REL SERIES
RE SERIES

MAINTENANCE-FREE VALVE
REGULATED LEAD-ACID BATTERIES

APPLICATION MANUAL

YUASA

INTRODUCTION

The Yuasa developed RE/REL Series of valve regulated lead acid batteries, a culmination of its long period of battery manufacturing experience since 1958, are now available to provide the highest energy density and longest service life and customer satisfaction at the highest level.

TECHNICAL FEATURES

High-Rate Discharge

RE/REL is improved by more than 15% compared with conventional battery at high-rate (10 min) discharging, which can be 45% of 20 hours-rate capacity.

Long-Life

RE/REL has a 10 year design life. This is twice that of the conventional battery at temperatures 20-25C.

Flame Retardant

RE/REL uses flame-retardant containers, and covers which fully comply with the American Safety Standard UL94, V-O.

Easy Connection

RE/REL has a faston-tab terminal, which enables easy connection.

Maintenance Free

It is not necessary to check specific gravity or add water, nor give equalizing charging.
RE/REL can be installed in any orientation (excluding the upside-down position).

MAIN APPLICATION

Mini-UPS (Uninterruptible Power Supplied)
PHS Base Station
PABX
CATV
Fire and Security Systems
Emergency Telecommunications Systems
Control Equipment
Solar Powered System

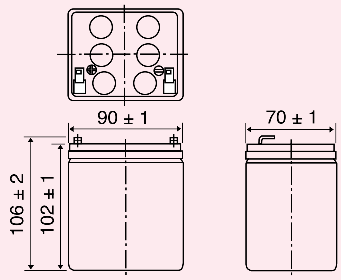
CONSTRUCTION

Container & Cover: flame retardant ABS synthetic resin.
Positive & Negative Plates: Special lead calcium alloy grids with pasted active material ensures longer life.
Separators: Micro glass fibre matting holding electrolyte in suspension.

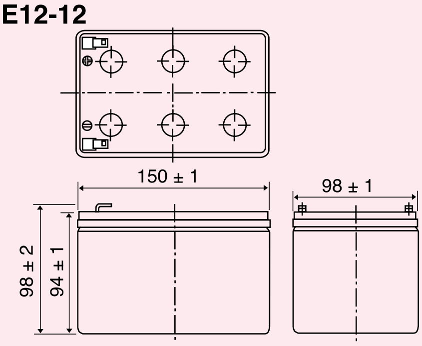
Valves: Maintains proper internal pressure by releasing gas if internal cell pressure rises abnormally because of high temperature or overcharging. Prevents ingress of oxygen..
Electrolyte: Dilute sulphuric acid completely absorbed by separators
Terminals: Faston tabs fully dealed.

