EXIDE INDUSTRIAL

POWERSAFE

EP Series

SEALED MAINTENANCE FREE VRLA BATTERIES

EXIDE INDUSTRIAL

SEALED MAINTENANCE FREE/ VALVE REGULATED LEAD ACID BATTERIES

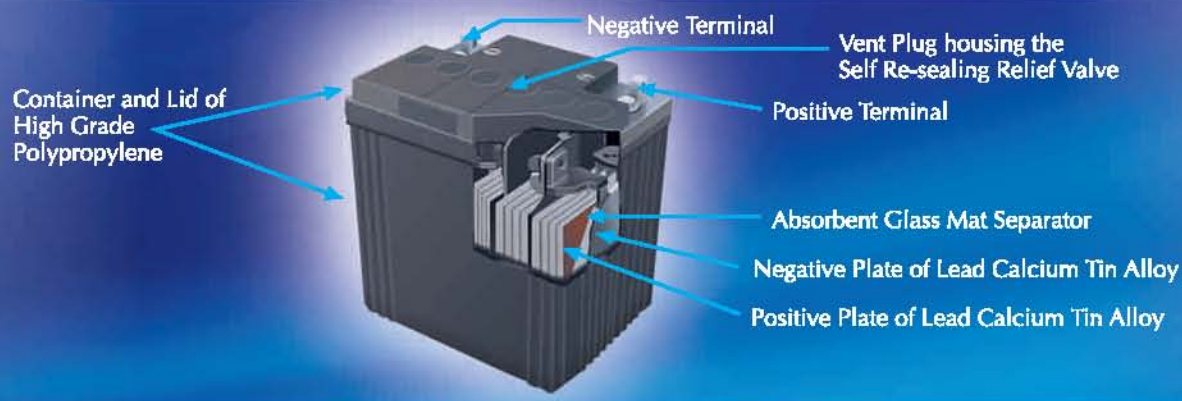
Exide Industries Ltd., the largest manufacturer of lead acid batteries in India, launched in the year 1997 the Power Pack of the future - The VRLA battery - a result of in-house R&D efforts and technical collaboration with M/s Shin-Kobe Electric Machinery Co., Japan, the manufacturers of HITACHI batteries.

The VRLA battery manufactured by Exide Industries Ltd. uses AGM or "Absorbent Glass Mat" technology. The electrolyte is in absorbed condition, held within the pores of the glass mat separator. The separator in turn, is tightly packed in between the positive and the negative plates.

To eliminate the harmful effects of early gassing, "lead antimony alloy" is replaced by "lead calcium tin alloy" in the plate grid structure. Very little electrolysis/gassing takes place and whatever water is converted to oxygen and hydrogen is reconverted back.

The released hydrogen is in its ionic state and, not being in gaseous form, cannot escape. The oxygen, though in gaseous form, cannot bubble upwards in the absence of any free electrolyte. It has to pass through the separator pores, through electrolyte and air pockets alternately and is forced to the surface of the negative plate. The oxygen reacts with the spongy lead of the negative plate and is recombined as shown :

Therefore this battery is also known as Oxygen Recombination Battery. The recombination is 100% efficient and no water is lost from the system.



At negative electrode	At positive electrode
$2Pb + O_2 \rightarrow 2PbO$ $PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$ $PbSO_4 + 2e^- + 2H^+ \rightarrow Pb + H_2SO_4$	$H_2O \rightarrow 1/2\ O_2 + 2H^+ + 2e^-$

At times, the rate of oxygen generation exceeds the rate of recombination due to imposition of higher than recommended charging voltages or due to operation in higher than recommended ambient temperature. This causes increase of pressure inside the battery and excess pressure is released through specially designed Self Re-sealing Relief Valve, and hence the name VRLA or Valve Regulated Lead Acid battery.

The only limitation of this versatile battery arises from the fact that these are temperature and charging voltage sensitive. Although maintenance by way of water topping up is not required, regular checking and assurance of proper charging voltage, depth of discharge and operating temperature is needed. This is true for all the VRLA or SMF batteries.

WHY EXIDE POWERSAFE

The Features	The Benefits
(1) **Sealed Maintenance Free :** No need for checking electrolyte level and topping throughout its life. Sealed construction ensures no leakage or seepage of electrolyte from terminal or casing.	• Saving of hundreds of litres of distilled/ demineralised water throughout its lifetime as compared to conventional batteries. • Saving of manpower for regular topping up and cleaning corroded terminals as in conventional batteries. • No damage of flooring by spillage of battery acid or water during maintenance. • No need of separate battery room.
(2) **Free from Orientation Constraints :** The sealed construction with immobilised electrolyte allows the battery to be installed in any position, horizontal, vertical, sideways – without any effect on its performance.	• Can be installed by stacking together in any convenient orientation or position, thereby saving huge floor space as compared to conventional batteries. • Saving of hundreds of square feet of costly floor space in metropolitan areas. • Battery can be installed inside offices and working areas – no need for separate battery rooms, costly acid proof flooring etc. Battery can be installed in a cabinet also.
(3) **Eco Friendly :** The unique gas recombination technology effectively nullifies generation of gas during normal use. It is totally eco friendly, ensuring clean and safe environment.	• No need for elaborate air exhaust systems as in conventional battery installations.
(4) **Minimal Voltage Drop :** Since battery emits no gases or fumes, it can be placed adjacent to the UPS system or other electronic equipment, ensuring minimal voltage drop between battery and equipment.	• Saving from transmission loss – Higher efficiency – Lower electricity consumption – Lower cost on cabling.
(5) **Easy Handling – Easy Installation :** Lightweight and compact. Modular construction, easy to install and easy to connect and commission.	• Does not require specially trained technical manpower for elaborate installation and commissioning procedures.
(6) **Ready To Use :** Available in fully (factory) charged condition.	• No delay between receipt and use. Instant power source.
(7) **Good Service Life :** Between 3 to 5 years life for small and medium monobloc range (EP range) depending on cyclic/float applications.	• Comparable with the best international makes. • Better than the international makes in the same capacity range.
(8) **Low Self Discharge :** Self discharge very low as compared to conventional flooded batteries.	• Can be stored for 3 to 6 months, depending on ambient temperature before recharge and without any loss of efficiency or performance. • Lower consumption of electricity during use.
(9) **Charge Retention & Recovery :** Excellent charge retention and recovery ability due to special design of plates and separators with an absolutely balanced electrolyte.	• Very long shelf life. • Leads to greatly improved ability to recover from deep discharge.
(10) **Superior High Rate Discharge :** Very low internal resistance and very high electrolyte – active material reactive interface – allows very high currents for short and medium duration.	• Requires smaller capacity (as compared to flooded batteries) for high rate discharges upto 15 mins/30 mins/ 60 mins duration.
(11) **High Reliability :** Tough construction and heavy duty design with superior corrosion resistant lead calcium tin alloy.	• Lower size, lower cost, lower space requirement. • Can deliver the rated performance throughout its service life.

EXIDE INDUSTRIAL POWERSAFE

ADVANTAGE EXIDE

- **Technology** : Manufactured in technical collaboration with Shin-Kobe Electric Machinery Co., Japan, maker of world-renowned Hitachi batteries. Exide Industries Ltd. is an ISO 9001 organisation.
- **Experience** : Over 60 years accumulated experience of Research & Development, field operations & feedback.
- **Manufacturing Base** : The only company having multilocational manufacturing units spread across the country with ultra large manufacturing capacities.
- **Result** : Factory fresh batteries, whenever and wherever you need them. VRLA batteries come in factory charged condition and thus, the fresher they are, the better.
- **Network** : Easy availability - with 26 Company branches, 30 Exide Powercentres and near 1000 Industrial dealers spread out all over the country.

  Trained manpower at all locations ensures immediate service and zero down time for your equipment. On line complaint registration through Toll Free No.1800-103-5454.
- **Solution Provider** : Experienced engineers are available to offer total solutions regarding equipment selection, installation, operation and maintenance.

  The only company in India to offer batteries from 2.5Ah - 20,000Ah and manufacturing SMF batteries right from 7Ah upto 5000Ah.
- **Eco-friendly Company** : ISO 14001, TS 16949, OHSAS 18001 certifications. Ensuring eco-friendly production process. The only company having own smelting house and large network to collect and recycle used batteries to avoid environmental damage.
- **Recycle Symbol** : The batteries manufactured both for domestic and exports are labelled with the recycle symbol.

