



VALVE-REGULATED
SEALED LEAD
ACID BATTERY



EHP Series

High Integrity

Technical Manual

Advanced Battery Technology

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Introduction

ABT Enduro EHP range of VRLA lead acid batteries have been designed specifically for use in applications. Which demand the highest levels of security reliability. With proven compliance to the most rigorous international standards.

Enduro EHP is recognized as premium battery for Telecom/Utilities applications. Enduro's reputation for long service life combined with excellent high rate performance also makes it the number one choice for high integrity, high specification UPS systems.

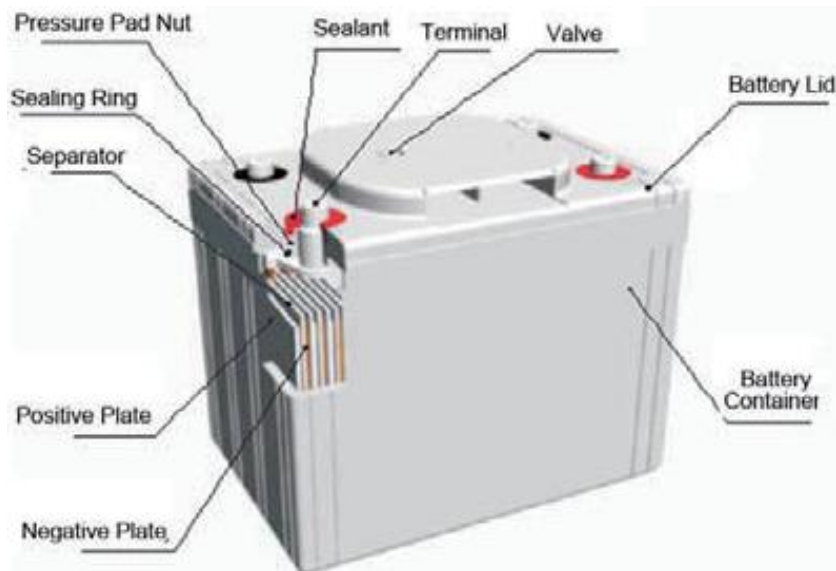
- Pb-Ca-Sn alloy grids designed to resist corrosion and prolong life.
- Low resistance microporous glass fibre separator.
- Low specific acid density.
- High integrity pillar seal.
- Maintenance-Free Operation.
- Low Pressure Venting System
- Low Self Discharge.
- U.L. Component Recognition
- Six months shelf life at 20°C
- Design life 12 years

Enduro EHP Valve Regulated Lead Acid batteries are the ideal energy source for many different standby applications.

Technical Features

- **Sealed Construction**
ABT's unique multiple sealing construction and sealing technique ensures that no electrolyte leakage should occur from the terminals or case of any Enduro EHP. This feature provides for safe and effective operation of Enduro EHP in any orientation.
- **Electrolyte Suspension System**
Enduro EHP utilize an electrolyte suspension system consisting of high microporous glass fibre separator. This suspension system helps to achieve maximum service life, by fully retaining the electrolyte and preventing its escape from the separator material.
- **Gas Generation**
Enduro EHP incorporates a unique design that effectively recombines over 99% of the gas generated during normal usage.
- **Low Maintenance Operation**
During the life of Enduro EHP, there is no need to check their specific gravity or add water etc.
- **Long Float Service Life**
The expected service life of the standard model Enduro EHP when used in standby applications is typically 12years.
- **Low Self Discharge-Long Shelf Life**
At temperatures of between 20 & 25 °C, the self discharge rate of Enduro EHP is approximately 3% per month of their rated capacity. This low self discharge rate permits storage for upto one year without any deterioration of battery performance.
- **Wide Operating Temperature Range**
Enduro EHP can be used over a wide range of ambient temperatures: discharge -20~60°C, charge -10~60°C, storage -20~60°C.
- **High Recovery Capability**
Enduro EHP have excellent charge acceptance and recovery capability, even after very deep discharge.

Construction



1. High conductivity pillars

Threaded terminals with brass inserts allow high conductivity and maximum torque retention.

2. High integrity pillar seal

Compression grommet designed for long life.

3. Self-regulating relief valve

Enduro EHP are equipped with a safe, low pressure venting system, which is designed to release excess gas and reseal automatically as the internal gas pressure rising to an unacceptable level. This low pressure venting system, coupled with the significantly high recombination efficiency, make Enduro EHP one of the safest valve regulated lead acid batteries available.

4. Rugged super-thick positive plates

Thick plates with grids cast from high purity Lead- Calcium-Tin alloy to ensure a long and reliability life.

5. Balanced negative plates

Ensure optimum gas recombination efficiency.

6. Containers and lid

Made from thick-walled ABS standard plastic, designed for unsurpassed mechanical strength (flame retardancy standard IEC707 FV0 and UL 94V0 optional).

7. Separators

Low resistance microporous glass fibre. The electrolyte is absorbed within this material.

8. Handle

Most size have handles integrated into the battery covers to facilitate ease of handling, installation and removal of the batteries.

Applications

- Telecommunication Systems
- Power supply system
- UPS
- Power plant generation and distribution
- High power back-up power sources.
- Cable Television
- Solar/Wind Powered Systems