Layout RE Series

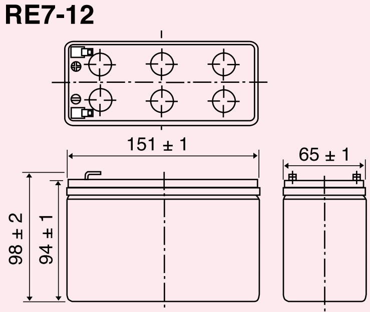
RE5-12



RE12-12



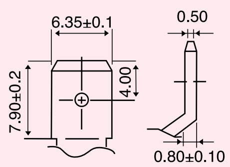
RE7-12



Shape of Terminal
Faston Tab #250

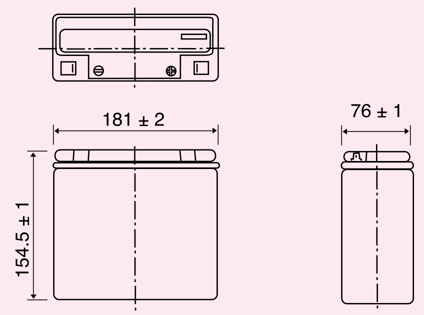
Unit: mm

RE5-12
RE7-12
RE12-12

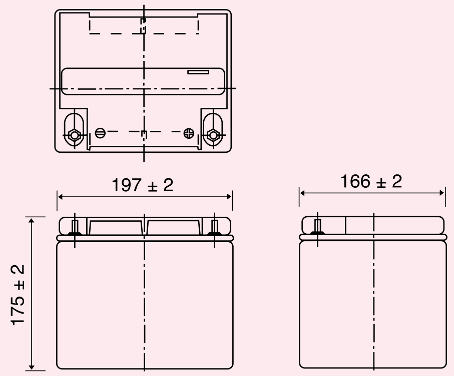


Layout REL Series

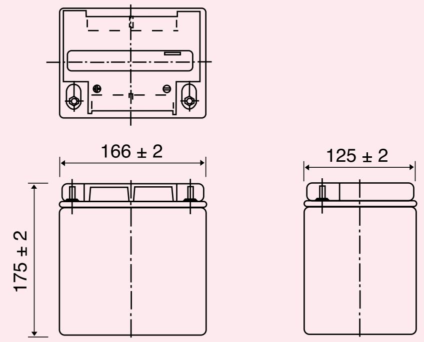
REL-B15-12



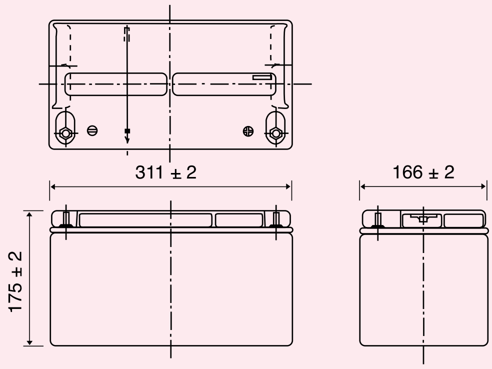
REL-B38-12



REL-B24-12

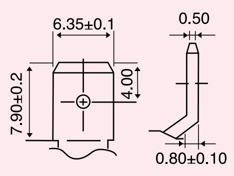


REL-B65-12



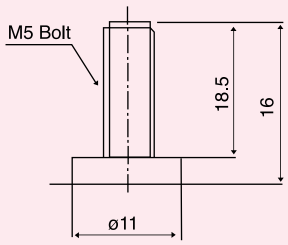
Shape of Terminal
Fasten Tab #250
REL-B15-12

Unit: mm



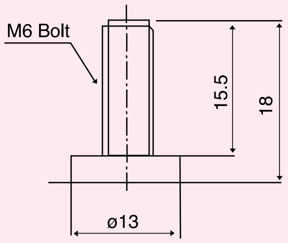
Nut Type M5

REL-B24-12
REL-B38-12



Nut Type M6

REL-B65-12



OUTLOOK

CHEMICAL REACTION AND SEALING MECHANISM

The chemical reaction taking place in a lead-acid storage battery is as shown in the following

$$PbO_2 + 2H_2SO_4 + Pb \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} PbSO_4 + 2H_2O + PbSO_4$$

PbO_2	$2H_2SO_4$	Pb	$PbSO_4$	$2H_2O$	$PbSO_4$
(Lead dioxide)	(Sulphuric acid)	(Spongy lead)	(Lead sulphate)	(Water)	(Lead sulphate)
Positive Active Material	Electrolyte	Negative Active Material	Positive Active Material	Electrolyte	Negative Active Material

formula:

At discharge, lead dioxide in positive plates and spongy lead in negative plates react with sulphuric acid in the electrolyte and gradually transform into lead sulphate. The sulphuric acid concentration decreases.

Conversely, when the battery is charged, the positive and negative materials which had been turned into lead sulphate gradually revert to lead dioxide and spongy lead respectively. This releases the sulphuric acid absorbed in the active materials and the sulphuric acid concentration increases, as shown in Fig.1.

When battery charging approaches its final stage, the charging current is consumed solely for electrolytic decomposition of water in the electrolyte, resulting in generation of oxygen gas from positive plates and hydrogen gas form negative plates. The generated gas will escape from the battery causing a decrease of the electrolyte, thereby requiring occasional water replenishment.

However, YUASA RE/REL Batteries utilize the characteristics of spongy lead, or negative active material, which is very active in moist conditions to react very quickly with oxygen, thereby suppressing the decrease of water and eliminating the need for water replenishment.

REACTION FROM BEGINNING OF CHARGE TO BEFORE THE FINAL STAGE

The process of charging from its beginning to the final stage is identical with that of conventional batteries as shown in Fig. 1.

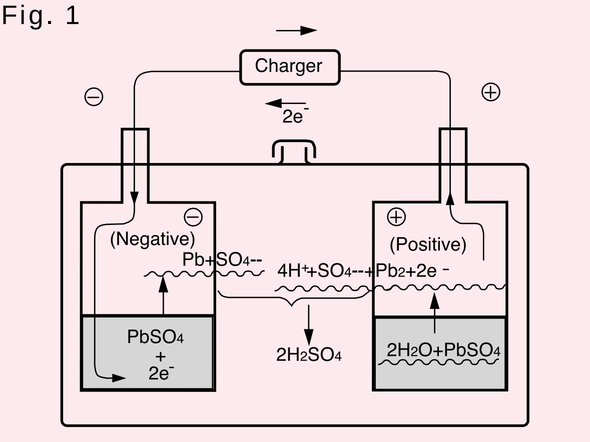
On the one hand, after the final stage of charging or under overcharge condition, the charging energy is consumed for electrolytic decomposition of water, The positive plates generate oxygen gas which reacts with the spongy lead in negative plates and the sulphuric acid in the electrolyte turning a part of negative plates into a discharged condition, thus suppressing the hydrogen gas generation from negative plates.

The part of negative plates which had turned to discharged condition through reaction with oxygen gas is then reverted to original spongy lead by subsequent charging. Thus, a negative plate keeps equilibrium between the amount which turns into spongy lead by charging and the amount of spongy lead which turns into lead sulphate through absorbing the gas generated from positive plate, which makes it possible for the battery to be of a sealed type.

