

Century RC 'V-Plus 1800 20C/30C' 3S

The Century RC 'V-Plus 1800 20C/30C' 3S pack came with a standard 'Align' type tap connector, with 16 AWG silicone leads but no power connector fitted. The silicone leads were subsequently terminated in a Deans Ultra. The whole pack was housed in a durable black shrink-wrap.

Key Information

- Pack capacity: 1800 mAh
- Pack configuration: 3S
- Dimensions: 23 (D) x 33 (W) x 101 mm (L)
- Mass: 132 g (with Deans Ultra)
- Max Cont. Discharge: 20C (36A)



Testing

All testing was carried out using:

- Charging with an FMA BalancePro 6S charger at 1C.
- Camlight High Power CC discharger with National Instruments DAQ running LabView to measure a calibrated J-type thermocouple and record individual cell voltages at 1, 3, 6, 9, 12 and 15C
- 'Burst' profile of 8 seconds at 10.8 A (6C) / 2 seconds at 36A (20C) for a mean current of 15.84 A (8.8C).
- 10 cycle test of the 'burst' profile
- Recommended pack cut-off voltage of 9V applied (3.0V x 3 cells)

Prior to testing the individual cell voltages were measured in the 'as shipped' condition.

These 'shipped' voltages were:

Cell 1: 4.184 V

Cell 2: 4.180 V

Cell 3: 4.180 V

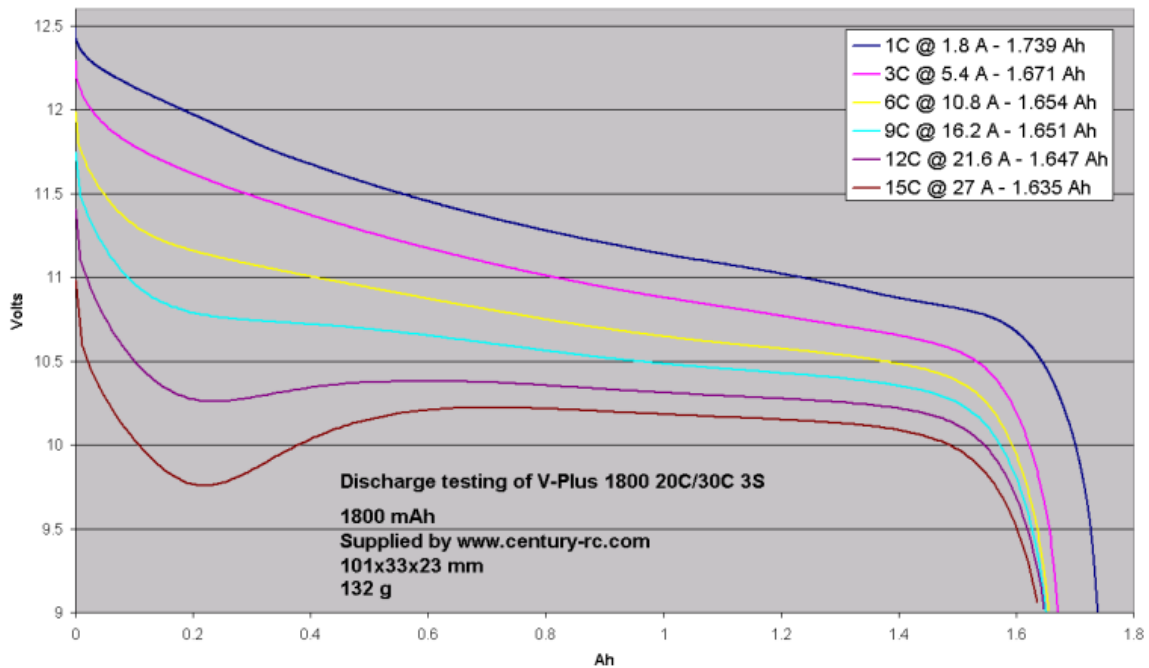
Which shows the pack was relatively well in-balance.

