

---

**2003 MY All Models Battery Care Manual**

---



---

**Contents**

INTRODUCTION .....	1
EQUIPMENT (Minimum standard) .....	2
EQUIPMENT (Optional) .....	3
HEALTH AND SAFETY PRECAUTIONS .....	4
SCENARIOS .....	5
PORT OF ENTRY .....	5
ARRIVAL AT THE DEALERSHIP .....	5
VEHICLES IN STORAGE .....	5
DELIVERY TO THE CUSTOMER .....	5
NEW BATTERY STORAGE & CHARGING .....	6
DRY CHARGE COMMISSIONING (overseas markets) .....	7
POST-CHARGE TEST .....	8
CHARGING IN SERVICE BATTERIES .....	9
BATTERY TESTING SECTION .....	10
BATTERY REPORT FORM (Midtronics) .....	11
BATTERY REPORT FORM (dealers without Midtronics) .....	12
OPEN CIRCUIT VOLTAGE TEST .....	13
SURFACE CHARGE (Removal) .....	13
MIDTRONICS TESTING .....	14
VEHICLE QUIESCENT CURRENT TESTING .....	15
BATTERY CURRENT DRAIN TYPICAL VALUES .....	16
SPECIFIC GRAVITY TESTING .....	17
VOLTAGE READING UNDER LOAD @ 2000 rpm .....	17
BATTERY HIGH RATE DISCHARGE TEST .....	18



**JAGUAR**

## INTRODUCTION

This publication sets out, for the benefit of importers and dealers worldwide, requirements for the care and maintenance of batteries, from the vehicle's despatch from the factory to its hand-over to the customer.

The clearly laid-out and illustrated sections guide importers and dealers through each stage of the vehicle's receipt, storage, pre-delivery and customer hand-over. Likewise, this publication can be used as a guide to the handling and care of batteries in service. It is vital to appreciate that unless each process is rigorously applied on all vehicles, the customer will receive a vehicle with a battery which will not provide a satisfactory service life.

It is very important that open circuit voltage and all other test results quoted throughout this publication are adhered to. If they are applied incorrectly batteries could be scrapped unnecessarily. Refer to **BATTERY TESTING SECTION** for detailed information (see page 10 onwards).

It is equally important therefore to note the following key points:

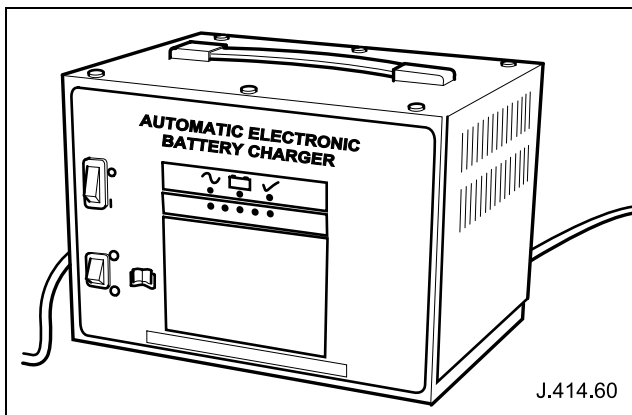
- All new vehicles leave Jaguar Cars fitted with a transit relay and, on certain models, have fused circuits disabled. The transit relay must be removed and the fuses (where applicable) refitted **NOT MORE THAN 24 HOURS** before the customer takes delivery.
- The battery will be damaged if it is allowed to slowly discharge over a number of weeks / months, or is left in a discharged state for a lengthy or indeterminable time period. For this reason the battery must be tested / re-charged if necessary every month, and **MUST BE** re-charged after every three-month period of storage (refer to the New Vehicle Storage Manual) and update the Storage History Sheet.
- The battery, under no circumstances should be disconnected with the engine running because, under these conditions, the alternator can give a very high output voltage. This high transient voltage will damage the electronic components in the vehicle. Loose or incomplete battery connections may also cause high transient voltage.
- Ignition keys must not be left in the ignition lock barrel when the transit relay has been removed and the fuses re-installed, otherwise quiescent current will increase and the battery will discharge more rapidly.

Both importers and dealers will appreciate their responsibility to ensure that only vehicles having a fully satisfactory battery may be processed further through the distribution selling chain.

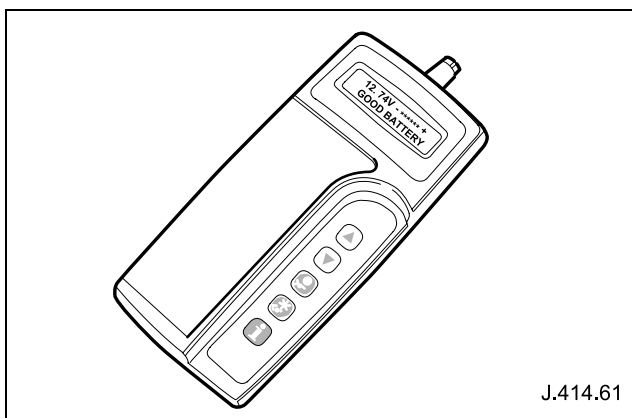
## EQUIPMENT (Minimum standard)

Existing minimum standards requirements are presently specified as follows:

