SECTION M

ELECTRICAL EQUIPMENT

ILLUSTRATIONS

Illustrations - Continued

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M.1. - GENERAL DESCRIPTION

All wiring diagrams and diagnosis charts will be found at the end of this Section.

The electrical system is a 12-volt earth return type employing either POSITIVE or NEGATIVE earth polarity. The system incorporates the charging, lighting, starter, ignition and auxiliary circuits, operating through a fuse mounted on the vehicle's bulkhead. The charging circuit employs a D.C. Generator. An A.C. Alternator is available from Lotus Cars (Service) Limited.

Negative earth polarity was introduced at Chassis No. 7895 (at commencement of Series 4 cars).

Polarity

Extreme care must be exercised when fitting service replacements to ensure that they suit the vehicle's earth polarity.

Certain units are interchangeable or adaptable for use with either earth polarity, but others fitted with electronic devices would become irreparably damaged if connected to an opposite polarity. The effects of polarity on the units are summarised as follows:-

Batteries, Ignition Coils, Ammeters:

These are suitable for both positive and negative earth systems provided they are connected to suit the vehicle's earth polarity.

Control Boxes:

These are suitable for both positive and negative earth systems, and if connected into a system with an opposite polarity, will automatically repolarize themselves, provided that the cables to the 'D' and 'F' positions are correctly connected.

D.C. Generators (Dynamos):

These are suitable for both positive and negative earth systems, provided they are repolarized after fitting.

Radios:

These are designed for one or other polarity and reversed connections will destroy the transistors. However, it is possible for a competent radio engineer to alter the internal connections to suit an opposite polarity.

Electric Clocks, Tachometers and Alternators:

These are designed for one or other polarity and cannot be adapted to suit an opposite polarity. Incorrect connections will render the instrument useless.

Servicing Equipment

It is important to note that the servicing of the system cannot be carried out satisfactorily unless the equipment recommended is available. Further, it will be seen that special equipment is needed for dismantling and re-assembling some units of the system, and should this equipment not be available, dismantling must not be attempted.

We recommend the Avometer 'Model 12' testing equipment (obtainable from Avo Ltd., 92-96 Vauxhall Bridge Road, London S.W.1, England), or the Wilkson 'WIL/25 Mk.1' two meter set (obtainable from J. Wilkes & Son (Electrical) Ltd., Bredon, Tewkesbury, Gloucester, England), both of which have been specially designed for automotive use and enables a wide range of checking operations to be carried out.

An instrument for testing the car instruments 'in situ' is available under Part No. 36 M 6183.

M.2. - BATTERY.

Description

The battery features a 'clean-top' design with a one-piece manifold venting system. The terminal posts are the flat type drilled to accomodate the bolts passing through the cable connectors.

The battery is mounted in the boot (trunk) and held in position by a clamp.

Batteries are supplied either filled and charged or 'dry-charged', that is with the cells in a charged condition and without electrolyte. Details of preparing 'dry-charged' batteries are given in later paragraphs.

Maintenance

Battery maintenance consists mainly of regular inspection and servicing.

1. Keep the battery and its surroundings clean and dry. Give particular attention to the top of the battery to prevent electrical leakage between the terminals.
2. Remove the manifold vent cover, and see that the vent holes are clear.
3. Check the electrolyte level and top up, when necessary. The correct level is just up to the perforated splashguard. Do not over-fill or acid will escape through the vent holes with detrimental effect to the connections and adjacent parts of the car. The use of a Lucas Battery Filler (or similar) will be found helpful in this topping-up process, as it ensures that the correct electrolyte level is automatically obtained and also prevents distilled water from being spilled over the top of the battery. Distilled water should always be used for topping-up. In an emergency, however,

drinking water or clean rain water may be used. The following waters must not be used:-

Salt water, chlorinated water, chemically softened water or stagnant water. Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

If a battery is found to need an excessive amount of topping-up, the cause should be sought. If an excessive charge is suspected, check the regulator setting. If one cell in particular is at fault, examine the container for cracks. NEVER transfer electrolyte from one cell to another.

