FOCUS

ELECTRICAL SYSTEM

BATTERIES AND CHARGING: SECOND EDITION

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Publication number S-70

CONTENTS

Automotive technology is advancing at a rapid pace. Increased sophistication and complexity are demanded by legislation and the owners of today's automobiles. In this climate, Jaguar owners expect increased reliability and serviceability from their automobiles. Much of the new technology occurs in the electrical / electronic systems employed to meet the need for performance and emissions control and for comfort and convenience.

USING THE BOOK

This FOCUS publication "ELECTRICAL SYSTEM — BATTERIES AND CHARGING: SECOND EDITION" provides current information on caring for and servicing Jaguar vehicle electrical power supply systems.

Designed to be a "generic" document, the book allows the specifications to be updated (specifications are contained on the Specification Card in the pocket of the back cover) as systems and components change in the future.

Four sections are used to cover the information:

GENERAL INFORMATION provides background information, test equipment specifications and precautions.

BATTERY CARE provides illustrated battery maintenance schedules.

BATTERY SERVICE PROCEDURES details battery-specific service and test procedures.

VEHICLE SERVICE PROCEDURES details service procedures involving the vehicle.

Specifications

When it is necessary to refer to the Specification Card to complete a procedure, SPEC. CARD appears in the accompanying illustration.

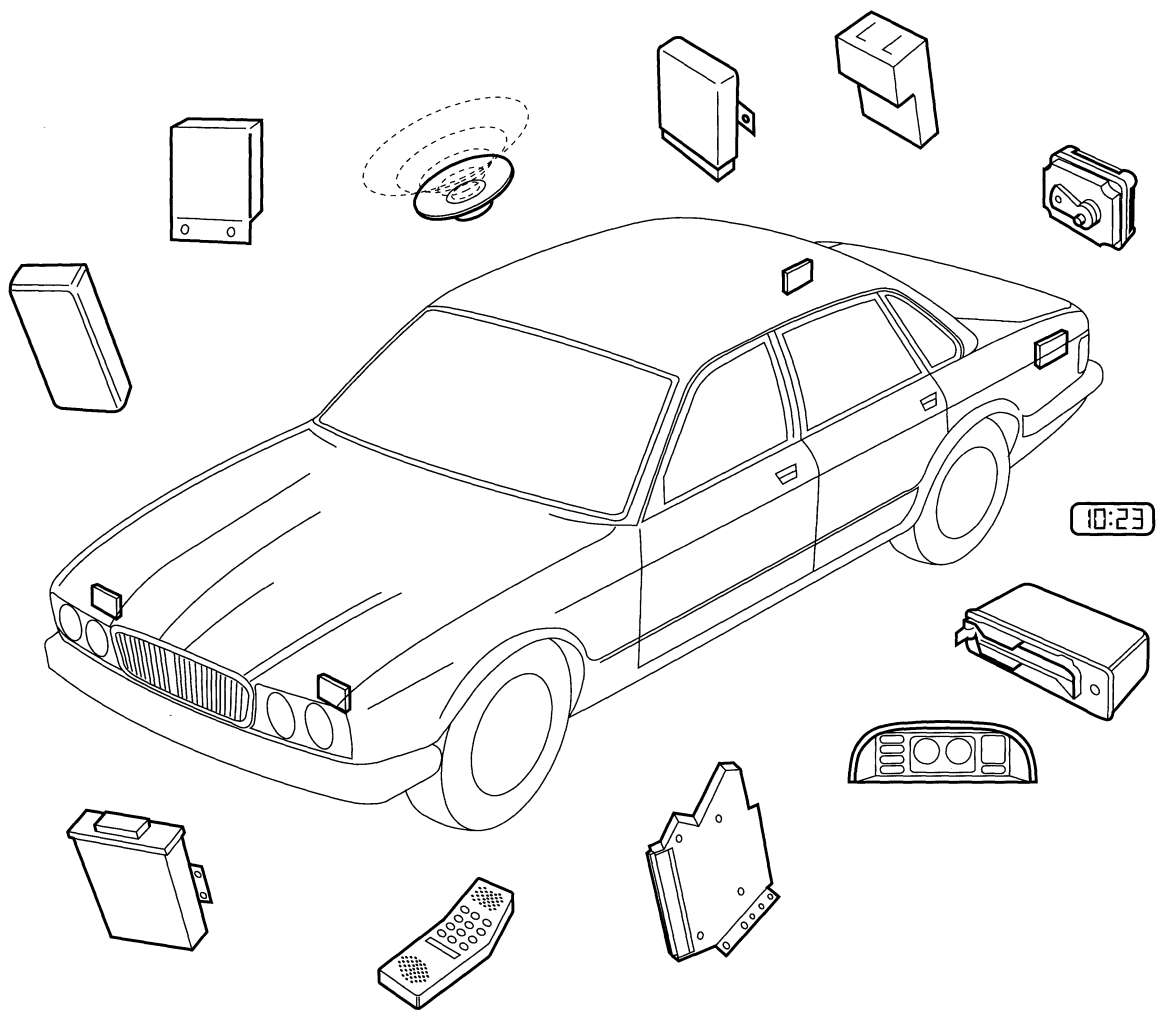
⚠ WARNING: THE OPERATIONS AND PROCEDURES CONTAINED IN THIS PUBLICATION ARE INTENDED FOR USE BY PROFESSIONAL TECHNICIANS WITH KNOWLEDGE OF JAGUAR VEHICLE SYSTEMS. ALL NECESSARY SAFETY PRECAUTIONS MUST BE TAKEN WHEN SERVICING OR TESTING SYSTEMS THAT HAVE THE POTENTIAL FOR CAUSING BODILY INJURY OR DEATH.

NOTE: Specific battery safety precautions are detailed on page 8.

ELECTRONICS / QUIESCENT CURRENT

The use of electronic components has increased the performance of modern automobiles, while at the same time satisfying legislative requirements for clean and efficient operation. Electronics have also made available comfort and convenience features now considered an integral part of luxury automobiles.

Many of the electronic circuits contain a memory that requires a continuous electrical power supply. Electronic clocks, for example, continuously draw a small amount of electrical current. Although each of these components may only consume a minute amount of electrical current, collectively these circuits can consume enough current to discharge the battery if the vehicle is not operated regularly. The problem is compounded further if accessories such as vehicle security systems and telephones are installed. These systems place a considerable electrical load on the battery when the vehicle is not operating. In addition to this current consumption, minute battery internal losses occur. The total electrical current consumed by the vehicle while at rest, including battery internal losses, is referred to as quiescent current.



QUIESCENT CURRENT SOURCES

IMPORTANT: IT IS EXTREMELY IMPORTANT THAT THE NEGATIVE EFFECTS OF QUIESCENT CURRENT ON THE BATTERY DURING PERIODS OF VEHICLE INACTIVITY OR LIMITED OPERATION (SHORT AND INFREQUENT TRIPS) BE UNDERSTOOD BY ALL PERSONS ASSOCIATED WITH THE CARE, SERVICING AND OPERATION OF JAGUAR CARS.

VEHICLE STORAGE

In order to reduce quiescent current to the normal battery internal losses during periods of new vehicle storage, Sedan Range vehicles are equipped with a transit isolation device; XJ-S vehicles must have the battery negative cable disconnected.

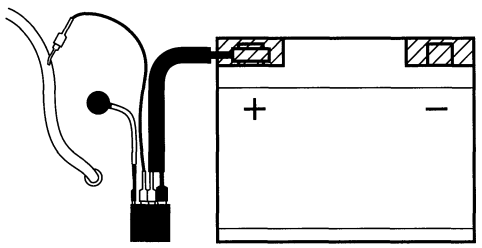
Sedan Range — Transit isolation device installed

The transit isolation device disables all vehicle circuits that contribute to quiescent current, while at the same time allowing the vehicle to be started and operated. To ensure the security of the vehicle with the transit isolation device installed, the doors and trunk must be locked manually.

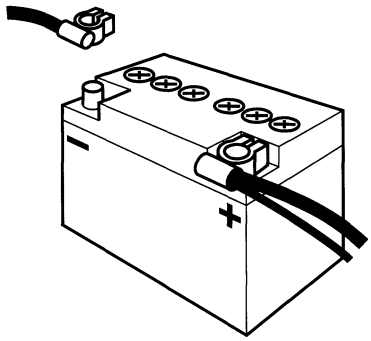
The transit isolation device is disconnected during PDI, then reconnected. During the 24-hour period before the vehicle is delivered to the customer, the device is removed from the vehicle. Details of these schedules and procedures are contained in this book.

XJ-S Range — Battery negative cable disconnected

XJ-S Range vehicles require that the battery negative cable be reconnected for any vehicle function to be enabled.



SEDAN RANGE
TRANSIT ISOLATION DEVICE INSTALLED

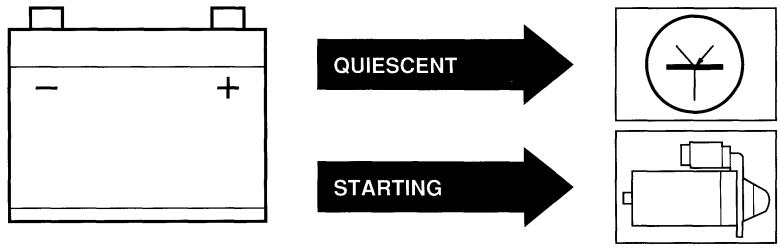


XJ-S RANGE
BATTERY NEGATIVE CABLE DISCONNECTED

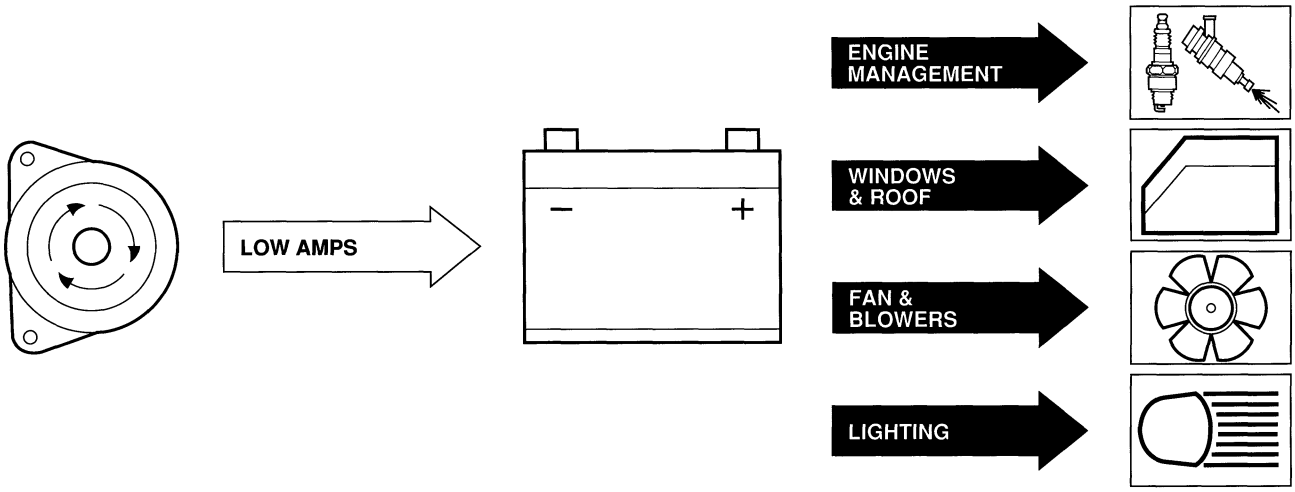
VEHICLE ELECTRICAL LOADS

The battery is the foundation of the vehicle's electrical power supply.

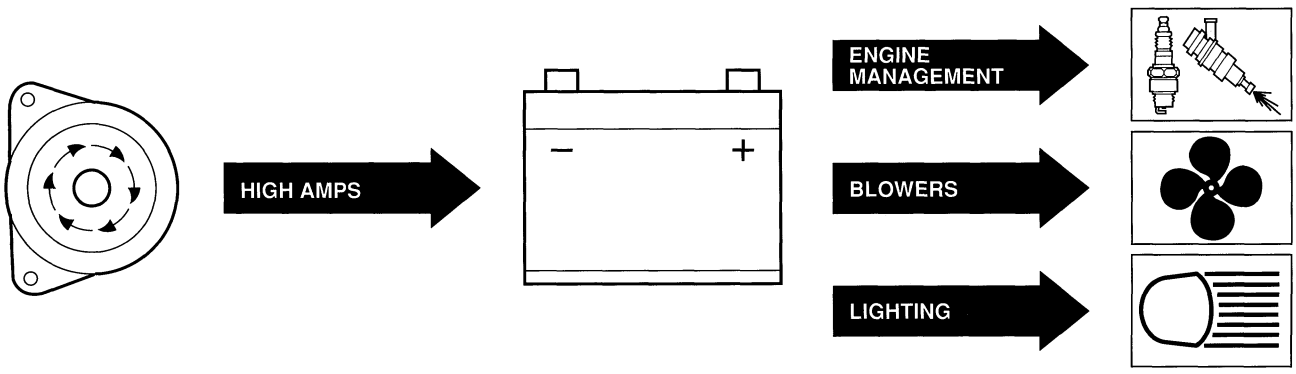
The battery is the sole source of electrical power for operating systems while the ignition is off and for starting.



