



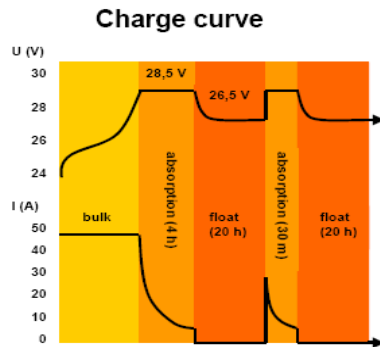
### SHICO BATTERY CHARGER

#### Perfect chargers for any type of battery

Charge voltage can be precisely adjusted to suit any sealed or unsealed battery system. In particular, sealed maintenance free batteries must be charged correctly in order to ensure a long service life. Over voltage will result in excessive gassing and venting of a sealed battery. The battery will dry out and fail.

#### Controlled charging

Every TG charger has a microprocessor, which accurately controls the charging in three steps. The charging process takes place in accordance with the IUoUo characteristic and charges more rapidly than other processes.



#### Use of TG chargers as a power supply

As a result of the perfectly stabilized output voltage, a TG charger can be used as a power supply if batteries or large buffer capacitors are not available.

#### Two outputs to charge 2 battery banks

The TG chargers feature 2 isolated outputs. The second output, limited to approximately 4 A and with a slightly lower output voltage, is intended to top up a starter battery.

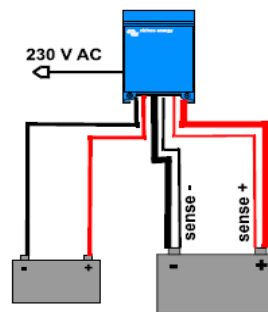
#### To increase battery life: temperature compensation

Every TG charger comes with a battery temperature sensor. When connected, charge voltage will automatically decrease with increasing battery temperature. This feature is especially recommended for sealed batteries which otherwise might be overcharged and dry out due to venting.

#### Battery voltage sense

In order to compensate for voltage loss due to cable resistance, TG chargers are provided with a voltage sense facility so that the battery always receives the correct charge voltage.

#### Application example



# SHICO

## POWER SUPPLY & BATTERY CHARGER MODEL : SH-90-

### Specifications

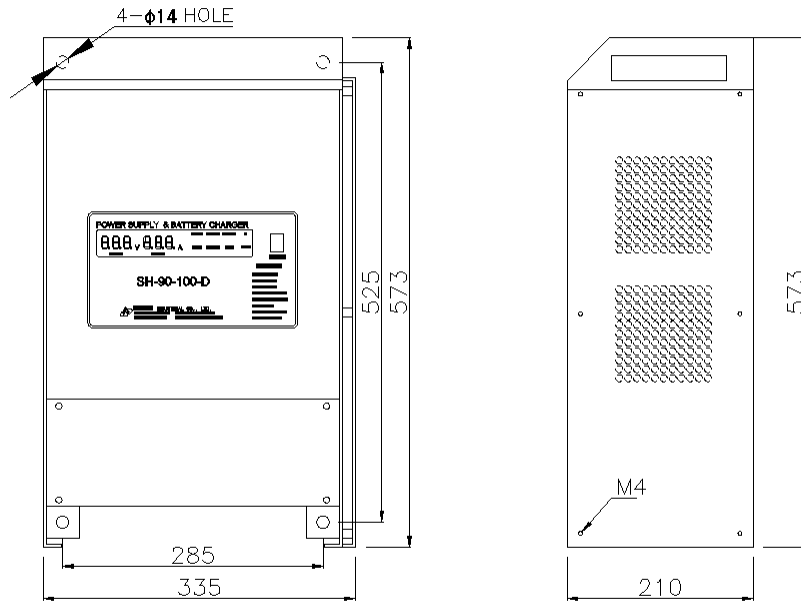
SPECIFICATION	VOLTAGE CURRENT				
	24/30 TG 24/50 TG	24/80 TG	24/100TG	48/25 TG	48/50 TG
Input Voltage (V AC)	230	230	230	230	230
Input Voltage range (V AC)	185-264	185-264	185-264	185-264	185-264
Frequency (Hz)	45-65				
Power factor	1				
Charge voltage 'absorption' (V DC)	28.5	28.5	28.5	57	57
Charge voltage 'float' (V DC)	26.5	26.5	26.5	53	53
Charge current house batt (A) (2)	30/50	75	100	25	50
Charge current starter batt (A)	4	4	4	n.a	n.a
Charge characteristic	Three step				
Battery capacity (Ah)	1500-500	400-800	500-1000	125-250	250-500
Temperature sensor	√				
Can be used as power supply	√				
Potential free contacts	√				
Forced cooling	√				
Protection (1)	a, b, c, d				
Operating temp range	-20 to 60°C (0-140°F)				
Humidity (non condensing)	Max 95%				
ENCLOSURE					
Material & Color	Aluminum (blue RAL 5012)				
Battery connection	M8 studs				
230 V AC-connection	Screw-clamp 2.5 mm <sup>2</sup> (AWG 6)				
Protection category	IP21				
Weight kg (lbs)	5.5(12.1)	10(22)	10(22)	5.5(12.1)	10(12.1)
OPTIONS					
Temperature sensor	√				
Charger output panel	√				
Charger switch panel	√				
Battery alarm panel	√				
MODEL SAMPLE					
Sh-90 -output voltage/current					
Sh-90 - 24 / 100A					