The results from these tests follow:

Discharged capacity, voltage and power

Discharge Rate (C)	Discharge Current (A)	Capacity (Ah)	Mean Voltage	Mean Power (W)	Mean Cell (V)
1	1.8	1.739	11.271	20.3	3.76
3	5.4	1.671	11.025	59.5	3.68
6	10.8	1.654	10.753	116.1	3.58
9	16.2	1.651	10.543	170.8	3.51
12	21.6	1.647	10.291	222.3	3.43
15	27	1.635	10.074	272.0	3.36

Discharge testing of V-Plus 1800 20C/30C 3S



Temperature: Celsius

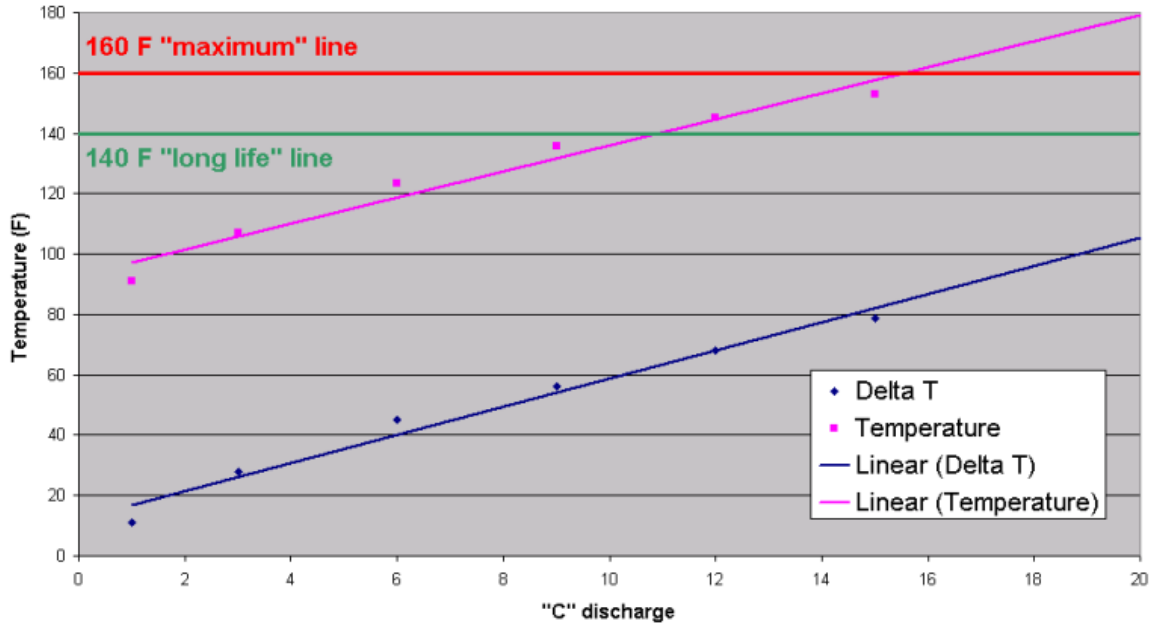
Discharge Rate (C)	Discharge Current (A)	Start Temp. (C)	Finish Temp. (C)	Delta Temp. (C)
1	1.8	26.8	32.9	6.1
3	5.4	26.2	41.6	15.4
6	10.8	25.7	50.8	25.1
9	16.2	26.4	57.7	31.3
12	21.6	25.0	62.8	37.8
15	27	23.3	67.1	43.8

Temperature: Fahrenheit

Discharge Rate (C)	Current (A)	Start Temp. (F)	Finish Temp. (F)	Delta Temp. (F)
1	1.8	80	91	11
3	5.4	79	107	28
6	10.8	78	123	45
9	16.2	80	136	56
12	21.6	77	145	68
15	27	74	153	79

Pack temperature with discharge, using a linear fit (worst case).

Discharge testing of V-Plus 1800 20C/30C 3S



Balance during discharge: individual cells

Cut-off level - 3.0V

Discharge Rate (C)	Current (A)	Capacity (Ah)	Cell 1 Term (V)	Cell 2 Term (V)	Cell 3 Term (V)	Imbalance (V)
1	1.8	1.739	2.818	3.357	2.821	0.539
3	5.4	1.671	2.883	3.288	2.804	0.484
6	10.8	1.654	2.958	3.242	2.810	0.432
9	16.2	1.651	2.949	3.208	2.811	0.397
12	21.6	1.647	2.969	3.197	2.859	0.338
15	27	1.635	2.979	3.204	2.881	0.323