The chemical reaction which takes place after the final stage of charging or under overcharging condition is as shown in Fig. 2, and the reaction

Reaction from Beginning of Charge to Before the Final Stage

Fig. 1



❶ Reaction at positive plate (oxygen generation)

① $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$

→ migrates to negative plate surface

❷ Reaction at negative plate

② (chemical reaction of spongy lead with oxygen)

$2Pb + O_2 \longrightarrow 2PbO$

③ (chemical reation of PbO with electrolyte)

$2PbO + 2H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O$

→ (To reaction ①)

④ (Reduction of $PbSO_4$)

$2PbSO_4 + 4H^+ + 4e^- \longrightarrow 2Pb + 2H_2SO_4$

→ (To reaction ③)

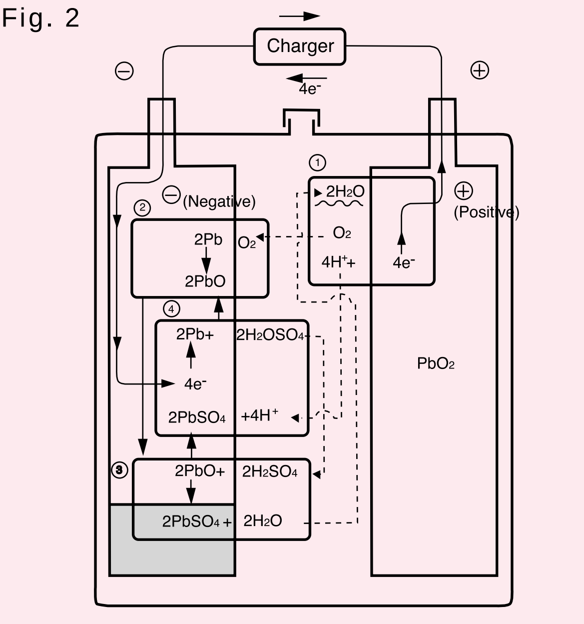
→ (To reaction ②)

Total reaction at negative plate

$O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$

Reaction after Final Stage of Charge

Fig. 2



formula is described on the next page.

As described above, the oxygen gas generated from the positive plates reacts quickly with the material in charged condition in the negative plates and returns to water causing very little loss thereof, thus making it possible to build the battery in a sealed construction.

DISCHARGING CHARACTERISTICS

Discharging capacity varies depending on discharge current (discharge rate). The smaller the discharge current, the more the discharge capacity is increased. The larger the discharge current, the lower the discharge capacity will be. At higher temperatures, the discharge capacity (Ah) of a battery increases and conversely at lower temperature, the discharge capacity decreases. Therefore, RE/REL batteries use a rated capacity at 20 hour discharge to the final discharge voltage of 1.75V/cell at 25C (77 F), 5C and –5C. Figs .3, 4 and 5 show the constant current discharge characteristics of RE/REL batteries.

Discharge Characteristics at Various Discharge Rates

Fig. 3: at 25˚C

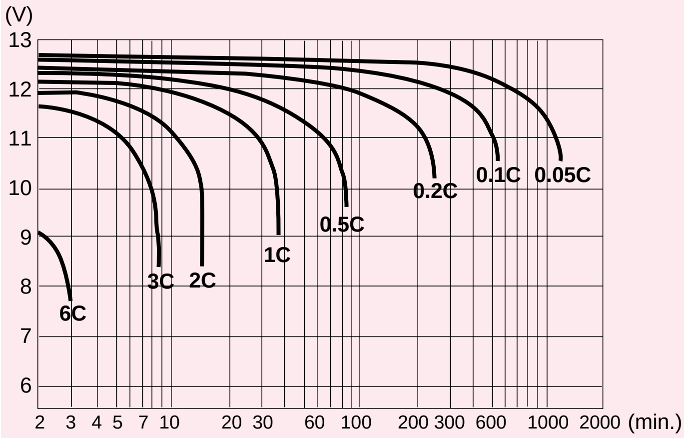


Fig. 4: at 5˚C

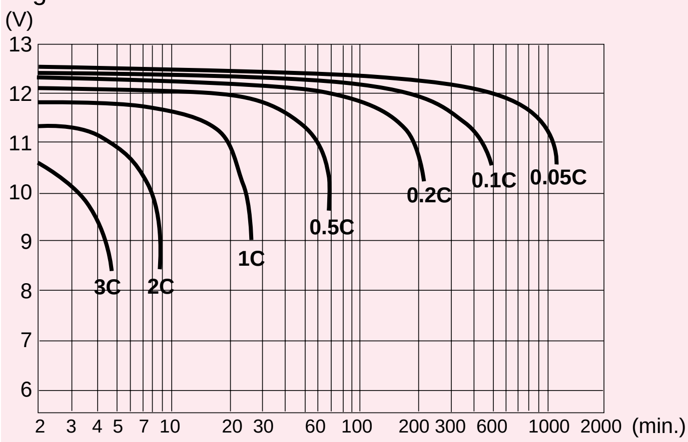
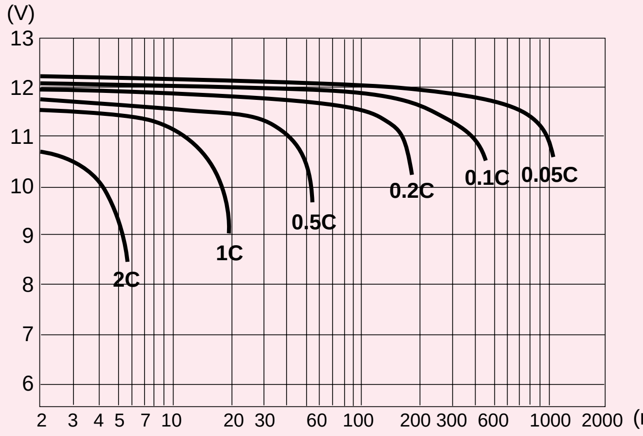