**SAMHOI INDUSTRY CO., LTD.**

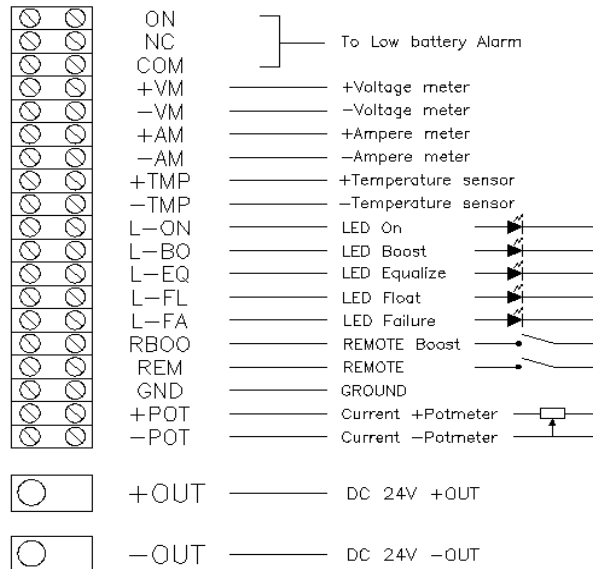
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TELEPHONE NUMBER : 055-321-0578~9 FAX NUMBER : 055-321-0573

# SHICO

## POWER SUPPLY & BATTERY CHARGER MODEL : SH-90-



### REMOTE PANEL CONNECTIONS



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### GEL BATTERY

#### 1. SHICO technology

Gel stands for gel type sealed batteries. Gas will escape through the safety valves only in case of overcharging or cell failure. Gel batteries have exceptional leak resistance, and can be used in any position. Gel batteries are maintenance free for life.

#### 2. Sealed AGM batteries

AGM stands for Absorbent Glass Mat. In these batteries the electrolyte is absorbed into a glass-fiber mat between the plates by capillary action. AGM batteries are more suitable for short-time delivery of very high currents (engine starting) than gel batteries.

#### 3. Sealed Gel batteries

Here the electrolyte is immobilized as gel. Gel batteries in general have a longer service life and better cycle capacity than AGM batteries.

#### 4. Low Self-discharge

Because of the use of lead calcium grids and high purity materials, Gel batteries can be stored during long periods of time without recharge. The rate of self-discharge is less than 2% per month at 20°C. The self-discharge doubles for every increase in temperature with 10°C. Gel batteries can therefore be stored

during up to a year without recharging, if kept under cool conditions.

#### 5. Exceptional Deep Discharge Recovery

Gel batteries have exceptional discharge recovery, even after deep or prolonged discharge. It should however be stressed that repetitive deep discharge and prolonged discharge have a very negative influence on the service life of all lead acid batteries, Gel batteries are no exception.

#### 6. Battery discharging characteristics

The rated capacity of Gel batteries refers to a 10 hour discharge, in other words: a discharge current of 0,1 C. The effective capacity decreases with increasing discharge current (see table 1). Please note that the capacity reduction will be even faster in case of a constant power load, such as an inverter.

Discharge time (constant current)	End voltage V	AGM Deep Cycle %	Gel Deep Cycle %	Gel Long Life %
20 hours	10,8	105	103	102
10 hours	10,8	100	100	100
5 hours	10,8	95	95	94
3 hours	10,8	82	81	79
1 hour	9,6	66	65	63
30 min	9,6	52	49	45
15 min	9,6	42	38	28
10 min	9,6	36	27	20
5 min	9,6	27	18	10
5 seconds		8 C	7 C	

Table 1: Effective capacity as a function of discharge time.

