Gunson

BATTERY CHARGERS MODEL 1 G4104

Suitable for Lead/Acid batteries only
(Not suitable for non-rechargeable batteries)

INSTRUCTIONS FOR USE

BEFORE COMMENCING CHARGING

It is advisable to disconnect the battery from the car or motorcycle circuits in order to avoid any possibility of damage to the vehicle's electrical accessories.

Charging a battery often causes droplets of electrolyte to be ejected from the filler cap holes. It is therefore better to remove the battery completely from the vehicle to avoid any possibility of these splashes causing damage to bodywork or engine parts.

Remember that battery electrolyte is a corrosive acid which can burn the skin.
Take particular care to protect eyes. If splashes occur, rinse with plenty of cold water.

Battery charging should be carried out in a well ventilated location, since gasses are released which are explosive, and which can build up in confined spaces.

Do not use the battery charger outdoors in the rain, since rain entering the charger constitutes a safety hazard.

If the battery has cell filler caps (or a single large cap for all cells) then all the individual caps or the single large cap should be removed or loosened before charging commences. This allows any gases that are generated during the charging process to escape.
Remember to refit and/or re-tighten the cell filler caps when charging is complete.

With the cell filler caps removed, the level of the electrolyte should be inspected. If the level of the electrolyte is below the level of the lead plates then the battery should be topped up with distilled or de-ionized water before charging commences. Take care to not overfill.
Add only enough water to reach to the top of the lead plates. Do not use tap water, which may damage the battery and reduce its life. Suitable distilled or de-ionized water can be obtained from your usual motor accessory supplier.

If the battery is of the "Maintenance Free" type, and has no cell filler caps, then refer to: "CHARGING SEALED BATTERIES".

2. COMMENCING CHARGING

Ensure that the charger is switched off at the mains. Then connect the positive lead of the charger (coloured RED) to the battery positive terminal (usually indicated by + or P) and the battery charger negative lead (coloured BLACK) to the negative terminal of the battery (usually indicated by - or N). ON NO ACCOUNT CONNECT THE BATTERY CHARGER TO THE MAINS BEFORE CONNECTING THE LEADS TO THE BATTERY,
Connecting "live" leads to a battery sparks can be produced which on rare occasions can ignite explosive gases in the battery cells. (Similarly, always switch off at the mains before disconnecting the clips from the battery).

Ensure that the battery charger 6v/12v switch is switched to the correct position for the battery being charged.

Connect the battery charger to the mains and switch on the mains.

The charger will now be charging the battery.

If a noticeable "click" sound is heard from the charger either immediately on switching on the mains, or within a few seconds of switching on the mains, then this is an indication that the automatic cut-out is being brought into operation due to an incorrect connection. Should this occur, immediately check that the correct connections of the battery charger have been made to the battery (i.e. red to plus, black to minus), and that the 6/12v switch is in the correct position.

An indication of the rate of charge can be obtained by connecting an ammeter (for instance Gunson's AUTORANGER or TESTUNE in series with the charger. Turn off the charger at the mains before connecting or disconnecting the ammeter, in order to avoid causing sparks.

3. DURATION OF CHARGING

A battery should be charged until it is fully charged, since a battery left in a partially charged or discharged state will slowly deteriorate.

On the other hand, a battery should not be excessively overcharged, since overcharging causes a loss of the water of the electrolyte to the atmosphere in the form of gas. This process is known as "gassing" and is the principal reason why a battery occasionally needs to be topped up with distilled or de-ionized water. Particular care needs to be taken to not overcharge a sealed or "maintenance free" battery, since no provision is made for replenishment of the water in the electrolyte in this type of battery.

Gunson's Model 1 battery charger charges both 6 and 12 volt batteries at a maximum rate of about one amp, which reduces as the battery nears full charge.

An approximate indication of the time needed to charge a reasonably new battery from the discharged state is shown in the table below. (Note: the battery size in "Ampere Hours" is usually marked on the battery).