Standards

- IEC60896-21/22:2004
- GB/T 19638.2-2005
- JIS C8704-1/2:2006
- Eurobat Guide

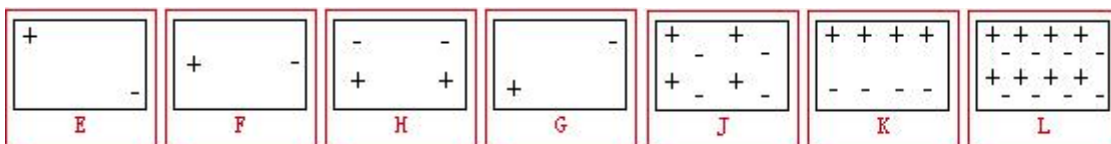
Certification

- CE
- UL
- GOST

General Specifications

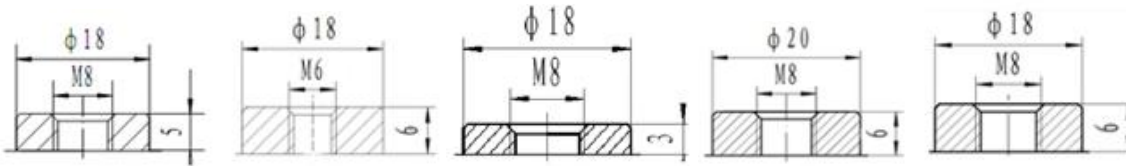
Battery Type	Nominal Voltage (V)	Nominal Capacity (Ah, 20°C)		Dimensions (mm)				Weight (kg)	Maximum Current (A, 20°C)		Internal Resistance (mΩ, 20°C)	Terminal Type	Terminal Layout
		C ₈ 1.80V/cell	C ₁₀ 1.80V/cell	Length	Width	Height	Total Height		In 1 min	In 1 sec			
EHP6-105	6	99	105	195	206	220	240	22.4	525	1260	2.62	M8×Φ18	E
EHP6-125	6	120	125	278	178	238	258	25.5	625	1500	2.63	M8×Φ18	E
EHP6-160	6	153.6	160	278	178	238	258	30.6	800	1840	2.35	M8×Φ18	E
EHP6-200	6	196	200	250.5	125.5	362	365	33.7	900	2000	1.55	M8×Φ18	G
EHP2-200	2	195.2	200	110	208	242	260	13.5	800	1400	0.58	M8×Φ18	F
EHP2-275	2	268.8	275	142	205	242	260	18.1	1100	1900	0.52	M8×Φ18	F
EHP2-300	2	292.8	300	142	205	242	260	18.6	1200	2100	0.48	M8×Φ18	F
EHP2-320	2	312.8	320	195	206	220	240	22.8	1300	2200	0.47	M8×Φ18	H
EHP2-400	2	390.4	400	195	208	253	258	25.6	1600	2800	0.42	M8×Φ18	H
EHP2-455	2	444.8	455	296	203	222	240	32.6	1800	3200	0.4	M8×Φ18	H
EHP2-515	2	503.2	515	296	203	222	240	34.7	2000	3400	0.38	M8×Φ18	H
EHP2-560	2	547.2	560	296	203	222	240	36.1	2200	3600	0.36	M8×Φ18	H
EHP2-600	2	568.8	600	252.0	175.0	348.5	357.5	36.2	2100	3600	0.16	M8×Φ20	H
EHP2-800	2	759.2	800	350.0	173.0	338.0	347.0	48.9	2800	4800	0.14	M8×Φ20	H
EHP2-1000	2	952	1000	430.0	173.0	338.0	347.0	60.3	3500	6000	0.14	M8×Φ20	H
EHP2-1200	2	1136	1200	510.0	175.0	338.0	347.0	72.7	4200	7200	0.15	M8×Φ18	K
EHP2-1500	2	1424	1500	318.0	341.0	341.0	351.0	88.1	5250	8500	0.16	M8×Φ18	J
EHP2-2000	2	1896	2000	433.0	342.0	341.0	351.0	120.0	6000	11000	0.09	M8×Φ18	J
EHP2-3000	2	2848	3000	629.0	346.0	341.0	351.0	176.0	9000	16600	0.08	M8×Φ18	L

Terminal Layout





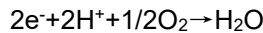
Terminals



Technology

Principle of VRLA batteries

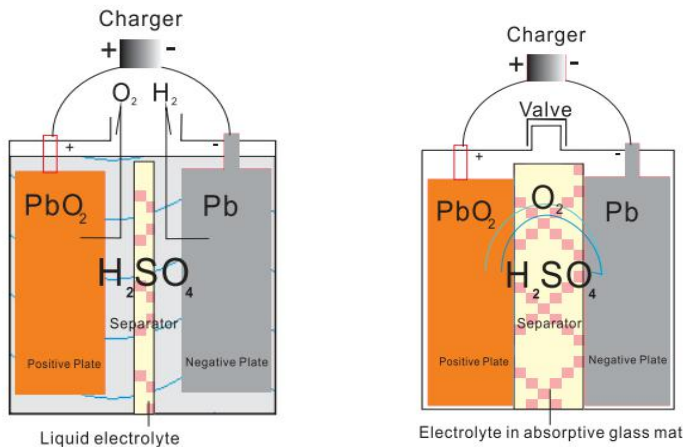
During charging of conventional lead acid battery, electrolyte is turned into water at the final stage and hydrogen generates from the negative plates and oxygen from the positive plates. This causes water loss and periodic watering is needed. However, evolution of oxygen and hydrogen gases does not occur simultaneously, because the recharge of the positive plates is not as efficient as the negative ones. This means that oxygen is evolved from the positive plate before hydrogen is evolved from the negative plate. At the same time, oxygen is evolved from the positive plate, a substantial amount of highly active spongy lead exists on the negative plate before it commences hydrogen evolution. Therefore, providing oxygen can be transported to the negative plates, conditions are ideal for a rapid reaction between lead and oxygen, for i.e., oxygen is electrochemically reduced on the negative plate according to the following formula, and the final product is water.



The current flowing through the negative plate drives this reaction instead of hydrogen evolution, which occurs, in a conventional battery.

This process is called gas recombination. If this process were 100% efficient no water would be lost from the battery. By careful design and selection of battery components, gas recombination efficiency is from 95% to 99%.

Principle of the oxygen reduction cycle follows:



Recombination efficiency

Recombination efficiency is determined under specific conditions by measuring the volume of by drogen emitted from the battery and converting this into its ampere-hour equivalent. This equivalent value is then subtracted from the total ampere-hours taken by the battery during the test period, and the remainder is the battery's recombination efficiency and is usually expressed as a percentage.