### Traction Battery Charger



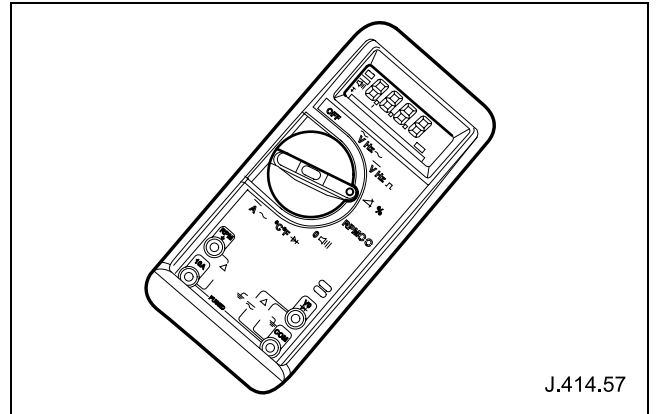
### Midtronics Tester



## EQUIPMENT (Optional)

Further equipment recommended by Jaguar:

**Digital Multi-meter:** 3.5 digit.



## HEALTH AND SAFETY PRECAUTIONS

**BATTERY CELLS CONTAIN SULPHURIC ACID AND EXPLOSIVE MIXTURES OF HYDROGEN AND OXYGEN GASES. IT IS THEREFORE ESSENTIAL THAT THE FOLLOWING SAFETY PRECAUTIONS ARE OBSERVED:**

1. Batteries emit highly explosive hydrogen at all times, particularly during charging. To prevent any potential form of ignition occurring when working in the vicinity of a battery:
  - Do not smoke when working near batteries.
  - Avoid sparks, short circuits or other sources of ignition in the battery vicinity.
  - Switch off current before making or breaking electrical connections.
  - Ensure the battery charging area is well ventilated.
  - Ensure the charger is switched off when: a) connecting to a battery; b) disconnecting from the battery.
  - Always disconnect the ground cable from the battery terminal first and reconnect it last.

2. Batteries contain poisonous and highly corrosive acid. To prevent personal injury, or damage to clothing or the vehicle, the following working practices should be followed when topping-up, checking the electrolyte specific gravity, removal, refitting or carrying batteries:

Always wear suitable protective clothing (an apron or similar), safety glasses, a face mask and suitable gloves. If acid is spilled or splashed onto clothing or the body, it must be neutralised immediately, then rinsed with clean water. A solution of baking soda, or household ammonia and water may be used as a neutraliser.

In the event of contact with the skin, drench the affected area with water. In the case of contact with the eyes, bathe the affected areas with cool clean water for approximately 15 minutes and seek urgent medical attention.

If battery acid is spilled or splashed on any surface of a vehicle, it should be neutralised and rinsed with clean water.

Heat is generated when acid is mixed with water. If it becomes necessary to prepare electrolyte of a desired specific gravity, SLOWLY pour the concentrated acid into water (NOT water into acid), adding small amounts of acid while stirring. Allow the electrolyte to cool if noticeable heat develops. With the exception of lead or lead-lined containers, always use non-metallic receptacles and / or funnels. Do not store acid in excessively warm locations or in direct sunlight.

3. Due to their hazardous contents, the disposal of batteries is strictly controlled.

When a battery is scrapped, ensure it is disposed of safely, complying with local environmental regulations. If in doubt, contact the local authority for advice on disposal facilities.



**SCENARIOS**

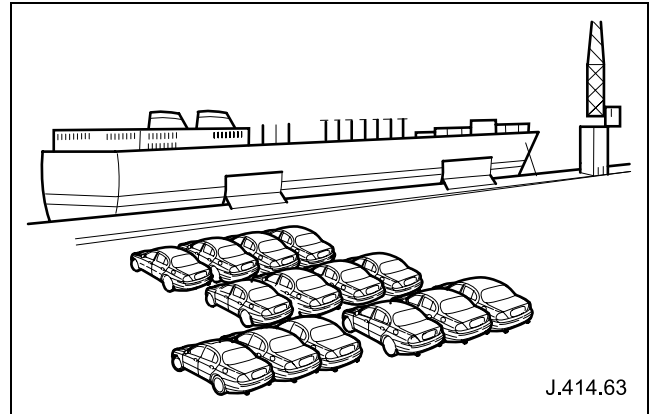
A **Midtronics tester** if available, may be used to determine the battery condition in the scenarios below:

**PORT OF ENTRY**

Immediately following the receipt of a vehicle at the port of entry, proceed as follows:

Carry out an open circuit voltage test (see page 13).

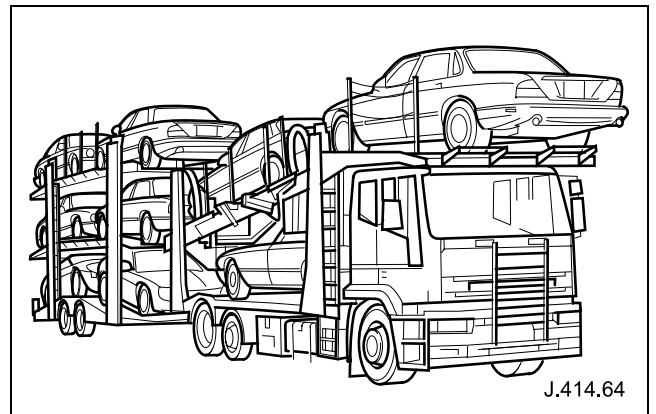
Compare your results ~ carry out the recommended actions accordingly.



**ARRIVAL AT THE DEALERSHIP**

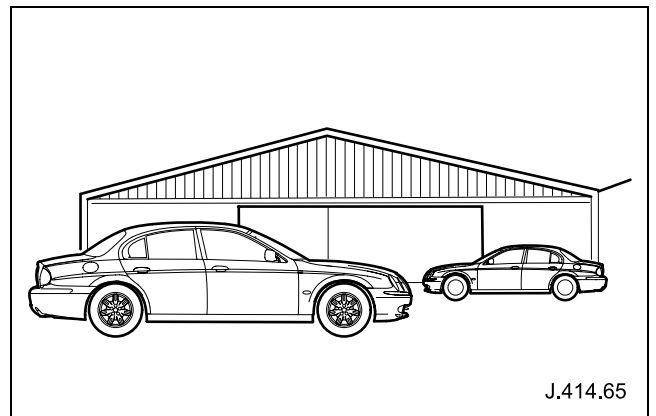
On arrival at the dealer a battery open circuit voltage test (see page 13) must be carried out to ensure the vehicle's battery is in a satisfactory condition to put into storage.