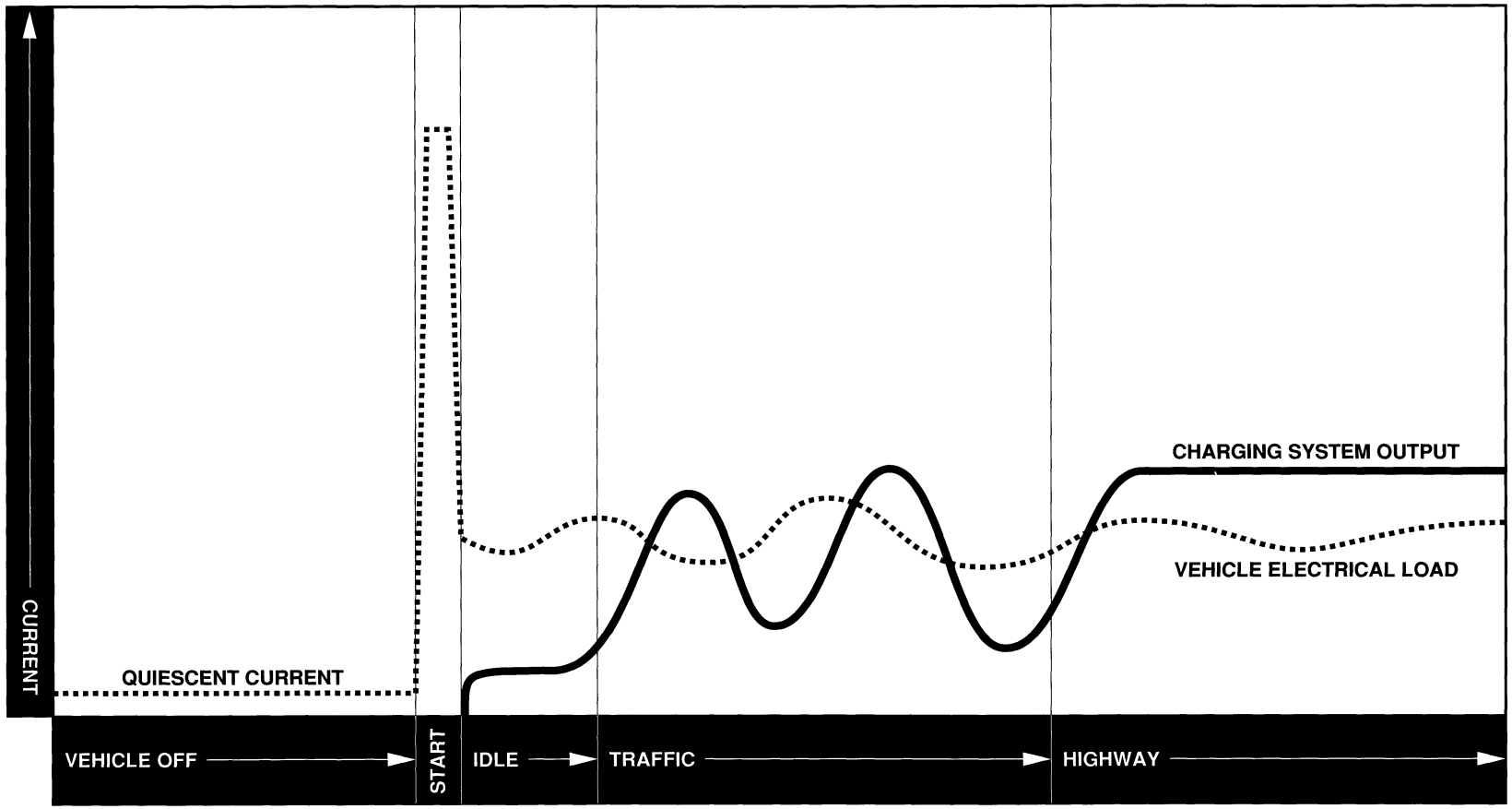
During low engine speed operation with many of the vehicle systems and accessories operating, the battery provides the required power to make up the difference between alternator output and vehicle demand for current.



The battery is recharged only when alternator output exceeds vehicle demand for current.



VEHICLE ELECTRICAL LOAD / CHARGING SYSTEM OUTPUT
TYPICAL DRIVING CYCLE



This chart illustrates the difference between the vehicle electrical load requirement and the charging system output during a typical driving cycle.

JAGUAR BATTERIES

BATTERY SPECIFICATIONS

Depending on the model and model year, the battery supplied in Jaguar vehicles varies. The Specification Card, contained in the back cover pocket of this book, lists the various battery specifications and battery interchangeability.

NEW BATTERY STOCK

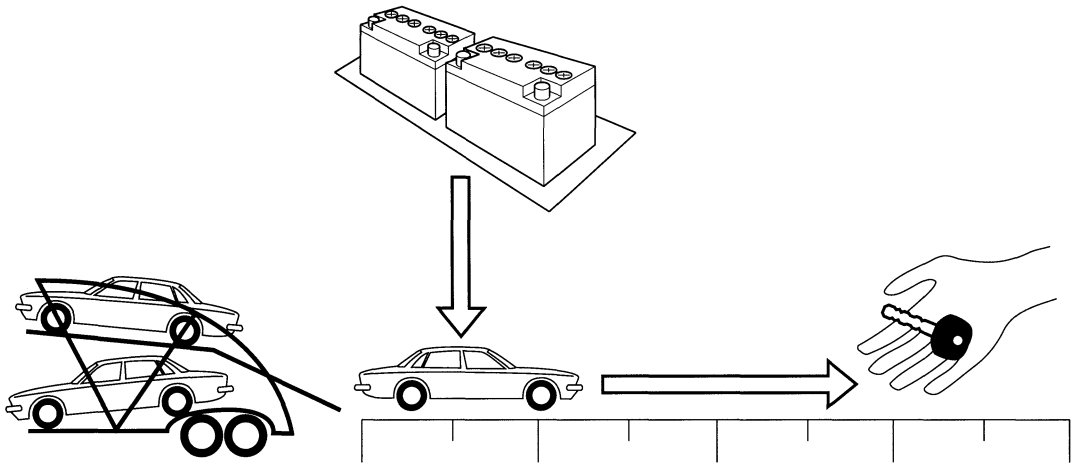
A supply of fully-charged new batteries should be maintained. These will be used for replacement purposes on vehicles in service. All batteries should be serviced as detailed in this book and placed in stock for future use.

BATTERY CLASSIFICATIONS

Jaguar batteries are classified into two categories: new batteries and in-service batteries.

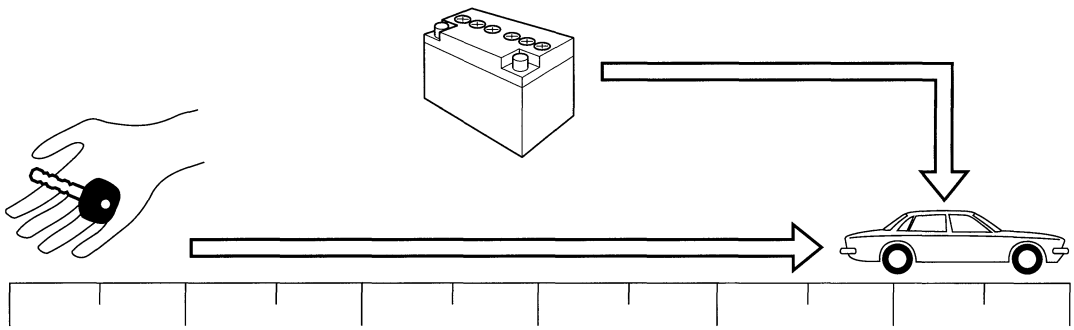
New batteries

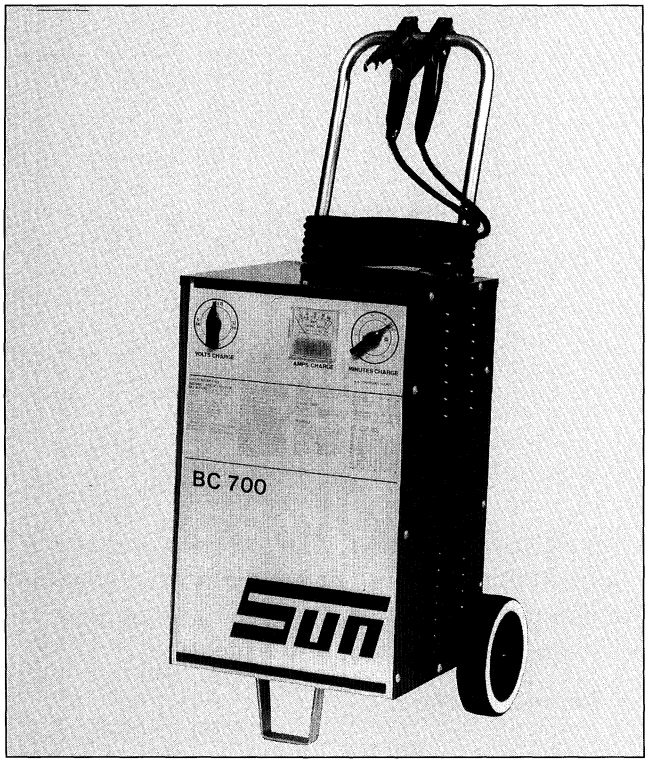
New batteries are batteries supplied in new vehicles up to the time of vehicle delivery to the customer and batteries that have been dry charge activated and then held in the dealer parts stock up to installation in a vehicle.



In-service batteries

In-service batteries are batteries in service after new vehicle delivery or after installation as a replacement.

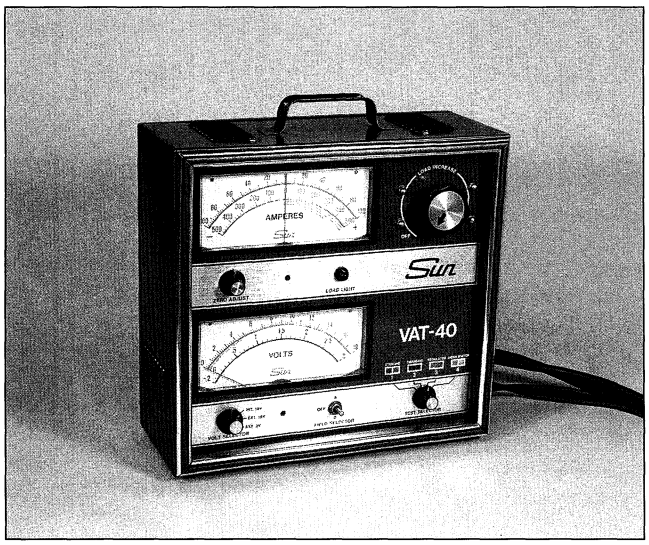




CHARGER

Required specification:

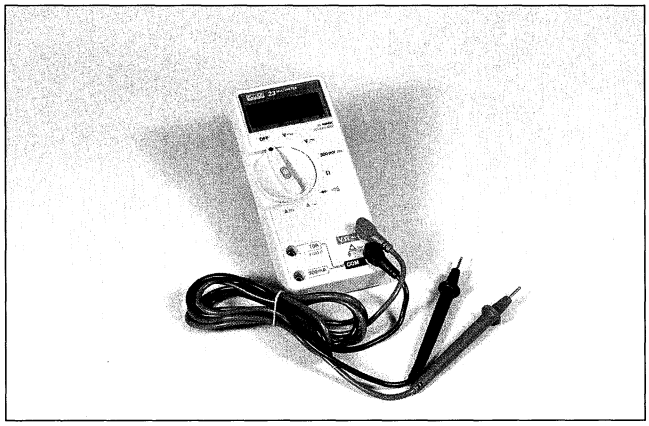
Must have an automatic timer
Must have an amps charge indicator
Must have a high / low voltage selector
Continuous duty charge — 70 / 60 amps



LOAD TESTER

Required specification:

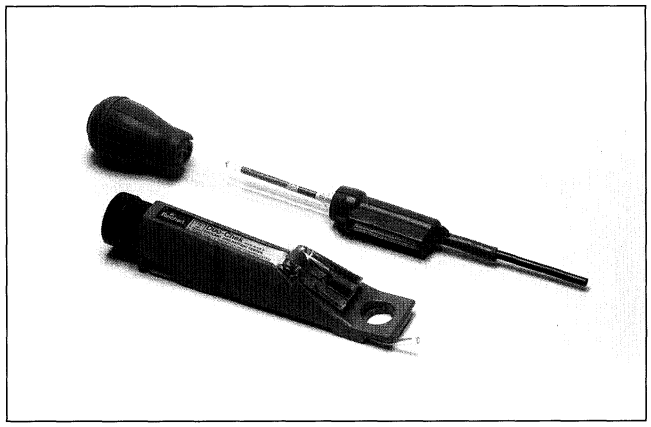
Must have a variable load control up to 500 amps
Must have an inductive pick-up



DIGITAL MULTIMETER

Required specification:

