



THE ULTIMATE POWER SOURCE™

## OPTIMA Batteries and Safety

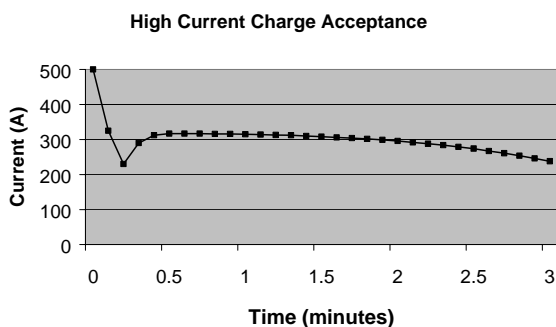
### Unrivalled safety:

The OPTIMA battery is well known for its unrivalled levels of safety. Unique OPTIMA SpiralCell Technology™ provides the highest operational security for people, equipment and the environment.

N.B. Please consult recommended charging instructions before charging OPTIMA batteries.

### High charge acceptance:

For example the ability to resist high charging currents and voltages means that the battery will vent gases later than conventional lead-acid batteries. OPTIMA can accept charging voltages as high as 15.6V and in-rush currents higher than 300 ampere. The graph below shows the first three minutes of charge acceptance at 14.4V and 0% state of charge.



Note:

- ◆ In rush current ~500 ampere
- ◆ Steady charge acceptance ~300 ampere
- ◆ Charge acceptance after three minutes is 240A

## Safety Vents:

There are two safety vents, on OPTIMA batteries, situated over cells two and five. Their function is twofold; firstly, to prevent oxygen entering the battery during normal usage and secondly to release pressure should batteries be subjected to excessive charging.



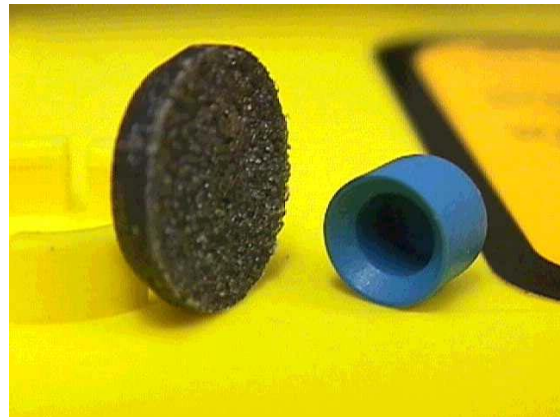
Battery vent - whole

Inside each vent is a neoprene valve, which is manufactured to precise tolerance limits. Should the pressure inside the battery increase due to overcharging then the valve will open to release the gas that has built up in the small battery headspace. The valves automatically open at  $>20\text{kPa}$  /  $>3\text{p.s.i.}$  Once the pressure has reduced sufficiently, the valve reseals to prevent oxygen entering the battery. Allowing oxygen into the battery would reduce battery life.



## Battery vent - showing stem

The valve sits on a stem. It is this stem where a pressure tester is applied during the final stages of production to test the integrity of the heat-seal between the lid and battery case. The pressure applied is  $72.4\text{kPa}$  ( $10.5\text{ p.s.i.}$ ) for six seconds.



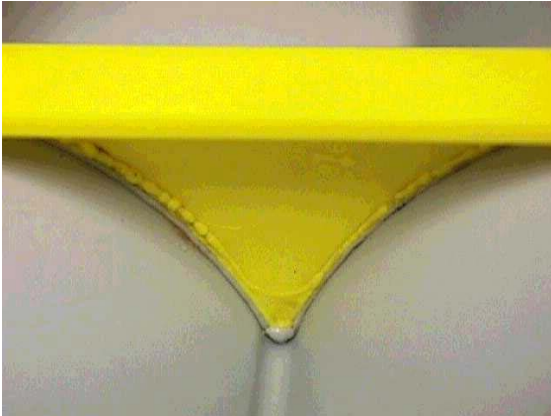
Arrestor and valve close-up

## Flame arrestors:

The top of each vent is covered with a highly porous polypropylene flame arrestor. This is because the gases vented from all lead-acid batteries are potentially explosive. Should vented gases catch fire then the arrestors will prevent flames from travelling back into the battery. Even though the OPTIMA battery has a very small head-space, this is further evidence that OPTIMA SpiralCell Technology™ minimises every potential risk.

### Heat seal:

The heat seal between lid and case is extremely strong. During manufacture the bond is made at a temperature of 371°C. This prevents oxygen entering the battery headspace, which would otherwise reduce battery life.



Heat seal - close-up

As a precaution, if the battery is to be mounted on its side it is best that the weight of the battery is taken by the case. This protects the seal from damaging vibration should the battery hold-downs be insufficient.

### Cast on Straps:

The cast on straps, that connect the six spiral cells are made from a pure lead / tin mixture. The high purity of the lead (99.999%) and the thickness of the straps ensure superb conductance. This is required due to the unrivalled cranking power provided by OPTIMA SpiralCell Technology™.



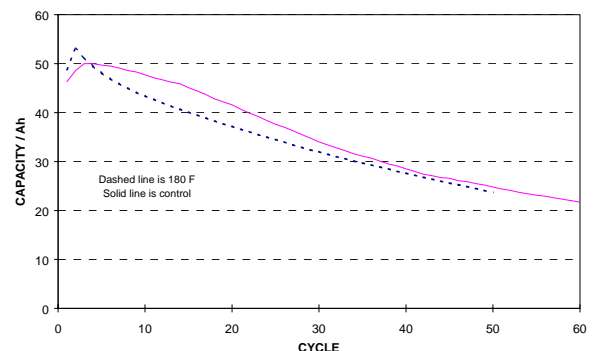
Cast on strap configuration  
The longest strap between cells four and five has the highest internal resistance. Therefore, it acts as a fuse should the battery be accidentally shorted for an excessive time. In such cases the strap will melt, breaking the circuit and thereby preventing further damage to the system. The picture below shows how the strap looks after such a short circuit has occurred.



Shorted cast on strap

### Heat resistance:

Like all lead-acid batteries the chemistry inside an OPTIMA battery is temperature dependent. However, the excellent heat dissipation characteristics of OPTIMA SpiralCell Technology™ ensures, that OPTIMA has increased resistance to exposure to high temperatures.



## High temperature resistance

The graph above shows the results of a destructive test made on some Red Top starter batteries at 20°C and 80°C. Note the remarkable similarity between the number of cycles achieved, at both temperatures.

### **No spilt acid:**

Corrosion of vehicle parts by spilt acid is both a major maintenance cost and a safety hazard. Due to the solidity of its construction and the fact that acid is retained within the fibre-glass separator no acid will spill from an OPTIMA battery even if the case is cracked open in an accident. This protects people, equipment and the environment. In addition, the batteries will not leak around the terminals thereby eliminating the need for replacing corroded terminal connectors, cabling and battery boxes.

### **Safety tips:**

When charging lead-acid batteries ensure the following:

- ◆ Provide adequate ventilation
- ◆ Prevent external flames and sparks
- ◆ Disconnect power supply before making or breaking DC contacts

**“The OPTIMA battery, the ultimate in battery safety”**

Please note: Flame arrestors and valves should not be removed at any time as this will negate the warranty and is also potentially dangerous.