- **Safety Conscious** : **Underwriters Laboratories Inc.® USA** certification for the products are available as an option.

APPLICATIONS

FOR STANDBY POWER

- UPS Systems
- Telecommunication Systems
- Office Automation Equipment
- Fire Alarm & Security Systems
- Electronic PABX Systems
- Cable Television Equipment
- Electronic Attendance & Cash Registers
- Process Instrumentation & Control
- Railway Signalling
- Power Plants & Substations
- Cellular Phones & Pagers (Base Stations & Transmitters)
- Geophysical Equipment
- PCO Monitors (Electronic)

FOR PORTABLE POWER

- Search Lights
- Portable Communication Sets
- Portable Testing & Measuring Instruments
- Medical Electronics
- Marine & Offshore Equipment
- Vending Machines & Weighing Scales
- Solar Lanterns

EXIDE POWERSAFE

SMALL AND MEDIUM SIZED SEALED LEAD ACID BATTERIES

Performance Characteristics conforming to JIS C8702

EP RANGE

General Applications

Battery Type	Nominal Voltage (V)	Rated Capacity (Ah) at 27°C. 20 hr 1.75 V/cell	10 hr 1.75 V/cell	3hr 1.7 V/cell	1.5 hr 1.7 V/cell	1 hr 1.6 V/cell	30 mins 1.6 V/cell	Dimensions (mm) Overall Height ±2	Height up to lid top ±2	Length ±1	Width ±1	Weight (Kg) (+/-5%)	Energy Density (Wh/l)	Specific Energy (Wh/Kg) Charged condition	Internal Resistance (m-ohm) Max at fully (5 secs)	Max Discharge Current Amps	Container/ Lid Material	Layout	Terminal
EP 7-12	12	7	6.5	5.2	5.0	4.2	3.5	100	94	151	65	2.22	91	31	22	105	ABS	b	F_2
EP 9-12/ EP 1234 W	12	9	8.1	6.8	6.4	5.4	4.5	100	94	151	65	2.39	117	42	18	135	ABS	b	F_2
EP 12-12	12	12	11.2	9.0	8.6	7.2	6.0	100	94	151	98	3.20	103	35	16	180	ABS	c	F_2
EP 17-12	12	17	16.0	12.9	12.2	10.2	8.5	167	167	181	76	5.00	88	33	15	255	ABS	d_2	F_4
EP 26-12 W	12	26	24.0	19.5	18.7	15.6	13.0	175	175	166	125	8.80	86	35	10	390	PP	e	F_5
EP 42-12	12	42	38.5	31.5	30.2	25.2	21.0	170	170	197	165	12.60	91	40	8	420	PP	f	F_6
EP 65-12	12	65	60.0	48.6	46.8	39.0	32.5	174	174	350	166	20.30	77	38	8	500	PP	h	F_7
EP 75-12	12	75	69.0	56.2	54.0	45.0	37.5	174	174	350	166	21.05	89	40	8	500	PP	h	F_7
EP 100-12	12	100	91.0	75.0	72.0	60.0	50.0	235	235	407	173	32.80	72	36	6	600	PP	h	F_8
EP 120-12	12	120	109.0	90.0	86.4	72.0	60.0	235	235	407	173	35.65	87	40	6	600	PP	h	F_8
EP 150-12	12	150	136.5	112.5	108.0	90.0	75.0	240	240	557	172	46.65	78	38	6	900	PP	h	F_8
EP 200-12	12	200	182.0	150.0	144.0	120.0	100.0	240	240	533	250	62.95	75	37	5	1200	PP	i	F_9

Table (1)

Advantages : International size – matches dimension of any International equipment.
High Rate performance – matches or betters High Rate performance of equivalent International types.

LAYOUT

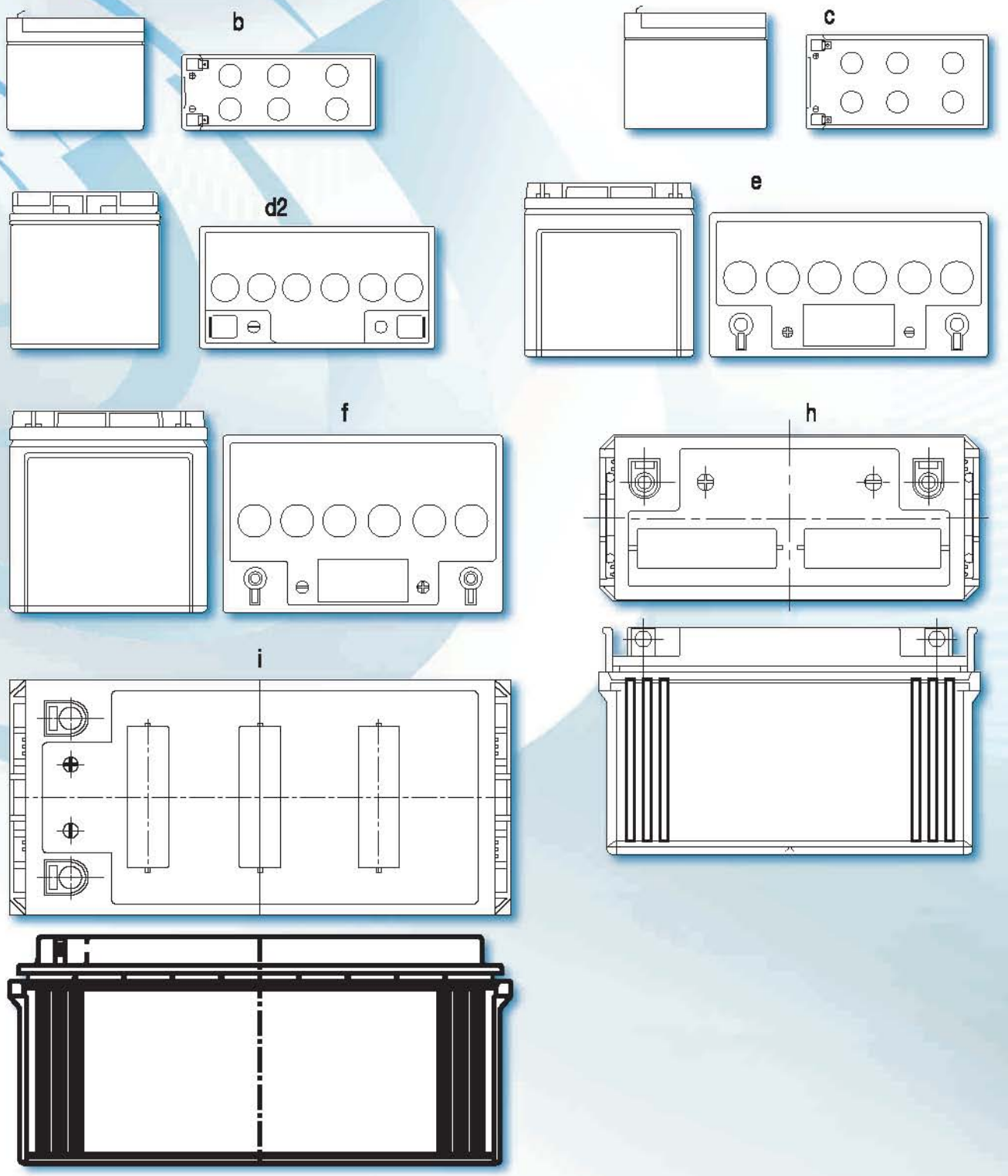


Figure (1)