Size	3 Ah	Charge time	3 hours
	6		6
	12		12
	35		35
	43		43

Less time will be needed if the battery is not reasonably new, or is not totally discharged.

The best way to measure whether a battery is fully charged is to use a measuring instrument such as Gunson's TESTUNE or START-CHECK, or a hydrometer. These instruments are available from any good motor accessory supplier.

It is useful to note that if a battery is "gassing" then this is an indication that the battery is at or near full charge. Gassing will be noticed by the presence of bubbles occasionally rising in the cells, often accompanied by a sulphurous smell. Battery charging should be discontinued if "gassing" is evident.

During charging, the battery charger may occasionally "cut out" for a few minutes (the user may hear a "click" from the battery charger as the cutout disconnects or re-connects). This is normal procedure, and is to guard against the battery charger overheating. The charger will cut out more often in warm weather or if it is placed in a position with poor ventilation or if the battery is very discharged.

The Cut-out is also a protection against the leads of the charger being inadvertently shorted together, or connected to the battery with reversed polarity. In either of these events, the cut-out will come into operation immediately. After a few seconds the cut-out will attempt to re-make the connection. Clearly the user should avoid making such incorrect connections, and should quickly switch off the charger if such incorrect connections are noticed.
IF A "CLICK" SOUND IS HEARD FROM THE CHARGER WITHIN A FEW SECONDS OF THE POWER BEING CONNECTED, THEN THE USER SHOULD EXAMINE THE CONNECTIONS TO ENSURE THAT THE CHARGER HAS BEEN CORRECTLY CONNECTED, AND THAT THE 6/12v SWITCH IS IN THE CORRECT POSITION.

4. AFTER CHARGING

When charging is complete, switch off the mains supply and unplug the charger before disconnecting the charger leads from the battery. **IT IS MOST IMPORTANT THAT THE MAINS IS DISCONNECTED BEFORE THE CHARGER LEADS ARE DISCONNECTED**, since otherwise sparks may be caused which may ignite the explosive mixture of gasses that may be given off during the charging process. Check the level of the electrolyte in each cell of the battery, and top up if necessary, taking care to not overfill. Electrolyte just sufficient to cover the plates of the battery is sufficient.
Replace the cell filler caps and tighten.

Wipe over the battery with a damp cloth to remove all traces of splashes of battery electrolyte.

Re-install the battery in the vehicle, remembering to clamp the battery in the battery compartment if such a clamp is provided.

Examine and clean the battery terminals and the battery lead clips (brushing with a wire brush if necessary), and re-connect the battery lead clips to the battery terminals. Apply a thin film of Vaseline or an aerosol type corrosion preventative to the connections, and re-attach any protective boot covers to the battery terminals.

The user may wish to carry out a further check to ensure that the alternator of the vehicle is operating satisfactorily and maintaining the battery at full charge under normal running conditions. Such a check is described under "NOTES ON BATTERY CARE".

5 CHARGING SEALED BATTERIES

Some batteries, often called low maintenance batteries, or maintenance free batteries, have cells which have no filler caps, and which are not intended to be topped up with water. It is important that such batteries are not allowed to "gas" since this will reduce the level of electrolyte in the cells, which can not be replenished.

It is known that "gassing" commences when the voltage at the terminals of the battery rises above a level which is around 14.1 volts for a 12 volt battery, and 7.05 volts for a 6 volt battery. Below this voltage there is negligible "gassing". It is therefore important with such batteries that the voltage at the battery terminals is kept at or below this value.

Such batteries are preferably charged with an "Automatic" or "Voltage Controlled" battery charger. They can be charged with care using a normal battery charger, but this preferably requires the use of an accurate voltmeter, such as Gunson's TESTUNE. Alternatively, for a 12 volt battery, Gun son's "Start Check" can be used.