Compare your results ~ carry out the recommended actions accordingly.



**VEHICLES IN STORAGE**

Perform an open circuit voltage test (see page 13). Compare your results ~ carry out the recommended actions accordingly. Providing the battery open circuit voltage is 12.5 volts or above, the transit relay in place, or the battery disconnected, the vehicle may be stored. The battery must be tested and / or re-charged every month, and **MUST BE** re-charged after every three-month period irrespective of any test. Record your test results on the Storage History Sheet (see New Vehicle Storage Manual) to indicate when a re-charge will be necessary.

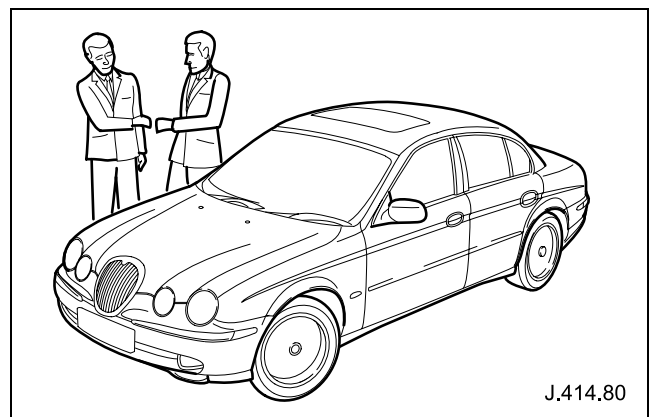


**DELIVERY TO THE CUSTOMER**

It is essential that the following actions are conducted in the 24 hours prior to the agreed hand-over time:

Perform an open circuit voltage test (see page 13) then set clock, set radio etc.

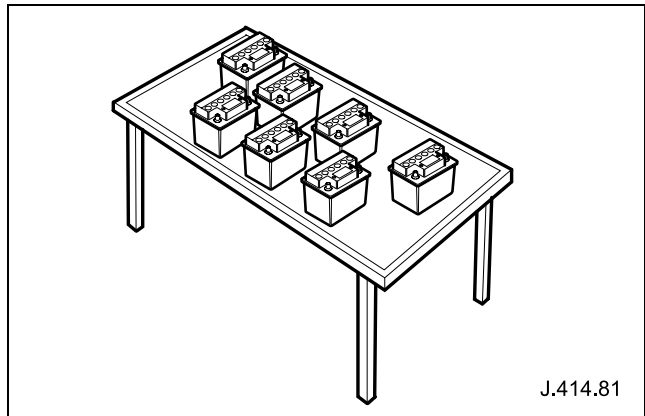
Compare your results ~ carry out the recommended actions accordingly.



## NEW BATTERY STORAGE & CHARGING

It is essential that a suitably ventilated defined area exists in each dealership for battery charging and post-charge checking. Likewise, an area should be allotted for scrap batteries, and clearly indicated as such. It is recommended that dealers always have fully charged batteries ready for use. However the battery **MUST BE** tested and charged if necessary every month, and charged after three months irrespective of any test.

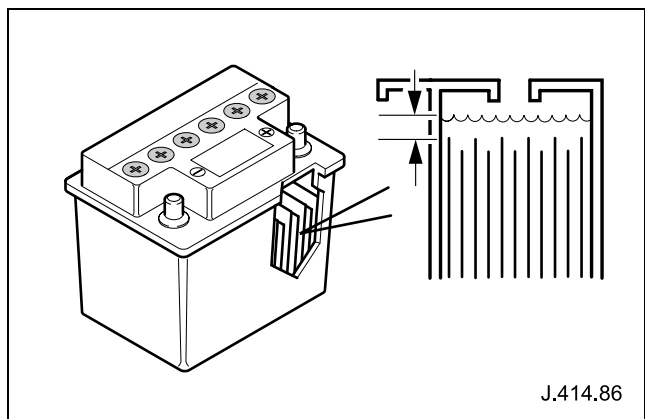
**Battery must be re-charged after a maximum of 3 months storage (see Storage History Sheet in the New Vehicle Storage Manual).**



J.414.81

To bring a serviceable but discharged battery back to a fully charged condition proceed as follows:

- Check electrolyte level by visual inspection of the maximum level indicator on the battery casing, indicating adequate level above the battery separators.
- Charge the battery by following the instructions given with the charger in use (see note below).
- Carry out a post-charge test (see page 8).



J.414.86

**Note:** Jaguar currently use two types of batteries which consist of Lead Antimony Sb and Lead Calcium Ca. It is very important that when charging batteries using the traction charger that the switch selector on the charger is selected for the correct type of battery. If the wrong switch is selected the result would be a battery that is not charged fully and / or overheating can occur.

Use the table below as a guide to the type of battery fitted and select the switch accordingly before commencement of charging.