Likely effects of higher LVC setting: individual cells

Alternate Cut-off levels - 3.1V

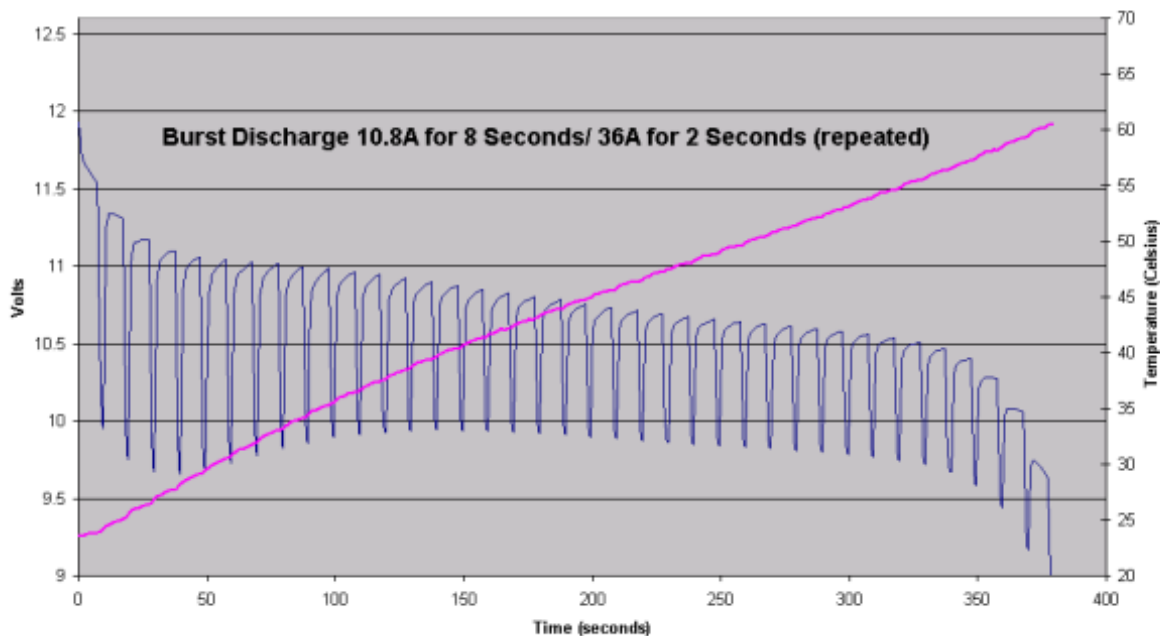
Discharge Rate (C)	Current (A)	Capacity (Ah)	Cell 1 Term (V)	Cell 2 Term (V)	Cell 3 Term (V)	Imbalance (V)
1	1.8	1.732	2.962	3.382	2.963	0.420
3	5.4	1.662	3.032	3.324	2.985	0.339
6	10.8	1.642	3.078	3.289	2.996	0.293
9	16.2	1.638	3.066	3.259	2.983	0.276
12	21.6	1.630	3.088	3.256	3.012	0.244
15	27	1.613	3.094	3.263	3.019	0.244

Alternate Cut-off levels - 3.2V

Discharge Rate (C)	Current (A)	Capacity (Ah)	Cell 1 Term (V)	Cell 2 Term (V)	Cell 3 Term (V)	Imbalance (V)
1	1.8	1.723	3.096	3.412	3.097	0.316
3	5.4	1.650	3.141	3.365	3.111	0.254
6	10.8	1.628	3.174	3.336	3.115	0.221
9	16.2	1.616	3.187	3.323	3.129	0.194
12	21.6	1.606	3.189	3.313	3.129	0.184
15	27	1.584	3.192	3.316	3.131	0.185