TERMINAL

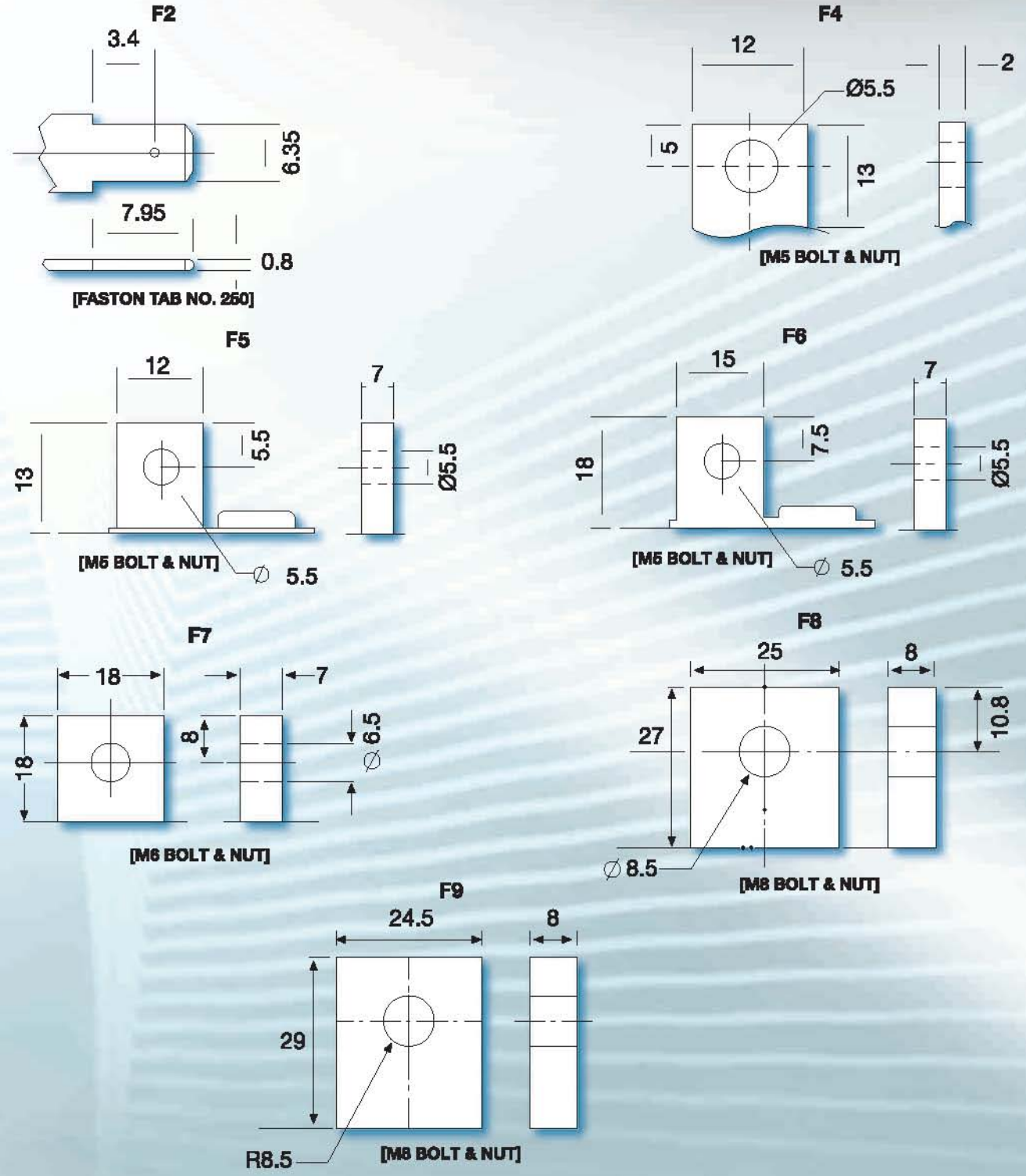


Figure (2)

EP Series

BATTERY CHARGING FOR EP SERIES

CHARGER

'Constant Potential' chargers, with current limit facility only, are recommended for normal continuous operation.

CHARGE LIMITS

Table (2) shows the charge voltage and limit current. The charge voltage of the battery has to be reduced with increasing temperature and increased with decreasing temperature. Accordingly, charging with a given voltage requires increased charge current when the temperature is high and reduced charge current at a lower temperature.

a) Even under high temperature, a charging voltage of 2.2V/cell is required.

b) Even under low temperature, the charging voltage must be set at less than 2.45V/cell so as to prevent gas generation from the battery.

c) The battery life will be shortened as service temperature rises.

CHARGE PARAMETERS

Recharge Voltages: Batteries to be recharged in CC-CV mode only.

Mode of Operation	Voltage settings per 12V unit for ambient temperature 20–30 deg C	Current Setting
Float	13.7V +/- 0.1V	Maximum: 0.3CA
Cyclic	14.7V +/- 0.1V	Minimum: 0.1CA
Temperature Compensation : (Reference 25 deg C) FLOAT : -18 mV / deg C / 12V unit CYCLIC : -30 mV / deg C / 12V unit		

Table (2)

EP Series

CHARGE CHARACTERISTICS

Charge under constant potential charging mode at 27°C

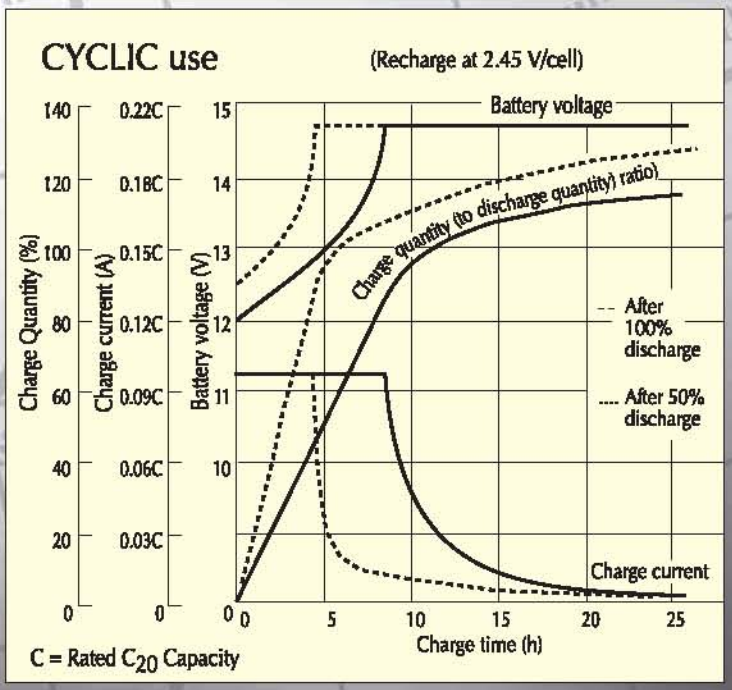


Figure (3)

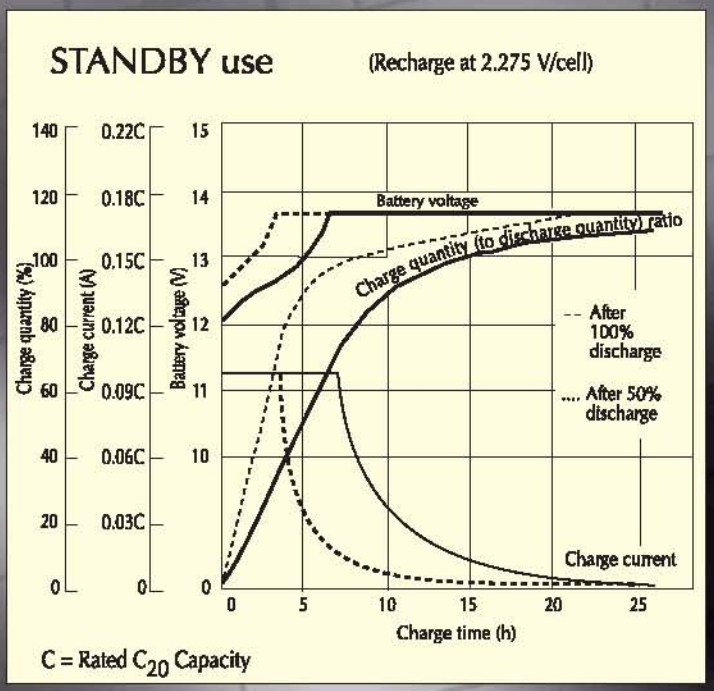


Figure (4)

SERVICE LIFE

The trend of service life of EP batteries under different operating conditions

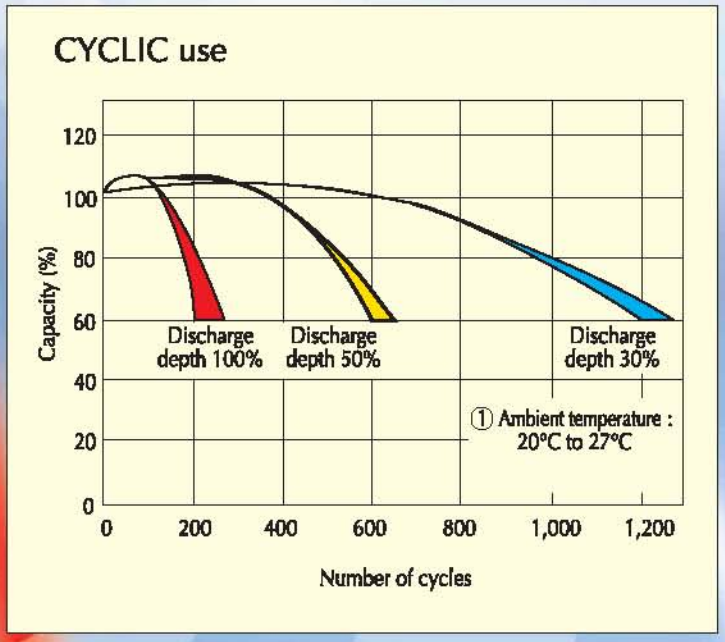


Figure (5)

