

## Battery Application Guide

### Construction

The Varley Red Top™ Range are Lead Acid batteries, constructed using an Absorbent Glass Mat (AGM) which separates the positive and negative plates. There are two main benefits of this:

1. The electrolyte (Sulphuric Acid) is adsorbed onto the fibres of this mat. There is little free liquid within Varley Red Top batteries as only enough acid is used to achieve the required performance levels. The AGM retains the electrolyte ensuring that, if the battery is punctured, there is minimal risk of electrolyte leakage.
2. The AGM also allows gas flow to occur between the positive and negative plates over a substantial area. This is important for a high level of gas recombination to occur. Recombination is where chemicals within the battery are converted back into their original state during overcharge. Recombination allows the battery to retain gases internally and be maintenance free for life. In order for recombination to occur, oxygen must flow from the positive plate to the negative plate. Recombination in AGM batteries is generally more efficient than in gel type batteries, which have a liquid barrier between the plates.

### Safety

Take care to avoid short circuiting the battery terminals or connected wiring. Varley Red Top™ batteries are designed to discharge at high power and may cause heating or a fire. Avoid wearing metal jewellery when handling batteries. Use insulated tools wherever possible.

### Before Installation

As delivered, the battery will be partially charged but, to ensure best performance, we recommend that it is charged overnight from a mains powered charger before installation in the vehicle. Please see below for charging information.

## Installation

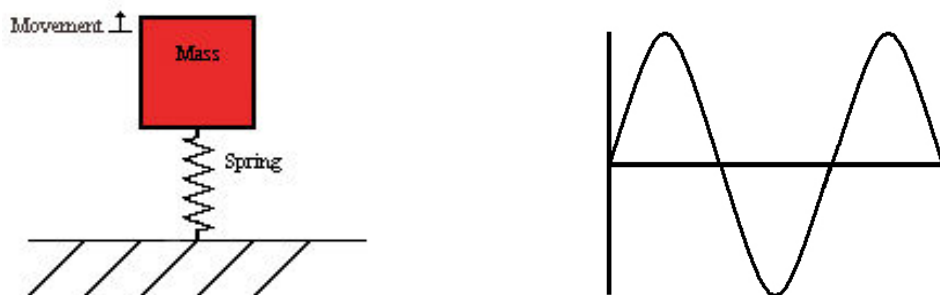
Do not obstruct any of the vents on the lid area of the battery with mounting hardware (for example, clamping plates). These vents are necessary to allow escape of gas in the event of the battery being subject to abusive conditions.

Do not fit the battery in a sealed, gastight compartment. It must be allowed to vent to outside air but no specific measures are required other than normal ventilation.

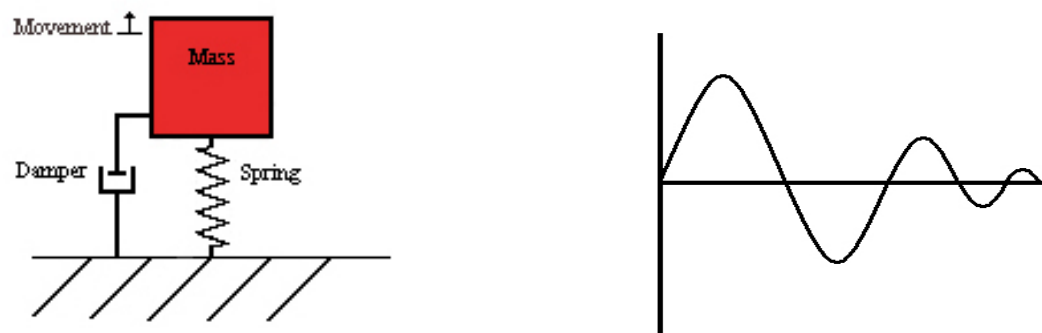
Even though quite robust, we suggest that batteries are installed in areas subject to lower levels of vibration and shock and are not exposed to direct heat radiation from, for example, exhaust systems. They can be safely mounted in cockpit areas.

A minimum thickness of 10mm closed cell anti-vibration foam padding is recommended to be used around the battery when mounting it to protect from excessive vibration and shock.

A battery installation on a car is effectively a mass on a spring and will oscillate continuously unless damped. The battery may suffer damage as it is accelerated back and forth by vibration especially at a system resonant frequency.