Fig. 5: at -5˚C



"C" is a value of the rated battery capacity expressed in Ah. For example in the case of REL-B15, the discharge rate). 1CA means a discharge of 0.1 x 15 = 1.5A, of discharge rate 1CA a discharge at 15A.

A battery, will reach its rated capacity in about five cycles of charge and discharge (Defined by SBA2101-1992 for NP batteries), or a float charge of one month minium.

The final discharge voltage is the lowest recommended voltage under load, or cut off voltage, for RE/REL batteries at various discharge rates. In general, lead acid batteries are damaged in terms of capacity and service life if discharged below the recommended cut off voltages. It is generally recognized that all lead calcium alloy grid batteries are subject to over discharge damage. For example, if a lead acid battery were discharged to zero volts, and left standing in either "on" or "off" load conditions for a long period of time, severe sulfation would occur, raising the internal resistance of the battery abnormally high. In such an extreme case, the battery may not accept charge. RE/REL batteries have been designed to withstand some levels of over-charge. Final discharge voltage is shown in Table 6.

Table 6: Constant Wattage of Discharge Characteristics

(W/Ah)

Final Discahrge Voltage (V/cell)	Discharge Time/Minutes													
	1	3	5	7	10	15	20	25	30	35	40	45	60	90
1.80	48.4	32.9	26.4	22.9	19.4	16.3	14.1	12.6	11.3	10.2	9.44	8.67	7.11	5.33
1.75	52.7	33.6	26.9	23.1	19.6	16.7	14.3	12.7	11.4	10.4	9.56	8.78	7.22	5.36
1.70	55.6	35.6	28.7	24.4	20.4	16.9	14.4	12.8	11.6	10.6	9.67	8.89	7.33	5.38
1.67	57.8	36.0	29.3	24.9	20.7	17.1	14.6	12.9	11.6	10.6	9.71	8.96	7.38	5.40
1.65	58.9	37.1	29.6	25.1	20.9	17.2	14.7	13.0	11.7	10.6	9.73	9.02	7.40	5.42
1.63	60.0	37.3	29.8	25.3	21.1	17.3	14.8	13.1	11.7	10.6	9.76	9.07	7.42	5.44
1.60	61.1	38.2	30.0	25.6	21.3	17.4	14.9	13.1	11.8	10.7	9.78	9.11	7.44	5.47
1.50	66.7	40.4	31.1	26.7	22.0	17.8	15.3	13.6	11.9	10.8	10.0	9.33	7.56	5.56

Battery Temperature: 25˚C

CHARGING CHARACTERISTICS

RE/REL – B requires constant current and constant voltage charging.

FLOAT-CHARGING

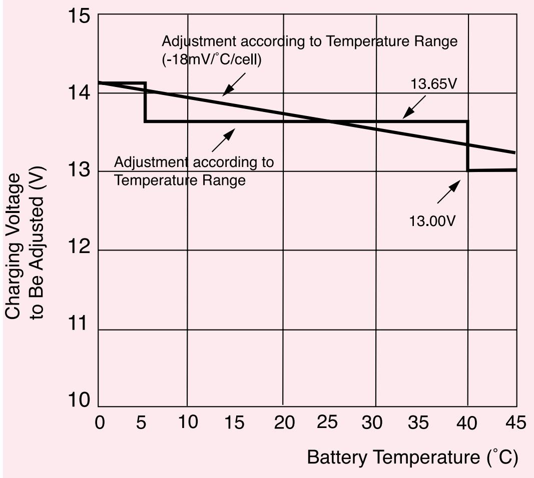
Float charge voltage must be kept at a value high enough to compensate for the battery's self-discharge and to keep the battery in a fully charged condition at all times but low enough to minimize life deterioration due to possible overcharge.

The optimum charge voltage for YUASA RE/REL-B battery is 13.65V (@ 2.275V/cell) under normal temperature conditions (25C or 77F), the allowed variance is +/-0.025CV/cell.

However, as the average ambient temperatures rises, charging voltage should be reduced to prevent overcharge. Accordingly, the recommended compensation factor is –3mV/C/cell at a standard center point of 25°C.