Part Number	Battery Type
JLM 10453	Lead Antimony (Sb)
LMC 1250 AA1	
LRA 1250 AA	
XR83 10655 AA	
Other part numbers	Lead calcium (Ca)

**DRY CHARGE COMMISSIONING (overseas markets)**

This specific gravity acid is correct at 25°C, for different temperatures apply the following formulae:

For each 10°C above 25°C subtract 0.007 and for each 10°C below add 0.007

Thus:

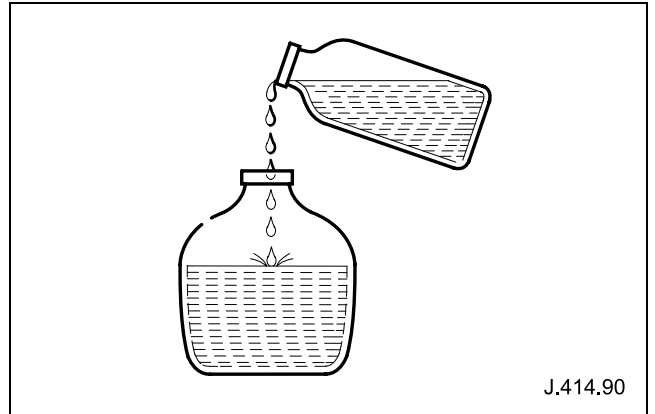
45°C = 1.2686

35°C = 1.2693

25°C = 1.270

15°C = 1.2707

5°C = 1.2714



**Note:** Always pour concentrated acid slowly into water; not water into acid.

- Pour the concentrated acid slowly into the water then check the specific gravity (using the table above).
- Fill the cells with 1.270 @ 25°C specific gravity acid electrolyte to the maximum mark indicated on the battery casing.
- Allow battery to stand for 15 minutes.
- Add extra acid electrolyte if necessary to the maximum mark indicated on the battery casing.
- Within 5 minutes place the battery on charge for 24 hours.
- After the charge period, check electrolyte level by visual inspection of the maximum level indicator on the battery casing, indicating adequate level above the battery separators.
- Fit vent lids and perform a post-charge test (see page 8).

## POST-CHARGE TEST

This test can be carried out with the use of a **Midtronics tester**, if available.

The purpose of this test is to ensure that the charging process has fully charged the battery and should always follow dry charge commissioning or new battery storage and charging.

**Note:** The figures quoted below only apply to new batteries; the post-charge test needs to show the battery has recovered to the higher voltage before putting it into storage.

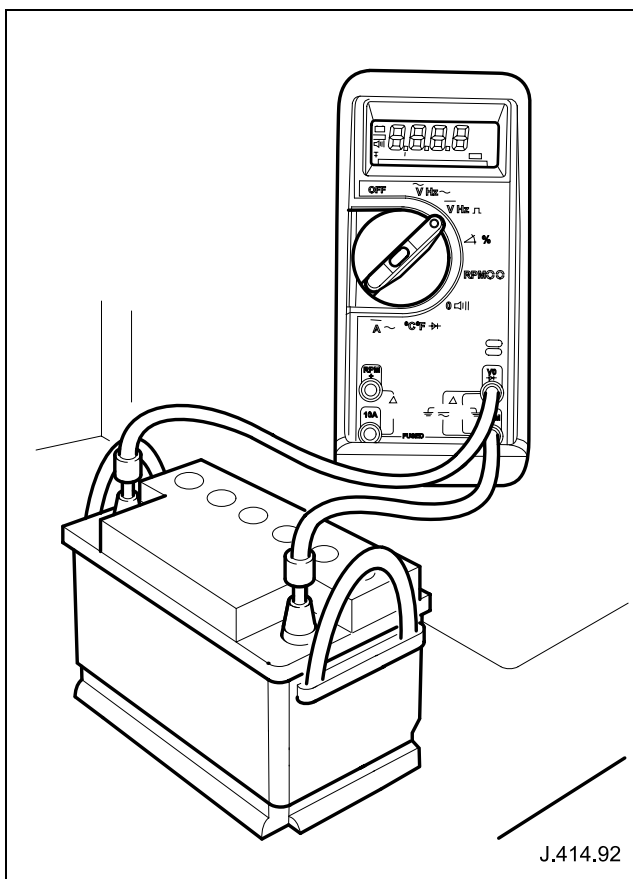
**AT LEAST 24 HOURS AFTER THE CHARGE CYCLE IS COMPLETED** or if this time restraint is unacceptable due to circumstances then:

- Remove the battery surface charge (see page 13).
- Carry out an open circuit voltage test (see page 13).

Then compare your results with those below if the battery is new and carry out the recommended actions accordingly (or refer to the figures on page 13 for in service batteries).

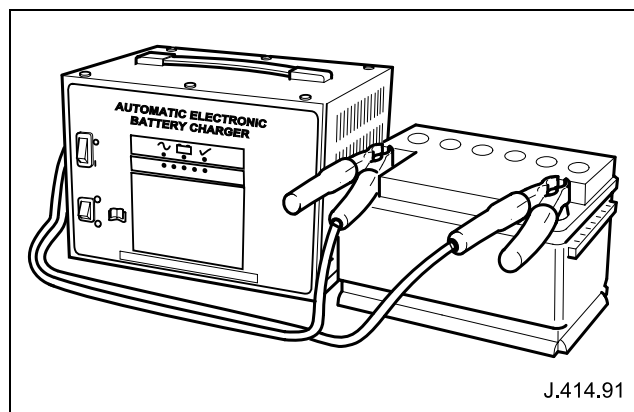
**O/C voltage ~ 12.69 or less: Scrap battery and / or submit for warranty.**

**O/C voltage ~ 12.7 or above: OK to use or store.**



**CHARGING IN SERVICE BATTERIES****CHARGING EQUIPMENT MUST BE USED IN THE FOLLOWING MANNER**

1. Do not boost charge the battery.
2. Do not charge at more than 16 volts.
3. Do not charge at more than 40 amps.
4. Do not during charging let the battery exceed a temperature of 50°C.
5. Do not charge more than one battery per charger.
6. Do not leave a battery in a discharged condition but promptly re-charge.
7. Use chargers with the following specification:
  - Automatic controls, no manual boost charge.
  - Automatic switch off at charge termination.(The use of such chargers will minimise potential battery damage caused by over charging.)
8. Always check the electrolyte levels before and after charging, top-up with distilled water if necessary.
9. After charging is complete, carry out a post-charge test (see page 8) and carry out the recommended actions accordingly.