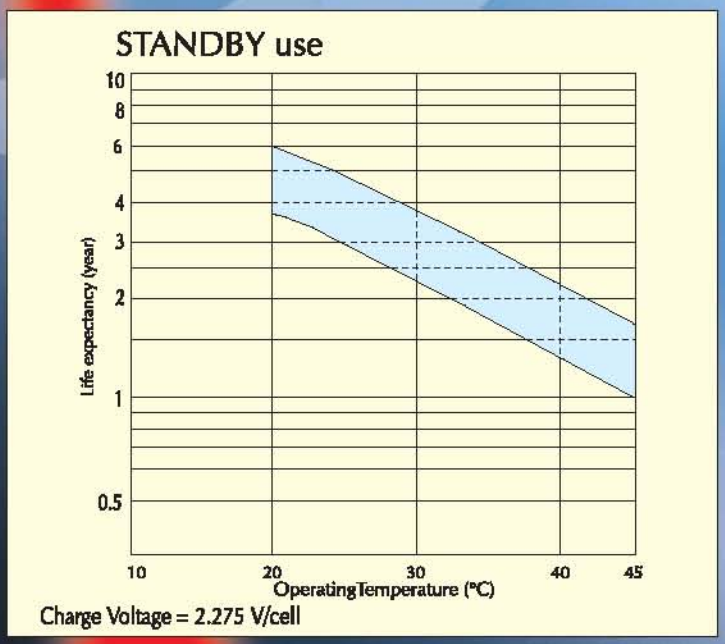
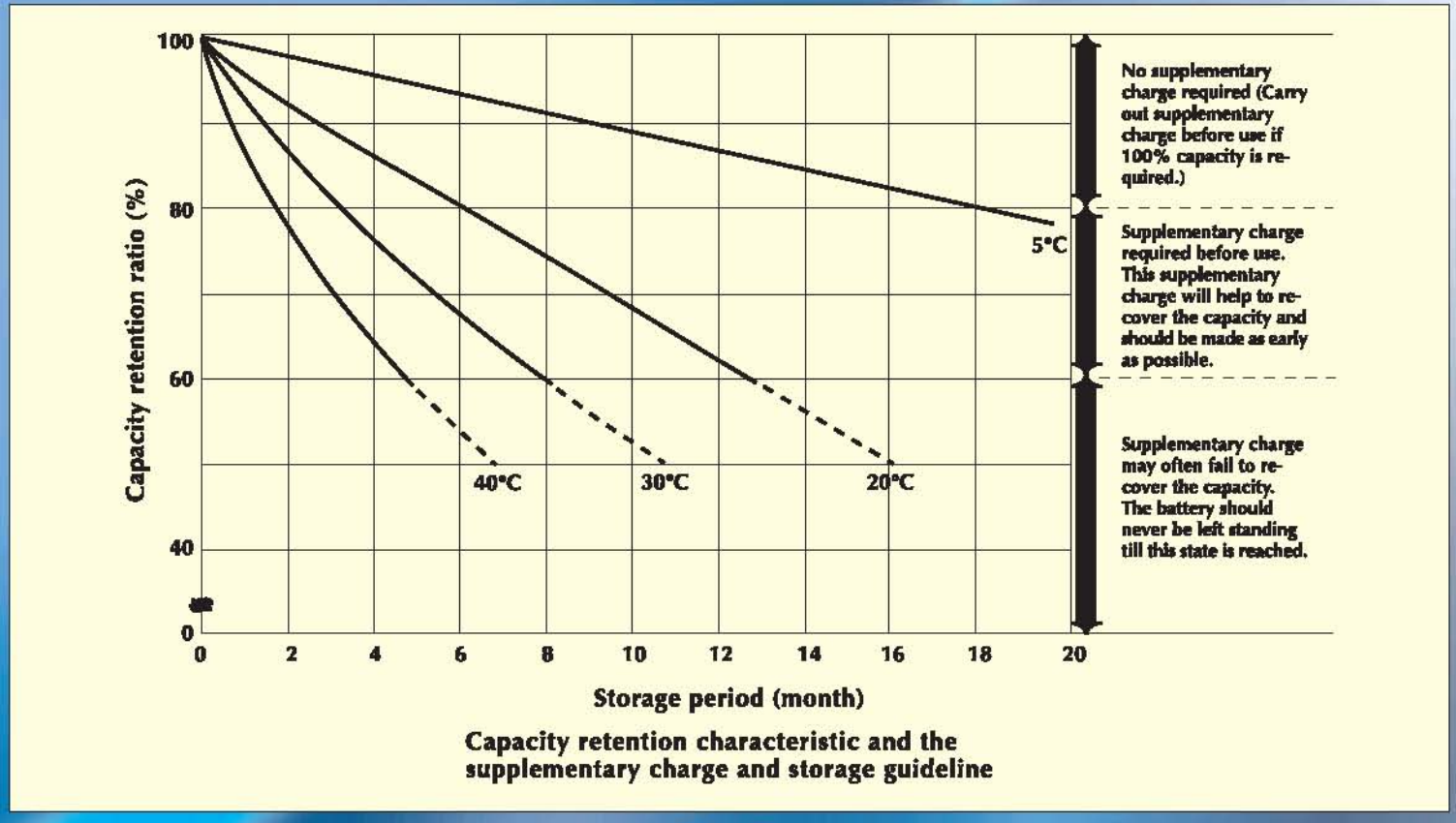


Figure (6)

Retention of Charge of EP Series under ideal storage conditions



Capacity retention characteristic and the supplementary charge and storage guideline

Figure (7)

CAPACITY RETENTION

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Maximum discharge current for various durations and cut-off voltages