As recombination is never 100%, some hydrogen gas is emitted from batteries through the safety valve. The volume of gas emitted is very small and typical average values on constant potential float at 20 °C are as follow:

Float voltage (V)	Volume of gas emitted (ml/cell/C ₂₀ /month)
2.26	3.7
2.36	24.0

Performance Data

EHP Series Constant Current Discharge (Amperes @ 20°C)

Constant Current Discharge Data Sheet -----Amperes(A)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10 h
EHP6-105	1.60	316.0	254.8	210.0	171.7	125.0	105.0	88.00	75.00	56.05	45.31	30.50	18.90	12.86	10.88
	1.65	290.3	239.6	197.7	163.4	121.0	103.0	87.00	74.00	55.25	44.63	30.20	18.47	12.75	10.79
	1.67	276.2	232.0	193.4	158.8	118.8	101.0	86.00	73.50	54.90	44.29	29.80	18.28	12.71	10.76
	1.70	261.0	223.4	188.3	153.6	116.2	100.0	85.00	73.00	54.33	43.78	29.50	18.02	12.62	10.69
	1.75	239.8	207.6	174.9	146.3	111.4	97.00	81.50	71.00	53.47	42.97	29.00	17.57	12.50	10.60
	1.80	222.0	192.5	166.2	138.4	106.4	93.20	77.00	68.00	52.45	41.99	28.20	17.13	12.38	10.50
EHP6-125	1.60	376.6	304.8	248.6	204.0	146.3	116.0	96.30	83.76	62.00	50.00	35.00	22.50	15.84	12.89
	1.65	339.8	273.4	230.6	189.8	141.5	114.2	93.40	81.33	61.00	49.00	34.34	22.22	15.59	12.81
	1.67	325.3	264.6	222.9	184.3	139.5	113.0	92.13	80.32	60.00	48.00	34.00	22.16	15.52	12.80
	1.70	309.5	254.7	214.4	178.0	136.9	111.8	90.50	78.98	59.00	47.00	33.52	22.02	15.39	12.73
	1.75	282.2	234.5	197.4	166.4	132.6	107.5	88.00	76.87	58.00	46.00	32.84	21.77	15.19	12.66
	1.80	259.4	216.8	184.0	156.8	127.4	102.0	84.90	74.42	56.00	44.00	32.15	21.56	15.00	12.50
EHP6-160	1.60	482.0	390.1	318.2	261.2	187.3	146.0	123.2	107.2	80.00	63.00	44.80	28.80	20.27	16.50
	1.65	435.0	350.0	295.1	243.0	181.2	143.0	119.5	104.1	79.00	62.00	43.95	28.44	19.96	16.40
	1.67	416.4	338.7	285.3	235.9	178.6	141.0	117.9	102.8	78.00	61.00	43.52	28.37	19.87	16.38
	1.70	396.2	326.0	274.4	227.8	175.3	139.0	115.9	101.1	77.00	60.00	42.91	28.18	19.70	16.30
	1.75	361.2	300.2	252.7	213.0	169.7	136.0	112.6	98.39	74.00	58.00	42.03	27.87	19.44	16.20
	1.80	332.0	277.5	235.6	200.7	163.1	132.0	108.7	95.26	71.00	56.00	41.15	27.60	19.20	16.00
EHP6-200	1.60	690.0	500.1	381.9	320.1	237.5	190.0	160.7	142.0	102.0	81.00	56.40	38.50	25.28	20.63
	1.65	649.0	469.5	362.9	306.3	231.3	187.0	157.7	140.0	101.0	79.00	55.24	38.02	25.02	20.46
	1.67	610.1	455.0	355.2	301.6	229.1	183.0	156.8	139.4	100.0	78.26	54.78	37.87	24.95	20.43
	1.70	568.7	438.7	346.1	295.6	225.9	180.0	155.2	138.3	99.0	77.20	54.10	37.57	24.78	20.32
	1.75	515.0	408.2	331.6	285.0	219.6	177.0	152.2	136.3	96.0	75.40	53.05	37.14	24.62	20.16
	1.80	485.0	383.2	316.2	273.9	213.3	174.0	149.4	134.5	93.0	74.00	51.88	36.70	24.50	20.00
EHP2-200	1.60	546	415	338	287	220	178	149	128	97	78	55.9	36.7	25.4	20.7
	1.65	496	380	313	267	208	170	143	125	94.7	76.7	55.1	36.3	25.2	20.5
	1.67	476	365	301	258	202	166	140	124	93.6	76.1	54.8	36.1	25.1	20.5
	1.70	453	349	289	249	196	161	137	122	92.2	75.3	54.4	35.9	24.9	20.4
	1.75	396	321	272	237	189	157	134	120	90.8	74	53.5	35.4	24.7	20.2
	1.80	348	298	257	226	182	152	130	115	88.3	72.2	52.7	35	24.4	20
EHP2-275	1.60	751	571	465	394	303	245	205	175	133	107	76.9	50.5	34.9	28.5
	1.65	683	523	430	367	286	234	197	172	130	105	75.8	49.9	34.6	28.2
	1.67	654	502	414	355	278	228	193	170	129	105	75.4	49.6	34.5	28.2
	1.70	623	480	398	342	269	222	188	167	127	104	74.7	49.4	34.3	28
	1.75	545	442	374	326	260	216	184	165	125	102	73.5	48.7	34	27.8
	1.80	479	409	353	311	250	209	178	158	121	99.3	72.4	48.2	33.6	27.5

Performance Data

EHP Series Constant Current Discharge (Amperes @ 20°C)