The method is to attach the voltmeter or the tester to the terminals of the battery, so that the voltage at the terminals of the battery can be monitored during the charging process. Charging is continued while the voltage remains below 14.1 volts for a 12 volt battery (or 7.05 volts for a 6 volt battery), or the LED of START-CHECK is "out", but is discontinued as soon as the battery terminal voltage reaches 14.1 volts (or the START-CHECK LED comes "on"). The battery is then allowed to rest for a period of say 30 minutes, and charging re-commenced. When the voltage again reaches 14.1 volts the charging is again discontinued, and so on. Eventually, after several cycles of charging and resting, the battery voltage will rise to 14.1 volts very soon after the charger is switched on, and then the battery can be deemed to be fully charged.

NOTES ON BATTERY CARE

1. INTRODUCTION

Essentially a battery is a unit for storing electricity. It acts as a reservoir for the electricity produced by the alternator, evening out the bumps and troughs in the electrical supply, and providing power for the various electrical systems of the car or motorcycle at times when the engine is not running. However, the big job that the battery has to do is to supply the massive surge of electrical power that is required in order to drive the starter motor to turn the engine. This is why, when a battery is beginning to fail, the first symptom is its inability to start the engine.

Vehicle batteries work on the lead\acid principle, and are made up of a number of cells, each with a nominal voltage of 2 volts, which are connected together internally to give a battery with the required total voltage. A car battery comprises 6 cells, connected together to give nominally 12 volts. 6-volt and 24-volt batteries would have 3 and 12 cells respectively.

Each cell consists of a number of positive plates interleaved with a number of negative plates, the two types of plate being held in very close together, but separated by ceramic separators. In a fully-charged battery (for instance when the battery is new), the positive plates are formed from lead peroxide, the negative plates from a spongy form of lead, the whole

assembly of plates being immersed in dilute sulphuric acid, having a specific gravity of about 1.300 (i.e. being about 1.3 times as heavy as water).

When current is drawn from a battery (due, for instance, to the lights being switched on), the lead peroxide and spongy lead both begin to change into lead sulphate, and the electrolyte becomes more dilute. When the battery is fully discharged (i.e., is "flat"), both plates largely consist of lead sulphate, and the liquid is very dilute, having a specific gravity of about 1.100.

As a battery is recharged, the positive plate changes back to lead peroxide, the negative plate to spongy lead, the sulphuric acid gets stronger, and eventually the state is reached where the battery is fully charged.

Also as the battery is recharged, the voltage at the terminals of the battery increases. When the voltage reaches around 14.1 volts for a 12 volt battery (7.05 volts for a 6 volt battery), further charging then causes the effect known as "gassing", which is where the water in the electrolyte is broken down into the gasses hydrogen and oxygen, which then bubble off, quite vigorously if the charge rate is high.

This gas mixture is explosive, which is why batteries should not be recharged in a confined space or in the presence of naked lights, and why the mains should always be switched off before connecting or disconnecting a battery charger to the mains so as to avoid the production of sparks.

Virtually no gassing occurs at charging voltages below 14.1 volts, which is one reason why alternator regulators are usually set at around this value. A battery can remain continuously connected to a voltage of up to 14.1 volts without being overcharged in any way.

With many cycles of discharging and recharging, the plates are continually changing into lead sulphate and back again, and occasionally particles will fall off and sink to the bottom of the battery to form sludge. As the sludge builds up, there is less lead available for the chemical processes, and the battery loses its capacity to carry charge. Batteries also deteriorate due to an effect known as "sulphation", which is where a permanent form of lead sulphate forms on the plates, shielding the plates from contact with the acid. Eventually these natural ageing processes cause the battery to deteriorate to the stage where it is incapable of starting the engine, and a new battery is required. The deterioration of a battery is often noticed in the first cold snap of winter, because not only is the engine oil thick and the engine more difficult to turn, but batteries having lower performance at low temperature.

To make batteries last a long time they must be cared for. It is important that the alternator voltage regulator is correctly set so that the battery is not overcharged. Vibration is bad for batteries, and so are very "deep" discharges, and very high charging rates. Also, it is important that batteries are kept fully charged, and on no account must a battery be left for an extended period in a discharged state, otherwise the dreaded "sulphation" will set in.