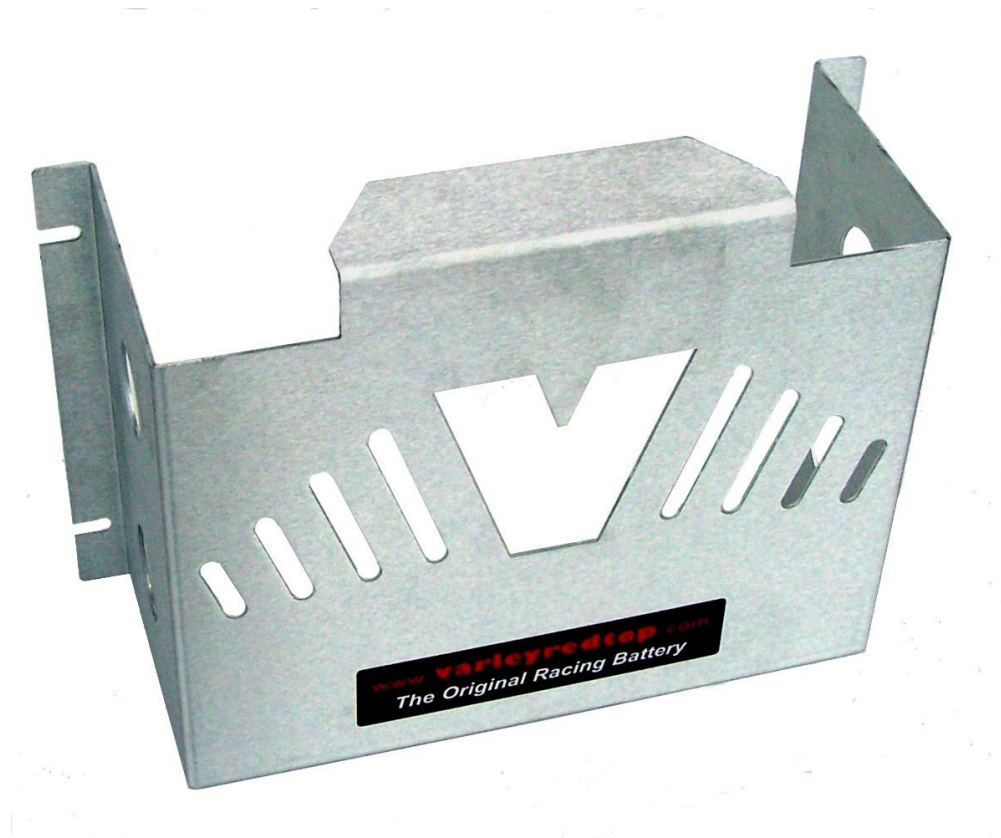


The padding acts as a damping medium to reduce the effect of vibration and limit any potentially damaging resonance. It is important that, when mounting the battery, the padding is not compressed too much, as this would minimise the damping effect.



Varley Red Top installation brackets are available from DMS technologies for the RT15, RT30 and RT40 models. These have been designed to allow the inclusion of 10mm foam in the mount. This foam is supplied with the brackets as a single sheet with cutting instructions.

Try to avoid using rubber straps to retain batteries as these form the "spring" in the above examples and can lead to resonance and subsequent failure.



## **Connections**

Battery cables should be supported to ensure they do not put excessive stress on the battery terminals or inject external vibration into the battery. If they are too short, removal can be difficult and damage incurred. If the cables are too long, they may move or vibrate when accelerating, braking or cornering, causing damaging forces to be transferred into the battery.

It is important that, when attaching cables to the battery terminals, these are tightened to no more than the recommended maximum (see data sheets). Some terminals are plated brass for high conductivity and overtightening runs the risk of stripping the thread or completely snapping off the terminal.

Female connectors are more robust than their male/stud counterparts that are prone to breaking through accidental over-tightening.

## **The Symptoms of Vibration Damage**

If you suffer a battery failure, you may be able to identify whether this is likely to be due to shock and vibration damage. Use a voltmeter to read battery voltage. If you measure an open circuit voltage of around 12V but as soon as a load is applied the voltage drops to zero, the battery is high impedance and may have sustained damage.

Vibration generally causes cracks to appear at the top of the plates or in the internal interconnections of the battery. When OCV is measured with a Voltmeter, normal voltage is shown because some parts of the damaged area are touching across the cracks. As soon as a load is applied and higher levels of current are required (for example, during engine starts) the high resistance causes the measured voltage to fall away. An example of this form of failure can be seen in the image below.