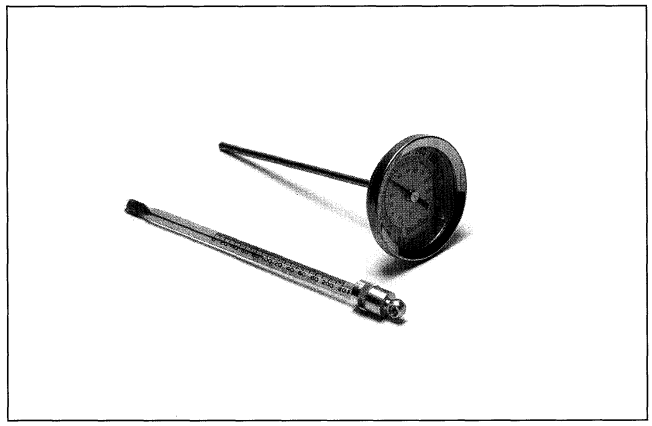
Must have a fused 2 amp range
3.5 digit ±0.03 volt accuracy



HYDROMETER

Required specification:

Must have temperature compensation; optical hydrometer recommended



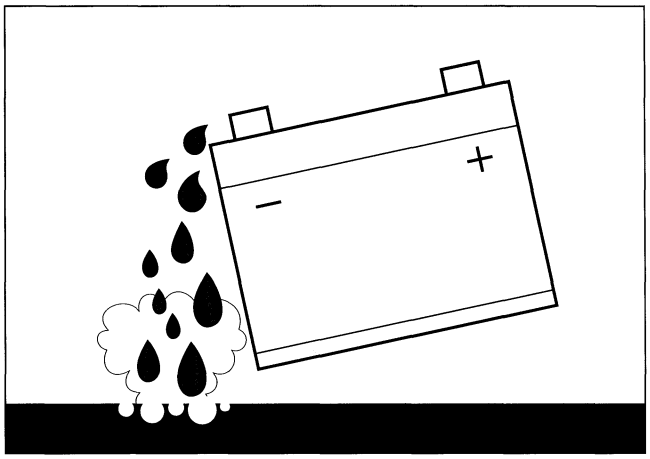
THERMOMETER

Required specification:

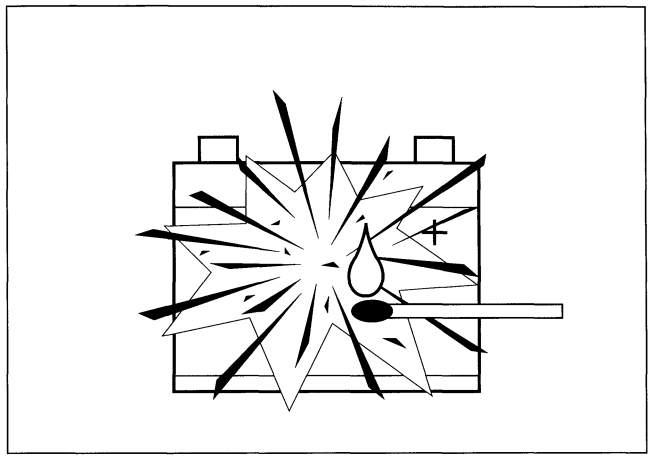
Glass thermometer recommended

BATTERY SAFETY PRECAUTIONS

BATTERY ELECTROLYTE



EXPLOSION



Automotive batteries are lead / acid type batteries containing an electrolyte solution. The electrolyte solution is made up of water and sulfuric acid. Sulfuric acid is highly corrosive and can cause severe burns if it comes in contact with human tissue. Seek immediate medical attention if electrolyte contacts the eyes. Batteries produce explosive gasses. Keep flames and sparks away. Do not smoke while working near batteries.

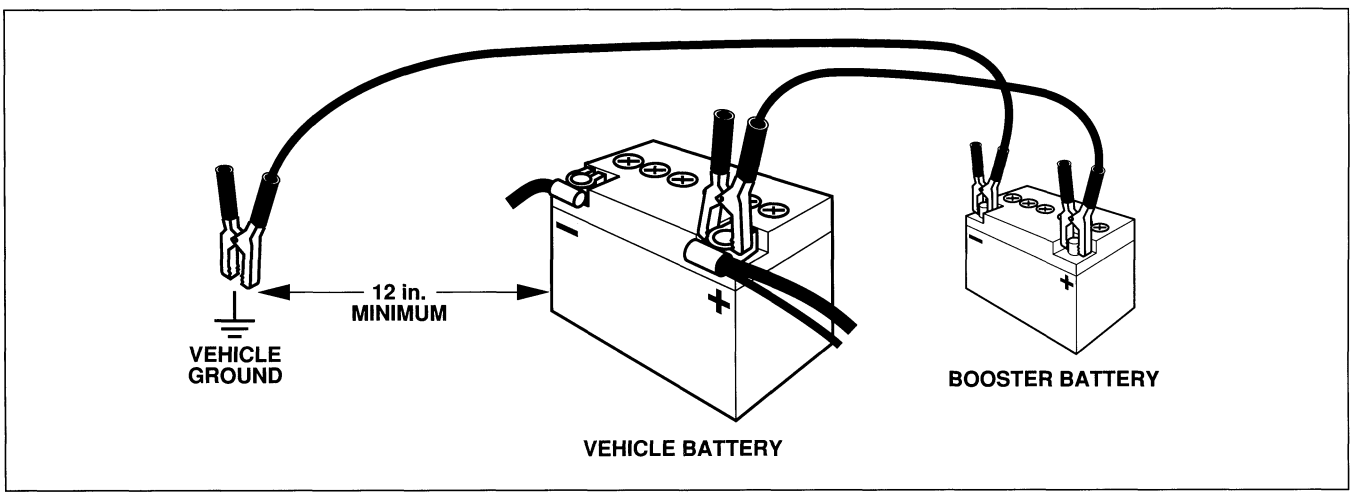
Always wear protective clothing and face and eye protection to prevent injury.

JUMP STARTING

If it becomes necessary to jump start a vehicle, the following procedure will ensure that sparks are avoided and that the vehicle's electrical circuits are not damaged.

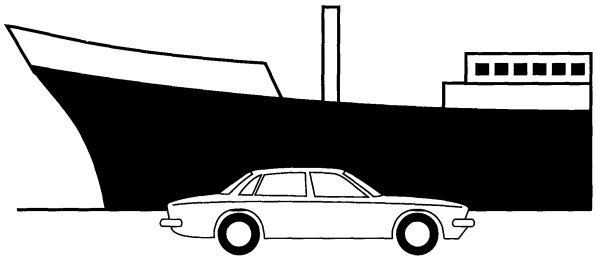
1 Connect the positive (red) cable between the vehicle battery and booster battery positive terminals.
2 Connect one end of the negative (black) cable to the booster battery negative terminal.
3 Connect the other end to a clean ground point on the vehicle at least 12 inches from the vehicle battery.
4 Start the engine and let it idle for 2 – 3 minutes. Check the instrument pack to ensure that the alternator is charging.
5 Turn on the headlights, then disconnect the negative jumper cable from the vehicle ground point.
6 Disconnect the remaining cables, then turn off the headlights.

NOTE: Turning on the headlights before disconnecting the booster battery reduces the risk of damage to the vehicle's electrical circuits.

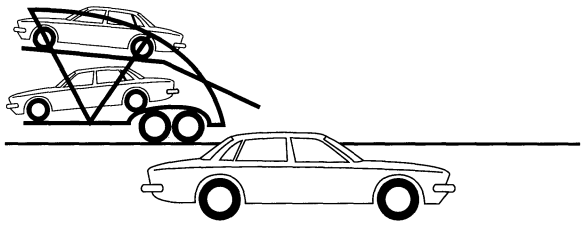


Jaguar vehicles must be delivered to the owner with a battery capable of providing reliable electrical power supply under all operating conditions. To ensure that the battery condition is such that this goal can be met, the procedures for handling and servicing detailed in this FOCUS book must be rigidly adhered to. The battery care procedures for the storage period between the time the new vehicle arrives at the dealership and the time it is delivered to the customer are the most critical for ensuring reliable and sustained battery service.

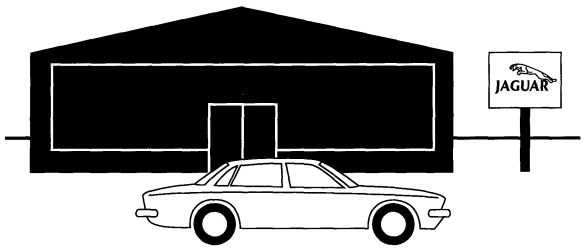
BATTERY CARE illustrates the steps to be followed to ensure that a new Jaguar vehicle is delivered to the customer with a battery capable of providing reliable electrical power supply under all operating conditions. Details of the procedures called for in this section are contained in the BATTERY SERVICE PROCEDURES and VEHICLE SERVICE PROCEDURES sections of this book.



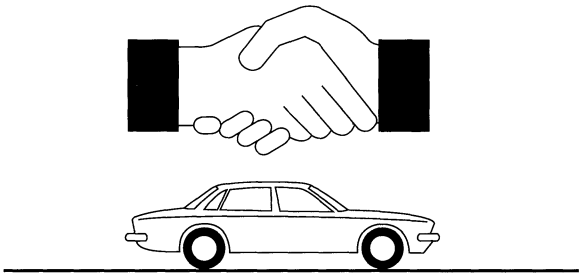
VEHICLE AT PORT OF ENTRY



VEHICLE DELIVERY TO DEALER



VEHICLE STORAGE AT DEALERSHIP



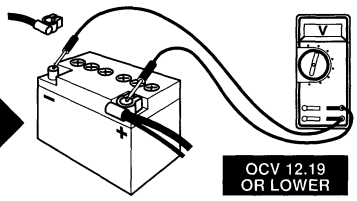
VEHICLE DELIVERY TO CUSTOMER

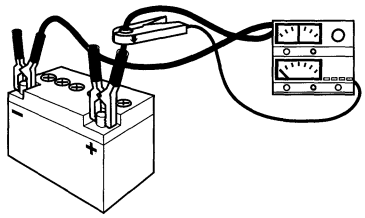
Battery care at the Port of Entry

Jaguar has initiated procedures to ensure that all vehicles leave the Port of Entry with a fully-charged battery. Every vehicle is subjected to a thorough battery testing and maintenance program prior to shipment to the dealer.

IMPORTANT: THE BATTERY CARE PROCEDURES FOR THE STORAGE PERIOD BETWEEN THE TIME THE NEW VEHICLE ARRIVES AT THE DEALERSHIP AND THE TIME IT IS DELIVERED TO THE CUSTOMER ARE THE MOST CRITICAL FOR ENSURING RELIABLE AND SUSTAINED BATTERY SERVICE.

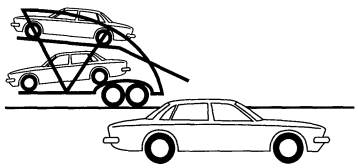
VEHICLE DELIVERY TO DEALER

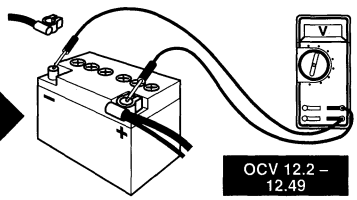


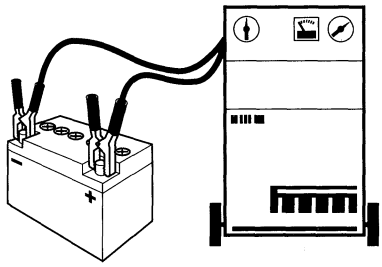


TEST BATTERY
(pages 24 – 25)

If battery proves unserviceable, replace from new battery stock;
complete BATTERY TEST REPORT: FORM W-18 for vehicle history file

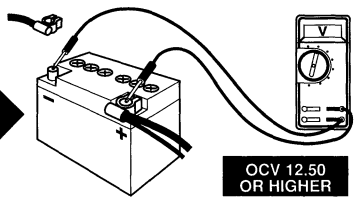




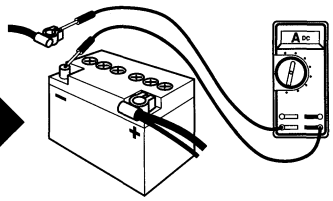


UPON RECEIPT:
CONDUCT AN OCV TEST (page 20);
RECORD OCV

CHARGE BATTERY (page 21);
PLACE VEHICLE IN STOCK



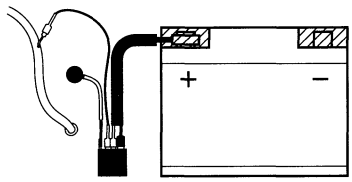
BATTERY OK;
PLACE VEHICLE IN STOCK



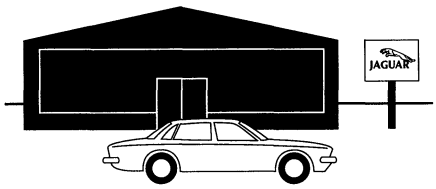
CHECK QUIESCENT CURRENT
(pages 26 – 28)

If excessive current drain exists, correct it;
PLACE VEHICLE IN STOCK

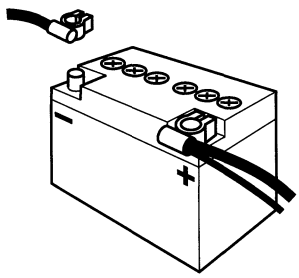
There should be no quiescent current with the transit isolation device installed (Sedan Range) or the battery negative cable disconnected (XJ-S Range)



SEDAN RANGE VEHICLES

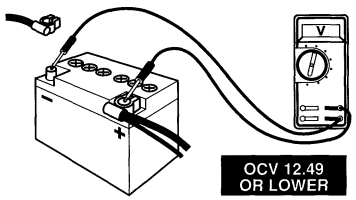


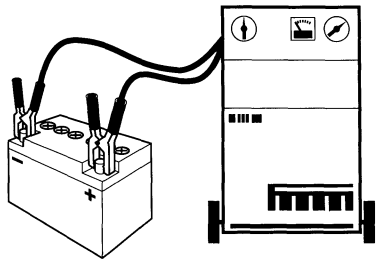
STORE WITH TRANSIT ISOLATION DEVICE INSTALLED (SEDAN RANGE) OR BATTERY NEGATIVE CABLE DISCONNECTED (XJ-S RANGE)



XJ-S RANGE VEHICLES

VEHICLE STORAGE AT DEALERSHIP

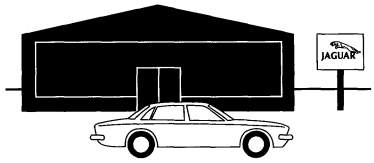




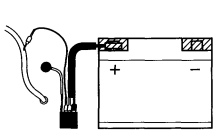
CHARGE BATTERY (page 21)

If the battery condition is suspect after charging, test the battery (pages 24 – 25).

