SuperSafe® T

FRONT TERMINAL

Contents

Application Guide

The SuperSafe® T front terminal series benefits from EnerSys® renowned Thin Plate Pure Lead (TPPL) manufacturing platform to deliver energy storage solutions that meet the requirements of emerging applications whilst offering end users enhanced performance in traditional float applications.

SuperSafe® T front terminal blocs retain long float characteristics with the added benefit of improved cyclability in grid assist and selected unreliable grid applications.

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Applications

Table 1 below outlines the suitability of SuperSafe® T front terminal blocs for various types of reserve power applications.

Application	Demands on Battery	Application Suitability
Reliable grid	- Stable grid - Controlled ambient temperature - Compensated float voltage - Very little cyclic use	Yes
Grid assist	- Regions where grid is supported with scheduled outages - Reasonable temperature control - Compensated float voltage - Medium level cyclic use	Yes
Unreliable grid (Low risk of PSoC)*	- Poor grid stability - Frequent power outages / scheduled & unscheduled - Poor temperature control - High cyclic use - Cycles can be shallow / deep - Low risk for uncontrolled partial state of charge	Yes
Unreliable grid (high risk of PSoC)*	- Poor grid stability - Frequent power outages / scheduled & unscheduled - Poor temperature control - High cyclic use - Cycles can be shallow / deep - High risk for uncontrolled partial state of charge	No

TABLE 1

Table 2 provides a summary of the operating charging parameters that will deliver optimum service life and performance relative to the type of application.

Application	Charge Parameter for Optimised Life and Performance
Reliable grid	✓ Temperature compensated float voltage equivalent to 2.29Vpc @ 20°C ✓ Charge current - minimum $0.1C_{10}$A, maximum unlimited, typically $0.5C_{10}$A
Grid assist	✓ Boost voltage equivalent to 2.40Vpc @ 20°C to fast charge ✓ Charge current – minimum $0.1C_{10}$A. Maximum unlimited, typically $0.5C_{10}$A ✓ Followed by float voltage with temperature compensation applied as required
Unreliable grid (Low risk of PSoC)*	✓ Boost voltage equivalent to 2.40Vpc @ 20°C to fast charge ✓ Charge current – minimum $0.1C_{10}$A. Maximum unlimited, typically $0.5C_{10}$A ✓ Followed by float voltage with temperature compensation applied as required

TABLE 2

*Partial state of charge

Operating Temperature Range

The recommended operating temperature for optimum life and performance is 20°C. However, SuperSafe® T front terminal blocs can be operated in the temperature range of -30°C to +45°C.

Storage

All lead acid batteries lose capacity when standing on open-circuit because of parasitic chemical reactions. The purity of the component materials used in the construction of SuperSafe® T front terminal blocs results in a very low rate of self-discharge delivering up to 2 years shelf life at 20°C before a refresh charge is required.

Batteries should be stored in a cool and dry area. Please note that high temperature increases the rate of self-discharge and reduces storage life. The maximum storage times before a refresh charge is required and recommended open circuit voltage audit intervals are illustrated in table 3.

Temperature (°C / °F)	Storage Time (Months)	OCV Audit Interval (Months)
+10 / +50	48	12
+20 / +68	24	12
+30 / +86	12	6
+40 / +104	6	3

TABLE 3

SuperSafe® T front terminal blocs must be given a refresh charge when the OCV approaches the equivalent of 2.10 Volts per cell or when the maximum storage time is reached, whichever occurs first.

Refresh Charge

A refresh charge should be performed at a constant voltage equivalent to 2.40Vpc with minimum $0.1C_{10}$ Amps current for a period of 24 hours.

Commissioning Charge

Before conducting a capacity discharge or commencing cycling, the battery must be given a commissioning charge. In float applications the commissioning charge shall consist of 96 hours of float charge at the recommended float voltage (2.29Vpc at 20°C) with no load connected to the battery. Alternatively the commissioning charge may consist of 24 hours charge at a voltage equivalent to 2.40Vpc at 20°C with minimum $0.1C_{10}$ A charge current, with no load connected.

Float Operation

The SuperSafe® T front terminal series is designed for continuous float operation on constant voltage chargers. Constant voltage charging is the safest, most efficient and recommended method of charging VRLA batteries.

The recommended float voltage setting is 2.29Vpc at +20°C. Therefore the system voltage setting equals the number of cells in series x 2.29Vpc.

Battery life and charging characteristics are affected by temperature. The optimum battery life will be achieved when the battery is operated at +20°C (see figure 1).