Discharge current in ampere to each voltage on EP type sealed lead acid battery

END VOLTAGE/ CELL	TEMP (°C)	DISCHARGE TIME																			
		0.5min.	1min.	2min.	3min.	4min.	5min.	7min.	10min.	15min.	20min.	30min.	1 hrs.	1.5 hrs.	2 hrs.	3 hrs.	4 hrs.	5 hrs.	6 hrs.	8 hrs.	10 hrs.
1.80	25	4.0C (3.2C)	3.9C (3.15C)	3.8C (3.1C)	3.7C (3.0C)	3.5C (2.8C)	3.2C (2.6C)	2.8C (2.3C)	2.3C (2.0C)	1.8C (1.65C)	1.5C (1.4C)	1.1C	0.64C	0.42C	0.36C	0.270C	0.210C	0.170C	0.145C	0.110C	0.090C
	5	3.2C (2.55C)	3.0C (2.4C)	2.7C (2.35C)	2.5C (2.3C)	2.3C (2.15C)	2.2C (2.0C)	1.9C (1.8C)	1.75C (1.65C)	1.4C (1.3C)	1.2C (1.1C)	0.95C	0.59C	0.34C	0.29C	0.230C	0.182C	0.147C	0.129C	0.098C	0.080C
	-5	2.5C (2.1C)	2.4C (2.05C)	2.2C (2.0C)	2.1C (1.95C)	1.9C (1.8C)	1.8C (1.6C)	1.6C (1.5C)	1.4C (1.3C)	1.1C (1.0C)	0.96C (0.86C)	0.76C	0.48C	0.28C	0.24C	0.198C	0.154C	0.125C	0.115C	0.087C	0.071C
1.70	25	5.6C (4.3C)	5.1C (4.2C)	4.9C (4.0C)	4.3C (3.7C)	4.0C (3.4C)	3.6C (3.2C)	3.0C (2.75C)	2.5C (2.3C)	1.9C (1.8C)	1.6C (1.5C)	1.15C	0.67C	0.48C	0.40C	0.290C	0.230C	0.190C	0.165C	0.130C	0.108C
	5	5.1C (3.8C)	4.6C (3.65C)	3.9C (3.4C)	3.4C (3.15C)	3.0C (2.8C)	2.8C (2.5C)	2.4C (2.1C)	2.0C (1.8C)	1.6C (1.5C)	1.3C (1.2C)	1.0C	0.62C	0.39C	0.32C	0.250C	0.199C	0.164C	0.143C	0.116C	0.096C
	-5	3.6C (2.9C)	3.4C (2.7C)	3.0C (2.65C)	2.8C (2.6C)	2.5C (2.3C)	2.3C (2.0C)	2.0C (1.85C)	1.7C (1.6C)	1.3C (1.2C)	1.1C (1.0C)	0.86C	0.53C	0.32C	0.27C	0.213C	0.168C	0.139C	0.123C	0.103C	0.086C
1.65	25	6.6C (4.85C)	5.9C (4.7C)	5.2C (4.45C)	4.6C (4.05C)	4.2C (3.65C)	3.8C (3.35C)	3.2C (2.85C)	2.7C (2.35C)	2.0C (1.85C)	1.65C (1.55C)	1.2C	0.69C	0.50C	0.41C	0.300C	0.240C	0.200C	0.170C	0.135C	0.110C
	5	5.6C (3.9C)	4.9C (3.8C)	4.1C (3.6C)	3.6C (3.3C)	3.15C (2.9C)	2.95C (2.6C)	2.5C (2.2C)	2.1C (1.9C)	1.7C (1.6C)	1.4C (1.3C)	1.05C	0.64C	0.40C	0.33C	0.260C	0.208C	0.173C	0.147C	0.120C	0.098C
	-5	4.4C (3.1C)	3.9C (3.0C)	3.3C (2.9C)	2.9C (2.7C)	2.6C (2.35C)	2.4C (2.1C)	2.1C (1.9C)	1.7C (1.6C)	1.35C (1.25C)	1.15C (1.05C)	1.88C	0.54C	0.34C	0.27C	0.220C	0.176C	0.147C	0.125C	0.107C	0.087C
1.60	25	7.6C (5.4C)	6.7C (5.2C)	5.6C (4.9C)	4.9C (4.4C)	4.4C (3.9C)	3.9C (3.5C)	3.3C (3.0C)	2.8C (2.4C)	2.1C (1.9C)	1.7C (1.6C)	1.25C	0.7C	0.51C	0.42C	0.310C	0.250C	0.210C	0.180C	0.140C	0.115C
	5	6.1C (4.0C)	5.2C (3.9C)	4.3C (3.75C)	3.8C (3.5C)	3.3C (3.1C)	3.1C (2.75C)	2.6C (2.3C)	2.2C (2.0C)	1.8C (1.7C)	1.5C (1.4C)	1.10C	0.66C	0.41C	0.34C	0.270C	0.216C	0.182C	0.156C	0.125C	0.102C
	-5	5.1C (3.3C)	4.4C (3.2C)	3.5C (3.1C)	3.0C (2.75C)	2.7C (2.4C)	2.5C (2.2C)	2.2C (2.0C)	1.75C (1.65C)	1.4C (1.3C)	1.2C (1.1C)	0.9C	0.55C	0.34C	0.28C	0.227C	0.183C	0.154C	0.132C	0.111C	0.091C

*The number in bracket shows the discharge current of rated capacity above 17Ah. C is rated capacity at 20 hrs.

Table (3)

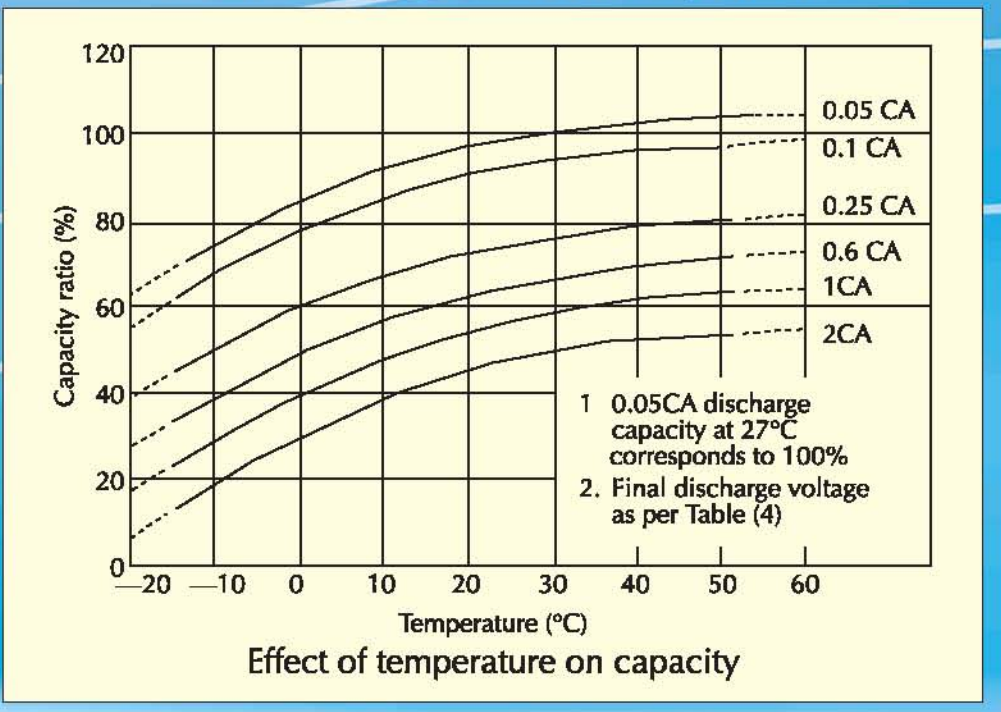
DISCHARGE CURRENT AND RECOMMENDED FINAL DISCHARGE VOLTAGE

Discharge Current (A)	Final Discharge Voltage (V/cell)
0.2 C > (A) or intermittent discharge	1.75
0.2 C < or = (A) < 0.5 C	1.70
0.5 C < or = (A) < 1.0 C	1.55
1.0 C < or = (A)	1.30

Table (4)

EFFECT OF TEMPERATURE ON CAPACITY

This figure represents the
relation between the temperature and discharge capacity