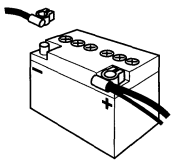
CONDUCT AN OCV TEST (page 20) AT END OF EACH 4-WEEK PERIOD



STORE FOR 4-WEEK PERIODS



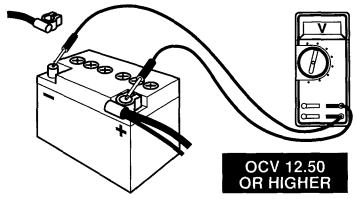
SEDAN RANGE



XJ-S RANGE

CONDUCT AN OCV TEST (page 20) AT THE END OF EACH PERIOD; RECORD OCV

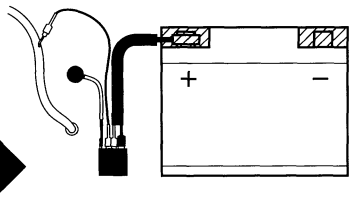
If the battery is connected and / or the vehicle is moved during the period, check the OCV.



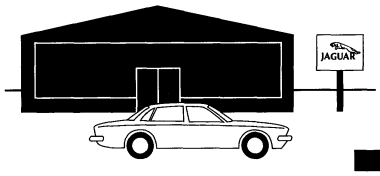
BATTERY OK;
CONDUCT AN OCV TEST (page 20)
AT THE END OF EACH 4-WEEK PERIOD

PERFORM THE PDI WITH ALL FUSES IN PLACE AND TRANSIT ISOLATION DEVICE DISCONNECTED (SEDAN RANGE) OR BATTERY CONNECTED (XJ-S RANGE)

⚠ CAUTION: DURING THE STORAGE PERIOD, SEDAN RANGE VEHICLES MUST HAVE THE TRANSIT ISOLATION DEVICE INSTALLED AND XJ-S RANGE VEHICLES MUST HAVE THE BATTERY NEGATIVE CABLE DISCONNECTED.



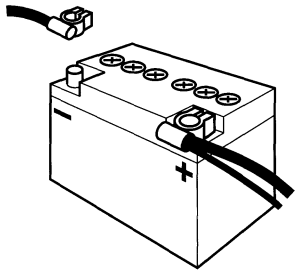
SEDAN RANGE VEHICLES



STOCK VEHICLES

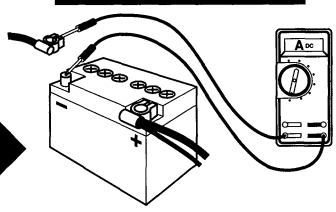
STORE FOR 4-WEEK PERIODS;
CONDUCT AN OCV TEST (page 20)
AT END OF EACH PERIOD; RECORD OCV

If the battery is connected and / or the vehicle is moved during the period, check the OCV.



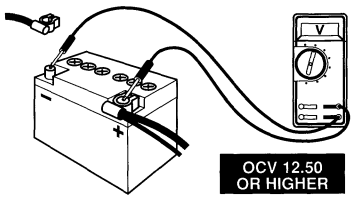
XJ-S RANGE VEHICLES

PRE-DELIVERY INSPECTION

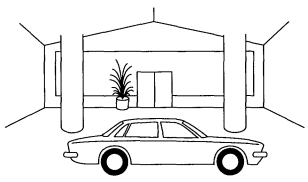


CHECK QUIESCENT CURRENT
(pages 26 – 28)

If excessive current drain exists, correct it;
RETURN VEHICLE TO STOCK

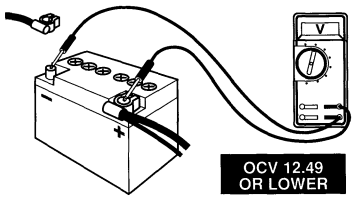


BATTERY OK; CONDUCT AN OCV TEST (page 20) AT THE END OF THE EACH 1-WEEK PERIOD



SHOWROOM VEHICLES

STORE FOR 1-WEEK PERIODS;
CONDUCT AN OCV TEST (page 20)
AT END OF EACH PERIOD; RECORD OCV

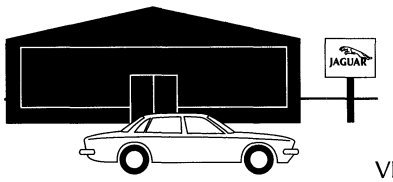


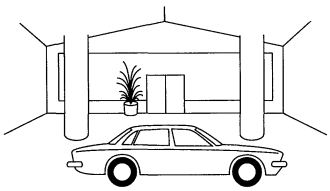
CHARGE BATTERY (page 21)

If the battery condition is suspect after charging, test the battery (pages 24 – 25).

CONDUCT AN OCV TEST (page 20) AT END OF EACH 1-WEEK PERIOD

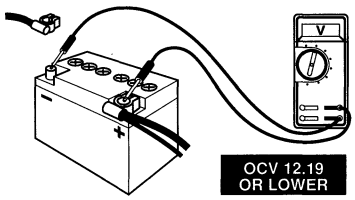
VEHICLE DELIVERY TO CUSTOMER

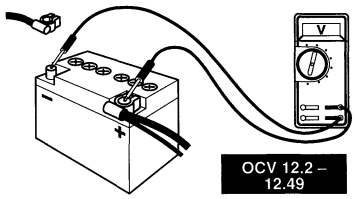


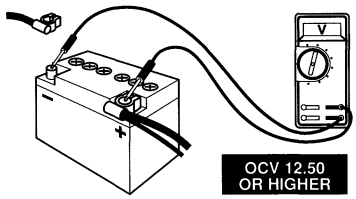


24 HOURS BEFORE
VEHICLE IS DELIVERED TO CUSTOMER,
REMOVE TRANSIT ISOLATION DEVICE
(SEDAN RANGE) OR RECONNECT
BATTERY (XJ-S RANGE)

CONDUCT AN OCV TEST (page 20)

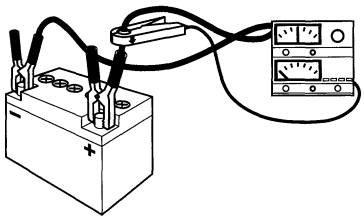






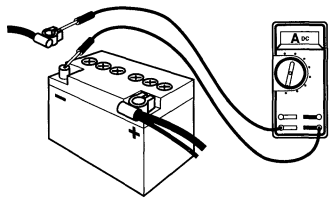
BATTERY OK; RECORD OCV;
DELIVER VEHICLE TO CUSTOMER

IMPORTANT: NEW JAGUAR VEHICLES MUST BE DELIVERED TO THE OWNER WITH A BATTERY CAPABLE OF PROVIDING RELIABLE ELECTRICAL POWER SUPPLY UNDER ALL OPERATING CONDITIONS.



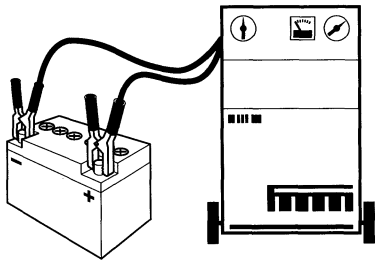
TEST BATTERY (pages 24 – 25)

If battery proves unserviceable, replace from new battery stock; complete BATTERY TEST REPORT: FORM W-18 for vehicle history file



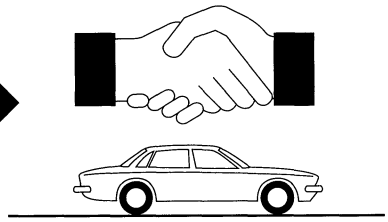
CHECK QUIESCENT CURRENT (pages 26 – 28)

If excessive current drain exists, correct it; DELIVER VEHICLE TO CUSTOMER



CHARGE BATTERY (page 21)

DELIVER VEHICLE TO CUSTOMER

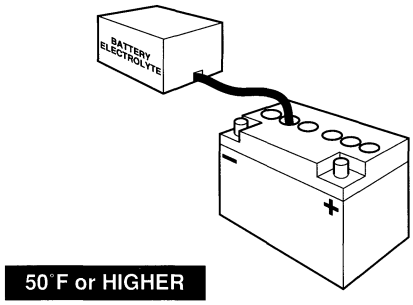


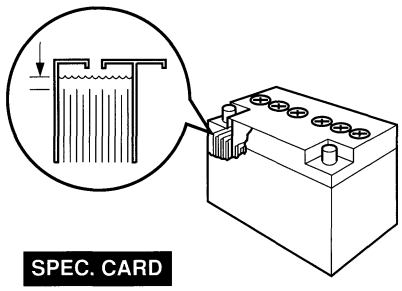
DRY CHARGE ACTIVATION

This dry charge activation procedure will ensure that new batteries provide maximum performance.

STEP 1: FILL THE BATTERY CELLS WITH ELECTROLYTE

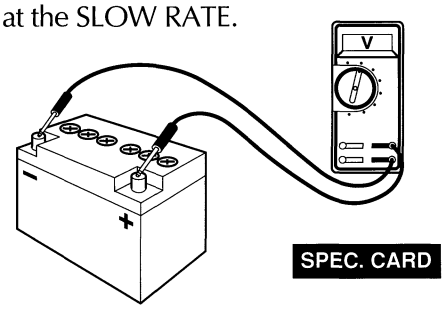
1 Ensure that the battery electrolyte temperature is 50°F or higher.
2 Remove the vent covers and equally fill all battery cells to the specified level.
3 Wait 15 minutes after the initial fill, then add electrolyte to bring the level in each cell back to specification.





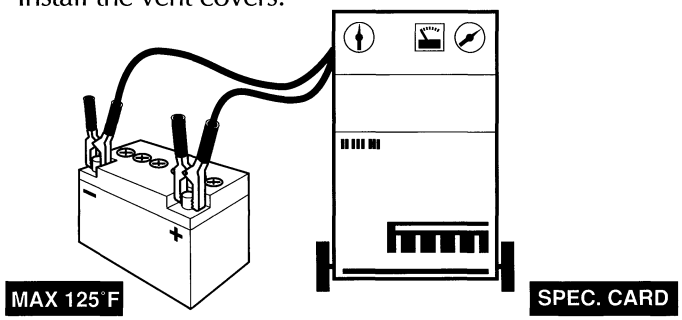
STEP 2: DETERMINE THE RATE OF CHARGE

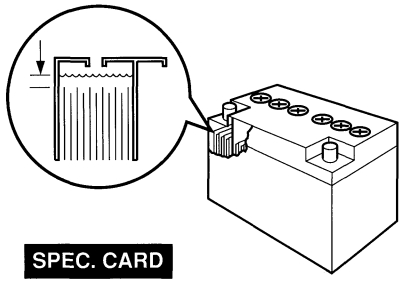
1 Within 5 minutes of completing the filling procedure, measure the open circuit voltage (OCV) as detailed on page 20.
2 Determine the rate of charge. Compare the OCV measurement to the values in Tables A and B on the specification card. Charge only at the SLOW RATE.



STEP 3: CHARGE THE BATTERY

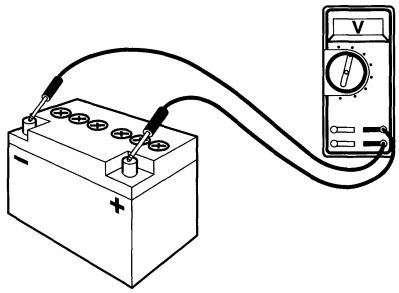
1 Charge the battery for the specified rate and time from Table B (SLOW RATE). Do not allow the electrolyte temperature to exceed 125° F during charging.
2 After the charge period, adjust the electrolyte level, with electrolyte, to the top-up specification.
3 Install the vent covers.