## BATTERY TESTING SECTION

**Note:** Due to this manual being published during a period when the Traction charger and Midtronics tester are to become mandatory equipment. We appreciate there will be a time period for the necessary equipment to reach all dealers and therefore have included 2 report forms for your convenience, one which includes the Midtronics recommended process and one without to allow for all dealers to become fully equipped. Only one of the forms should be filled and returned dependent on the level of equipment available. Likewise the test processes are also included detailing information on how to carry out a specific gravity test and a battery high rate discharge test to aid those dealers at the time of publication of this document who are still without their full equipment compilation. However the next publication of this document will not include the latter information and it will be expected that all dealers will be fully equipped well in time for the revised document.

The following section gives a detailed description of how to accurately diagnose a battery condition.

The first page is a Battery Report Form which must be used in conjunction with the test pages. Mandatory fields on the Report Form are shaded and they must be filled in. Likewise, we actively encourage all other fields to be filled in with as much information and detail as possible.

To accurately determine the battery condition, you **MUST** carry out battery testing as indicated on the battery report. Following the tests in the order shown on the Report Form will encourage a logical and methodical approach to accurately diagnosing battery faults, failure to follow this routine rigorously and the result will be incorrectly diagnosed battery conditions.

## BATTERY REPORT FORM (Midtronics)

GENERAL INFORMATION (Note: Mandatory fields are shown as shaded and must be filled in)													
Customer's Name					Dealer Code (Export)								
Job Number					Corporate I.D. (UK)								
Date						Battery Date Code							
Technician's Name					No. of Battery Changes								
Vehicle Make & model					Customer's Signature								
VIN													
Give a detailed description of the symptoms experienced by the customer (attach separate sheet if necessary)													
DIAGNOSTICS (Battery Testing)													
1. Loose battery clamps			YES		NO		10. Quiescent drain (page 15)						mA
2. Loose hold down clamps			YES		NO		11. Voltage reading under load @ 2000 rpm (page 17)						
3. Corroded terminal / posts			YES		NO		HF / RW – headlamps – heater						
4. Physical damage / leaks			YES		NO		Type of Midtronics tester used for diagnosis						
5. Low electrolyte			YES		NO		Jaguar				Tick one box Only		
6. Alternator ~ belt tension			OK		NOT		Land Rover						
7. Surface charge removed			YES		NO		Volvo						
8. Wait 10 min. O/C V. (page 13)													Comments:
9. Midtronics test (page 14)													
Code before charge													
<i>If initial O/C voltage is below 12.5 volts, charge battery for 24 hours. Then remove surface charge.</i>													
Code after charge													
Result after charge													
<i>If 'charge and re-test' is the result before and after charge, then replace battery.</i> <i>If the test after charging gives a result 'good &amp; re-charge', charge a further 24 hours, then re-test.</i> <i>Replace battery only if 'replace battery', 'bad cell' or 'charge &amp; re-test' has been displayed twice.</i>													

## BATTERY REPORT FORM (dealers without Midtronics)

GENERAL INFORMATION (Note: Mandatory fields are shown as shaded and must be filled in)									
Customer's Name				Dealer Code (Export)					
Job Number				Corporate I.D. (UK)					
Date				Battery Date Code					
Technician's Name				No. of Battery Changes					
Vehicle Make & model				Customer's Signature					
VIN				Technician's Signature					
Give a detailed description of the symptoms experienced by the customer (attach separate sheet if necessary)									
DIAGNOSTICS (Battery Testing)									
1. Loose battery clamps		YES		NO		11. Voltage reading under load @ 2000 rpm (page 17)			
2. Loose hold down clamps		YES		NO		HF / RW – headlamps – heater			
3. Corroded terminal / posts		YES		NO		12. High rate discharge test (page 18)			
4. Physical damage / leaks		YES		NO		Temperature			
5. Low electrolyte		YES		NO		Reading after 15 seconds			
6. Alternator ~ belt tension		OK		NOT		Comments:			
7. Surface charge removed		YES		NO					
8. Wait 10 min. O/C V. (page 13)				-					
9. Quiescent drain (page 15)					mA				
10. Specific Gravity (without Midtronics) (page 17)									
No. 1 Cell				-					
No. 2 Cell				-					
No. 3 Cell				-					
No. 4 Cell				-					
No. 5 Cell				-					
No. 6 Cell				-					

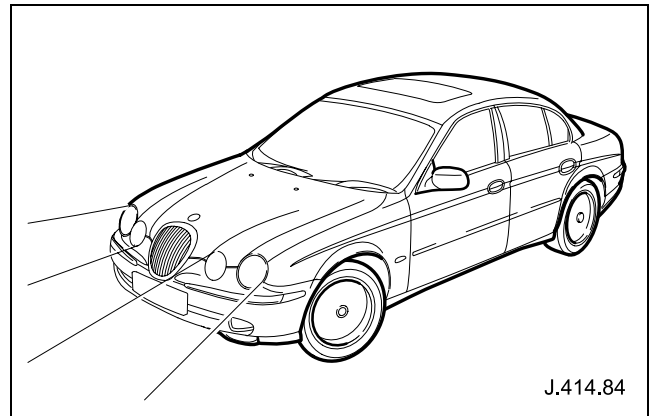


**OPEN CIRCUIT VOLTAGE TEST**

**SURFACE CHARGE (Removal)**

Before carrying out an open circuit voltage check, you must ensure that there is no battery surface charge present. The battery may be tested either on a bench or on the vehicle. A vehicle which has had its battery charged or been driven within 24 hours prior to the test must have its surface charge removed using one of the following methods:

- Wait 24 hours before the test is performed.
- Or switch on the headlights on main-beam for 5 minutes for all models except X-TYPE which should be for 2 minutes only.