A battery that has failed due to shock and vibration damage cannot be repaired or recovered. It is recommended that you protect your battery by using proper mounting methods with foam. Hard rubber mats such as those found in tool chest drawers offer minimal protection as they do not effectively damp vibration.

## **Discharging**

Varley Red Top™ batteries are designed to provide high power discharges for engine starting, pumps and other such applications. They are not designed as "hotel load" batteries used for large numbers of charge/discharge cycles and will fail quickly if used in this mode.

DMS can supply alternative batteries to meet all these application requirements.

## **Charging**

Varley Red Top™ batteries should be kept fully charged at all times especially when the battery is in storage. If the battery is not kept charged, the plates will eventually sulphate causing an increase of internal resistance. This resistance stops the battery supplying its maximum amount of cranking current and capacity.

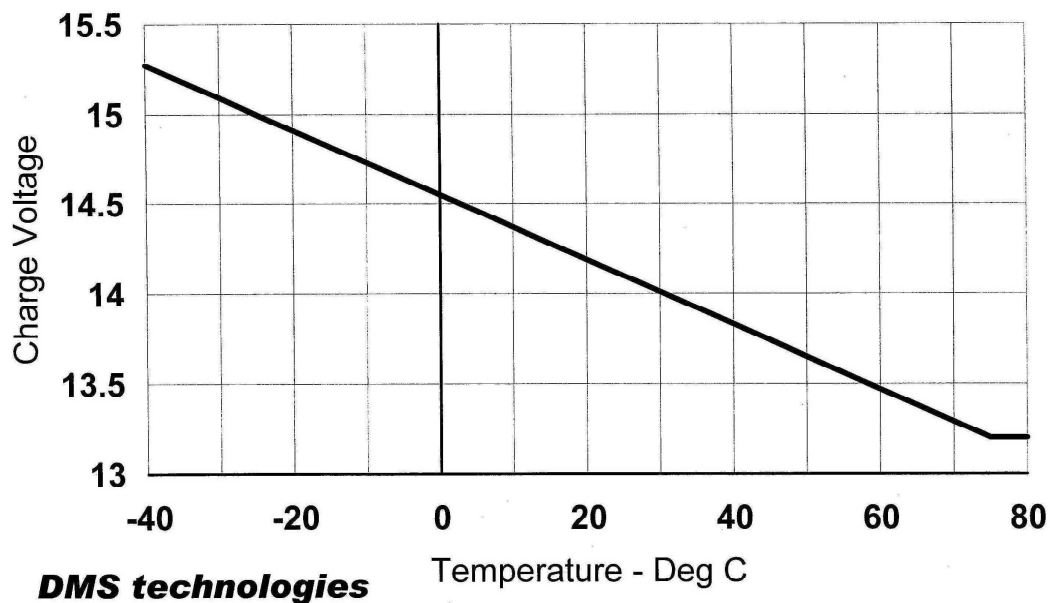
Leaving batteries flat or connected to a vehicle or other equipment with a low level parasitic drain current is a very damaging condition and is not covered by DMS warranty. Try to disconnect the battery if leaving a vehicle for extended periods of storage. In some cases, a battery can be recovered from this condition but the performance is usually compromised.

A battery will be damaged by excessive overcharge. Pressure and heat will build up inside the battery causing it to "balloon" as shown in the picture below. Excessive overcharge can occur when:

1. The alternator regulator malfunctions, allowing the output voltage to exceed the recommended level, forcing too much current into the battery.
2. A mains charger, which is not suited for use with AGM batteries, is used. So called "Boost Chargers" which are used to recover sulphated wet batteries should not be used on Varley Red Top™ batteries. To prevent overcharge of Varley Red Top batteries, the charger voltage should be limited to 14.4V.
3. The battery is positioned in a high temperature environment, such as near the exhaust, without sufficient heat shielding. When a battery is hot, the chemical reactions within it occur at a faster rate. This means that it accepts a charge current at a higher than normal rate. Ideally, the charge voltage should be adjusted to compensate the temperature of the battery.



Below is a graph that indicates how alternator output voltage should be varied based on battery temperature. This graph is typical of all batteries within the Varley Red Top™ range. If the battery is to be installed in a potentially high temperature environment, temperature sensitive strips may be useful to record the peak temperature and help engineers ensure no issues arise.