STEP 4: TEST THE OPEN CIRCUIT VOLTAGE

1 Measure the battery open-circuit voltage (OCV) as detailed on page 20. If the OCV is 12.7 or higher, the battery may be put into service or placed in new battery stock. Consult page 18 for storage details. If the OCV is 12.69 or lower, recharge the battery (STEP 5).



12.7 V or HIGHER
BATTERY OK

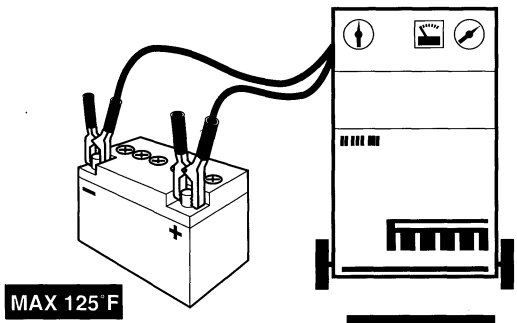
12.69 V or LOWER
RECHARGE BATTERY

STEP 5: RECHARGE IF NECESSARY

1 Determine the rate of charge. Compare the OCV measurement to the values in Tables A and B on the specification card. Charge only at the SLOW RATE.

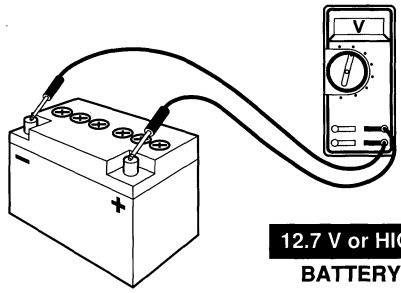
2 Remove the vent covers and charge the battery for the specified rate and time from Table B (SLOW RATE). Do not allow the electrolyte temperature to exceed 125°F during charging.

3 After the charge period, measure the battery open circuit voltage (OCV) as detailed on page 20. If the OCV is 12.7 or higher, the battery may be put into service or placed in new battery stock. Consult page 18 for storage details. If the OCV is 12.69 or lower, test the battery as detailed on pages 24 – 25.



MAX 125°F

SPEC. CARD



12.7 V or HIGHER
BATTERY OK

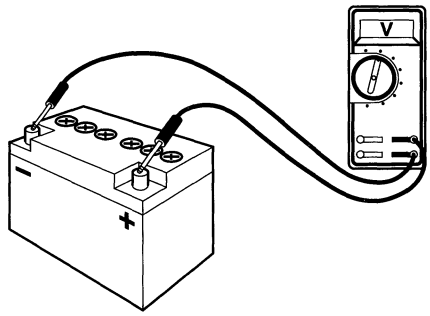
12.69 V or LOWER
TEST BATTERY

NEW BATTERY STORAGE AND CHARGING

A supply of fully-charged batteries should be maintained for immediate installation when necessary. This procedure is used to store and charge new batteries.

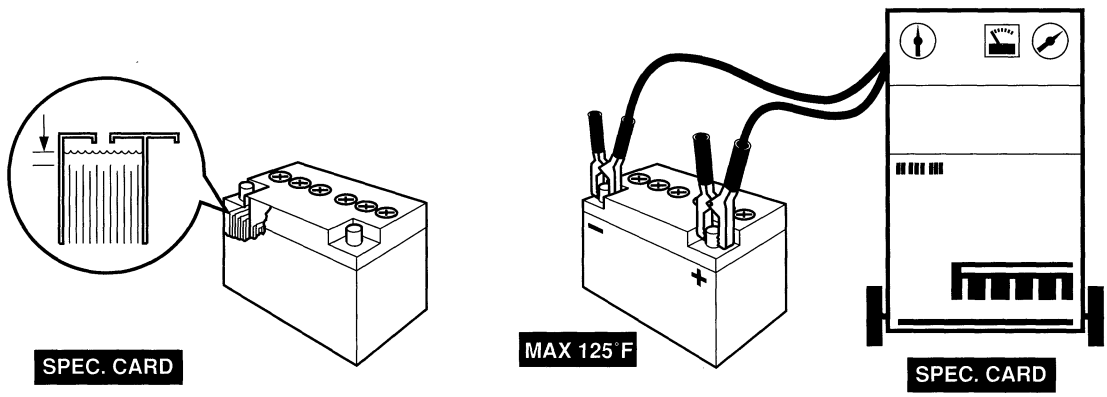
STEP 1: STORE THE BATTERY FOR 4-WEEK PERIODS

Providing that the battery open-circuit voltage (OCV) is 12.5 or higher, the battery may be stored for a 4-week period. At the end of the period, measure the OCV. If the OCV is 12.5 or higher, the battery may remain in stock for another 4-week period. If the OCV is 12.49 or lower, the battery requires service (STEP 2).



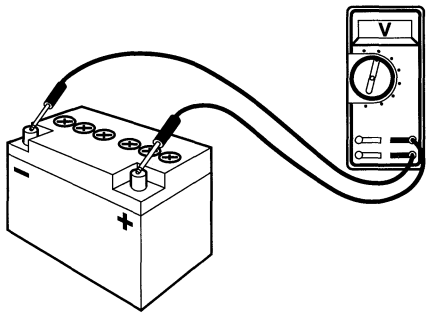
STEP 2: CHARGE THE BATTERY

1 Check the electrolyte level. Top-up to the specified level with distilled water.
2 Determine the rate of charge. Compare the OCV measurement to the values in Tables A and B on the specification card. Charge only at the SLOW RATE.
3 Remove the vent covers and recharge the battery for the specified rate and time from Table B (SLOW RATE). Do not allow the electrolyte temperature to exceed 125°F during charging.
4 After the charge period, measure the battery open circuit voltage (OCV) (STEP 3).



STEP 3: TEST THE OPEN CIRCUIT VOLTAGE

1 Measure the battery open-circuit voltage (OCV) as detailed on page 20. If the OCV is 12.7 or higher, the battery may be put into service or returned to stock. If the OCV is 12.2 to 12.69, recharge the battery (STEP 4). If the OCV is 12.19 or lower, test the battery as detailed on pages 24 – 25.



12.7 V or HIGHER
BATTERY OK

12.2 V to 12.69 V
RECHARGE BATTERY

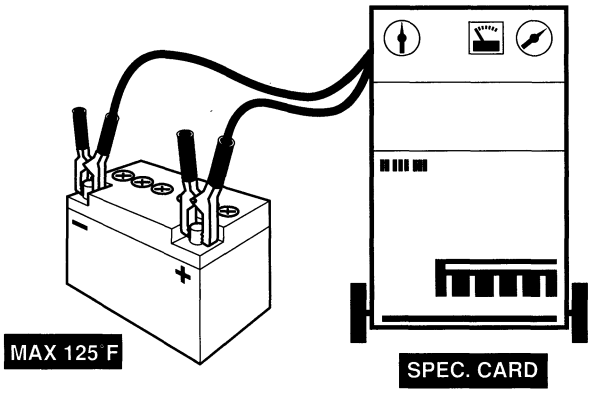
12.19 V or LOWER
TEST BATTERY

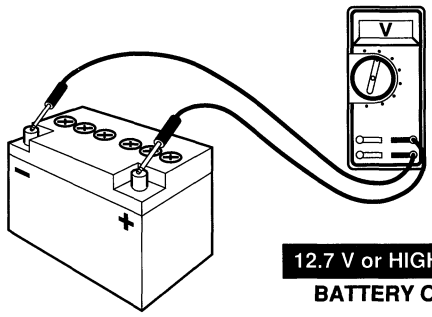
STEP 4: RECHARGE IF NECESSARY

1 Determine the rate of charge. Compare the OCV measurement to the values in Tables A and B on the specification card. Charge only at the SLOW RATE.

2 Remove the vent covers and recharge the battery for the specified rate and time from Table B (SLOW RATE). Do not allow the electrolyte temperature to exceed 125°F during charging.

3 After the charge period, measure the battery open-circuit voltage (OCV) as detailed on page 20. If the OCV is 12.7 or higher, the battery may be put into service or placed in stock. If the OCV is 12.69 or lower, test the battery as detailed on pages 24 – 25.





12.7 V or HIGHER
BATTERY OK

12.69 V or LOWER
TEST BATTERY

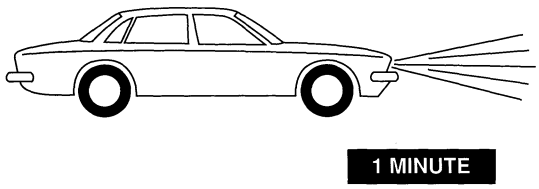
OPEN CIRCUIT VOLTAGE TEST

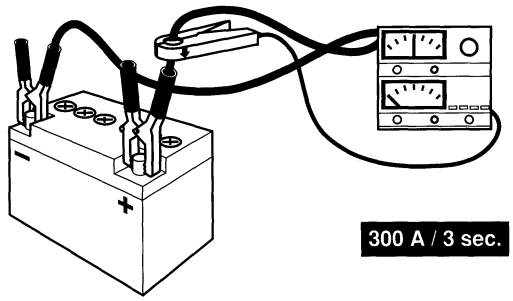
The open circuit voltage (OCV) test will indicate the battery state of charge. This test can be conducted with the battery installed in a vehicle.

STEP 1: REMOVE THE SURFACE CHARGE (IF NECESSARY)

1 **Battery in vehicle** — If the battery has been charged or the engine run in the previous 4 hours, remove the surface charge by switching on the headlights for 1 minute. Wait 5 minutes before proceeding to STEP 2.

2 **Battery removed from vehicle** — If the battery has been charged in the previous 4 hours, remove the surface charge with a discharge tester. Connect the discharge tester to the battery following the equipment manufacturer's instructions. Apply 300 amps for 3 seconds. Wait 5 minutes before proceeding to STEP 2.



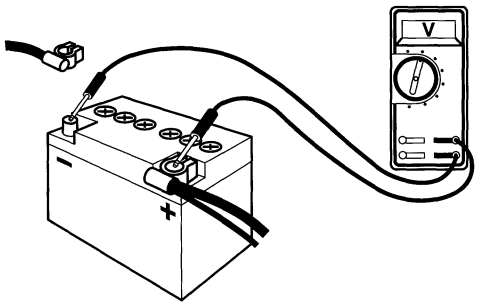


STEP 2: MEASURE THE BATTERY VOLTAGE

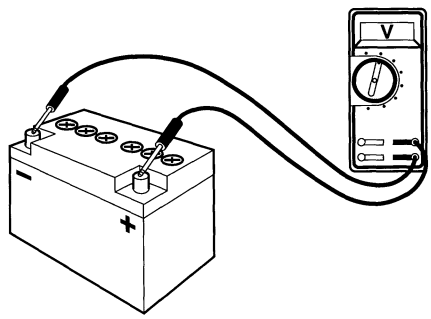
1 If the battery is installed in a vehicle, disconnect the negative cable.

2 Connect the multimeter across the battery terminals and record the voltage reading.

NOTE: If the transit isolation device is installed *and operating correctly*, it is not necessary to remove the negative cable.



BATTERY IN VEHICLE

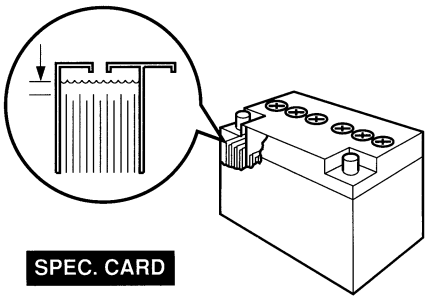


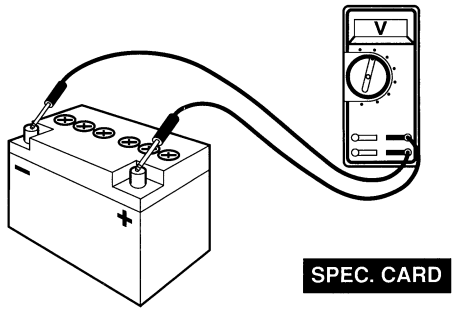
BATTERY REMOVED

This charging procedure should be used to charge a discharged but serviceable battery.

STEP 1: PREPARE THE BATTERY FOR CHARGING

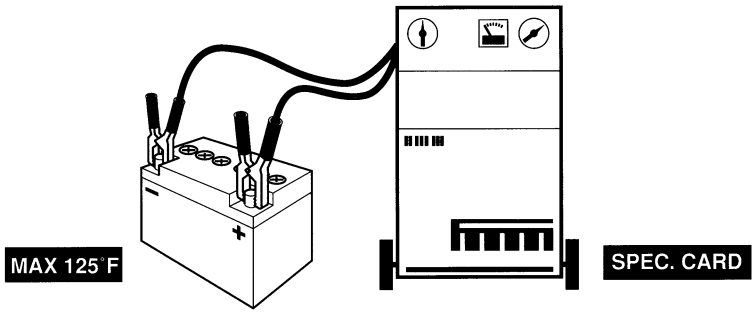
1 Check the electrolyte level. Top-up to the specified level with distilled water.
2 Measure the open circuit voltage (OCV) as detailed on page 20, or measure the specific gravity of the electrolyte with a hydrometer.
3 Compare the measurement to the values in Tables A and B on the specification card. Charge only at the SLOW RATE.