**Open circuit voltage test (Multi-meter connections)**

Battery O/C voltage should be measured after 10 minutes has elapsed following surface charge removal. Measure the O/C voltage of the battery by using your Midtronics tester or a 3.5 digital multi-meter. Connect the red positive lead of the digital multi-meter to the battery positive terminal post and the black negative meter lead to the negative battery terminal post, as shown below (**with no additional loads present and engine stationary**).

- Compare your results and carry out the recommended actions accordingly, as shown below.

**Note:** If preliminary findings give unsatisfactory results (i.e. 12.45 volts or less) then enter the readings obtained onto the Battery Report Form, and proceed with a full battery diagnosis.

**Results obtained:**

**Open circuit voltage ~ 12.45 volts or less**

- Fit replacement battery.
- Scrap or return removed battery.

**Unsatisfactory result:** See note above and carry out a full diagnostic routine.

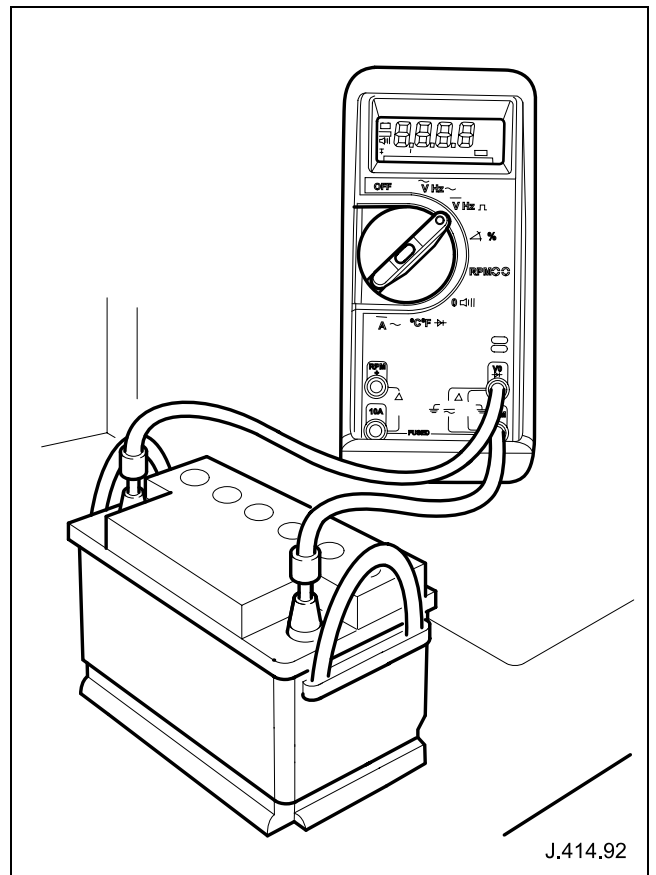
**Open circuit voltage ~ 12.45 to 12.49 volts**

- Remove and re-charge battery.
- Charge the battery by following the instructions given with the charger in use (see note on charging on page 6).
- Carry out a post-charge check (see page 8).
- If the result after charging the battery is 12.49 volts or less then fit a replacement battery.
- Scrap or return removed battery.

**Open circuit voltage ~ 12.5 volts or above**

Do one of the following:

- @ Port of entry ~ deliver to the dealership.
- @ Dealership ~ deliver to the customer or put into storage.



## MIDTRONICS TESTING

(Suitable for 12 volts batteries only)

**Note:** The battery surface charge must be removed before this test (see page 13).

### TEST PROCEDURE

- Ensure the battery terminals / connectors are clean.
- Connect red clip to positive (+) battery terminal.
- Connect black clip to negative (-) battery terminal.
- Rock clips back and fourth to ensure a good connection to the battery.

**Note:** DO NOT connect the tester to any other circuit or chassis point.

#### Step 1

Use the 'Arrow' buttons to scroll to the battery's labelled CCA rating.

#### Step 2

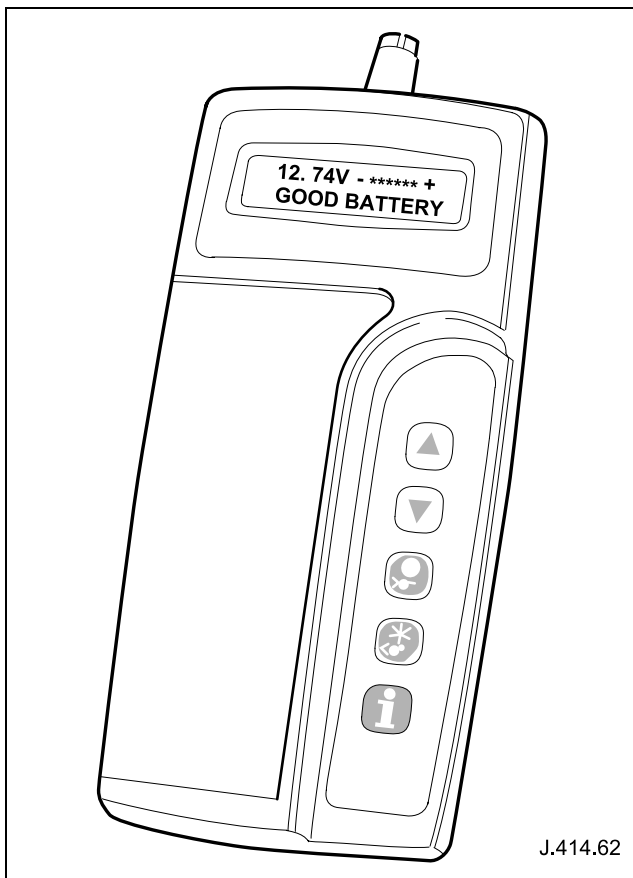
Press the 'Test' button that corresponds to the correct battery temperature. i.e. if the temperature is above 0°C press the 'Sun' button. If the battery temperature is below 0°C press the 'Ice Crystal' button. Carry out action, based on tester results (see table below).