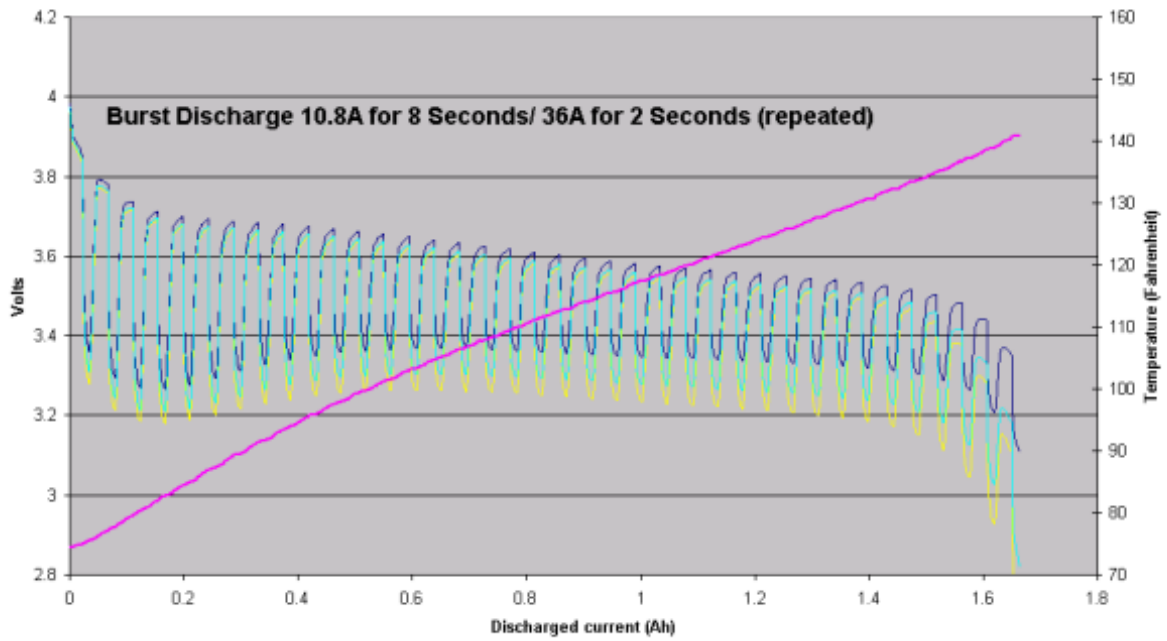
Burst Profile: Volts / Temperature against Time (6C/20C)

Cyclic discharge testing of V-Plus 1800 20C/30C 3S



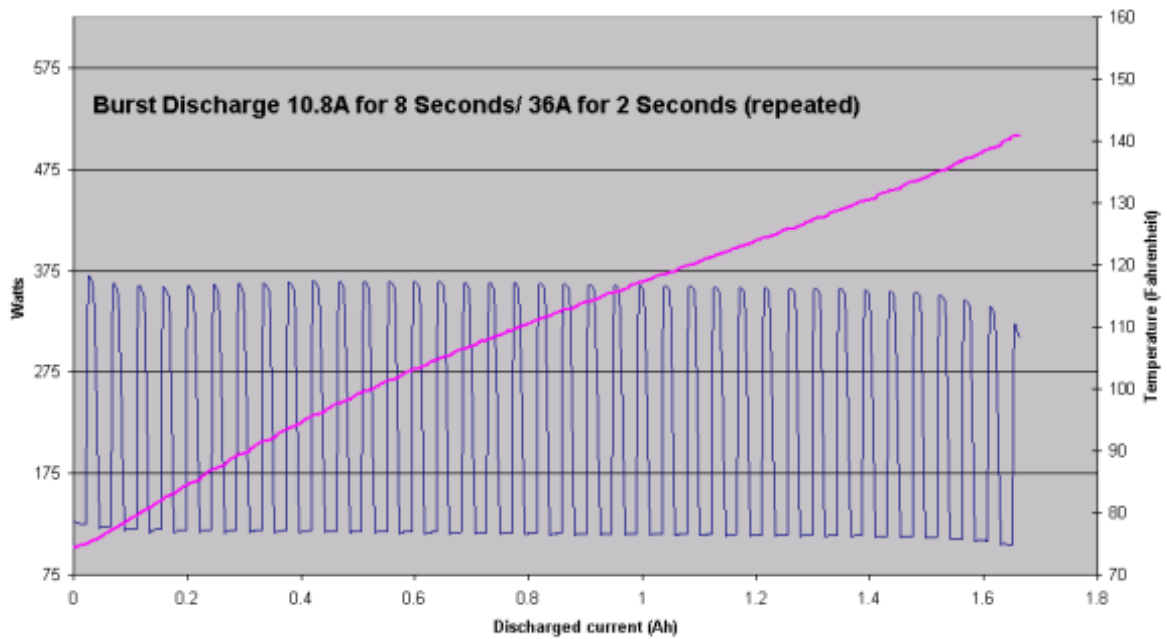
Burst Profile: Volts / Temperature against discharged current – each cell (6C/20C)