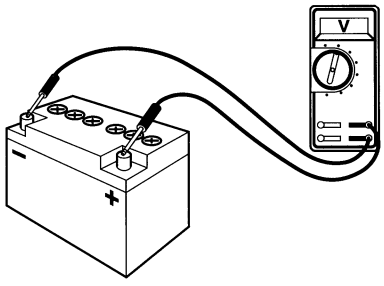
STEP 2: CHARGE THE BATTERY

1 Charge the battery for the specified rate and time from Table B (SLOW RATE). Do not allow the electrolyte temperature to exceed 125°F during charging.
2 After the charge period, measure the battery open circuit voltage (OCV) (STEP 3).



STEP 3: CHECK THE BATTERY STATE OF CHARGE

Measure the battery open circuit voltage (OCV) as detailed on page 20. If the OCV is 12.7 or higher, the battery may be returned to service. If the OCV is 12.2 to 12.69, recharge the battery (STEPS 1 and 2). If the OCV is 12.19 or lower, test the battery as detailed on pages 24 – 25.



12.7 V or HIGHER
BATTERY OK

12.2 V to 12.69 V
RECHARGE BATTERY

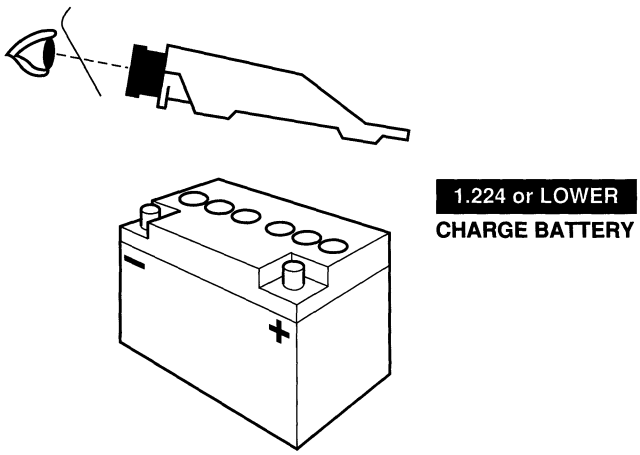
12.19 V or LOWER
TEST BATTERY

BATTERY LOAD TEST

This procedure is used to ensure that a battery is in satisfactory condition for service. The test should be used in conjunction with the battery test procedure on pages 24 – 25.

STEP 1: DETERMINE IF THE BATTERY REQUIRES CHARGING

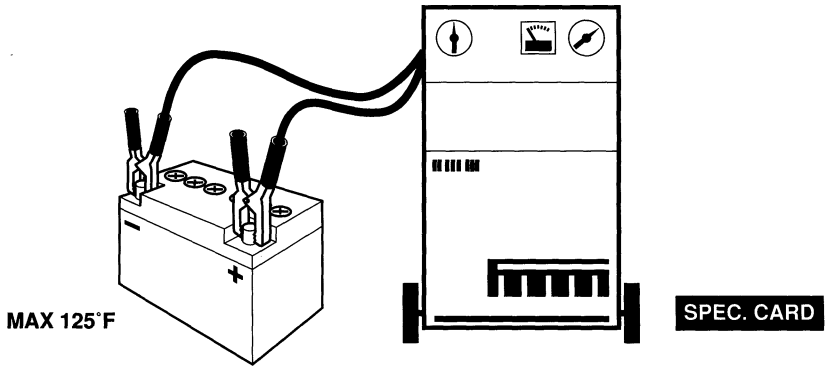
Measure the specific gravity of each battery cell. Ensure that the readings are temperature-compensated. If the lowest cell reading is 1.224 or lower, proceed to STEP 2. If the lowest cell reading is 1.225 or higher, proceed to STEP 3.



STEP 2: CHARGE THE BATTERY

1 Determine the rate of charge. Compare the OCV measurement to the values in Tables A and B on the specification card. Charge at the maximum rate for the initial charge; slow rate for recharge.

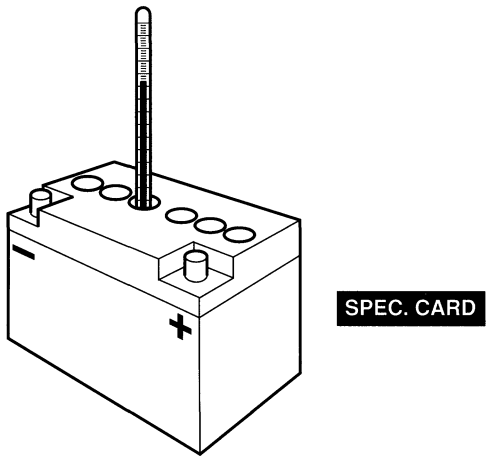
2 Charge the battery for the specified rate and time from Table B (MAXIMUM RATE — initial charge; SLOW RATE — recharge). Proceed to STEP 3. Do not allow the electrolyte temperature to exceed 125°F during charging.



STEP 3: DETERMINE THE LOAD TEST VALUES

1 Measure the battery electrolyte temperature in one of the center cells. Compare the temperature reading to the Table C temperatures on the specification card to determine the required minimum voltage reading when the battery is placed under load.

2 Consult the specification card for the battery cold-cranking amps (CCA) rating. The battery is loaded to 1/2 the CCA rating.



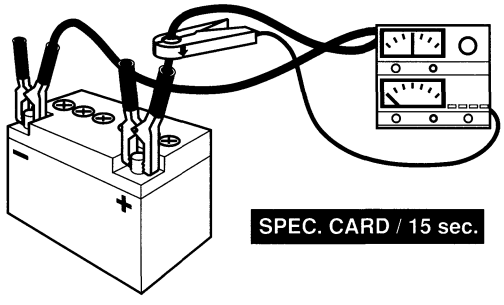
STEP 4: LOAD TEST THE BATTERY

1 Connect the load tester to the battery following the equipment manufacturer's instructions.

2 Apply the test current (1/2 of the CCA rating) to the battery for 15 seconds. Observe and record the battery voltage throughout the test. Immediately reduce the current to 0.

3 If the observed voltage is at or above the minimum voltage (Table C), the battery is OK for service.

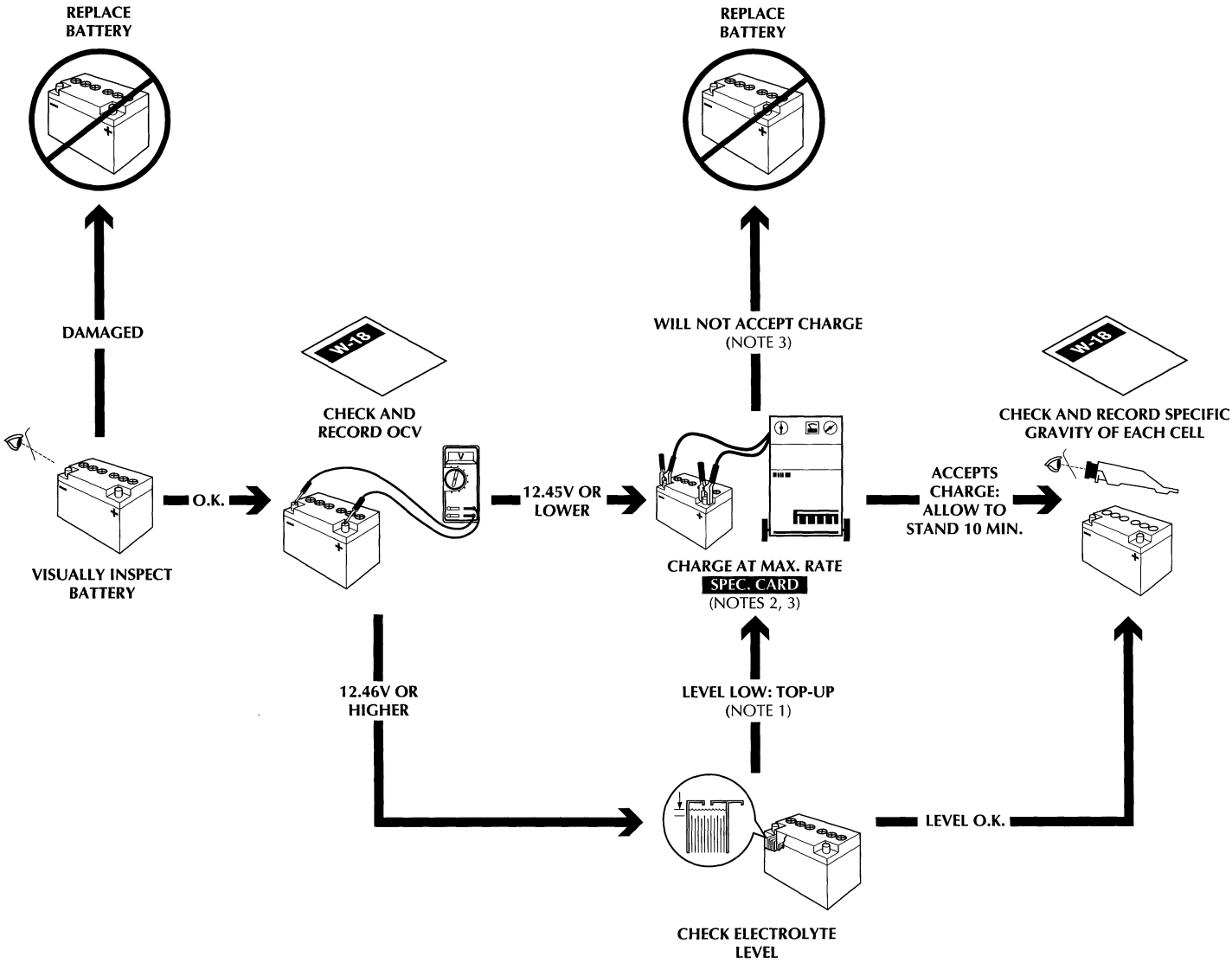
4 If the observed voltage is below the minimum voltage, the battery is defective.



BATTERY TEST PROCEDURE

The battery test procedure should be used to confirm the condition of a battery that is suspected to be defective. This test procedure follows the test procedure on the BATTERY TEST REPORT: FORM W-18. Form W-18, shown on pages 33 – 34, must be completed whenever a battery is tested.

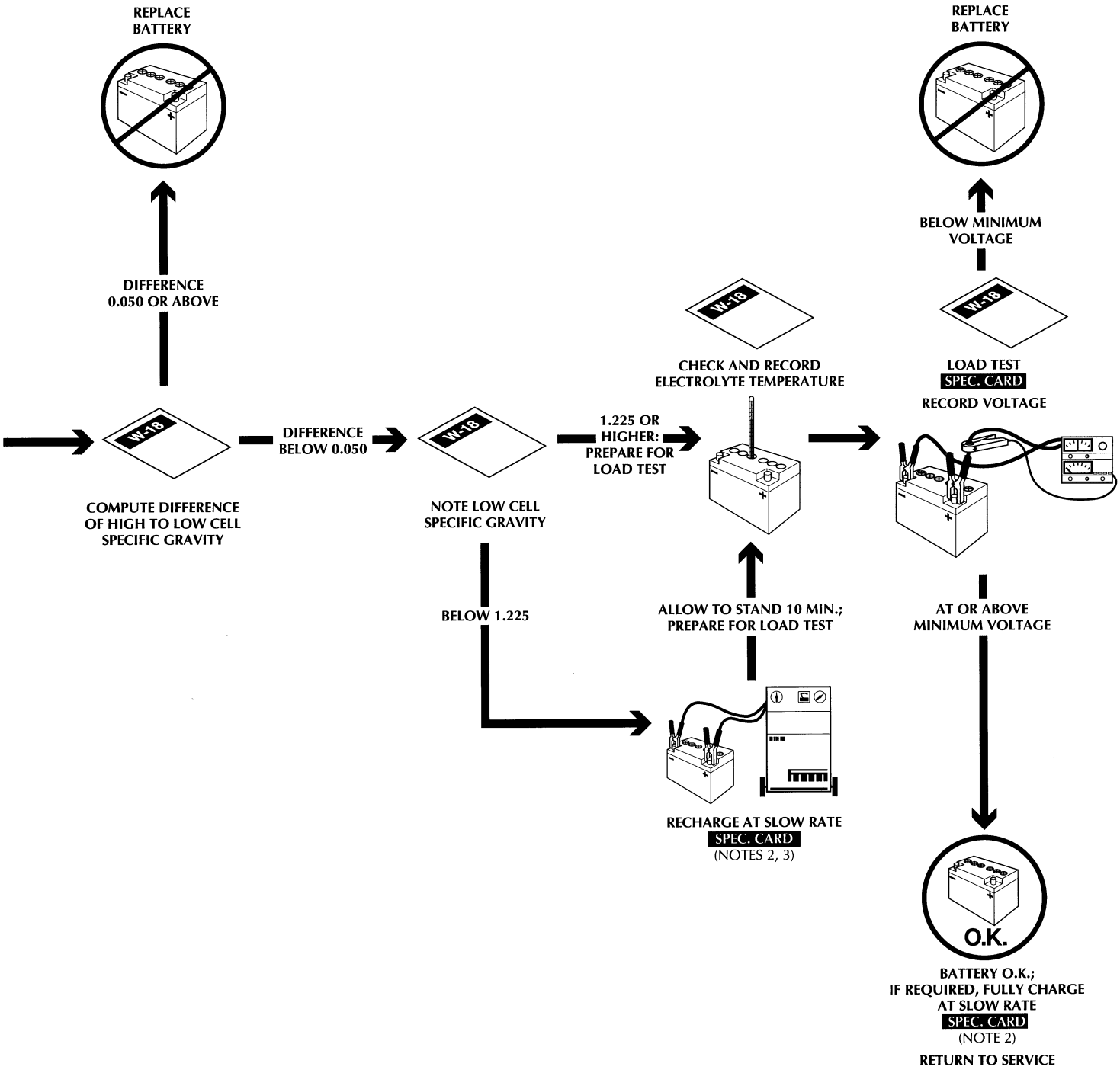
When conducting a battery test, use the service and test procedures detailed in this book for completing each step of the Test Procedure.