#### Step 3

Press the 'Information' button to view the test code.

#### Step 4

- Enter the readings obtained on to the Battery Report Form (see page 11).



Tester Results	Actions
GOOD BATTERY	Return to service.
GOOD – RE-CHARGE	Fully charge the battery and return to service.
CHARGE & RE-TEST	Fully charge the battery. Before re-testing remove surface charge. If this result remains after surface charge removal – replace the battery.
REPLACE BATTERY or BAD CELL BATTERY	Ensure surface charge was removed, if so, disconnect the battery from the vehicle and re-test. If this result remains after surface charge removal – replace the battery. <b>* Warning: Do not charge *</b>
UNABLE TO TEST	Disconnect the battery from the vehicle and re-test.

Press the 'Information' button and carefully note the 6-digit 'test code' on the battery, job card and the Battery Report Form. The battery tester will always generate a 'test code' on completion of every test.

## VEHICLE QUIESCENT CURRENT TESTING

If an open circuit voltage test gives a result in the region of 12.45 to 12.49 volts, it is recommended that you ensure the battery isn't slowly being discharged by an electrical consumer that is remaining on after the vehicle's shutdown period (see page 16 for typical shutdown periods). Likewise if a customer complains of a vehicle battery that discharges continuously or when left for a prolonged period of time it is recommended that you perform a quiescent drain test as described below:

### Method of Measurement

In order to correctly measure quiescent drain, it is preferable to use WDS with the current probe attachment. If this is not possible, then an ammeter may be used. Whichever method is used, technicians **MUST** adhere to the following procedure.

**Note: Do NOT** use a multi-meter to check the battery drain on vehicles with an electronic throttle (e.g. XK8 1997~) as the current drawn by the throttle is in excess of the fuse rating in most multi-meters, and damage to your multi-meter may result.

### Using WDS with current probe

- Switch off all electrical loads and remove the ignition key.
- Connect current probe to WDS.
- Calibrate the probe.
- Clamp around the battery lead / fuse box lead. **Go to Test results.**

### Using a multi-meter rather than WDS

- Disconnect the battery negative lead.
- Connect the ammeter between the battery negative post and negative lead using clips.
- Select high meter range (i.e. equal or more than 10 amps) then switch the multi-meter on. **Go to Test results.**

### Test results (both methods)

- Switch ignition 'on' then 'off' (DO NOT CRANK) and remove the key.
- Close or latch all doors and remove any other potential electrical consumers.
- Observe / compare the readings obtained over the timescales identified (see page 16).
- Enter the reading obtained on to the Battery Report Form (see page 12).

**Note:** The preferred method of testing following an excessive current consumption figure is to use the clamp of the ammeter around individual fuse box leads to the various suspected circuits to identify a potential cause. Rather than the old method of pulling fuses out, in a one after the other fashion.

The main reasons for using the current probe to determine which fuse box / circuit the drain is going through are:

1. Many modules take a considerable time to power down, every time the fuse is removed and refitted, the quiescent drain figures will need 45 minutes to reset.
2. Sometimes the drain is caused by a module 'holding on' to something that has been switched off. Sometimes it is only a relay winding that is activated. Pulling the fuse can allow this to 'reset' and the drain will be lost and undiagnosed. Similarly, if for example, the headlights of an S-TYPE are switched on, removing the switch input will not turn them off. Therefore the reading obtained would be incorrect and could mislead.

## BATTERY CURRENT DRAIN TYPICAL VALUES

The battery drain should be measured (see page 15 using WDS where available) with the vehicle in the double-locked armed state (i.e. vehicle alarm fully armed), with all doors and other body apertures either closed or latched, so as to appear closed from an electrical point of view.

The test should take place after the vehicle has entered shutdown mode. The time taken for this to occur after key-off varies according to model. (Refer to the table below.)

**Note:** When the vehicle is armed, the effect of the LED flashing is to cause a pulsation in the measured current drain. In this case, either the time average current should be taken (using a meter with an averaging function) or the current reading should be taken, ignoring the brief high current peaks.

The current drain after the initial shutdown period, should not exceed the value shown in table.

Model	Shutdown Period (minutes)	Typical Values Battery Drain (mA)
XJS 3.2	60	< 30.0
SOV 3.2	60	< 37.3
XJ6 4.0	60	< 38.6
XJS	60	< 43.9
XJ6 (95 MY)	60	< 43.0 *
XJ8	60	< 30.0
XK8	60	< 30.0
S-TYPE	40	< 30.0
X-TYPE	30	< 30.0
XJ6 (New Model)	40	< 30.0
XJ8 (New)	40	< 30.0

**Note:**

- \* Further drop after 72 hours, to 30 mA, but this would not be part of the standard test.
- The total current drain will be higher if certain Jaguar-approved accessories (e.g. Tracker; Cool bag; Trailer Tow Module) are fitted.

