired in parallel with same gauge and length DC wire.
- Supply voltage will be set at 240Vac 1PH. Supply voltage cabling will be the same gauge and length wire.
- Load simulated by load bank/generator.
- Screen records of charger dashboards will be done with Apple iPads to document charger performance.
- Fluke 381 and 89IV True RMS Multimeters with remote display will be used to validate voltage readings.

Test procedure

- 240Vac is applied to both battery chargers.
 - Voltage checked and verified.
- DC load started and brought to 135Vdc.
 - Generator DC voltage checked and verified.
- Set rotary switches on chargers for 2.23VPC, 133.8Vdc.
 - Charger DC voltage checked and verified.

Test cont.

- DC load voltage was turned down from 135Vdc to 133.8Vdc .
- DC breakers are closed to begin the test.
- The right hand charger begins to sense the drop in voltage and current begins to rise. Notice the left hand charger has not responded yet.

Serial Number:	4453917
UIM Firmware:	v1.21
Webserver Firmware:	v8.99
Battery Voltage:	133.81 VDC
DC Output Current:	0.02 ADC
DC Output Power:	2.94 W

Serial Number:	4295549
UIM Firmware:	v1.21
Webserver Firmware:	v3.10
Battery Voltage:	133.73 VDC
DC Output Current:	1.79 ADC
DC Output Power:	239.65 W

Test cont.

- The load is now coming up and the RH charger has reached nearly 60% it's rated capacity. The LH charger now begins to build current to support the load as well.

Serial Number:	4453917
UIM Firmware:	v1.21
Webserver Firmware:	v8.99
Battery Voltage:	133.21 VDC
DC Output Current:	4.77 ADC
DC Output Power:	635.29 W

Serial Number:	4295549
UIM Firmware:	v1.21
Webserver Firmware:	v3.10
Battery Voltage:	133.83 VDC
DC Output Current:	20.39 ADC
DC Output Power:	2728.73 W

Test cont.

- Now the RH charger is nearly at 78% of its capacity and the LH charger continues to come up to source the load as needed.

Serial Number:	4453917
UIM Firmware:	v1.21
Webserver Firmware:	v8.99
Battery Voltage:	132.92 VDC
DC Output Current:	10.55 ADC
DC Output Power:	1403.01 W

Serial Number:	4295549
UIM Firmware:	v1.21
Webserver Firmware:	v3.10
Battery Voltage:	133.67 VDC
DC Output Current:	25.62 ADC
DC Output Power:	3424.87 W

Test procedure cont.

- Finally the LH charger reaches its max output at the same time as the RH charger.

Serial Number:	4453917
UIM Firmware:	v1.21
Webserver Firmware:	v8.99
Battery Voltage:	128.26 VDC
DC Output Current:	30.30 ADC
DC Output Power:	3885.70 W

Serial Number:	4295549
UIM Firmware:	v1.21
Webserver Firmware:	v3.10
Battery Voltage:	128.62 VDC
DC Output Current:	29.84 ADC
DC Output Power:	3838.42 W

Understanding what you're seeing

- The chargers will share the load autonomously as long as all Webserver and Rotary Switch settings are the same.
 - Theory of operation is similar to the chargers *Power Saving Mode* with multiple iPMs in a single chassis.
- The chargers will increase/decrease current as quickly as the load changes.

5.11 Start-up behavior

When tested in accordance with 9.1.15, energizing the charger with a connected load of 10 percent or more of the charger rating shall not result in output voltage greater than 106 percent of the voltage setting, shall not activate the overvoltage shutdown, and shall stabilize to within the deviation limits specified in 5.5 within 15 seconds. A fully charged test battery must be connected.

5.12 Output surge withstand

These surges may occur across the DC output terminal or from either DC output terminal to ground. The battery charger shall be tested in accordance to ANSI/IEEE C37.90.1 with both the oscillatory and fast transient wave forms with 2500 volt peak.

5.13 Output grounding

In applications where either the positive or negative output is grounded a single point grounding method is recommended. The grounding method must meet all code requirements.

5.14 Output noise

5.14.1 Ripple

The ripple voltage shall be measured in terms of rms voltage at the terminals of a connected test battery. The limits specified in Table 6 shall apply for charger output ranges from 0% to 100%. Filtered chargers shall be used for valve-regulated lead acid batteries.

Table 6 – Ripple voltage limits

Nominal Charger Voltage	Condition	Limit
12/24/48	Unfiltered on battery	1% V rms
	Filtered on Battery	30 mV rms
	Filtered off Battery	1% V rms
	Battery Eliminator	30 mV rms
120 or 130	Unfiltered on battery	2% V rms
	Filtered on Battery	100 mV rms
	Filtered off Battery	2% V rms
	Battery Eliminator	100 mV rms
240 or 260	Unfiltered on battery	2% V rms
	Filtered on Battery	200 mV rms
	Filtered off Battery	2% V rms
	Battery Eliminator	200 mV rms

5.15 Efficiency

NOTE—The charger should be designed to produce an efficiency that is high for the circuit topology that is used. The efficiency may be less for lower DC output voltages.

5.16 Electrical Isolation

The input and output circuits shall be electrically isolated from each other and from the charger ground.

Ripple data

- Ripple was captured by a Fluke meter model 89IV True RMS Multimeter.
- With the charger on, but no output, ripple was captured at the load was 14.14mV.
- At 40% charger output, ripple was captured at the load was 69.90mV.
- At full output, ripple was captured at the output at the load was 49.39mV.
- It is important to understand, the more chargers/iPMs you have in a system, the lower ripple will become because of the capacitance built into each iPM.

Ripple Current Testing/Lester Electrical

	ACV Input	Amps DC Output	ACmV at battery (avg)
Power saving mode disabled and 8 Bay charger with 8 iPMs			
	115.4	0.05	5.198
	115.2	1	9.61
	114.3	24	16.463
	114.3	26	20.26
ENER-008 Battery set SBS190F 10 batteries or 60 cells at 2.27 volts per cell float for 136.2 volt float			
	115.7	1	7.04
	114.9	24	16.016
	115.4	30	25.298
Power saving mode enabled and 8 Bay charger with 8 iPMs			
	116	1	7.424
ENER-008 Battery set SBS190F 10 batteries or 60 cells at 2.27 volts per cell float for 136.2 volt float			
	115.6	1	4.579