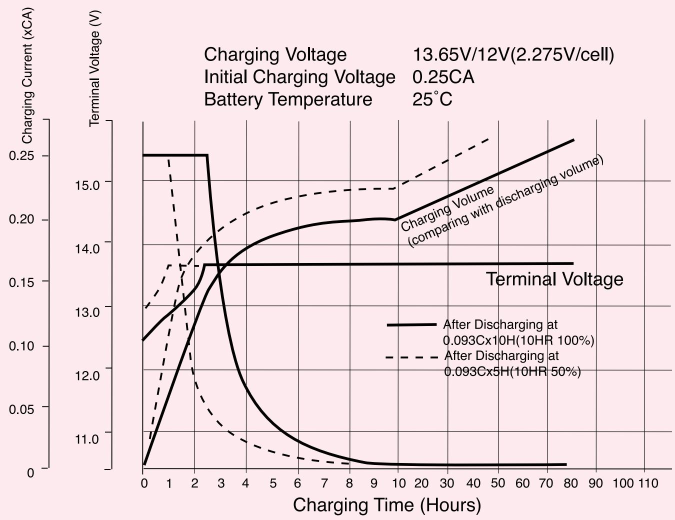
Fig. 7 shows the relationship between battery temperature and recommended charging voltage in accordance with Linear Compensation and Stepwise Compensation. If the charging voltage is not properly adjusted, it may cause battery explosion, acid-leakage or fire, and if temperature rises to 35C or more, thermal runaway may occur.

Fig. 7: Relationship between Battery Tempaerature and Recommended Charging Voltage



Recovery charge after the battery has been discharged can be carried out at the float charge voltage of 13.65V. Fig. 8 shows the charging characteristics at a constant current (0.25CA) and a constant voltage (13.65V) after discharge of 50% and 100% of the 20HR rated capacity. The time required to complete the charging varies by

Fig. 8: Charging Characteristics at a Constant Current/Voltage



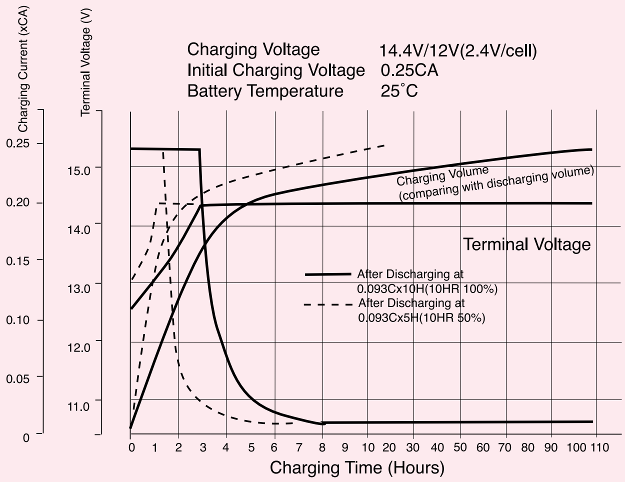
the amount of the previous discharge, initial charge current and temperature.

CYCLE-CHARGING

Fig. 9 shows the charging characteristics at a constant voltage of 14.4 V. At the voltage, the time to reach full charge condition is reduced. However, if charging at the voltage continues after full charge is reached, damage to the battery will occur and shorten its life. To prevent this happening, timer control or 2 stage charging (automatic switch over to 13.65V once full charge is reached) should be utilised. Initial charge current should be less than 0.25C.

In order to attain optimum service life, temperature compensated charging voltage is recommended. The compensating factor for cyclic use is –4mV/°C/Cell at a standard centre point of 25°C.

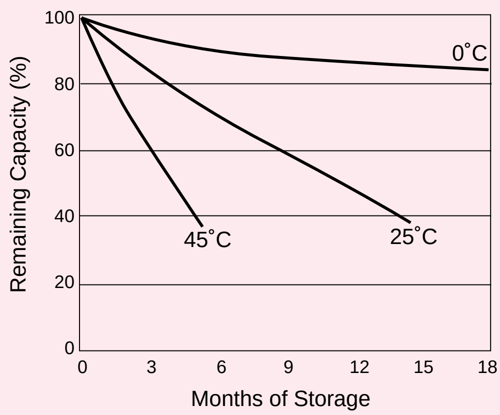
Fig. 9: Charging Characteristics at a Constant Current/Voltage



STORAGE

The self-discharge rate of RE/REL batteries is approximately 3% per month when stored at an ambient temperature of 25°C. The self-charge rate will vary as a function of storage temperature. Fig.10 shows the relationship

Fig. 10: Self Discharge Characteristics



between storage times at various temperatures and the remaining capacity.