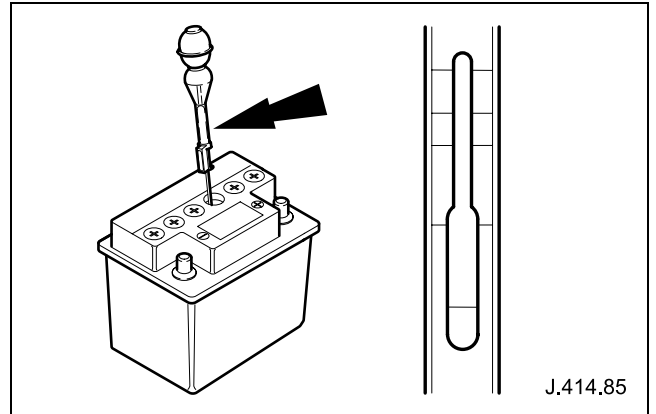
## SPECIFIC GRAVITY TESTING

(Dealers without Midtronics)

The SI (System International) measures the strength of the battery electrolyte as density in grams per cubic metre ( $\text{g/m}^3$ ) @ 25°C.

This can be measured by means of a battery hydrometer which measures the battery electrolyte specific gravity (density).

Temperature correction is necessary if readings are taken at anything other than 25°C.



### Test procedure

- Remove all battery cell covers or caps, and visually inspect to ensure sufficient electrolyte is present, do not top-up any cells before testing. If topping-up is necessary then you must charge the battery fully then remove any surface charge before continuing with this test.
- Squeeze the bulb of the battery hydrometer and insert the tube into the first cell (No. 1 cell) and draw the battery electrolyte out of the cell and into the hydrometer.
- Allow for any air bubbles to disappear and the float level to stabilise before reading the value displayed by the level of the fluid on the float. Then enter this figure onto the Battery Report Form for cell No. 1.
- Repeat the above operation for the remaining five cells and enter the readings onto the Battery Report Form (see page 12).

### Results

- Compare the six cells for consistent readings, regardless of what the readings are, they should ALL be similar. A significantly lower / higher reading in one cell indicates a bad cell and the battery must be replaced.

Readings obtained	Condition	Actions necessary
1:110 – 1:130	Discharged	Re-charge battery fully ~ Remove surface charge then re-test.
1:230 – 1:250	Approx. 70% charged	Re-charge battery fully ~ Remove surface charge then re-test.
1:270 – 1:290	Charged	Battery serviceable ~ Carry out the remaining tests on Battery Report Form.

## VOLTAGE READING UNDER LOAD @ 2000 rpm

Connect the red positive lead of a 3.5 digital multi-meter to the battery positive terminal post and the black negative meter lead to the negative battery terminal post.

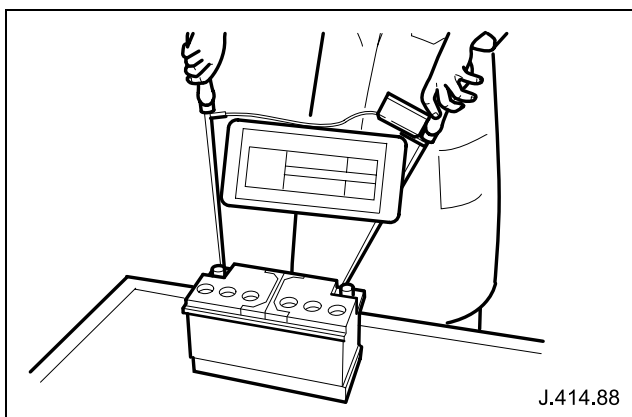
- Start the vehicle's engine and leave to idle for a few minutes.
- Switch on electrical loads: Heated front and / or heated rear screens, headlamps on main-beam and the heater blower on full speed.
- Increase the engine's speed to 2000 rpm.
- When the rpm has remained stable for a few minutes read the voltage on the multi-meter.
- Enter the reading obtained on to the Battery Report Form (see page 12).

## BATTERY HIGH RATE DISCHARGE TEST

(Dealers without Midtronics)

The purpose of this test is to ensure that the battery is in a satisfactory condition for service. (This is a severe test for the battery and generally indicates the ability of the battery to perform under heavy load.) It will determine if the battery can perform under such loads that it may have to deal with when starting in cold conditions for example.

**Note:** You should remove the battery from the vehicle when carrying out a High Rate Discharge test. It is essential that the battery is fully re-charged (see page 6) subsequent to this test.



Perform an open circuit voltage test (see page 13).

Open circuit voltage ~ 12.5 volts or above and with a room temperature of 20°C.

### Connect the high rate discharge tester as follows:

- Remove the battery from the vehicle and take off cell tops (during this test observe cells for excessive gassing and bubbling from individual cells indicating a potential faulty cell).
- Connect the testers red lead to the positive and the black lead to the negative battery leads.
- Set the current at 300 amps for new vehicles and new batteries, **for 15 seconds** OR 210 amps for in service vehicles and in service batteries.
- The voltmeter should read 9.6 volts or above after 15 seconds have elapsed.
- Enter the reading obtained on to the Battery Report Form (see page 12).

**The battery must be charged after this test (see page 6).**

**If the voltage is 9.6 volts (or greater) at 20°C (or greater) throughout the 15-second test period, then the battery is serviceable.**

With open circuit temperatures that differ from those recommended for testing, refer to the table below:

Degrees °C	Degrees °F	Minimum acceptance voltage
20	70	9.6
15	60	9.5
10	50	9.4
4	40	9.3
<b>Note:</b> Testing below 4°C is not recommended.		