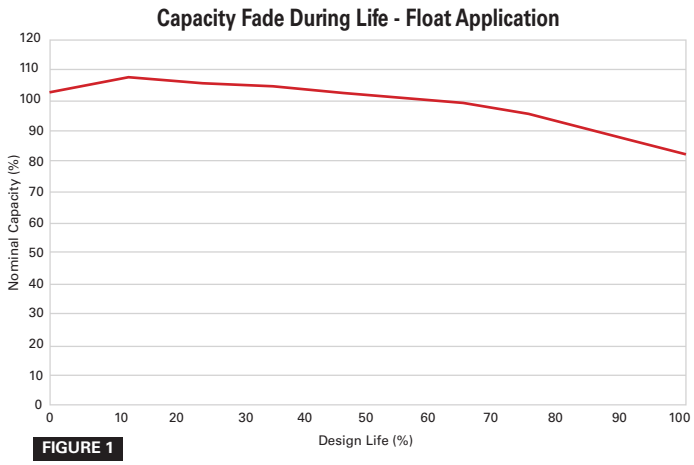

FIGURE 1

Battery life is reduced by 50% for every 10°C/18°F increase in temperature (see **figure 2**). Float voltage compensation reduces the charging current as battery temperature increases and partially negates the adverse effect of high temperature.

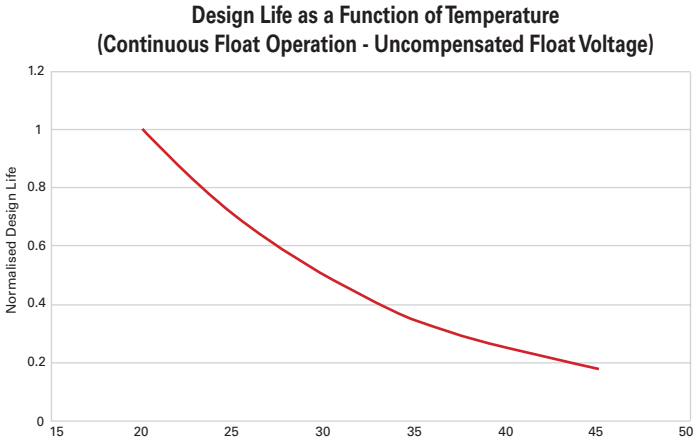

FIGURE 2

The recommended float voltage temperature compensation is:
- 2.29Vpc +4mV per cell per °C below 20°C
- 2.29Vpc -4mV per cell per °C above 20°C

(refer to **figure 3** for further details)

Temperature compensation is capped at +40°C/+104°F as at this temperature the compensated charge voltage approaches the natural open circuit voltage of the battery and there is insufficient overvoltage to keep the battery in a fully charged condition.

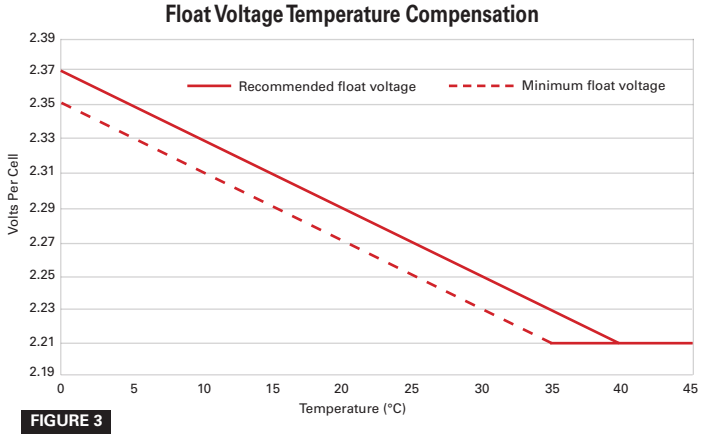

FIGURE 3

Due to the very low internal resistance, SuperSafe®T-FT monoblocs will accept unlimited current during recharge, although typically $0.5C_{10}$ A is used as a maximum.

Figure 4 illustrates the typical time to full state of charge when recharged with temperature compensated float voltage as a function of available charge current from varying depths of discharge.