NOTE 1: Only use distilled water for topping up electrolyte.

NOTE 2: The electrolyte must not exceed 125°F during charging.

NOTE 3: A sulphated battery will not accept charge due to internal resistance. The specific gravity readings will be even but low (@ 1.18 or less), even after two charging cycles. Charge the battery for at least ten minutes before concluding that the battery will not accept a charge.

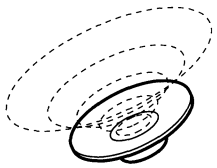

REPLACE BATTERY
DIFFERENCE 0.050 OR ABOVE
W-18
COMPUTE DIFFERENCE OF HIGH TO LOW CELL SPECIFIC GRAVITY
DIFFERENCE BELOW 0.050
W-18
NOTE LOW CELL SPECIFIC GRAVITY
BELOW 1.225
1.225 OR HIGHER: PREPARE FOR LOAD TEST
W-18
CHECK AND RECORD ELECTROLYTE TEMPERATURE
ALLOW TO STAND 10 MIN.; PREPARE FOR LOAD TEST
RECHARGE AT SLOW RATE
SPEC. CARD
(NOTES 2, 3)
REPLACE BATTERY
BELOW MINIMUM VOLTAGE
W-18
LOAD TEST
SPEC. CARD
RECORD VOLTAGE
AT OR ABOVE MINIMUM VOLTAGE
O.K.
BATTERY O.K.; IF REQUIRED, FULLY CHARGE AT SLOW RATE
SPEC. CARD
(NOTE 2)
RETURN TO SERVICE

QUIESCENT CURRENT TEST

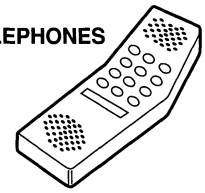
This procedure will measure the vehicle's quiescent current (current consumption with the ignition off).

STEP 1: DISCONNECT ALL ACCESSORIES

Disconnect all accessories such as security systems, telephones and radar detectors.



SECURITY SYSTEMS

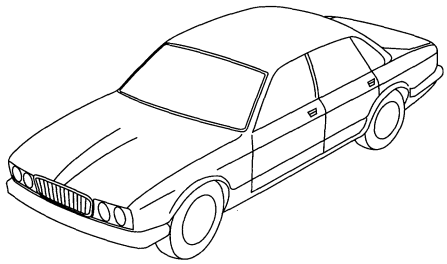


STEP 2: TURN OFF OR DISABLE ALL SWITCHED VEHICLE CIRCUITS

All switched vehicle circuits must be turned off or disabled. These circuits include interior and reading lights, door lights, trunk lights and passive restraint. Ensure that the passive restraint system is in the front docked position.

⚠ CAUTION: IF THIS STEP IS NOT PERFORMED, THE MULTIMETER FUSE MAY FAIL.

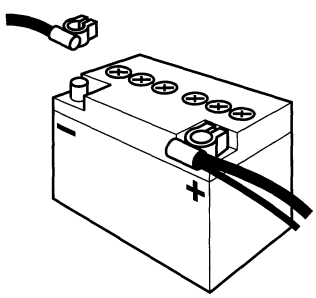
INTERIOR LIGHTS
READING LIGHTS
DOOR LIGHTS
TRUNK LIGHTS



PASSIVE RESTRAINT

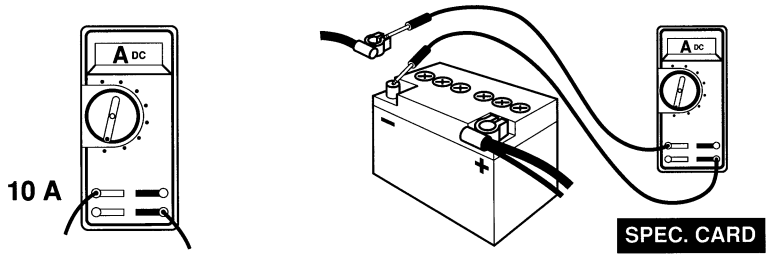
STEP 3: DISCONNECT THE BATTERY NEGATIVE CABLE AND TRANSIT ISOLATION DEVICE

1 Disconnect the battery negative cable.
2 If installed, disconnect the transit isolation device as detailed on page 29.



STEP 4: MEASURE THE INITIAL QUIESCENT CURRENT WITH THE RIDE LEVELING CIRCUIT OPERATING (SEDAN RANGE ONLY)

1 Set up the digital multimeter by connecting the meter leads to the COM and 10 A test sockets and selecting the DC amps scale.
2 Refer to the Specification Card for the initial quiescent current range and time periods.
3 Connect the COM test lead to the battery negative terminal and the positive test lead to the disconnected battery negative cable.
4 Observe the quiescent current and compare with the specifications shown on the Specification Card.
5 Remove the ride leveling fuse and continue to STEP 5.

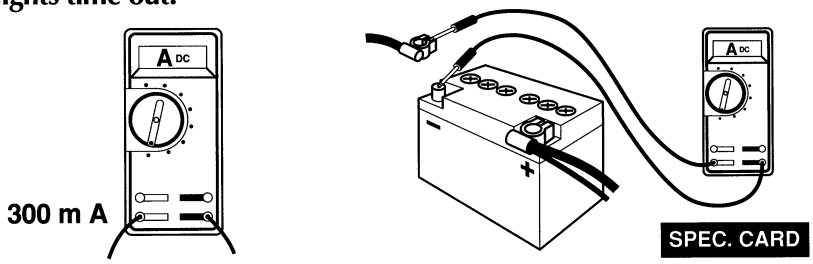


SEDAN RANGE — INITIAL QUIESCENT CURRENT

STEP 5: MEASURE THE QUIESCENT CURRENT

1 Set up the digital multimeter by connecting the meter leads to the COM and 300 mA test sockets and selecting the DC amps scale.
2 Refer to the Specification Card for the quiescent current range.
3 Connect the COM test lead to the battery negative terminal and the positive test lead to the disconnected battery negative cable.
4 Observe the quiescent current and compare with the specifications shown on the Specification Card.
5 If the quiescent current is higher than specified, refer to Quiescent Current Fault Finding (page 28).

NOTE: The quiescent current will be high (less than 300 mA) for approximately the first 20 seconds as the interior lights time out.



STEP 6: MEASURE THE QUIESCENT CURRENT WITH ACCESSORIES CONNECTED

1 Reconnect the vehicle accessories, one at a time.
2 Measure the quiescent current as each accessory is connected.
3 Observe the quiescent current and compare with the accessory specifications shown on the Specification Card.
4 If the quiescent current is higher than specified, repair the accessory.

QUIESCENT CURRENT FAULT FINDING

The circuits, components and fuses included in this procedure are detailed in the applicable electrical guide. If the quiescent current is higher than specified, connect the multimeter as instructed in STEP 5 on the previous page and proceed as follows:

STEP 1: ENSURE THAT ALL ACCESSORIES ARE DISCONNECTED

1 Ensure that all accessories, such as security systems and telephones, are disconnected.

STEP 2: ENSURE THAT ALL SWITCHED VEHICLE CIRCUITS ARE TURNED OFF OR DISABLED

1 Ensure that all switched vehicle circuits are turned off or disabled. These circuits include interior and reading lights, door lights, trunk lights and passive restraint.
2 Ensure that the passive restraint system is in the front docked position.

STEP 3: CHECK FUSED BATTERY FEED CIRCUITS

1 One at a time, remove the fuses from the battery feed circuits. Be sure to maintain the correct order for reinstallation.
2 As each fuse is removed, observe the ammeter. If the current falls when a fuse is removed, investigate that circuit.
3 Refer to the Electrical Guide wiring diagram and disconnect connectors and components until the cause of the high current is found.
4 Continue removing fuses until all battery feed fuses are removed. If the quiescent current is still too high, continue to STEP 4.

STEP 4: CHECK BATTERY FEED CIRCUITS CONTAINING IN-LINE FUSES

1 Repeat the STEP 3 procedure for the battery feed circuits containing in-line fuses. If the quiescent current is still too high, continue to STEP 5.

STEP 5: CHECK CIRCUITS CONTAINING RELAYS

1 One at a time, remove all relays. Be sure to maintain the correct order for reinstallation.
2 As each relay is removed, observe the ammeter. If the current falls when a relay is removed, investigate that circuit.
3 Refer to the Electrical Guide wiring diagram and disconnect connectors and components until the cause of the high current is found.
4 Continue removing relays until all are removed. If the quiescent current is still too high, continue to STEP 6.

STEP 6: CHECK UNFUSED BATTERY FEED CIRCUITS

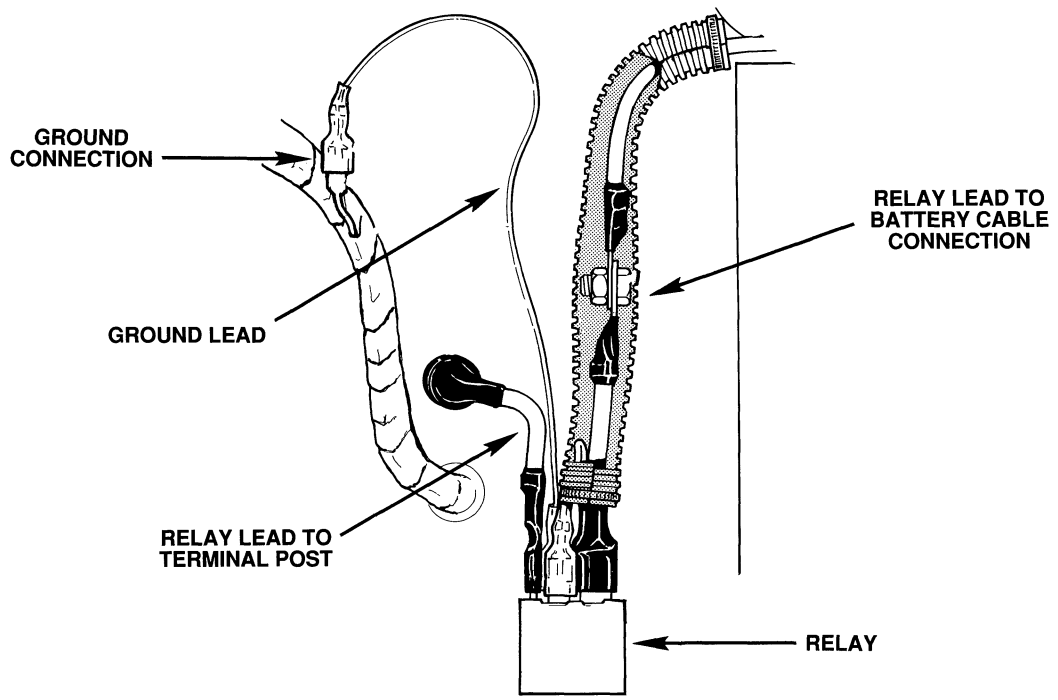
If the quiescent current is still too high with all battery feed fuses removed, and relays disconnected, the fault is located in one of the unfused battery feed circuits. Consult the Electrical Guide to identify these circuits. Be sure to include the alternator and starter circuits.

TRANSIT ISOLATION DEVICE REMOVAL

Disconnect the transit isolation device to perform pre-delivery inspection, then reconnect. Remove the transit isolation device 24 hours before vehicle delivery to the customer.

DISCONNECT PROCEDURE

1 Disconnect the ground lead at the relay.
2 Disconnect the relay lead from the right terminal post.
3 Remove the nut and bolt joining the battery cable to the other relay lead.
4 Connect the battery cable to the right terminal post.
5 Reverse the sequence to reconnect the transit isolation device.



REMOVAL PROCEDURE

1 Disconnect the ground lead at the harness spade connector.
2 Insulate the spade connector and tape it to the harness.
3 Disconnect the relay lead from the right terminal post and remove the rubber boot.
4 Remove the nut and bolt joining the battery cable to the other relay lead.
5 Install the rubber boot on the battery cable and connect the battery cable to the right terminal post.
6 Position the rubber boot over the terminal.
7 Remove the relay and associated wiring.
8 After removal of the transit isolation device, manually operate the door locks twice to bring them into sequence. All vehicle functions will return to normal. Set the radio and clock.