4. When fitting the connectors to the battery, first smear the terminal posts with petroleum jelly or silicone grease.

5. Examine the earth connection to ensure that it is clean and free from rust or corrosion.

6. Specific Gravity Test.

Measure the specific gravity of the electrolyte in each cell in turn, with a hydrometer. The reading given by each cell should be approximately the same; if one cell differs from the other by more than .040, an internal fault in the cell is indicated. If the level of the electrolyte is so low that a hydrometer reading cannot be taken, the battery should be topped-up with distilled water and recharged. No attempt should be made to take a reading after adding the distilled water until the battery has been on charge for at least thirty minutes. NEVER transfer the electrolyte from one cell to another. The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of plates; if it is very dirty or contains small particles in suspension, it is possible

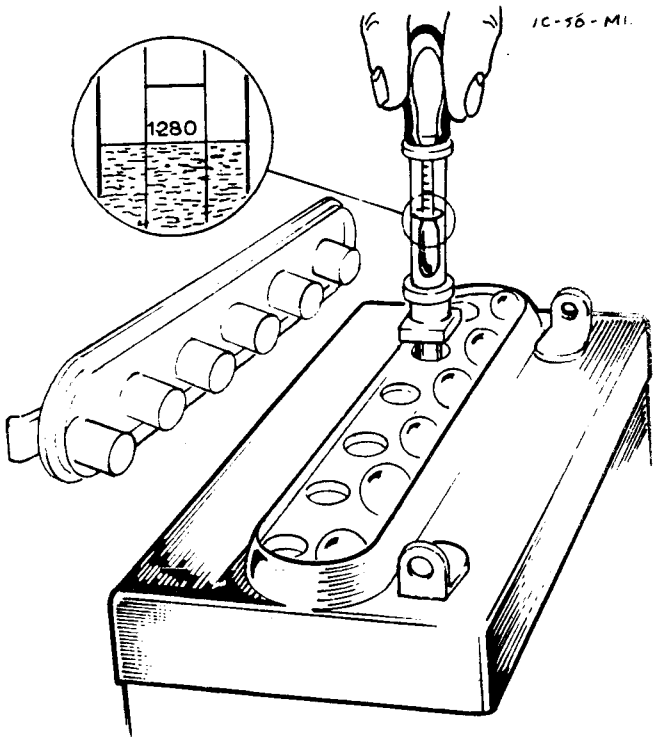

Fig. 1. SPECIFIC GRAVITY TEST

that the plates are in a bad condition.

Check the specific gravity of the electrolyte (see Fig.1) as an indication of the state of charge of the battery, using a hydrometer.

The specific gravities and their indications are as follows:

Climatic temperature of 15°C.

Fully charged	1.280
25% discharged	1.240
50% discharged	1.200
75% discharged	1.160
Fully discharged	1.120 and below

The specific gravity reading varies with the temperature of the acid electrolyte and it is customary to correct it to the corresponding value at a standard temperature of 15°C as follows:-

For each 10°C. above 15°C. add .007 to the reading.

For each 10°C. below 15°C. subtract .007 from the reading.

If the car is out of use for any length of time the battery should not be allowed to run down or to remain in a discharged condition. It should be recharged about every 2 weeks from an independent electrical supply.

7. Heavy Discharge Test

No attempt should be made to carry out a heavy discharge test on this type of battery. The specific gravity test described in the foregoing paragraphs will provide a clear indication of the condition of the battery, provided the test has been carried out correctly. If any doubt remains, the battery should be checked by the nearest Exide agent.

Remember that if the battery is subjected to heavy loads (i.e. long periods of night parking with lights on) without suitable opportunities for recharging, a low state of charge is only to be expected. A fault in the charging system or neglect during a period out of commission may also be responsible for any trouble.

Acid spillage or creepage can be neutralised by wiping the affected area with a fluffless cloth moistened with a dilute alkaline solution such as ammonia.

Recharging from an External Supply

If tests indicate that the battery is discharged, but is otherwise in good condition, it should be recharged either on the vehicle by a period of daytime running or on the bench from an external supply.

If the latter, the battery should be charged until the specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the top of the separator guard by the addition of distilled water.

A battery in which all cells show a general falling off in efficiency will often respond to the process known as 'cycling'. This process consists of fully charging the battery as described earlier, and then discharging it by connecting to a lamp board, or other load, at the same rate.

Preparing New Batteries

Batteries are normally supplied 'dry-charged' and before fitting to the car must be filled with acid as described under 'Filling the Cells'. No initial charging is necessary, although, if time permits, a short freshening charge is advantageous.

Preparation of Electrolyte

Electrolyte of the specific gravity stated in the following table is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1.840 specific gravity.

The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add the water to the acid as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the following table:-

Climates normally below 27°C. (80° F.):

Add one part (by volume) of acid of 1.840 specific gravity to 3.2 parts (by volume) of pure distilled water to obtain a final specific gravity of 1.260 at 15.5°C. acid temperature.