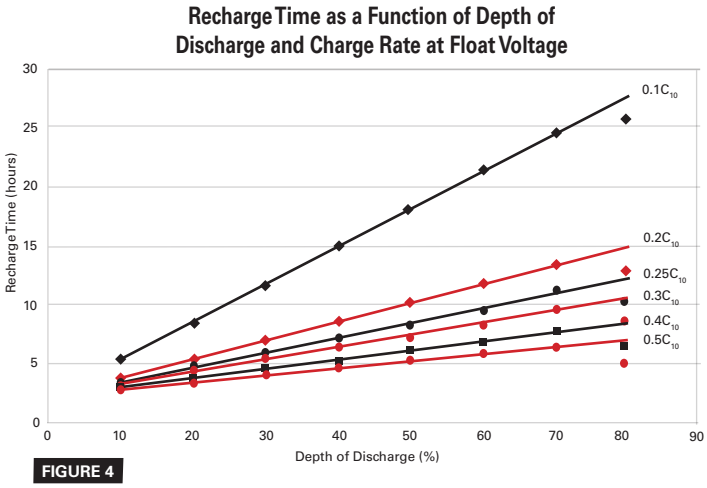

FIGURE 4

Fast Charging Operation

The inherently high charge acceptance of the core TPPL technology used in the SuperSafe® T front terminal series is suited for applications which require a fast time to repeat duty. In such applications the rectifier voltage should be set at 2.40Vpc at 20°C.

As with float charge, temperature compensation for voltage is applicable to fast charge techniques. The profile below (**figure 5**) gives the recommended compensation to charge voltage for temperature.

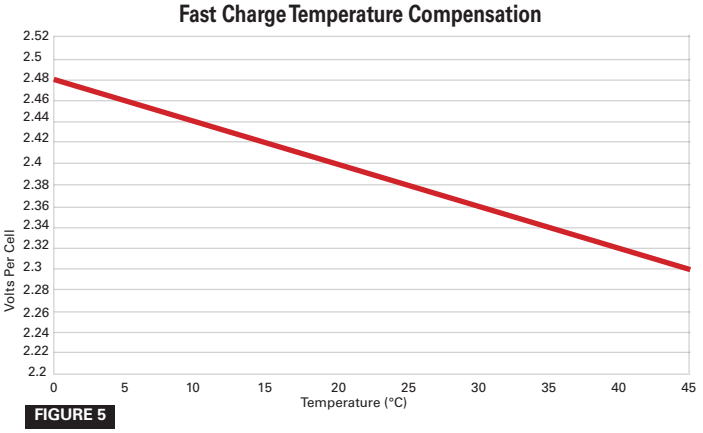

FIGURE 5

Once fully charged the voltage can be changed to float voltage with temperature compensation as required.

Fast Charging Current Limit

In addition to the influence of charge voltage, the available charge current will impact on time to repeat duty. **Figure 6** illustrates the typical time to full state of charge (2.40Vpc) as a function of available charge current from varying depths of discharge.

Recharge Time as a Function of Depth of Discharge and Charge Rate at Boost Voltage (2.40Vpc)

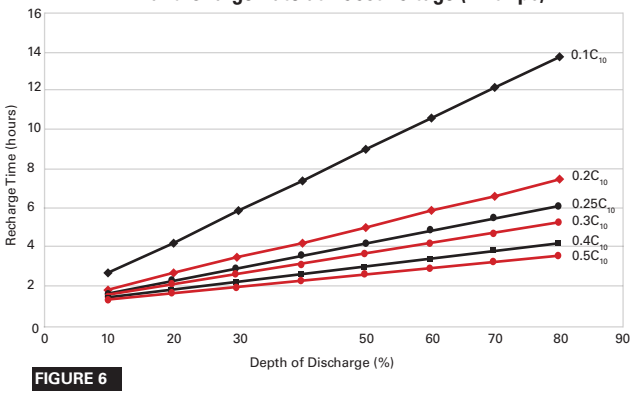

FIGURE 6

Grid Assist & Selected Unreliable Grid Cycling

The SuperSafe® T front terminal series has the added capability to deliver high cyclic performance in grid assist and unreliable grid applications where there is a low risk of partial state of charge operation.

Figure 7 indicates the cyclic capability in a typical unreliable grid application. Please note that the obtained life is dependent on site conditions.

Typical Number of Cycles as a Function of Depth of Discharge in Unreliable Grid Application at 20°C (Optimum Recharge Conditions)

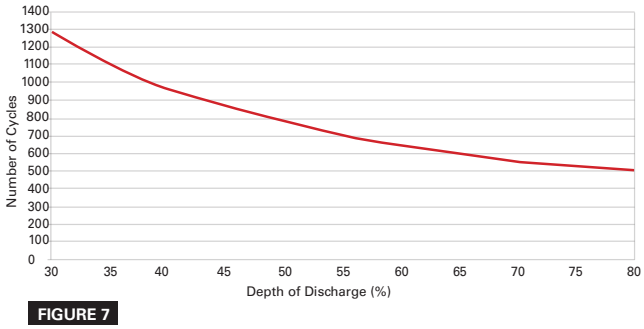

FIGURE 7

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