Constant Current Discharge Data Sheet -----Amperes(A)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-300	1.60	819	623	507	430	330	267	224	191	145	117	83.9	55.1	38.1	31.1
	1.65	745	570	469	400	312	255	215	188	142	115	82.7	54.5	37.7	30.8
	1.67	713	548	452	387	303	249	210	186	140	114	82.2	54.2	37.7	30.8
	1.70	680	524	434	373	294	242	205	183	138	113	81.5	53.9	37.4	30.6
	1.75	595	482	408	356	284	236	201	180	136	111	80.2	53.2	37	30.4
	1.80	522	446	386	339	273	228	195	173	132	108	79	52.5	36.6	30
EHP2-320	1.60	874	664	541	459	352	285	239	204	155	125	89.5	58.8	40.7	33.1
	1.65	794	609	500	427	332	272	229	201	151	123	88.2	58.1	40.3	32.9
	1.67	761	584	482	413	323	265	224	198	150	122	87.7	57.8	40.2	32.8
	1.70	725	558	463	398	313	258	219	195	148	120	87	57.4	39.9	32.6
	1.75	634	514	436	379	303	251	214	192	145	118	85.6	56.7	39.5	32.4
	1.80	557	476	411	362	291	243	208	184	141	116	84.3	56	39.1	32
EHP2-400	1.60	1092	831	677	573	440	357	298	255	194	156	112	73.5	50.8	41.4
	1.65	993	761	625	534	415	340	286	251	189	153	110	72.6	50.3	41.1
	1.67	951	730	603	517	404	332	280	248	187	152	110	72.2	50.2	41
	1.70	906	698	578	497	392	323	274	243	184	151	109	71.8	49.9	40.7
	1.75	793	643	545	474	378	314	268	240	182	148	107	70.9	49.4	40.5
	1.80	696	595	514	452	364	304	259	230	177	144	105	70	48.8	40
EHP2-455	1.60	1242	945	770	652	501	406	339	290	221	177	127	83.6	57.8	47.1
	1.65	1129	865	711	607	472	386	325	285	215	174	125	82.6	57.2	46.7
	1.67	1082	831	686	588	460	377	319	282	213	173	125	82.1	57.1	46.6
	1.70	1031	794	658	566	445	367	312	277	210	171	124	81.7	56.7	46.3
	1.75	902	731	619	539	430	357	305	273	207	168	122	80.6	56.2	46
	1.80	792	677	585	514	414	346	295	262	201	164	120	79.7	55.6	45.5
EHP2-515	1.60	1406	1069	871	738	567	459	384	329	250	201	144	94.6	65.4	53.3
	1.65	1278	979	805	688	535	437	368	323	244	198	142	93.5	64.8	52.9
	1.67	1224	940	776	665	520	427	361	319	241	196	141	93	64.6	52.8
	1.70	1167	899	745	641	504	416	353	313	238	194	140	92.5	64.2	52.4
	1.75	1021	828	701	611	487	405	345	309	234	190	138	91.3	63.6	52.1
	1.80	896	766	662	582	469	391	334	297	227	186	136	90.2	62.9	51.5
EHP2-560	1.60	1529	1163	947	802	616	499	418	357	272	218	157	103	71.2	58
	1.65	1390	1065	875	748	582	476	401	351	265	215	154	102	70.5	57.5
	1.67	1331	1023	844	723	566	465	393	347	262	213	153	101	70.3	57.4
	1.70	1269	977	810	696	548	452	384	341	258	211	152	101	69.8	57
	1.75	1110	900	762	664	530	440	375	336	254	207	150	99.2	69.2	56.7
	1.80	975	833	720	633	510	425	363	323	247	202	147	98.1	68.4	56

Performance Data

EHP Series Constant Current Discharge (Amperes @ 20°C)

Constant Current Discharge Data Sheet -----Amperes(A)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-600	1.60	1260	973	805	693	550	461	399	348	267	217	160	107	74	61.8
	1.65	1145	891	744	646	519	439	383	342	261	213	158	106	73.3	61.3
	1.67	1107	855	716	624	504	428	375	337	257	211	156	105	73	61.1
	1.70	1046	818	689	602	489	418	367	332	254	209	155	105	72.6	60.8
	1.75	915	753	648	574	473	406	359	330	250	205	153	103	71.9	60.4
	1.80	803	697	612	547	455	393	347	314	243	201	150	102	71.1	60
EHP2-800	1.60	1680	1298	1074	924	734	615	533	464	356	289	213	143	98.7	82.4
	1.65	1527	1189	993	861	692	586	511	456	347	284	210	141	97.7	81.7
	1.67	1476	1140	955	832	672	571	500	449	343	281	209	140	97.3	81.4
	1.70	1395	1091	918	802	653	557	489	443	339	279	207	139	96.9	81.1
	1.75	1220	1005	864	765	630	542	478	440	333	274	204	138	95.9	80.5
	1.80	1071	930	816	729	607	524	463	419	324	268	200	136	94.9	80
EHP2-1000	1.60	2100	1622	1342	1156	917	769	666	580	445	361	266	178	123	103
	1.65	1909	1486	1241	1077	865	732	639	570	434	355	263	176	122	102
	1.67	1845	1425	1194	1040	840	714	625	562	429	352	261	175	122	102
	1.70	1743	1363	1148	1003	816	696	611	553	423	349	259	174	121	101
	1.75	1525	1256	1081	956	788	677	598	550	416	342	255	172	120	101
	1.80	1339	1162	1020	912	759	655	579	524	405	334	250	170	119	100
EHP2-1200	1.60	2520	1947	1611	1387	1101	922	799	696	534	433	320	214	148	124
	1.65	2291	1783	1489	1292	1038	878	766	684	521	426	315	211	147	123
	1.67	2214	1709	1433	1248	1009	857	750	674	514	422	313	210	146	122
	1.70	2092	1636	1377	1204	979	835	734	664	508	418	311	209	145	122
	1.75	1830	1507	1297	1147	946	813	717	660	500	411	306	206	144	121
	1.80	1606	1395	1224	1094	910	786	695	629	486	401	300	204	142	120
EHP2-1500	1.60	3150	2433	2014	1733	1376	1153	999	870	667	542	400	268	185	155
	1.65	2864	2228	1861	1615	1298	1098	958	855	651	533	394	264	183	153
	1.67	2767	2137	1791	1560	1261	1071	938	843	643	528	391	263	182	153
	1.70	2615	2045	1721	1505	1223	1044	917	830	635	523	388	261	182	152
	1.75	2287	1884	1621	1434	1182	1016	896	825	625	514	382	258	180	151
	1.80	2008	1744	1530	1368	1138	982	869	786	607	502	375	255	178	150
EHP2-2000	1.60	4200	3245	2685	2311	1834	1537	1331	1160	890	722	533	357	247	206
	1.65	3818	2971	2481	2153	1731	1464	1277	1140	869	710	525	352	244	204
	1.67	3689	2849	2388	2080	1681	1428	1250	1123	857	704	521	351	243	204
	1.70	3486	2727	2295	2006	1631	1392	1223	1107	846	697	518	349	242	203
	1.75	3050	2512	2161	1912	1576	1355	1195	1100	833	685	509	344	240	201
	1.80	2677	2325	2040	1824	1517	1310	1158	1048	810	669	500	340	237	200

Performance Data

EHP Series Constant Current Discharge (Amperes @ 20°C)

Constant Current Discharge Data Sheet -----Amperes(A)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-3000	1.60	6300	4867	4027	3467	2752	2306	1997	1740	1335	1084	799	535	370	309
	1.65	5727	4457	3722	3230	2596	2196	1916	1710	1303	1065	788	529	366	307
	1.67	5534	4274	3582	3119	2521	2142	1875	1685	1286	1055	782	526	365	305
	1.70	5230	4090	3443	3009	2447	2088	1834	1660	1269	1046	777	523	363	304
	1.75	4575	3767	3242	2868	2364	2032	1793	1650	1249	1027	764	516	360	302
	1.80	4016	3487	3060	2735	2276	1965	1737	1571	1214	1003	750	510	356	300