2. TESTING BATTERY CHARGE

The traditional way is to use a hydrometer, but these can be a bit messy, and not everyone has one. Of course with sealed batteries hydrometers are no use anyway. There is another way, which is to make a very accurate measurement of the voltage at the battery terminals. Gunson's TESTUNE, or a good quality digital voltmeter (DVM) is needed. For 12 volt batteries, Gunson's START-CHECK can also be used.

There is one slight complication, which is that it takes batteries a long time to settle down to a stable voltage when they have been on charge, or when they have been used to provide current. In fact, it takes longer for a battery to settle down when it has been on charge, than when it has been used to provide current. To get an accurate measurement, it is best to wait several hours, say overnight, with the battery totally disconnected. However, a reasonably good indication of the state of charge of a battery can be obtained by carrying out the following procedure: With the battery in the vehicle, and irrespective of whether the battery has been on charge (or the engine running and the battery being charged by the alternator), switch the headlamps on for 1 minute, then disconnect the battery and wait a further 15 minutes at least before making the measurement.

A fully charged battery should measure 12.65 to 12.9 volts or thereabouts. Part charged is typically 12.15 to 12.65, and a flat battery is below 12.15. TESTUNE has coloured bands to indicate these ranges. START-CHECK does the same thing by means of a LED (light emitting diode) display, where individual LEDs are accurately set to be illuminated at these voltages. For a 6 volt battery, the voltages are exactly half those given above, i.e.: Fully charged 6.32 to 6.45 volts, part charged 6.07 volts to 6.32 volts, and flat below 6.07 volts.
Remember that as a battery ages it ceases to be able to carry a full charge, and this will be reflected in the voltage measurement. Also remember that this test measures battery charge, it does not say whether the battery is faulty: some faulty batteries can in fact carry a full charge; you just can not get at it.

3. TESTING FOR FAULTY BATTERIES

Undoubtedly the best test of a faulty battery, a test so conclusive that you can be sure that the battery is worn out, and that you are not wasting money by buying a new one, is to use a "high current discharge meter". Unfortunately these are so expensive that only the trade can afford them, although you often find one in a good quality car accessory shop for use by the counter staff. To give your battery a fair test, make sure that it is fully charged before taking it along to the professionals.

Another good way to test a battery, which gives a fairly good indication, is to test a battery at what it is supposed to do, that is to crank the engine. Before carrying out this test it is absolutely essential to test for voltage drops in the starter circuit (see section 4 below: TESTING BATTERY TERMINALS). It is also essential that the battery is as fully charged as it can be.

Having satisfied yourself that there are no other faults, the method then is to simply disable the engine so that it can not start (for instance, by disconnecting the electrical supply from the ignition coil, which is either + or - depending on the particular system), and crank the engine on the starter, carefully measuring the time for which the starter is cranking briskly. Eventually the battery will "die" and the cranking will become very laboured and might even stop altogether. The change in cranking speed from brisk to laboured is usually quite sudden and easy to identify. Both TESTUNE and START-CHECK have tests which give a visual indication of the moment when a 12 volt battery is deemed to be flat. A good battery will briskly crank the engine for a minute and more, even in the coldest weather. If your battery dies after a few seconds, it is a sure sign that it needs replacing.

One word of warning: starter motors are not designed for continuous cranking, so do not carry on for more than a minute or so without waiting for the motor to cool.

Another fault that batteries can have is that they can "self discharge" - a battery that appears to be fully charged today can be flat tomorrow or the day after. It is easy to confuse this fault with a fault in the circuits of the car - a glove compartment light that stays on all the time for instance. To check whether a battery can hold charge it is necessary to test its charge over a period of days using a hydrometer or good quality voltmeter. To check whether current is leaking from the battery to the car when everything is supposed to be switched off, it is necessary to use an ammeter, or the "leakage current test" of TESTUNE, which accurately measures leakage whether it is a few milliamps or a few amps. The TESTUNE scale has coloured bands to show acceptable levels of "leakage" (e.g. due to a car clock, security system or computer that are on all the time), and unacceptable levels (e.g. the light on in the boot).