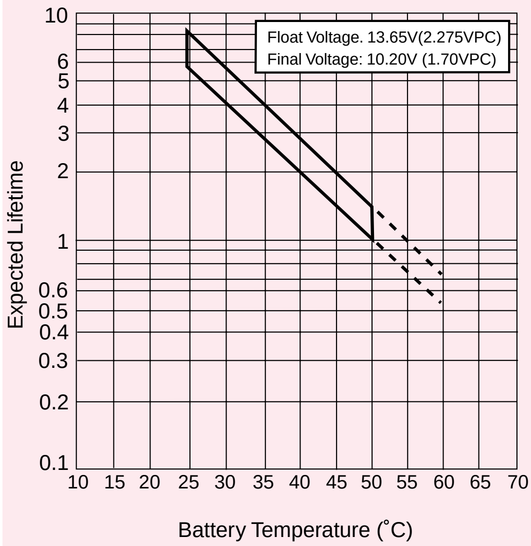
LIFE CHARACTERISTICS

FLOAT SERVICE LIFE

RE/REL batteries are designed to operate in float/standby service for 10 years at 25°C based upon a normal service condition in which float charge voltage is maintained between 2.275VPC +/-0.005V.

In normal float service the gasses generated inside a RE/REL battery are continually recombined into the negative plates and return to the water content of the electrolyte. Therefore, electrical capacity and eventual end of service life is brought about by the gradual corrosion of the electrodes (grids). This process will be accelerated by high ambient operating temperatures, cyclic operation and/or high/low charging voltage. Fig.11 shows the relationship between Temperature and Float Service life.

Fig. 11: Relationship between Temperature & Float Service Life

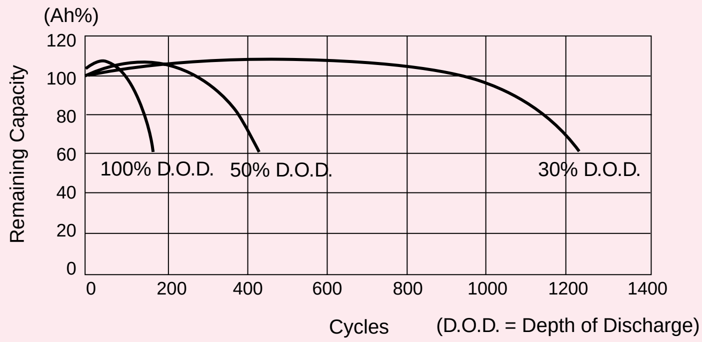


CYCLE SERVICE LIFE

There are a number of factors that will affect the length of cyclic life of a battery. The most significant are frequency of discharge and the manner in which the battery is charged with depth of discharge being the most important. Fig. 12 illustrates the effects of depth of discharge on cyclic life and the relationship between the number of cycles which can be expected and the depth of discharge is readily apparent. If an extended cycle life is required then it is common practice to select a battery with a larger capacity then what is required to support the load. Thus, at the specified discharge rate over the specified time, the depth of discharge will be shallower and the cyclic service life will be prolonged. The battery will reach its maximum efficiency after about 50 discharge cycles.

Fig. 12: Characteristics of Cycle Life

Discharge Current	0.17CA (1.7V/cell)
Charging Current	0.09CA
Charging Volume	120% of discharged current
Temperature	20°C-25°C



EXAMPLES OF CAPACITY CALCULATION

Current at end of discharge: 3.6A
Discharge duration: 30 min.
Lowest battery use temperature: 25C
Minimum permissible voltage: 10.8V (1.8V per cell)
When a calculation is made on an RE type battery in the Table-13 from the above condition, the K value is 0.93. From this, 3.6A x 0.93 = 3.48Ah.
Hence RE5-12 battery is used.

Discharge Time (Minutes)	K value at 25˚C minimum permissible voltage (V/cell)					
	1.80	1.75	1.70	1.60	1.50	1.40
2	0.208	0.190	0.180	0.169		
3	0.235	0.215	0.200	0.191	0.182	0.171
5	0.292	0.270	0.253	0.242	0.233	0.223
7	0.353	0.322	0.306	0.295	0.286	0.280
10	0.440	0.405	0.385	0.372	0.365	0.360
15	0.570	0.532	0.519	0.502	0.498	
20	0.669	0.660	0.640	0.630	0.620	
25	0.82	0.780	0.760	0.745	0.735	
30	0.93	0.90	0.88	0.86	0.845	
35	1.05	1.02	0.99	0.97	0.95	
40	1.17	1.13	1.10	1.08	1.06	
45	1.29	1.25	1.21	1.18	1.16	
50	1.40	1.36	1.32	1.29	1.27	
60	1.62	1.58	1.54	1.50	1.47	
90	2.26	2.20	2.14	2.08		
120	2.86	2.79	2.71			
180	4.00	3.90	3.75			
240	5.00	4.90	4.79			
300	6.05	5.90	5.75			
360	7.00	6.85				
420	8.0	7.80				
480	9.0	8.7				
540	9.5	9.7				
600	10.8	10.5				
1200		20.0				