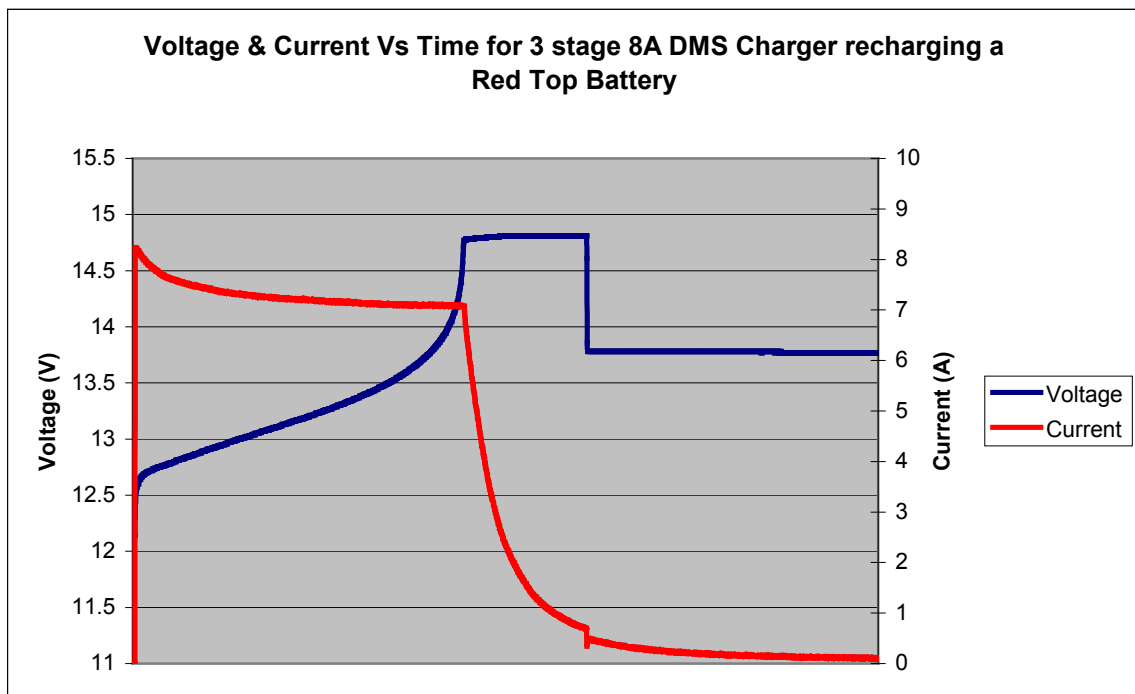
## Mains Charging

Although charging Varley Red Top™ batteries from an alternator is fine, it is always good practice to regularly utilise a mains charger to ensure you obtain the best performance and life from your battery.

DMS technologies supply two mains chargers for use with our Varley Red Top™ batteries and both have “Three Stage” charging capabilities. The three stages of a multi-stage charger are as follows:

1. Constant Current (CC) – Sometimes referred to as bulk charge. This is where most of the capacity is returned to the battery. Using the DMS technologies 8A charger on a Varley Red Top™ 30 battery, the constant current stage would take less than 3 hours.
2. Constant Voltage (CV) – This is a very important stage as it balances up each of the 6 cells within the battery. If the cells are not balanced, the battery life will be compromised. This stage may take up to 4-6 hours.
3. Trickle Charge (TC) – This is where lower charge voltage is supplied to the battery to maintain it. This stage is a safety feature to ensure that the battery and charger can be connected indefinitely without damage being caused to either component.

Below is a graph showing how the Voltage and Current changes during the recharge process.



DMS technologies supply two chargers to suit the Varley Red Top™ racing battery range.

## 2.7A Three Stage Plugtop Charger      8A Three Stage Benchtop Charger



The 8A charger is the most popular because it offers a much faster recharge time due to the high current and it has a wide input voltage (100V – 240V) that allows its usage on all electrical systems worldwide.

Our chargers are ideal for maintaining your Varley Red Top™ racing batteries during the winter break.

**WHATEVER YOU DRIVE, WHATEVER THE NEED,**

**DMS technologies designs and manufactures specialist battery systems and portable power units. For further details or technical support, contact our Sales Team.**

DMS technologies reserves the right to change specification without notice

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