Cyclic discharge testing of V-Plus 1800 20C/30C 3S

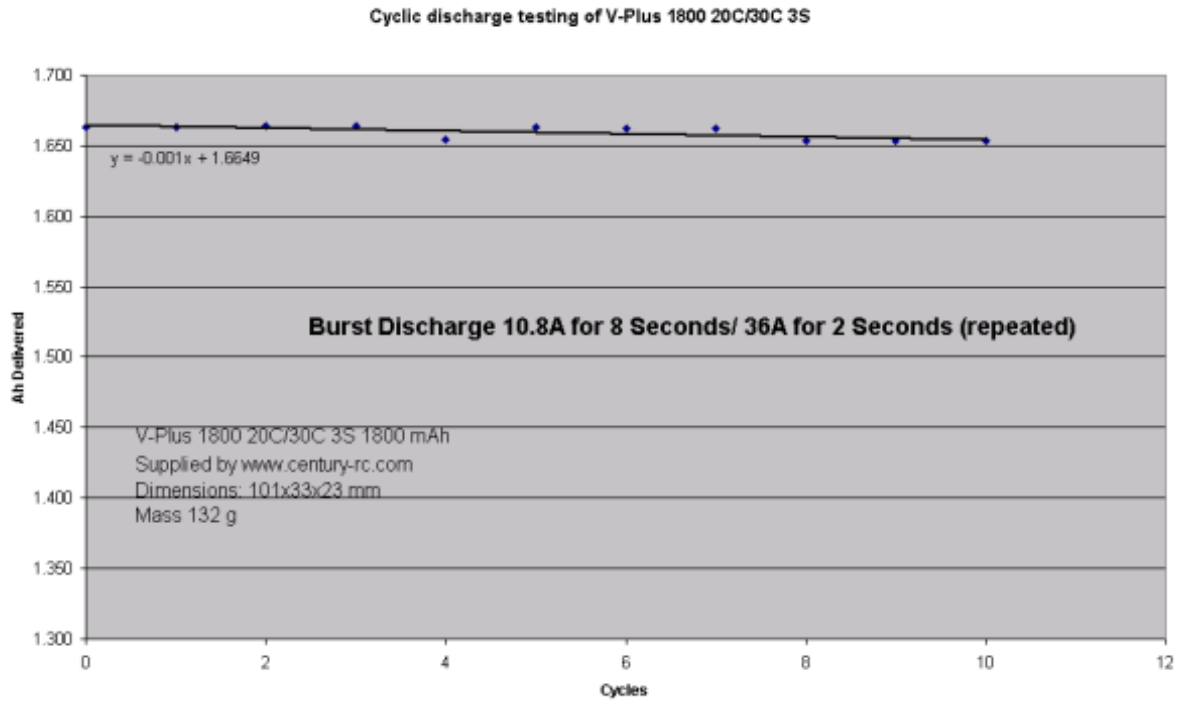


Burst Profile: Watts / Temperature against discharged current (6C/20C)

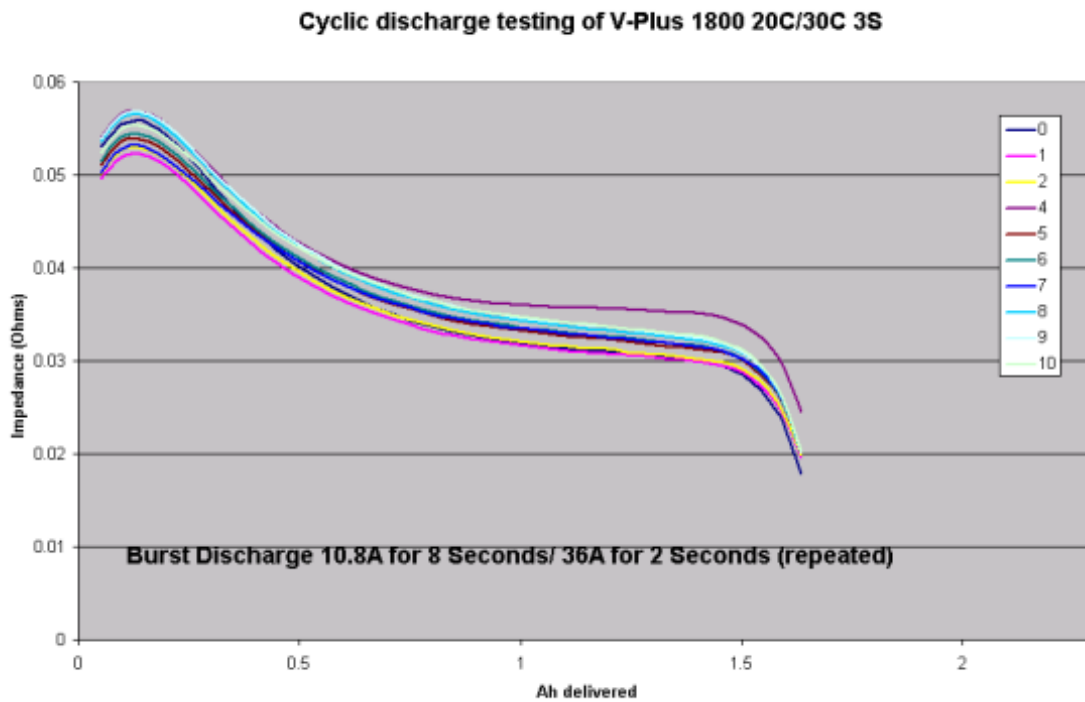
Cyclic discharge testing of V-Plus 1800 20C/30C 3S