4. TESTING BATTERY TERMINALS

When a vehicle will not start because the starter will not turn the engine quickly enough, the problem may be dirty or corroded battery terminals. The same effect is caused by faults such as a bad solenoid, loose or frayed earth straps etc, which may be tested in a similar way.

The problem with battery terminals (and solenoid, earth straps etc) is that they have to carry such a high current that even the minutest resistance, due to dirty deposits or corrosion, can impede the flow of the current and prevent the car from starting.

The way to test for this fault is to measure the voltage drop across the component while the engine is being cranked on the starter. For example, to check battery terminals hold one meter probe on the terminal that fits on to the battery post and hold the other probe right on the terminal post itself. Then the engine should then be cranked on the starter, having first prevented the engine from starting by disconnecting the + or - lead from the coil. If the terminal is making good contact then the voltage drop will be zero even measured on a 0 - 1 volt scale. A reading of 0.25 volts is a bit worrying, and 0.5 volts is an indication of a definite fault (halve the se voltages for a 6 volt vehicle). Gunson's TESTUNE has a suitable voltage scale with coloured bands to indicate good and bad battery terminals, solenoid, earth straps etc.

5. TESTING ALTERNATORS

A faulty alternator will eventually result in damage to the battery, either through undercharging or overcharging.

The way to test an alternator is to use a voltmeter connected directly across the terminals of the battery while the engine is running, but be sure to start with the battery in a reasonable state of charge.

If the alternator is working correctly, the voltage across the terminals of the battery will normally be within the range 13.5 - 14.1 volts (half this for a 6 volt battery). This is the voltage that the alternator provides to keep the battery fully charged but not overcharged. However, it should be noted that some vehicle manufacturers specify a rather higher voltage for the alternator regulator, and reference should be made to the workshop manual for the exact recommended voltage for a particular vehicle.

An alternator should be able to hold this voltage at the battery terminals at all speeds above idle (as soon as the ignition warning light goes out), and the reading should be approximately the same irrespective of any electrical equipment that is switched on, such as headlamps, windscreen wiper motor etc.

If the voltage reading is too low, or falls too low when equipment is switched on (e.g. headlamps), then the alternator is undercharging.

If the voltage is too high, or rises too high when the engine speed is increased (with or without the headlamps on), then the alternator is overcharging.

Although any good quality voltmeter should be capable of carrying out this test, the Gunson TESTUNE has been designed particularly to make this test easy. It has an offset scale (one that does not start at zero, in fact it starts at 12v, and only measures voltages in the range 12v to 17v) to give a scale that is greatly expanded to be accurate and easy to read at the appropriate voltages for alternator tests. It also has coloured bands to show when an alternator is OK, or when it is undercharging or overcharging.

TECHNICAL SPECIFICATIONS

INPUT
MODEL 1 230V AC 50Hz 15 W

OUTPUT
6V 1.5A RMS(EFF) 1.0A DC(ARITH) CONTINUOUS

12V 1.2A RMS(EFF) 0.8A DC(ARITH) CONTINUOUS

RECOMMENDED MINIMUM BATTERY CAPACITY: 6Ah

FULL OVERLOAD PROTECTION

REVERSE POLARITY PROTECTION

THERMAL CUTOUT PROTECTION

CONFORMS TO BS 3456

DOUBLE INSULATED

GUARANTEE

This guarantee is additional to the purchaser's statutory rights.

The Tool Connection has made every effort to ensure that this BATTERY CHARGER is of the highest quality.

If this BATTERY CHARGER should need service or repair, it should be returned direct to **The Tool Connection Limited**,
Kineton Road, Southam,
Warwickshire CV47 0DR
Tel: Technical Service Department ++44 (0)1926 818181

When goods are returned for service or repair, full details of faults requiring attention should be given, and also date of purchase.