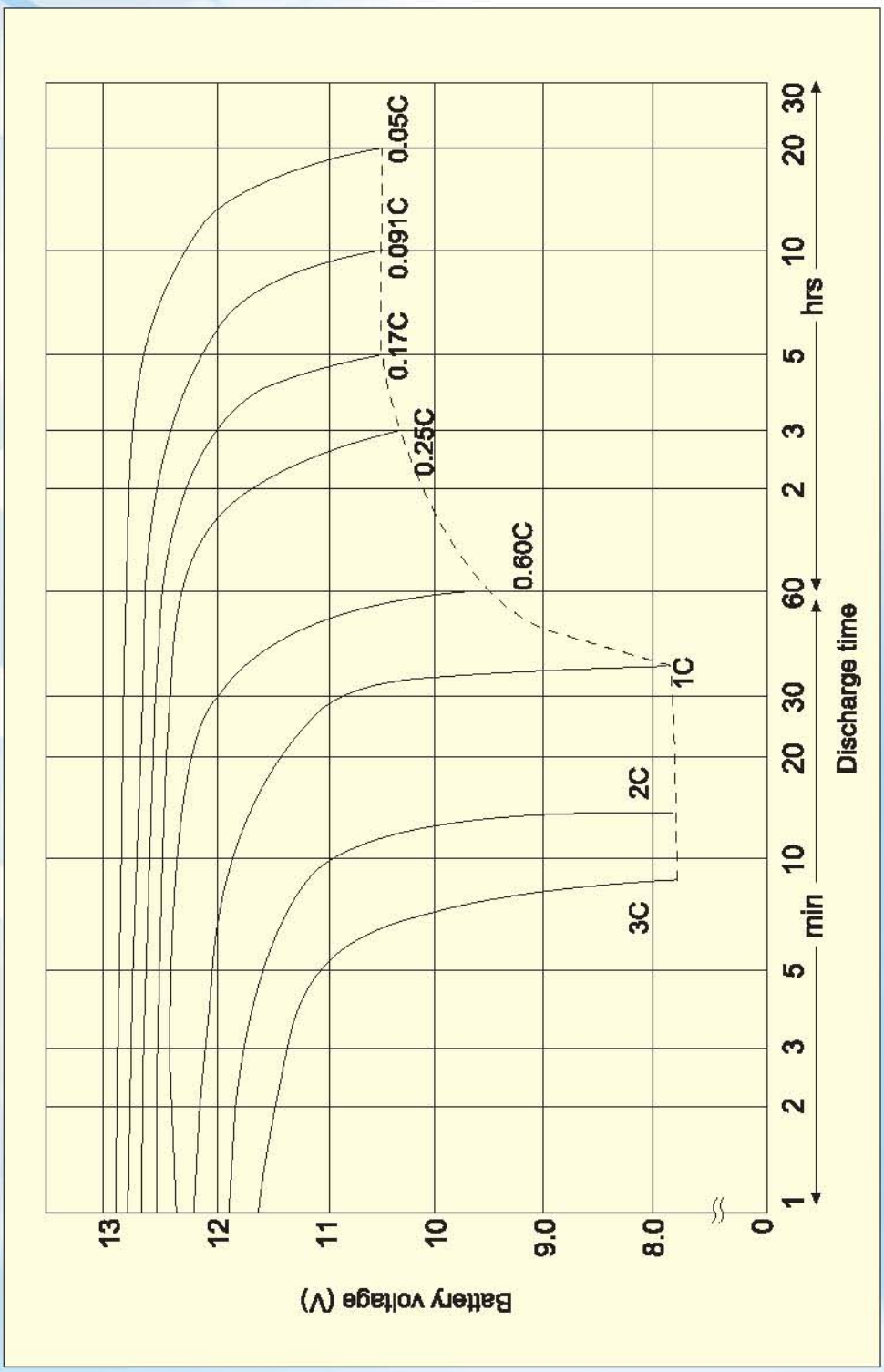


Effect of temperature on capacity

Figure (8)

EP Series

DISCHARGE CHARACTERISTICS



C = Rated C_{20} Capacity

Figure (9)

EXIDE INDUSTRIAL POWERSAFE

CONSTANT POWER DISCHARGE RATINGS IN WATTS PER BATTERY FOR EP RANGE AT 27°C

END VOLTAGE/CELL	BATTERY TYPE	DISCHARGE TIME												
		5 min	10 min	15 min	20 min	30 min	60 min	120 min	180 min	240 min	300 min	360 min	480 min	600 min
1.80	EP 7-12	284	200	155	128	95	55	33	20.5	16.8	14.0	12.1	9.6	8.0
	EP 9-12/ EP 1234W	297.6	209.1	162.9	134.2	101.3	61.4	38.1	26.5	21.6	18.0	15.7	12.4	10.3
	EP 12-12	486	342	265	219	162	94	56	35.0	28.8	24.0	20.9	16.5	13.7
	EP 17-12	541	376	299	248	184	220	71	50.0	40.8	34.0	29.6	23.4	19.4
	EP 26-12 W	905	637	497	408	293	185	114	76.4	62.4	52.0	45.2	35.6	29.6
	EP 42-12	1393	980	763	629	475	293	180	123.5	100.8	84.0	73.0	58.0	47.9
	EP 65-12	2263	1590	1240	1022	772	470	292	191.1	156.0	130.0	113.1	89.7	74.1
	EP 75-12	2534	1788	1389	1150	864	526	328	216.0	178.0	150.0	130.5	103.5	83.5
	EP 100-12	3307	2323	1810	1491	1125	682	423	294.0	240.0	200.0	174.0	138.0	114.0
	EP 120-12	3968.4	2787.6	2172	1789.2	1350	818.4	507.6	352.8	288	240	208.8	165.6	136.8
	EP 150-12	4960.5	3484.5	2715	2236.5	1687.5	1023	634.5	441	360	300	261	207	171
	EP 200-12	6614	4646	3620	2982	2250	1364	846	588	480	400	348	276	228
1.70	EP 7-12	315	221	168	137	101	57	34	22.2	18.0	14.7	13.0	10.0	8.4
	EP 9-12/ EP 1234W	329.4	231.2	175.3	142.5	108.0	65.2	75.4	28.6	23.2	18.9	16.7	13.0	10.8
	EP 12-12	539	378	287	234	173	97	58	38.1	31.0	25.2	22.3	17.3	14.4
	EP 17-12	600	421	321	262	194	117	73	54.0	43.9	35.7	31.6	24.5	20.4
	EP 26-12 W	1006	705	536	436	313	193	117	82.7	67.1	54.6	48.3	37.4	31.2
	EP 42-12	1548	1084	825	671	507	305	185	133.5	108.3	88.2	78.1	60.5	50.4
	EP 65-12	2510	1761	1340	1090	823	496	300	206.7	167.7	136.5	120.9	93.6	78.0
	EP 75-12	2816	1988	1500	1220	921	555	337	238.5	193.5	157.5	139.5	108.0	90.0
	EP 100-12	3660	2569	1948	1583	1200	724	438	318.0	258.0	210.0	186.0	144.0	120.0
	EP 120-12	4392	3082.8	2337.6	1899.6	1440	868.8	525.6	381.6	309.6	252	223.2	172.8	144
	EP 150-12	5490	3853.5	2922	2374.5	1800	1086	1257	477	387	315	279	216	180
	EP 200-12	7320	5138	3896	3166	2400	1448	1676	636	516	420	372	288	240
1.60	EP 7-12	332	227	174	141	103	59	35	23.1	18.5	15.4	13.4	10.5	8.4
	EP 9-12/ EP 1234W	345.1	217.4	181.4	145.6	108.6	67.4	40.5	29.7	23.8	19.8	17.3	13.5	10.8
	EP 12-12	569	389	298	241	176	101	59	39.6	31.7	26.4	23.0	18.0	14.4
	EP 17-12	632	434	334	270	200	123	77	56.1	44.5	37.4	32.6	25.5	20.4
	EP 26-12 W	1059	716	556	449	320	200	119	85.8	68.6	57.2	50.0	39.0	31.2
	EP 42-12	1630	1022	857	690	517	316	190	138.6	110.9	92.4	80.6	63.0	50.4
	EP 65-12	2644	1660	1393	1121	840	513	308	214.5	171.6	143.0	124.8	97.5	78.0
	EP 75-12	2961	1867	1560	1255	940	577	345	244.5	196.0	165.0	141.0	112.5	90.0
	EP 100-12	3834	2416	2015	1618	1207	749	450	330.0	264.0	220.0	192.0	150.0	120.0
	EP 120-12	4600.8	2899.2	2418	1941.6	1448.4	898.8	540	396	316.8	264	230.4	180	144
	EP 150-12	5751	3624	3022.5	2427	1810.5	1123.5	675	495	396	330	288	225	180
	EP 200-12	7668	4832	4030	3236	2414	1498	900	660	528	440	384	300	240

Table (5)

ADDITIONAL INFORMATION REGARDING EXIDE POWERSAFE

Heat Dissipation:

A VRLA battery under normal float condition shall dissipate heat into the atmosphere. For the overall heat load calculation, taking into account a worst case operation, the rate of heat dissipation may be taken as 0.45 Watts/100 Ah C_{20} capacity/cell.

Hydrogen Evolution:

Hydrogen gas evolved by a lead acid battery may be estimated from the following formula:

$$\text{Hydrogen gas evolved per hour} = 0.45 \times 10^{-3} \times n \times I \times C \text{ m}^3 \text{ at N.T.P.}$$

where, n = number of 2V cells

I = Float current, 0.2 A/100 Ah for a VRLA cell

C = C_{20} capacity of Cell

To design for the ventilation (air flow) requirement so that the hydrogen percentage in the air is always below 4% (lower explosive limit), the air flow rate may be estimated as:

$$Q = d \times s \times 0.45 \times 10^{-3} \times n \times I \times C \text{ m}^3/\text{hr}$$

Where, d = dilution ratio (100 – 4)/4 = 24

S = factor of safety, eg. 5

For a VRLA, the above may be simplified as:

$$Q = 0.0108 \times n \times C$$

Ripple Current:

VRLA batteries should be charged by pure D.C. source only. For optimum life the A.C. ripple content should not exceed 5A per 100Ah C_{20} capacity.

Overdischarge:

Compared to the alkaline battery, the sealed lead acid battery is very sensitive to overdischarge. And overdischarge results in failure to recover normal capacity, reduced capacity or shortened service life. Overdischarge also occurs by leaving the battery in a discharged state. The EP type sealed lead acid battery overcomes this. If this battery is overdischarged and left standing in a discharged state for several days, it can recover its original capacity when charged.