Cyclic performance: Capacity with repeated burst cycles(6C/20C)

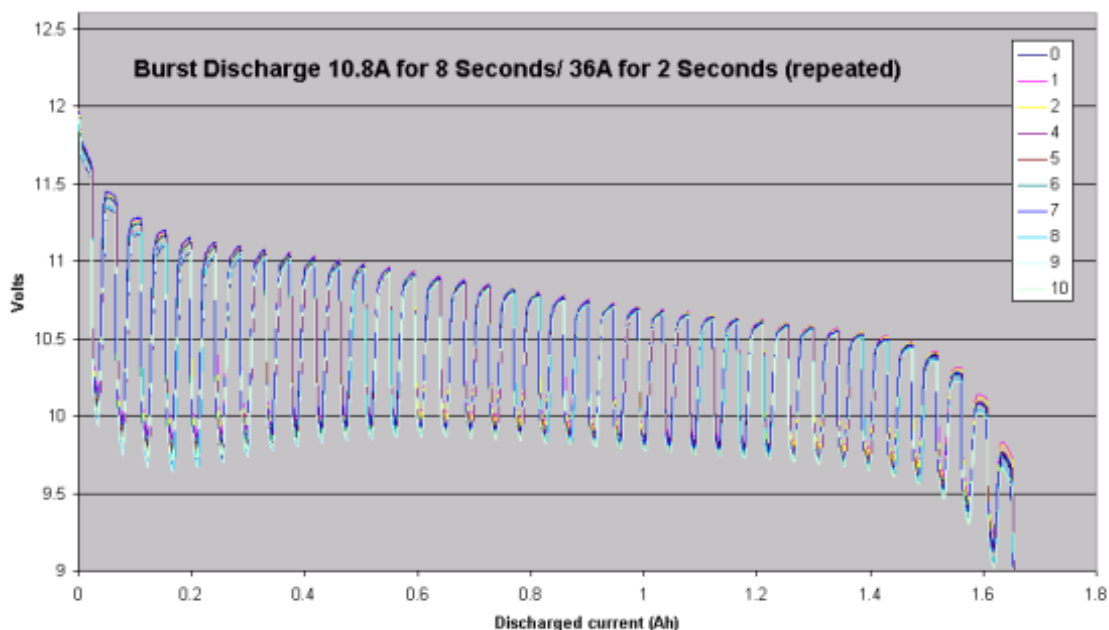


Cyclic performance: Impedance with repeated burst cycles(6C/20C)



Cyclic performance: Voltage with repeated burst cycles(6C/20C)