Discharge Time (Minutes)	K value at 25˚C minimum permissible voltage (V/cell)					
	1.80	1.75	1.70	1.60	1.50	1.40
2	0.340	0.300	0.261	0.245	0.220	0.210
3	0.372	0.339	0.305	0.290	0.267	0.225
5	0.450	0.420	0.390	0.370	0.355	0.340
7	0.520	0.495	0.465	0.446	0.436	0.420
10	0.625	0.600	0.570	0.555	0.540	0.530
15	0.790	0.760	0.740	0.715	0.700	
20	0.93	0.91	0.88	0.86	0.84	
25	1.06	1.03	1.01	0.98	0.96	
30	1.20	1.16	1.14	1.11		
35	1.31	1.28	1.25	1.23		
40	1.43	1.40	1.37	1.34		
45	1.56	1.51	1.49	1.47		
50	1.69	1.65	1.61	1.58		
60	1.92	1.89	1.85	1.83		
90	2.63	2.56	2.52			
120	3.30	3.20	3.15			
180	4.55	4.42	4.35			
240	5.70	5.55				
300	6.75	6.60				
360	7.80	7.60				
420	8.8	8.6				
480	9.8	9.6				
540	10.8	10.6				
600	11.8	11.6				
1200						

Discharge Time (Minutes)	K value at 25˚C minimum permissible voltage (V/cell)					
	1.80	1.75	1.70	1.60	1.50	1.40
2	0.520	0.460	0.402	0.360	0.340	0.320
3	0.580	0.500	0.450	0.410	0.390	0.385
5	0.670	0.585	0.545	0.505	0.485	0.470
7	0.750	0.670	0.630	0.590	0.560	0.550
10	0.86	0.790	0.750	0.710	0.680	0.670
15	1.04	0.97	0.94	0.87	0.86	
20	1.20	1.13	1.09	1.03	1.00	
25	1.37	1.29	1.24	1.17		
30	1.53	1.42	1.37	1.32		
35	1.70	1.57	1.52	1.45		
40	1.81	1.72	1.64	1.58		
45	1.95	1.85	1.78	1.70		
50	2.08	2.00	1.94	1.86		
60	2.35	2.26	2.18			
90	3.12	3.05	2.90			
120	3.85	3.70	3.60			
180	5.15	5.00	4.85			
240	6.30	6.15				
300	7.50	7.30				
360	8.7	8.4				
420	9.7	9.5				
480	10.8	10.5				
540	12.0	11.5				
600	12.8	12.5				
1200						

DESIGN/APPLICATION TIPS TO ENSURE MAXIMUM SERVICE

Yuasa RE/REL batteries are a highly efficient maintenance free electrochemical system designed to provide years of trouble free electrical energy. The performance and service life of these batteries can be maximized by observing the following guidelines:

Heat kills batteries. Avoid placing batteries in close proximity to heat sources of any kind. The longest service life will be attained where the battery temperature does not exceed 20C (also see notes 4 & 9 hereunder). When calculating the correct float voltage setting, whether or not temperature compensation is required, full consideration must be given to the temperature of the battery and room ambient. For the purpose of the calculation, consider the temperature of a battery on float to be 1C above local ambient. Also, if the battery is used in an enclosure, the temperature gradient of the enclosure itself must be included in the calculation. I.e. The operating temperature of the battery is given by: -Room temperature + enclosure temperature + 1C.

Install the batteries on the lowest step of a device to prevent temperature rise. Arrange the batteries and the ventilation holes in the housing container so that the temperature difference among the batteries is suppressed to below 3C. Keep the batteries from contacting device walls, or with each other.

Since a battery may generate ignitable gases, do not install close to any equipment that can produce electrical discharges in the form of sparks.

When the battery is operated in a confined space, adequate ventilation should be provided.

The battery case is manufactured from high impact ABS plastic resin. It should not be placed in an atmosphere of, or in contact with organic solvents or adhesive materials.

Correct terminals should be used on battery connecting wires. Soldering is not recommended but if unavoidable please refer to us for further guidance.

Avoid operating at temperatures outside the range –15 to +50C for float/standby applications. +5 to +35 C for cyclic use is recommended.

When there is a possibility of the battery being subjected to heavy vibration or mechanical shock, it should be fastened securely and the use of shock absorbent material is advisable.

When connecting the batteries, free air space must be provided between each battery. The recommended minimum space between batteries is 0.2 inches (5mm) to 0.04 inches (10mm) In all installations due consideration must be given to adequate ventilation for the purposes of cooling.

When the batteries are to be assembled in series to provide more than 100V, proper handling and safety procedures must be observed to prevent accidental electric shock. (See note 16 below)

If 2 or more battery groups are to be used, connected in parallel, they must be connected to the load through lengths of wires, cables or busbars that have the same loop line resistance as each other. This makes sure that each parallel bank of batteries presents the same impedance to the load as any other of the parallel banks thereby ensuring correct equalisation of the source to allow for maximum energy transfer to the load.

To obtain maximum life, the ripple current flowing in the battery, from any source, should not exceed 0.1C Amps R.M.S.

When cleaning the battery case ALWAYS use a water soaked or dampened cloth but NEVER use oils, organic solvents such as petrol, paint thinners etc. DO NOT even use a cloth that is impregnated or has been in contact with any of these or similar substances.