Climates normally above 27°C. (80°F.):

Add one part (by volume) of acid of 1.840 specific gravity to 4.3 parts (by volume) of pure distilled water to obtain a final specific gravity of 1.210 at 15.5°C. acid temperature.

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings - unless a thermometer is used to measure the actual temperature, and a correction applied to the reading as previously described - and before pouring the electrolyte into the battery.

Filling the Cells.

Whilst these batteries leave the factory in the fully 'dry-charged' condition, they may slowly lose some charge in storage. In view of this, the following filling instructions must

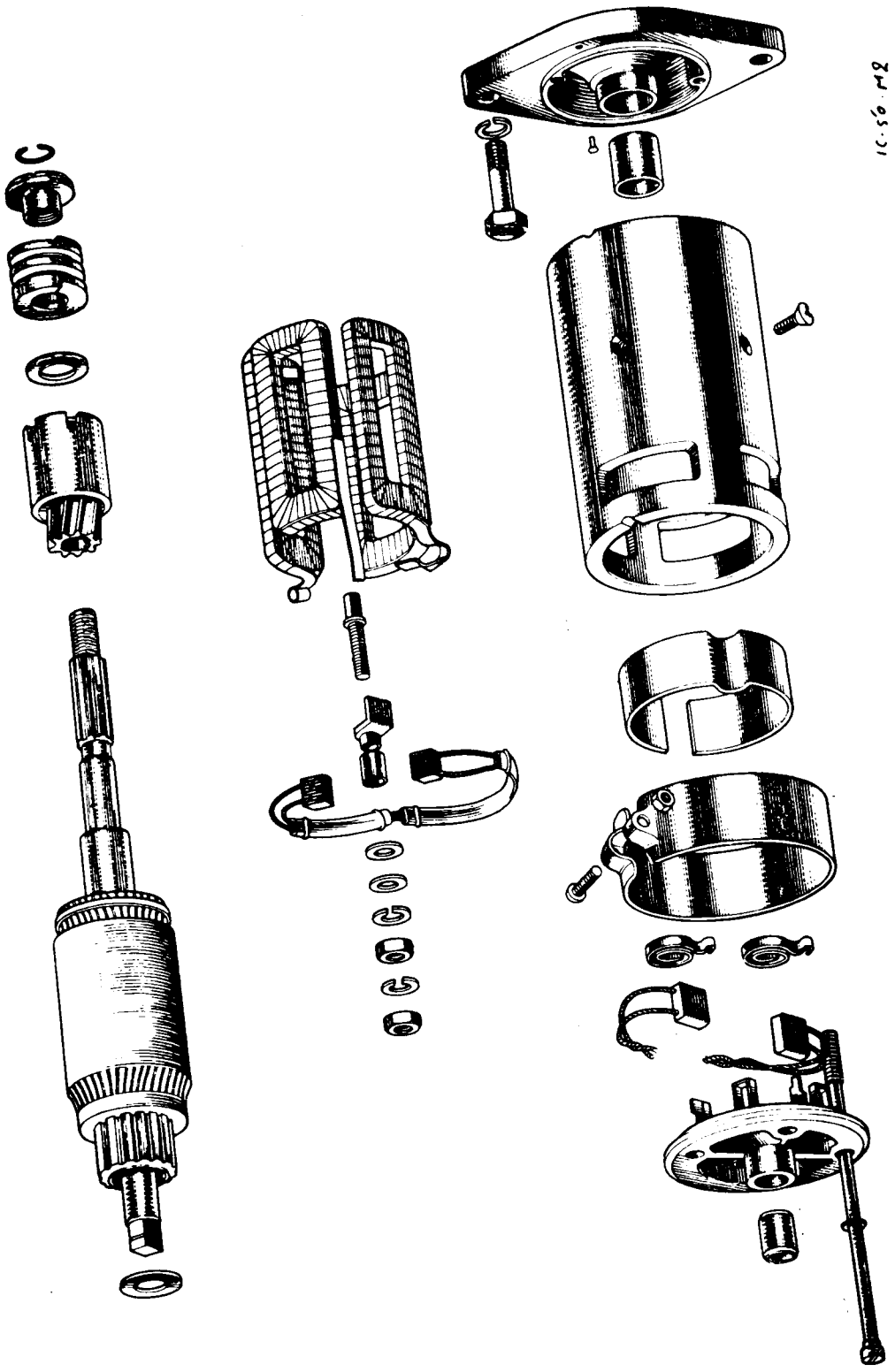

Fig. 2. STARTER MOTOR COMPONENTS - TYPE M35G