(the lowest row gives the maximum allowable 5 seconds is charge current) Our AGM deep cycle batteries have excellent high current performance and are therefore recommended for high current applications such as engine starting. Due to their construction, Gel batteries have a lower effective capacity at

high discharge currents. On the other hand, Gel batteries have a longer service life, both under float and cycling conditions.

### 7. Effect of temperature on service life

High temperature has a very negative effect on service life. The service life of Gel batteries as a function of temperature is shown in table 2.

Average operating temperature	AGM deep cycle years	Gel Deep Cycle years	Gel Long Life years
20°C / 68°F	7 - 10	12	20
30°C / 86°F	4	6	10
40°C / 104°F	2	3	5

Table 2: Design service life of Gel batteries under float service

### 8. Effect of temperature on capacity

As is shown by the graph below, capacity reduces sharply at low temperatures.

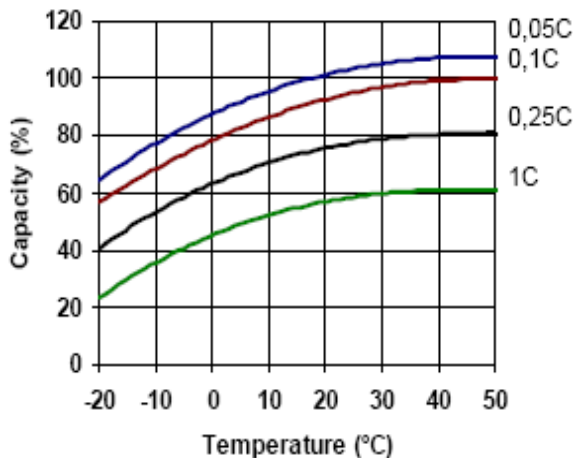


Fig 1: Effect of temperature on capacity

### 9. Cycle life of Gel batteries

Batteries age due to discharging and recharging. The number of cycles depends on the depth of discharge, as is shown in figure 2.

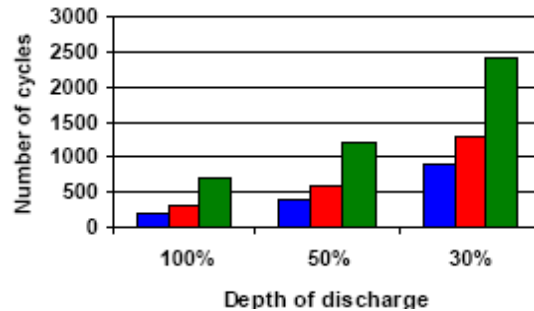


Fig 2: Cycle life

### 10. Battery charging in case of cycle use: the 3-step charge characteristic

The most common charge curve used to charge Gel batteries in case of cyclic use is the 3-step charge characteristic; whereby a constant current phase (the bulk phase) is followed by two constant voltage phases (absorption and float), see fig. 3.

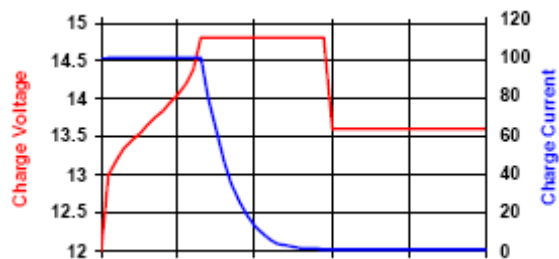


Fig3: Three-step charge curve

During the absorption phase the charge voltage is kept at a relatively high level in order to fully recharge the battery within reasonable time. The third and last phase is the float phase: the voltage is lowered to standby level, sufficient to compensate for self-discharge.

Disadvantages of the traditional 3-step charge characteristic:

- During the bulk phase the current is kept at a constant and often high level, even after the gassing voltage (14,34 V for a 12 V battery) has been exceeded. This can lead to excessive gas pressure in the battery. Some gas will escape through the safety valves, reducing service life.
- Thereafter the absorption voltage is applied during a fixed period of time, irrespective of how deep the battery has been discharged previously. A full absorption period after a shallow discharge will overcharge the battery, again reducing service life. (a. o. due to accelerated corrosion of the positive plates)
- Research has shown that battery life can be increased by decreasing the float voltage to an even lower level when the battery is not in use.

### 11. Battery charging: longer battery life with Gel 4-step adaptive charging

Gel developed the adaptive charge characteristic. The 4-step adaptive charge

curve is the result of years of research and testing.