EP Series

However, it is necessary to avoid overdischarge situations as much as possible. Also check the following points when charging.

Precautions:

(1) The original capacity can be recovered after two or three consecutive overdischarges or leaving the battery in discharged state. Beyond this limit, the battery may not recover to its original capacity.

(2) Always perform constant voltage charging with a 2.45V/cell or constant current charging with 0.05 CA. The charge voltage of 2.275V/cell may not be enough to recover to the capacity above. In this case repeat charge and discharge two or three times.

Figure 10 shows an example of the charge characteristic after overdischarge and leaving the battery in a discharged state. As this figures shows, the charge current may not flow in the initial period of charge. This is not abnormal since the charge current flows as charging continues.

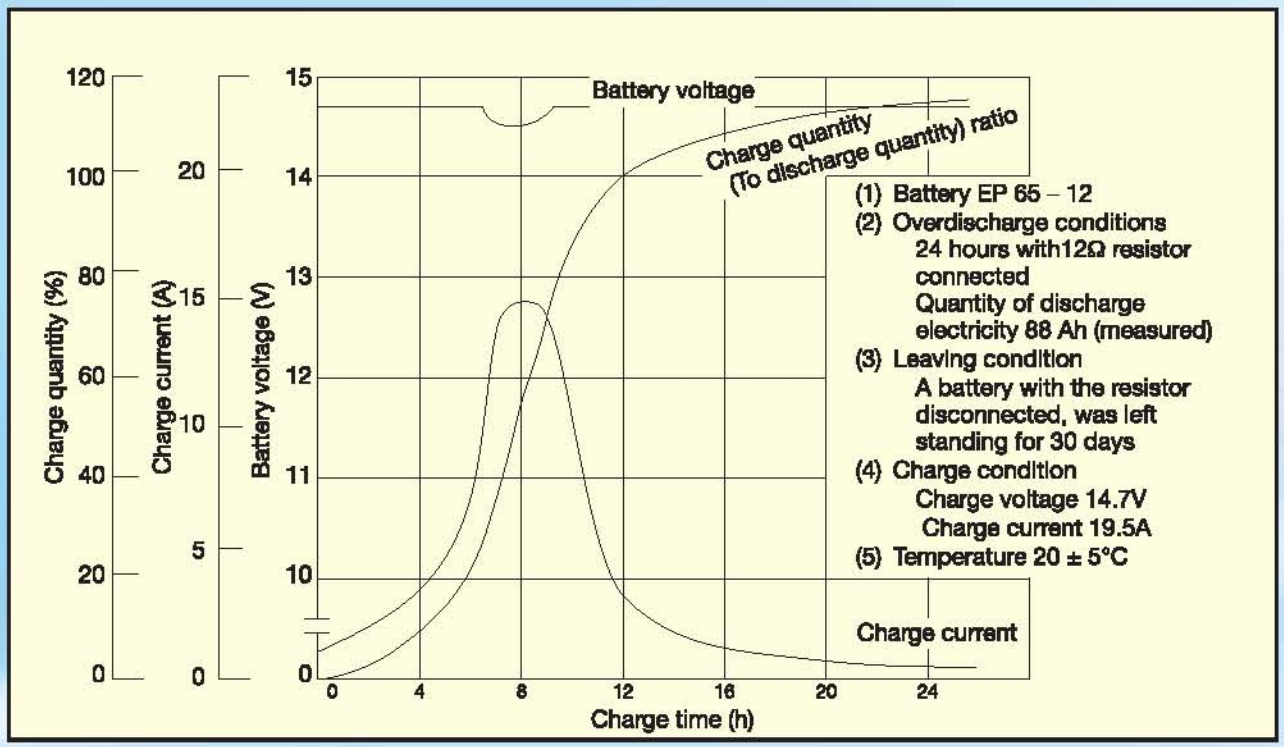


Figure (10)

OPERATIONAL INSTRUCTIONS FOR SMF BATTERIES

- We recommend charging the battery at an ambient temperature of 5 to 35°C to prevent any adverse effects on its effective life.
- Charge current should be 0.3CA for EP series (where C refers to nominal capacity and A refers to current in amps.) or less.
- In case of frequent deep discharges we recommend the charging time to be prolonged as much as 1.5 to 2 times as that of regular charging once every 5 times of discharge.
- The battery should never be left in discharged condition, otherwise the capacity to hold the charge may not be recovered. Immediate recharging recommended.
- The battery should be secured against excessive impact or vibration. We recommend installation of the battery at the lowest level of the equipment and farthest from heat source.
- New and old batteries should never be used in series. Batteries of different capacities and performances should never be used in the same bank. We do not recommend more than 4 parallel strings (of identical capacities) whatsoever.
- Discover the cause and replace any defective batteries if abnormalities noticed on voltage, temperature, electrolyte leakage or physical deformities.
- No attempts to be made to reverse charge the battery. While using a long-stored battery supplementary charging is preferred. (Constant volt : 2.45 V/cell; Constant current : 0.05 CA; Charge time : 6 to 12 hrs; Temp : 5 to 35°C.)
- We recommend transporting the battery in the upright position. Never bend the terminals nor solder directly. Always use the appropriate connectors.
- If battery bank is placed on steel racks/cabinets ensure an insulation between the battery base and the steel tray. This could be a coat of durable (acid resistant) paint or any other insulating medium. Steel racks should preferably be well grounded.

Powersafe Production

OPERATING MANUAL FOR THE EP TYPE SEALED MAINTENANCE FREE BATTERY

This manual describes precautions to be observed when operating the EP sealed lead acid battery (henceforth called the "battery") which requires no water addition.

General Handling Precautions Before Use

A. Storage and Supplementary Charging

(1) During storage, the capacity of the battery decreases due to self-discharging.

Store the battery in a cool dry place, where the monthly average temperature exceeds 27°C (below 30°C), carry out supplementary charging every 3 to 6 months. Where the monthly average temperature falls below 27°C, carry out supplementary charging every 12 months.

(2) When using a stored battery, always carry out supplementary charging before use.

(3) For supplementary charging, refer to Table 6.

Supplementary Charge Parameters

Charging Method	Charge Time (h)	Ambient Temperature (°C)
Constant Charge Voltage at 2.45 V/cell	6 to 12	5 to 35
Constant Charge Current at 0.05 CA	6 to 12	

Table (6)

B. Transporting

(1) When transporting the battery, never allow excessive vibration or jolting.

(2) We recommend transporting the battery in an upright position.

(3) When transporting a battery connected to equipment, secure it firmly and keep the circuit open.

Precautions for Design of Power Supply Unit

• Charging

A. For Standby Use (Trickle Charge or Float Charge)

(1) Charge the battery at a constant voltage of 2.275 V/cell (20°C). When charging at an ambient temperature of 5°C or below or 35°C or above, it is necessary to adjust the charge voltage in relation with the temperature.

The temperature coefficient should be – 3.3mV/°C/ cell.

(2) Initial charge current should be 0.3CA (where C is the nominal capacity value and A is amperes) or less.

(3) We recommend charging the battery at an ambient temperature between 5 to 35°C to prevent any adverse effects on its service life.

B. For Cyclic Use

(1) Maintain a constant voltage charge at a voltage of 2.45 V/cell (27°C). When charging at an ambient temperature of 5°C or below or 35°C or above, it is necessary to adjust the charge voltage in relation with the temperature. The temperature coefficient should be – 5m V/°C/ cell.

(2) The maximum charge current should be 0.3CA or less.

(3) To avoid overcharging, on completion of charge, we recommend charging to be stopped or the constant voltage to be reduced to 2.275V/cell (27°C).

(4) We also recommend charging the battery at an ambient temperature between 5 to 35°C to prevent any adverse effects on its effective life.

(5) In case the battery has to be discharged deeply and frequently during use, to avoid poor charging, we recommend the charging time to be extended to as much as 1.5 to 2 times that of usual charging, once every five cycles of discharge & recharge.

(6) If higher than recommended/faster charge is required, please consult us.

•Discharge

(1) The maximum discharge currents (for 5 seconds) should never exceed the values shown in Table 1.

(2) Final discharge voltage and discharge current should be as shown in Table 3. For a particular discharge rate, never discharge the battery to voltage less than the values shown in this table. Repeated excessive discharging will shorten the battery's life.

(3) After discharging, immediately recharge the battery. Never leave it discharged. The capacity to hold charge may not be fully recovered if the battery is left discharged for a long period.