Performance Data

EHP Series Constant Power Discharge (Watt per cell @ 20°C)

Constant Power Discharge Data Sheet -----Watt(W)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP6-105	1.60	537.0	430.0	353.0	293.3	217.0	191.6	156.0	138.0	101.0	78.50	54.57	37.50	24.87	20.61
	1.65	502.7	411.3	339.8	281.8	211.4	187.2	153.0	136.8	100.0	77.30	54.17	37.06	24.74	20.53
	1.67	490.2	402.7	333.5	277.3	209.2	185.4	152.0	136.3	99.5	77.00	54.05	36.90	24.71	20.54
	1.70	475.8	392.4	325.8	271.6	206.1	182.9	151.0	135.2	99.0	76.40	53.71	36.60	24.58	20.47
	1.75	442.6	373.3	311.1	262.0	199.7	177.8	148.0	133.5	97.0	75.20	53.21	36.09	24.44	20.41
	1.80	410.0	350.7	297.6	251.1	193.0	172.5	145.0	131.7	94.0	74.10	52.70	35.60	24.33	20.34
EHP6-125	1.60	629.7	514.1	419.5	351.6	264.5	218.0	186.0	157.2	122.10	92.08	65.83	44.14	29.81	24.66
	1.65	593.8	487.5	404.4	339.7	257.9	217.0	183.0	155.2	120.50	90.80	65.00	43.76	29.70	24.59
	1.67	573.7	474.1	395.3	334.0	255.2	216.0	182.0	154.2	119.79	90.31	64.75	43.62	29.70	24.60
	1.70	551.4	458.8	384.7	327.0	251.5	215.0	181.0	152.5	118.60	89.46	64.25	43.31	29.58	24.52
	1.75	511.5	421.9	357.8	314.5	243.8	212.0	179.0	150.3	116.70	87.89	63.58	42.73	29.38	24.45
	1.80	462.2	387.8	337.8	301.6	235.2	206.0	177.0	147.7	114.60	86.25	62.75	42.03	29.22	24.37
EHP6-160	1.60	806.0	658.0	537.0	450.0	338.6	280.0	235.0	201.2	156.3	117.9	84.26	56.50	38.16	31.57
	1.65	760.0	624.0	517.7	434.9	330.1	279.0	233.0	198.7	154.3	116.2	83.20	56.01	38.01	31.47
	1.67	734.4	606.8	506.1	427.6	326.7	278.0	231.5	197.3	153.4	115.6	82.89	55.84	38.01	31.49
	1.70	705.8	587.2	492.4	418.6	321.9	277.0	230.0	195.2	151.8	114.5	82.24	55.44	37.86	31.39
	1.75	654.7	540.0	458.0	402.5	312.0	275.0	227.0	192.4	149.4	112.5	81.38	54.70	37.61	31.29
	1.80	591.6	496.4	432.4	386.0	301.0	272.0	223.0	189.0	146.7	110.4	80.32	53.80	37.40	31.19
EHP6-200	1.60	1180	840.0	676.0	555.0	435.0	355.0	301.6	270.0	195.0	155.0	108.6	74.00	48.50	40.83
	1.65	1112	811.1	652.4	542.6	424.6	349.0	297.0	267.2	192.0	153.3	107.3	73.28	47.97	40.23
	1.67	1082	797.1	641.7	534.4	419.7	347.0	295.1	266.1	190.0	152.9	106.9	73.03	47.85	40.09
	1.70	1048	780.0	628.4	524.1	413.2	342.0	292.0	264.0	188.0	151.8	106.1	72.48	47.53	39.79
	1.75	985.9	740.8	604.4	507.8	404.5	335.0	287.1	260.2	184.0	150.4	105.0	71.59	46.83	39.19
	1.80	930.0	703.0	577.7	487.5	396.3	330.0	282.8	257.0	180.0	149.0	104.0	70.50	46.30	38.60

Performance Data

EHP Series Constant Power Discharge (Watt per cell @ 20°C)

Constant Power Discharge Data Sheet-----Watt (W)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-200	1.60	796	673	559	487	371	300	257	224	173	142	102	67.9	48.9	39.8
	1.65	731	611	512	449	344	283	244	217	166	137	99.5	66.8	48.3	39.1
	1.67	691	590	496	437	332	276	237	214	164	135	98.7	66.5	48.1	39
	1.70	645	560	476	420	321	268	231	210	162	133	97.5	65.9	47.7	38.8
	1.75	578	518	444	390	301	252	220	201	158	130	95.5	64.6	47.1	38.3
	1.80	531	475	407	360	283	238	212	192	153	126	93.5	63.5	46.5	37.7
EHP2-275	1.60	1094	926	768	669	510	413	353	309	238	195	141	93.4	67.2	54.8
	1.65	1005	841	704	617	474	389	335	298	229	188	137	91.8	66.4	53.8
	1.67	950	811	682	601	457	379	326	294	226	186	136	91.4	66.1	53.6
	1.70	887	770	655	577	442	369	317	289	223	183	134	90.6	65.6	53.3
	1.75	795	712	610	537	414	347	303	276	217	178	131	88.9	64.7	52.6
	1.80	730	653	559	494	389	328	292	263	210	174	129	87.3	63.9	51.8
EHP2-300	1.60	1193	1010	838	730	556	451	385	337	260	213	153	102	73.3	59.7
	1.65	1096	917	768	674	517	424	366	325	250	205	149	100	72.4	58.7
	1.67	1037	885	744	656	498	413	356	321	246	203	148	100	72.2	58.5
	1.70	968	840	714	630	482	403	346	316	243	200	146	98.8	71.6	58.2
	1.75	867	777	666	585	452	378	331	301	236	195	143	97	70.6	57.4
	1.80	797	713	610	539	424	357	319	287	229	189	140	95.3	69.7	56.5
EHP2-320	1.60	1273	1077	894	779	593	481	411	359	277	227	164	109	78.2	63.7
	1.65	1169	978	819	718	551	453	390	347	266	219	159	107	77.3	62.6
	1.67	1106	944	794	699	531	441	380	342	263	216	158	106	77	62.4
	1.70	1032	896	762	672	514	429	369	337	260	213	156	105	76.3	62
	1.75	925	829	710	625	482	403	353	321	252	208	153	103	75.3	61.2
	1.80	850	760	651	575	452	381	340	306	245	202	150	102	74.3	60.3
EHP2-400	1.60	1591	1347	1118	974	742	601	513	449	346	283	205	136	97.8	79.7
	1.65	1462	1223	1024	898	689	566	488	433	333	274	199	134	96.6	78.3
	1.67	1382	1180	992	874	664	551	475	428	329	270	197	133	96.2	78
	1.70	1290	1120	952	840	643	537	462	421	324	266	195	132	95.4	77.5
	1.75	1156	1036	888	781	603	504	441	401	315	260	191	129	94.2	76.5
	1.80	1062	950	813	719	565	476	425	383	306	253	187	127	92.9	75.3
EHP2-455	1.60	1810	1532	1271	1108	843	684	584	511	394	322	233	155	111	90.6
	1.65	1663	1391	1165	1021	784	644	555	493	379	311	226	152	110	89
	1.67	1572	1342	1128	994	755	627	540	487	374	307	225	151	109	88.7
	1.70	1468	1274	1083	955	731	610	525	479	369	303	222	150	109	88.2
	1.75	1315	1178	1010	888	686	574	501	456	359	295	217	147	107	87
	1.80	1208	1081	925	818	643	542	483	436	348	287	213	145	106	85.7