Do not attempt to dismantle the battery. If accidental skin/eye contact is made with the electrolyte, wash or bathe the affected area/part straight away with liberal amounts of clean fresh water and seek IMMEDIATE medical attention.

DO NOT INCINERATE batteries as they are liable to rupture if placed into a fire. Batteries, that have reached the end of their service life, can be returned to us for safe disposal.

Touching electrically conductive parts might result in an electric shock. Be sure to wear rubber gloves before inspection or maintenance work.

The use of mixed batteries with different capacities, that may have been subjected to different uses, be of different ages and are of different manufacturers is liable to cause damage to the battery itself and/or the associated equipment. If this is unavoidable please consult us beforehand.

To obtain maximum life, batteries should never be stored in a discharged state.

In order to obtain maximum working life, when the batteries are used in an UPS system, the following is advised-
Where the D.C. imput exceeds 60 volts, each battery should be insulated from the battery stand by using suitable polypropylene or polypethylene material.

In high voltage systems the resistance between battery and stand should always be greater than 1 Megohm. An appropriate alarm circuit could be incorporated to monitor any current flow.
Daily check and service: If during periodical checks of the RE/REL batteries abnormally in performance, or such damages as cracks and deformation of the container and lid, or electrolyte leakage is detected, replace the battery.

GLOSSARY

Ampere (A)…The unit for measuring the flow of the electric current.
Ampere hour (Ah)…The current in (A: Amperes) multiplied by time in (h hours)
Used to indicate the capacity of a battery
Capacity (C)…Ampere hours that can be discharged from a battery.
Cell…The minimum unit of which a battery is composed, consisting of positive and negative plates, separators, electrolyte, etc. In valve regulated lead acid batteries, the nominal voltage is 2 colts per ce cell.
Charging (Charge)...The process of storing electrical energy in a battery in a chemical form.
Cyclic Service…The use of a battery with alternate repetition of charging and discharging.
Cycle Service Life…The total number of cycles expected at a given depth of discharge.
Deep Discharge…(a) Discharge of a battery until100% of the capacity is exhausted.
(b) Discharge of a battery until the voltage under load drops below the specified final discharge voltage. (Over discharge)
Depth of Discharge…The ratio of discharge capacity vs. the rated capacity of a battery.
Discharging (Discharge)...The process of drawing stored energy out of a battery in the form of electrical power.
Energy Density…The ratio of energy that can be discharged from a battery to the volume of that battery measured in Watt Hours (WH) per cubic inch, or litre.
Float Service…Method of use in which the battery and the load are connected in parallel to a float charger (or rectifier) so the constant voltage is applied to the battery continuously, maintaining the battery in a fully charged state and to supply power to the load from a battery without interruption or load variation.
Gas Recombination…The process by which oxygen gas generated from the positive plates during the final stage of charging is absorbed into the negative plates, reducing the potential at the negative plates, so suppressing the generation of hydrogen
Impedance…The ratio of voltage variation vs. current variation in alternating (a.c.) supply.
Internal Resistance…The term given to the resistance inside a battery, consisting of the sum of resistance of the electrolyte, the positive and negative plates & separators, etc.
Life Expectancy…Expected service life of a battery expresses in total cycles or time in float service in relation to a specified application.
Nominal Capacity…The nominal value of rated capacity. (Nominal capacity: 20 hour rate)
Nominal Voltage...The nominal value of rated voltage. In lead acid batteries, nominal voltage is 2 volts per cell.
Open Circuit Voltage…The voltage of a battery which is isolated electrically from any external circuit, i.e. the voltage is measured in a no load condition.
Parallel Connection…Connection of a group of batteries by interconnecting all terminals of the same polarity, thereby increasing the capacity of the battery group but not increasing voltage.
Recovery Charge…The process of charging a discharged battery to restore its capacity in preparation for subsequent discharge.
Sealed…The word “Sealed” is used as a relative term when referring to cells in RE/REL batteries compared with open vented free electrolytes types.
Self Discharge…Loss of capacity without external current drain.
Series Connection…Connection of a group of batteries by sequentially interconnecting the terminals of opposite polarity thereby increasing the voltage of the battery group but not increasing capacity.
Shallow Discharge…Discharge of a battery in which discharge is less that 50% depth of discharge. (D.O.D.)
Shelf Life…The maximum period of time a battery can be stored, under specified conditions, without needing supplementary charging.
Standby Service…General term for an application in which the battery is maintained in a fully charged condition by trickle or float charging. Synonymous with Float Service.
Trickle Charge…Continuous charging by means of a small current designed to compensate for self discharge in a battery which is isolated from any load. For valve regulated lead acid batteries, constant voltage charging is common.

Yuasa Battery Sales
(UK) Ltd
Hawksworth
Industrial Estate, Swindon,
Wiltshire SN2 1EG
Tel: 01793-645700
Fax: 01793-645701
Website:
www.yuasa-battery.co.uk

Registered number 1548820

Cat. No.
RELAppMay02

E&O.E.