•Installation and Connection

(1) Secure the battery firmly to protect it from excessive vibration or impact.

(2) When placing the battery in equipment, keep it away from heat generating parts (e.g. transformer) and install it in an upright position and as low a position in the equipment as possible. We recommend providing adequate ventilation in the cubicle.

(3) The battery may release a combustible gas under overcharge/high ambients. Avoid installation in closed equipment or near equipment which may produce sparks (i.e. near a switch or fuse).

(4) Using vinyl chloride sheathed wire or a vinyl chloride sheet may crack the battery container and cover. Either keep it away from the battery or use a non plasticizing vinyl chloride material.

(5) Never bend the battery terminal nor solder directly.

(6) Avoid using the battery in the following places :

a. Areas exposed to direct sunlight.

b. Areas where there is excessive radioactivity, infrared radiation or ultraviolet radiation.

c. Areas filled with organic solvent vapour, dust, salt or corrosive gases.

d. Areas of abnormal vibration.

(7) When connecting the battery to a charger or a load, keep the circuit switch OFF and connect the battery's (+) pole to the (+) pole of the charger or the load and the battery's (–) pole to the (–) pole of the charger or the load.

(8) Never use batteries of different capacities, batteries of different performances or new and old batteries together.

(9) When batteries are to be used in parallel, please consult us.

Precautions during the application with UPS systems

• Ambient temperature and installation place

(1) Use the battery in an environment where the ambient temperature is within the range of 0 to 45°C.

(2) In case where more than one battery is used, the difference in temperature between batteries must be within 3°C.

(3) The battery must be kept away from the heat source of equipment.

(4) Install the battery at the lowest level of the equipment.

(5) Install the battery at a well-ventilated place in the structure. The ventilation ports must be provided at upper and lower levels with enough distance.

(6) The battery case is made of plastic resin (ABS or PP resin). Ensure that it is not affected by organic solvent, oil, plasticizer etc. When fixing the battery, care must be exercised not to expose it to uneven load of screws etc.

• Miscellaneous

(1) New and old batteries must not be used together in series.
The time difference in product lots between batteries in a battery bank, must be within one month.

(2) Store batteries under as low a temperature as possible. Even when batteries are kept under normal temperature, supplementary charging must be done at least once every six months.

Daily Inspection and Servicing

(1) When the following abnormalities are observed, discover the cause and replace any defective batteries :

a) Any voltage abnormalities
b) Any physical defects (e.g. a cracked or deformed container or cover)
c) Any electrolyte leakage
d) Any abnormal temperatures

(2) Clean any dust deposition with a wet cloth. Never use organic solvents (e.g. gasoline or thinners). Otherwise the container or cover may develop cracks.

(3) When installing the battery as an emergency power supply for fire–fighting equipment, inspect it according to the Fire–fighting Equipment Emergency Power Supply Inspection Standard or Inspection Procedure.

Other Precautions

(1) The battery may produce a combustible gas. To prevent a rupture never place the battery near or in fire.

(2) Never short circuit the terminals. Shorting may cause the battery to burn.

(3) Never disassemble or reassemble the battery.

(4) If the battery cracks and dilute sulphuric acid comes in contact with the skin or clothing, wash it off immediately with water. If dilute sulphuric acid comes in contact with one's eyes, wash them with a lot of water and see a doctor.

(5) Never attempt to reverse charge the battery. This not only fails to charge the battery, but also diminishes its performance and may cause the electrolyte to leak.

Life of Battery

Generally the EP battery's effective life is 3 to 5 years for standby use and 200-250 cycles (100% depth of discharge) or more for cyclic use. The effective life may be shortened when the proper conditions are not maintained (i.e. for charging, discharging, working temperature and storage).

Fastening Bolts and Nuts

In fastening bolts and nuts, the specified torque values be observed to prevent any damage to the terminals.

BOLT AND NUT SIZE	FASTENING TORQUE
DIAMETER	N-m
M5	2.5
M6	4.9
M8	12.3

Disposal of Batteries

Lead acid batteries contain lead, acid and chemicals which are hazardous to the environment. This means that a lead acid battery needs to be disposed of carefully after its useful life is over. However, the hazardous contents are recyclable. Therefore, please return these batteries after use to our dealers or any authorised smelter for careful disposal. This is also as per rules given by Ministry of Environment, Government of India. For further clarifications contact our nearest branch.

Statutory Notice:

All batteries contain lead, which is harmful for human beings and environment. As per statutory requirements, the used battery must be returned to the authorized dealer, manufacturer or at the designated collection centres.

• Judgement of battery life

For judging the end of service life of a battery, reference may be made to Table 7.

No.	Item to be checked	Checking method	Criteria for judgement	Time to check
1	Actual load test	After disconnecting the batteries from the power source, keep them at rest for 1 or 2 hours, discharge the batteries under actual load, then measure the voltage.	Seek the reference time based on the standard characteristic curve corresponding to discharging conditions (temperature, discharge current etc.) When the actual measured capacity is less than 80%, it is judged that the batteries have completed their life.	When the batteries have completed the average number of years of life span/ reduction in backup time.
2	1CA discharging capacity	After disconnecting the battery from the power source, keep it at rest for 1 to 2 hours, discharge with 1CA by means of a discharge test device, then measure the voltage.	The completion of the battery life span is based on less than 22 minutes of the discharge duration time (80% of the 1CA discharge capacity as per JIS).	When the battery has completed the average number of years of life span/reduction in backup time.
3	Float charging voltage (Group voltage)	After confirming that the total voltage meets the designated value, measure the voltage of each battery.	It is judged that the batteries have completed their life span if a specific battery has indicated the voltage out of the designated range. The designated limit of voltage dispersion shall be set at 0.5V/cell.	When the battery has completed the average number of years of life span/reduction in backup time.
4	Appearance	Visually check the battery case, cover, terminal etc.	It is judged that the battery has completed its life span when abnormalities such as bulging of battery container, corrosion of terminal etc. are observed.	Periodical check is required since these abnormal phenomena do not necessarily occur in only the actual terminal stage of the battery life.
5	Period of time of battery use	Check the period of time for which the battery has been used by confirming the indications of date of battery replacement, date of installation or any other records.	It is judged that the battery has completed its life span when the period of time for which the battery has been used reaches the prescribed number of years.	

Table (7)

EXIDE OFFERS PEACE OF MIND

Exide ensures Quality, Reliability and Peace of Mind through a wide range of products and services offered through a vast network of trained professionals which few can match.

Technical Services

- Technical advice on selection of proper design and capacity of the battery suitable for your requirement – FREE
- Preliminary checkup and service of your new Exide Battery and charging equipment – FREE
- Inspection of your Battery systems regarding proper usage and maintenance for obtaining maximum life & performance followed by advice/corrective action
- Health check of your batteries to ascertain life expectancy
- Training workshops for your maintenance/operating personnel

Annual Maintenance Contract

We undertake Annual Maintenance Contracts ensuring:

- Periodic checkup and preventive maintenance
- Immediate Breakdown Service - Virtually Zero Downtime
- Longer life for your equipment - Extra mileage out of your investment
- No wastage of man hours - 100% performance and zero worries for you

Breakdown Service/Repair Service

(Pertaining to Exide make battery only)

- Timebound service on site
- First-Aid advice over telephone
- Free of cost service and spares for failure due to manufacturing defect within warranty
- Chargeable service for failures outside warranty terms

EXIDE INDUSTRIAL
POWERSAFE

NETWORK

For more information please contact us:

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4, Satellite Complex, Near Mansi Tower Premchand Nagar Road, Satellite, Ahmedabad - 380 054	(079) 65108207	(079) 26769932
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4, Parishram, 1st Floor, Behind Diamond Complex, Fatehgunj, Vadodara - 390 002	(0265) 2791947	(0265) 2791947
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Station Road, Jugsalai, (Near Ghora Chowk), (PP)Jamshedpur - 831 006	(0657) 2293022/2290785	(0657) 2290894
Guwahati		
C/o. AIC & C CO. Ganeshguri, G. S. Road, Guwahati - 781 005	(0361) 2342500/2341119	(0361) 2345097 (PP)
Cuttack		
C/o M/s B. Verma & Sons, At/Po: Bhanpur, Gopalpur, Cuttack - 753 011	(0671) 2686151	—
Siliguri		
3rd Mile, Sevoke Road, Choudhuri Industrial Compound, Salugara, Siliguri - 734 018	(0353) 2540321	—
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