Performance Data

EHP Series Constant Power Discharge (Watt per cell @ 20°C)

Constant Power Discharge Data Sheet-----Watt (W)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-515	1.60	2049	1734	1439	1254	955	774	661	578	446	365	263	175	126	103
	1.65	1882	1574	1319	1156	887	729	628	558	429	352	256	172	124	101
	1.67	1779	1519	1277	1125	855	710	611	551	423	348	254	171	124	100
	1.70	1661	1442	1226	1081	828	691	594	542	418	343	251	170	123	99.8
	1.75	1488	1334	1143	1005	776	649	568	516	406	334	246	166	121	98.5
	1.80	1368	1224	1047	926	728	613	547	493	394	325	241	164	120	97
EHP2-560	1.60	2228	1885	1565	1363	1038	841	719	628	485	397	286	190	137	112
	1.65	2046	1712	1434	1257	964	792	683	607	466	383	279	187	135	110
	1.67	1935	1652	1389	1224	930	772	665	599	460	378	276	186	135	109
	1.70	1806	1568	1333	1176	900	751	646	589	454	373	273	184	134	109
	1.75	1618	1450	1243	1093	844	706	617	562	441	363	267	181	132	107
	1.80	1487	1331	1139	1007	791	667	595	536	428	354	262	178	130	105
EHP2-600	1.60	1836	1578	1331	1178	927	777	687	612	476	394	292	198	142	119
	1.65	1687	1433	1219	1086	861	732	653	591	458	380	284	194	141	117
	1.67	1588	1373	1177	1051	832	713	636	583	452	375	281	193	140	116
	1.70	1489	1313	1134	1016	804	694	618	574	446	370	279	192	139	116
	1.75	1334	1214	1057	944	753	652	590	547	434	361	273	188	137	114
	1.80	1226	1114	968	870	706	616	569	522	421	351	267	185	135	113
EHP2-800	1.60	2448	2104	1774	1571	1236	1036	916	816	635	525	390	264	190	159
	1.65	2249	1910	1626	1448	1148	976	871	788	611	507	379	259	188	156
	1.67	2117	1830	1569	1401	1110	951	848	777	603	500	375	258	186	155
	1.70	1985	1750	1512	1354	1071	925	824	765	595	493	371	256	185	154
	1.75	1778	1618	1409	1259	1005	869	787	729	578	481	364	251	183	152
	1.80	1634	1485	1291	1160	942	821	759	697	561	468	356	247	180	151
EHP2-1000	1.60	3060	2630	2218	1963	1545	1295	1146	1020	794	656	487	330	237	198
	1.65	2811	2388	2032	1811	1435	1220	1089	985	764	634	474	324	234	195
	1.67	2646	2288	1961	1752	1387	1188	1060	971	754	625	469	322	233	194
	1.70	2481	2188	1890	1693	1339	1157	1030	957	744	616	464	320	232	193
	1.75	2223	2023	1762	1574	1256	1087	984	912	723	601	455	314	229	190
	1.80	2043	1856	1614	1450	1177	1027	948	871	701	585	445	308	226	188
EHP2-1200	1.60	3672	3156	2661	2356	1854	1554	1375	1224	953	787	585	396	285	238
	1.65	3373	2865	2438	2173	1722	1464	1307	1182	916	760	569	389	281	234
	1.67	3175	2745	2353	2102	1665	1426	1272	1165	905	750	563	386	280	233
	1.70	2977	2625	2268	2032	1607	1388	1237	1148	893	740	557	384	278	231
	1.75	2668	2428	2114	1889	1507	1304	1181	1094	868	721	546	377	274	228
	1.80	2452	2228	1937	1740	1413	1232	1138	1045	841	701	534	370	271	226

Performance Data

EHP Series Constant Power Discharge (Watt per cell @ 20°C)

Constant Power Discharge Data Sheet-----Watt (W)															
Battery Type	End Voltage	Discharge Time													
	(V/cell)	5 min	10 min	15 min	20 min	30 min	40 min	50 min	1 h	1.5 h	2 h	3 h	5 h	8 h	10h
EHP2-1500	1.60	4590	3945	3327	2945	2317	1943	1718	1530	1191	984	731	495	356	297
	1.65	4217	3582	3048	2716	2153	1830	1634	1478	1145	950	711	486	352	292
	1.67	3969	3432	2941	2628	2081	1782	1590	1456	1131	937	704	483	350	291
	1.70	3722	3282	2835	2540	2009	1735	1546	1435	1116	925	696	480	347	289
	1.75	3335	3035	2642	2361	1884	1630	1476	1368	1085	901	682	471	343	286
	1.80	3065	2785	2421	2175	1766	1540	1423	1306	1052	877	668	463	338	283
EHP2-2000	1.60	6120	5261	4435	3926	3090	2590	2291	2040	1588	1312	974	660	475	396
	1.65	5622	4776	4064	3621	2870	2440	2178	1970	1527	1267	948	648	469	389
	1.67	5292	4576	3922	3504	2774	2376	2119	1942	1508	1250	938	644	466	388
	1.70	4962	4376	3780	3386	2679	2313	2061	1913	1488	1233	928	639	463	386
	1.75	4446	4046	3523	3148	2511	2173	1968	1823	1446	1202	909	628	457	381
	1.80	4086	3713	3228	2900	2355	2053	1897	1741	1402	1169	891	617	451	377
EHP2-3000	1.60	9180	7891	6653	5890	4634	3886	3437	3060	2382	1968	1462	990	712	595
	1.65	8433	7163	6096	5432	4305	3659	3267	2955	2291	1901	1422	972	703	584
	1.67	7938	6863	5883	5255	4162	3565	3179	2913	2261	1875	1407	966	699	581
	1.70	7443	6563	5670	5079	4018	3470	3091	2870	2232	1849	1393	959	695	579
	1.75	6669	6069	5285	4722	3767	3260	2952	2735	2169	1803	1364	941	686	571
	1.80	6129	5569	4842	4349	3532	3080	2845	2612	2103	1754	1336	925	677	565