Cyclic discharge testing of V-Plus 1800 20C/30C 3S



Summary of cyclic discharge: individual cycles

Cycle	Run	Max P (1/2C) Watts	Min P (1/2C) Watts	Mean P Watts	Max T Celsius	Imped. (ohm)	Total Ah
0	CYC0	356.6	116.1	167.1	60.6	0.0327	1.663
1	CYC1	357.6	116.4	167.8	61.6	0.0325	1.663
2	CYC2	357.0	116.3	167.6	62.3	0.0329	1.664
3	CYC3	355.6	116.0	166.0	62.9	0.0338	1.664
4	CYC4	351.1	115.5	165.5	56.4	0.0365	1.654
5	CYC5	355.6	116.2	167.3	63.7	0.0340	1.663
6	CYC6	355.1	116.2	167.2	64.1	0.0344	1.662
7	CYC7	355.6	116.3	167.5	64.6	0.0343	1.662
8	CYC8	354.1	116.0	166.3	64.3	0.0352	1.654
9	CYC9	353.6	116.0	166.2	64.5	0.0355	1.654
10	CYC10	353.8	116.0	166.4	64.8	0.0355	1.653

	Slope	Intercept	80% Value
Capacity	-0.00105	1.664916	1.332
Imped.	0.00029	0.032848	0.125

Cycles to 80% cap. 319

Closing notes:

The temperature of the pack reached ~140F with a 12C discharge (26.4A) – this is the limit of the ‘comfort zone’ that I usually apply when looking for long cyclic life. At 15C the pack delivered a mean voltage and power of 10.07 Volts and 272 Watts.

The cells appeared to be quite closely matched, and tracked within 10’s of mV right up to the ‘knee’ in the discharge curve. The measured difference in individual cell capacities was less than 50 mAh for this 3S 1800 mAh pack.

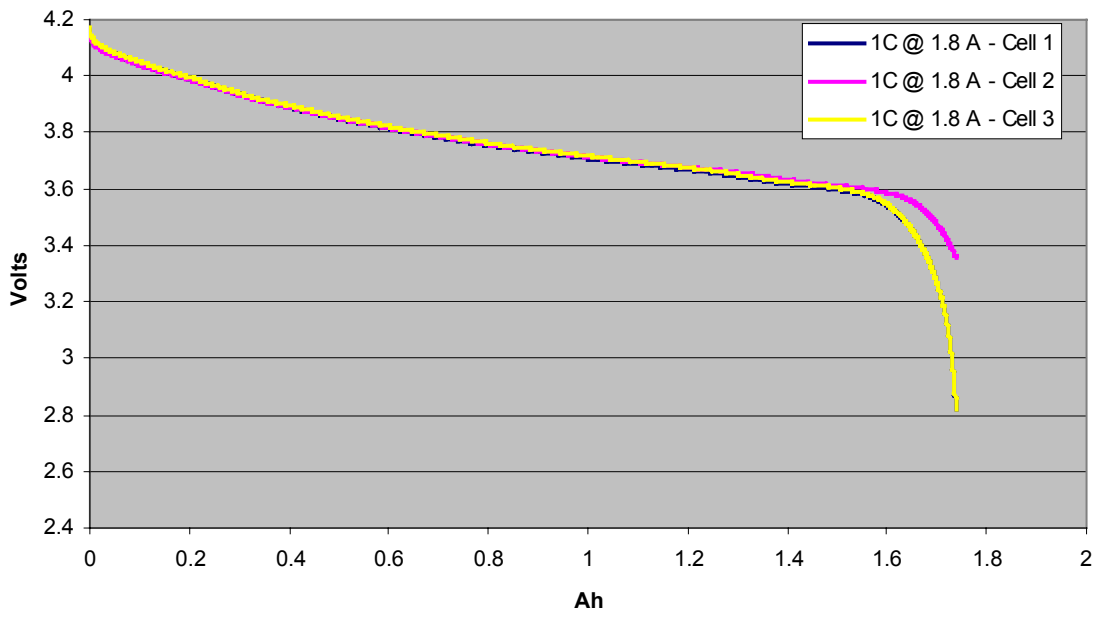
I would recommend utilising a balance charging technique with this pack, backed up by utilising a 3.1 or 3.2 V LVC or cell discharge protection: although the cells were quite closely matched, the sharp voltage drop towards discharged state could produce an over-discharged cell when using a 3.0V cut-off.

The pack gave good results with the repeated burst cycling: the variation in pack performance was within the measurement errors and I would expect this pack to survive several hundred cycles.

The silicone power leads are thinner than some competitors (16 AWG as opposed to 14/12 AWG) which is not as suitable for high current loads. The temperature behaviour, dip in discharge, and mean voltage lead me to give a cautious rating of 12C continuous, or 15C with some cyclic capacity loss..

(Individual cell behaviour with pack discharge follows)

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