The Gel adaptive charge curve solves the 3 main problems of the 3-step curve:

- Battery Safe mode in order to prevent excessive gassing, Gel has invented the 'Battery Safe Mode'. The battery Safe Mode will limit the rate of voltage increase once the gassing voltage has been reached. Research has shown that this will reduce internal gassing to a safe level.

#### - Variable absorption time

Based on the duration of the bulk stage, the charger calculates how long it will keep the battery in absorption. If the bulk time is short, this means the battery was already charged and the resulting absorption time will be short. A longer bulk time will also result in a longer absorption time.

#### - Storage mode

After completion of the absorption period the battery should be fully charged, and the voltage is lowered to the float or standby level. If no discharge occurs during the next 24

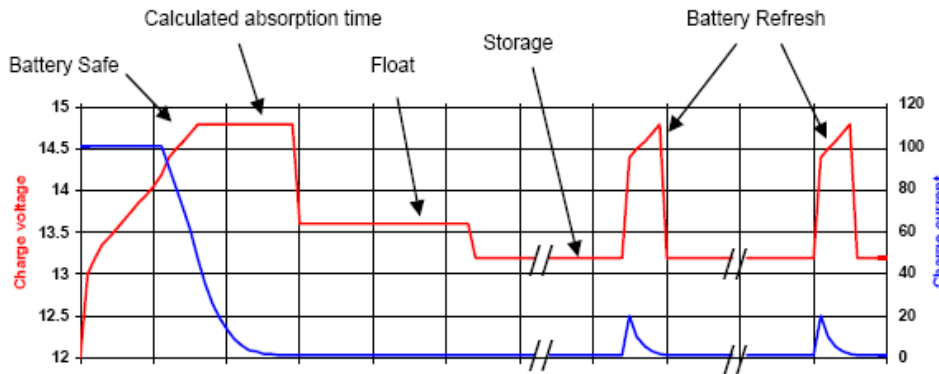


Figure 3:  
Four-step adaptive  
charge curve

hours, the voltage is reduced even further and the battery goes into storage mode. The lower storage voltage reduces corrosion of the positive plates once every week the charge

voltage is increased to the absorption level for a short period to compensate for self discharge (Battery Refresh mode).

### 12. Battery charging in case of standby use: constant voltage float charging

When a battery is not frequently deeply discharged, a 2-step charge curve can be used. During the first phase the battery is charged with a limited current (the bulk phase). Once a preset voltage has been reached the battery is kept at that voltage (the float phase). This charge method is used for starter batteries in vehicles, and in uninterruptible power supplies (UPS).

### 13. Optimum charge voltage of Gel batteries

The recommended charge voltage settings for a 12 V battery are shown in the following table.

	Float service	Cycle service Normal	Cycle service Fastest recharge
<b>Victron AGM Deep cycle</b>			
Absorption		14,2 - 14,6	14,6 - 14,9
Float	13,5 - 13,8	13,5 - 13,8	13,5 - 13,8
Storage	13,2 - 13,5	13,2 - 13,5	13,2 - 13,5
<b>Victron Gel Deep Cycle</b>			
Absorption		14,1 - 14,4	
Float	13,5 - 13,8	13,5 - 13,8	
Storage	13,2 - 13,5	13,2 - 13,5	
<b>Victron Gel Long Life</b>			
Absorption		14,0 - 14,2	
Float	13,5 - 13,8	13,5 - 13,8	
Storage	13,2 - 13,5	13,2 - 13,5	

Table 3: Recommended charge voltages

### 14. Effect of temperature on charging voltage

The charge voltage should be reduced with increased temperature. Temperature compensation is required when the temperature of the battery is expected to be less than 10°C / 50°F or more than 30°C / 85°F during long periods of time. The recommended temperature compensation for Gel batteries is -4 mV / Cell (-24 mV /°C for a 12 V battery). The center point for temperature compensation is 20°C / 70°F.

### 15. Charge current

The charge current should preferably not exceed 0,2 C (20 A for a 100 Ah battery).

The temperature of a battery will increase by more than 10°C if the charge current exceeds 0,2 C. Therefore temperature compensation is required if the charge current exceeds 0,2 C.

### 12 Volt Deep Cycle AGM

Article number	Ah	V	lxwxh mm	Weight kg
BAT412121080	120	12	409x176x225	38

### General Specification

Technology: flat plate AGM  
Terminals: copper  
Rated capacity: 10 hr discharge at 25 degr C  
Cycle design life: 200 cycles at 100% discharge\*

**SHICO**

BATTERY CHARGER

MODEL : SH-90-100

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