Selection of battery size

The following examples are designed to illustrate the method of determining which Enduro EHP cell type will support your required duty load.

Constant current discharge

EXAMPLE A. To demonstrate constant current calculation and also the effect of temperature.

A nominal 50V telecommunications system using a 24cell battery and requiring 102 amps constant current will operate satisfactorily at a minimum battery terminal volts level of 42 volts.

Calculate the battery type required for 2 hours standby duration the basis of:

- (a) 20°C operating temperature
- (b) 5°C operating temperature

METHOD

- (1) Minimum allowable volts per cell
 $42 \text{ volts} / 24 \text{ cells} = 1.75 \text{ V/cell}$
- (2) Hence, cell performance requirement is 102 amps constant current to 1.75Vpc
- (3) By reference to constant current performance table relating to 1.75 volts per cell level (see page 05)

(a) At 20°C

2V275cell size is smallest available size to use (105 amps available).

Conclusion: use 24—2V275cells

(b) At 5°C

By reference to the table on page 16 of this product guide, available current output at 20°C is reduced by factor 0.9.

Therefore at 5°C--2 hours output is reduced to, on 2V275 size, $105 \text{ amps} \times 0.9 = 94.5 \text{ amps}$.

Hence 2V275 cell size too small!

Try the largest next size-2V320. At 5°C available

current output is $123 \text{ amps} \times 0.9 = 110.7 \text{ amps}$.

Conclusion: Use 24—2V320 cells

Constant power discharge

EXAMPLE B. To demonstrate constant power calculation.

An inverter system requires a D.C. constant power input of 35.0 kW in the voltage range 486 volts maximum, 383 volts minimum.

Calculate the optimum battery size required for 20°C operation for a 1 hour standby period.

METHOD

- (1) Number of cells = $486 \text{ V} / 2.26 \text{ Vpc} = 215 \text{ cells}$.
- (2) Minimum volts per cell $383 / 215 = 1.781 \rightarrow 1.80 \text{ Vpc}$
- (3) Watts per cell = $35000 \text{ Watts} / 215 \text{ cell} = 154.88 \text{ watts per cell}$.
- (4) Hence cell performance requirement is 162.79 watts to 1.80Vpc at 20°C.
- (5) By reference to the constant power performance table (see page 08) relating to 1.80 volts per cell level, 6V160 monobloc is the smallest available size to use.

Operating Characteristics

The **Enduro EHP** range of cells should be charged using constant potential chargers.

Float voltage

At normal room temperature (20°C/68° F), the recommended float voltage is equal to 2.27Vpc.

To optimized battery performance it is recommended that the float voltage is adjusted for room ambient temperatures in accordance with the following table.

Temperature (°C)	Float voltage per cell	Temperature (°C)	Float voltage per cell
≤0	2.34	30	2.23
10	2.30	35	2.22
20	2.27	40	2.20
25	2.25	≥45	2.18

Under these conditions a recharge will be completed in approximately 72 hours.

Charging current

A discharged VRLA battery will accept a high recharge current, but for those seeking a more economical charging system a current limit of 0.08C₁₀: 0.1C₁₀ (A) is adequate.

Note: for a completely discharged battery, 80% of the capacity is replaced approximately.

10 hours at 0.1C₁₀ 6 hours at 0.3C₁₀ 5 hours at no current limit applied

Fast recharge

Increasing the charge voltage to 2.40 volts per cell can reduce recharge time and it is possible, depending on the depth of discharge, to halve the recharge time. Under these conditions, however, the charge must be monitored and must be terminated when the charge current remains reasonably steady for 3 consecutive hours after the voltage limit has been reached. At the beginning of charge the current must be limited to 0.1C₁₀: 0.125C₁₀(A). This charge regime, in order to achieve a normal service life, must not be used more than once per month.

The effect of temperature on capacity

Correction factors for capacity at different temperatures are shown in the following table, the reference

Duration of discharge	0°C	5°C	10°C	15°C	25°C	30°C	35°C	40°C	45°C
5min to 59min	0.8	0.86	0.91	0.96	1.0	1.04	1.06	1.09	1.1
1 hour to 24 hours	0.86	0.90	0.94	0.97	1.0	1.03	1.05	1.06	1.07

Operating Instruction and Guidelines

Accidental deep discharge

e.g.

- (1) discharge at a lower current for a longer time than the original system specification.
- (2) failure of the charging system.
- (3) battery not recharged immediately after a discharge.

When a battery is completely discharged:

- (1) The utilization of the sulphuric acid in the electrolyte is total and the electrolyte now consists only of water. During recharge this condition may produce metallic dendrites which can penetrate the separator and cause a short circuit in a cell.
- (2) The sulphation of the plate is at its maximum and the internal resistance of the cell is also at its maximum.

The battery should be recharged under a constant potential of 2.26 volts per cell with the current limited to a maximum of $0.3C_{10}(A)$ in order to prevent excessive internal heating. For instance, for a 6V 105 the maximum charge current is 31amps. If the sulphation of the cell/battery is extensive, then there charge of the battery may require more than 96 hours.

Note: Deep discharging will produce a premature deterioration of the battery and a noticeable reduction in the life expectancy of the battery.

For optimum operation the minimum voltage of the system should be related to the duty as follows:

Duty	Minimum end voltage
$5\text{min} \leq t < 1\text{h}$	1.65V
$1\text{h} \leq t < 5\text{h}$	1.70V
$5\text{h} \leq t < 8\text{h}$	1.75V
$8\text{h} < t < 20\text{h}$	1.80V

In order to protect the battery it is advisable to have system monitoring and low voltage cut-out.

Float charge ripple

Excessive ripple on the D.C. supply across a battery has the effect of reducing life and performance.

It is recommended therefore, that voltage regulation across the system including the load, but without the battery connected, under steady state conditions, shall be better than $\pm 1\%$ between 5% and 100% load.

Transient and other ripple type excursion scan be accommodated provided that, with the battery disconnected but the load connected, the system peak to peak voltage including the regulation

limits, falls within $\pm 2.5\%$ of the recommended float voltage of the battery.

Under no circumstances should the current flowing through the battery when it is operating under float conditions, reverse into the discharge mode.

Electro-Magnetic Compatibility (EMC)

Enduro EHP products are covered by the EMC statement in EN50226 which reads as follows:

Rechargeable cells or batteries are not sensitive to normal electromagnetic disturbances, and therefore no immunity tests shall be required. Free-standing rechargeable cells or batteries electrically isolated from any associated electrical system are for all practical purposes electromagnetically inert, and therefore the requirements for electromagnetic compatibility shall be deemed to be satisfied.

Note: It should be noted that rechargeable cells or batteries are part of an electrical system, and the manner in which they are used could invoke the requirements of the electromagnetic compatibility upon that system. In such cases, the requirements of electromagnetic compatibility shall be accommodated by the design of the system.

Maintenance

- Every month, check that the total voltage at the battery terminals is $(N \times 2.26V)$ for a temperature of 20°C .
N=the number of cells in the battery and $2.26=20^\circ\text{C}$ float voltage.
- Once a year, take a reading of the individual cell or monobloc voltages. A variation of $\pm 4.5\%$ on individual voltages from the average voltage is acceptable.
The system must be checked once or twice a year.
- New and old batteries cannot be used together. The batteries of various specifications and from different manufacturers cannot be used together.

Principal factors affecting the life of recombination batteries

- Deep discharge
- Poor control of float voltage
- Cycling or micro-cycling
- Poor quality of charging current (excessive ripple)
- High ambient temperature
- Overcharge

Installation and Commissioning Charge

Warning

Enduro EHP cells or monoblocs are already charged when delivered. They should be unpacked carefully. Avoid short circuiting terminals of opposite polarity as these units are capable of discharging at a very high current, especially if the lid or the container is damaged.

Unpacking

It is advisable to unpack all the cells or monoblocs and accessories before commencing to erect and not to unpack and erect cell by cell.

All items should be carefully checked against the accompanying advice notes to ascertain if any are missing. Advise the Sales Department of any discrepancies.

Transit insulation covers are fitted to one pole or a rigid plastic insulating cover is provided which totally protects the unit terminals. These are factory fitted to all products of the range and there is no need to remove them until access to the terminals is required.

Setting up the battery stands

The structure should be assembled in accordance within instructions supplied with the equipment.

To level the stand use the adjustable insulating feet.

Mounting in a cabinet

Ensure that the cabinet:

- Is sufficiently strong to cope with the weight of the battery.
- Is suitably insulated.
- Is naturally ventilated

Connecting the cells

● Torque setting

Tighten the nuts or bolts to the recommended levels of torque indicated on the product label.

Always use insulated tools for fitting and torquing up battery connections.

● In series

The number of cells in series (N) will not affect the selected float voltage per cell. Therefore, charging float voltage = $N \times \text{Cell float Voltage}$.

No special circuit arrangements are required.

● In parallel

Using constant voltage chargers, and ensuring that the connections made between the charger and the batteries have the same electrical resistance, no special arrangements have to be made for batteries in parallel.

Although no special circuit arrangements are required, where the parallel connection is made at the charger or distribution board, to avoid out of step conditions, the busbar run length and the area of cross section should be designed so that the circuit resistance value for each string is equal within limits $\pm 5\%$.

General recommendations

- Do not wear clothing of synthetic material to avoid static generation.
- Use only a clean soft damp cloth for cleaning the cells.
- Do not use chemicals or detergents.
- Use insulated tools.
- Commence installation at the least accessible point.
- Consult the drawing for the correct position of the cell poles.

Commissioning charge

Ensure that the batteries will be operated in a dry and clean environment.

Before use, the batteries should be charged at a constant float voltage adjusted according to the ambient temperature.

e.g. 2.26 volts per cell at 20°C for 48 to 96 hours or, alternatively, a voltage of 2.36 volts per cell at 20°C can be used to reduce the commissioning period from 24 to 15 hours.

Where the batteries have been stored under harsh conditions, this increased voltage recharge is particularly effective.

Battery Storage

Storage conditions

The battery should store in a dry, clean, ventilated and preferably cool location. Avoid placing batteries in close proximity to heat sources of any kind.

Storage time

As the batteries are supplied charged, storage time is limited. In order to easily charge the batteries after prolonged storage, it is advisable not to store batteries for more than:

- 6 months at 20°C
- 3 months at 30°C
- 6 weeks at 40°C

Battery state of charge

The battery state of charge can be determined by measuring the open-circuit voltage of cells in rest position for 72 hours at 20°C.

State of charge	The open-circuit voltage (V/cell)
100%	≥2.12
80%	≥2.10
60%	≥2.07
40%	≥2.04
20%	≥2.00

Open circuit voltage variation with temperature is about 2.5mV per cell per 10°C.

Recharge of stored batteries

Following storage and before putting the batteries into service, are refreshing charge shall be performed at 20°C for 48 to 96 hours.

A current limit is not essential, but for optimum charge efficiency the current output of the charger can be limited to 10% of the 3-hour capacity rating.

The necessity of a refreshing charge can also be determined by measuring the open circuit voltage of a stored battery. Refreshing charge is advised if the voltage drops below 2.09 volts per cell.

Failure to observe these conditions may resulting really reduced capacity and service life.

ABT VRLA Battery:

PowerLine/Thunder/Enduro/Sunwind/e-Trek/Gel

ABT World Wide

Our sales growth is due to a complete Global Network with Master distributors and Country managers who apply ABT commercial strategy and through Global Key Account, in



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