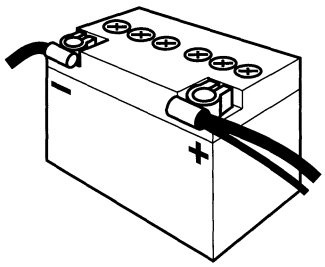
⚠ CAUTION: THE HARNESS GROUND CONNECTOR MUST BE CAREFULLY INSULATED AND SECURED TO PREVENT INADVERTENT SWITCHING ON OF THE IGNITION.

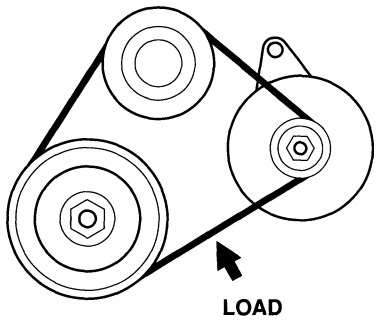
CHARGING SYSTEM TEST

The battery condition must be determined and corrected if necessary before performing a charging system test. The circuits included in this procedure are detailed in the applicable electrical guide.

STEP 1: PRELIMINARY CHECKS

1 Ensure that the battery connections are clean and tight.
2 The alternator drive belt must be in good condition and have the correct tension as specified on the Specification Card.
3 Adjust the alternator belt tension with the jack screw.

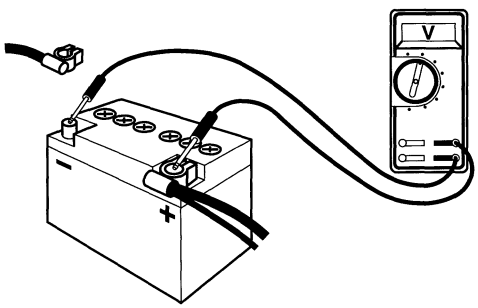


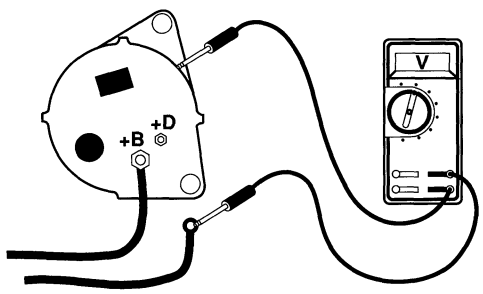


SPEC. CARD

STEP 2: CHECK CONNECTIONS AND CONTINUITY

1 Observe the charging warning indicator in the instrument pack when the ignition is switched on. Do not start the engine. If the warning indicator does not light, a fault exists in the warning indicator circuit. Switch the ignition off.
2 Measure and record the battery open-circuit voltage (OCV) as detailed on page 20.
3 Remove the +D (IND) lead at the alternator.
4 Switch on the ignition, but do not start the engine.
5 Check the voltage at the +D (IND) lead terminal and compare with the specification. If the voltage is less than specified, a fault exists in the circuit between the battery and the alternator +D (IND) terminal.

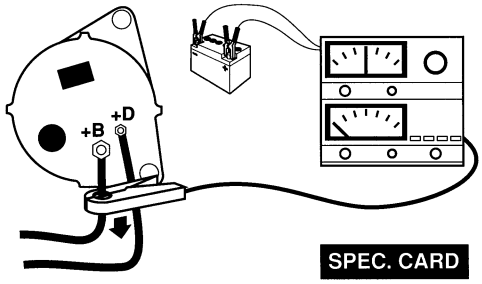




SEDAN RANGE	MAX 1.5 V LOWER THAN OCV
XJ-S RANGE	MAX 1 V LOWER THAN OCV

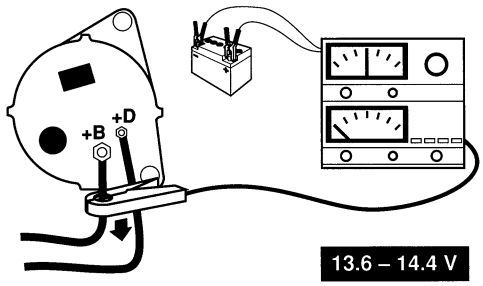
STEP 3: CHECK ALTERNATOR OUTPUT

1 Connect the discharge tester inductive ammeter pick-up to the alternator +B (MAIN) lead at the alternator as indicated.
2 Connect the tester positive and negative cables to the battery.
3 Run the engine at 3000 rpm and load the battery until the voltage drops to the value specified on the Specification Card.
4 Observe the ammeter when the specified voltage is reached and record the ammeter reading.
5 Compare the reading to the alternator output specification on the Specification Card. If the alternator output does not reach the specification, a fault exists within the alternator assembly.



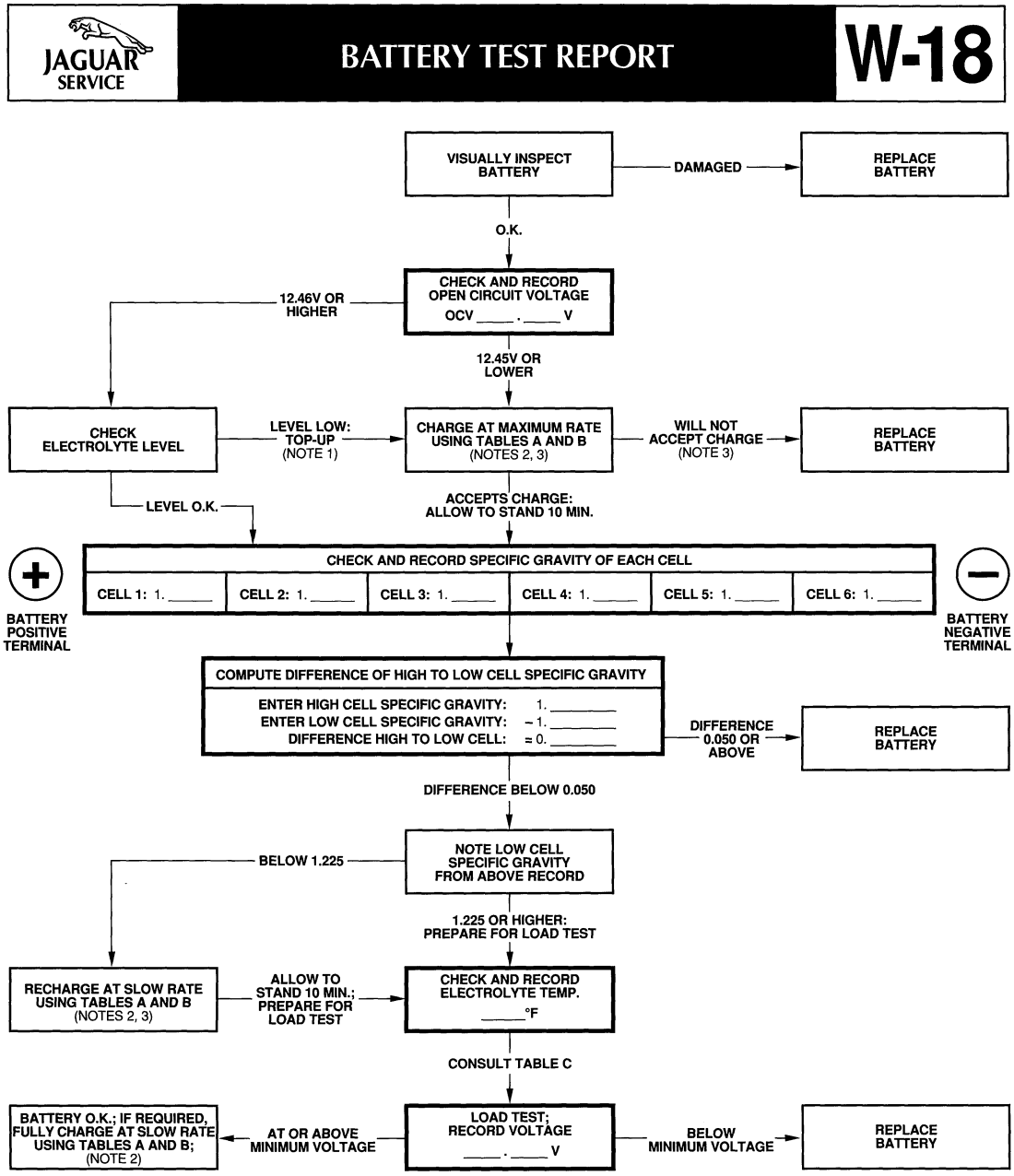
STEP 4: CHECK REGULATOR OPERATION

1 With the tester connected as in STEP 3, run the engine at 3000 rpm.
2 When the charging amperage drops to 15 amps or lower, the voltage should read 13.6 – 14.4 volts. If the voltage is not within specification, replace the alternator and retest.



BATTERY TEST REPORT

BATTERY TEST REPORT: FORM W-18 must be completed whenever a battery is tested. The procedures on FORM W-18 follow procedures detailed in this publication, which should be consulted whenever a battery is tested. The form is shown here for information purposes only and is not intended for workshop use.



VIN _____ MILEAGE _____ BATTERY P/N _____

DEALER _____ R.O. NUMBER _____

SERVICE MANAGER SIGNATURE _____ DATE _____

DSM SIGNATURE _____ ACCEPT ____ REJECT ____ DATE _____

SEE REVERSE SIDE FOR TABLES A, B & C AND NOTES 1, 2 & 3

TABLE A — BATTERY STATE OF CHARGE					
OPEN CIRCUIT VOLTAGE	**12.70V**	**12.45V**	**12.20V**	**12.00V**	**11.80V**
SPECIFIC GRAVITY (Temp. compensated hydrometer)	**1.270**	**1.225**	**1.190**	**1.150**	**1.120**
% CHARGED	**100%**	**75%**	**50%**	**25%**	**0**

TABLE B — RATE OF CHARGE			
BATTERY CONDITION		CHARGE RATES	
SPECIFIC GRAVITY (Temp. compensated hydrometer)	STATE OF CHARGE	MAXIMUM CHARGE RATE / TIME	SLOW CHARGE RATE / TIME
1.190 – 1.225	**50% – 75%**	**20 amps / 60 min.**	**5 amps / 120 min.**
1.150 – 1.190	**25% – 50%**	**30 amps / 60 min.**	**10 amps / 120 min.**
1.120 – 1.150	**0 – 25%**	**40 amps / 60 min.**	**15 amps / 120 min.**

TABLE C — LOAD TEST		
TEST LOAD	ELECTROLYTE TEMPERATURE	MIN. VOLTAGE UNDER 15 SEC. LOAD
LOAD TO 1/2 BATTERY COLD CRANKING AMPS (CCA) RATING SEE SPECIFICATION CARD PROVIDED WITH PUBLICATION S-70, ELECTRICAL SYSTEM — BATTERIES AND CHARGING: SECOND EDITION	**70°F**	**9.6**
	60	**9.5**
	50	**9.4**
	40	**9.3**
	30	**9.1**
	20	**8.9**
	10	**8.7**
	0	**8.5**

NOTE 1: ONLY USE DISTILLED WATER FOR TOPPING UP ELECTROLYTE.

NOTE 2: THE ELECTROLYTE MUST NOT EXCEED 125°F DURING CHARGING.

NOTE 3: A SULPHATED BATTERY WILL NOT ACCEPT CHARGE DUE TO INTERNAL RESISTANCE. THE SPECIFIC GRAVITY READINGS WILL BE EVEN BUT LOW (@ 1.18 OR LESS), EVEN AFTER TWO CHARGING CYCLES. CHARGE THE BATTERY FOR AT LEAST TEN MINUTES BEFORE CONCLUDING THAT THE BATTERY WILL NOT ACCEPT A CHARGE.

FOCUS

NOTES

SPECIFICATIONS

BATTERY SPECIFICATIONS (1988 MY – ON)

	AMP HOUR RATING	RESERVE CAPACITY	COLD CRANKING AMPS	FILL LEVEL
CHLORIDE BLUE TYPE 175	**60**	**110 min.**	**520 amps**	**4 – 6 mm above plate**
CHLORIDE WHITE TYPE 440	**45**	**75 min.**	**420 amps**	**4 – 6 mm above plate**
VARTA WHITE TYPE DIN55	**52**	**85 min.**	**430 amps**	**4 – 6 mm above plate (MAX/MIN mark on case)**

Interchangeability:
Varta White can be used as replacement for both Chloride batteries. DO NOT REPLACE THE VARTA WHITE WITH A CHLORIDE BATTERY.

TABLE A — BATTERY STATE OF CHARGE

OPEN CIRCUIT VOLTAGE	**12.70V**	**12.45V**	**12.20V**	**12.00V**	**11.80V**
SPECIFIC GRAVITY (Temp.-compensated hydrometer)	**1.270**	**1.225**	**1.190**	**1.150**	**1.120**
% CHARGED	**100%**	**75%**	**50%**	**25%**	**0**

TABLE B — RATE OF CHARGE

BATTERY CONDITION		CHARGE RATES	
SPECIFIC GRAVITY (Temp.-compensated hydrometer)	STATE OF CHARGE	**MAXIMUM** CHARGE RATE / TIME	**SLOW** CHARGE RATE / TIME
1.190 – 1.225	**50% – 75%**	**20 amps / 60 min.**	**5 amps / 120 min.**
1.150 – 1.190	**25% – 50%**	**30 amps / 60 min.**	**10 amps / 120 min.**
1.120 – 1.150	**0 – 25%**	**40 amps / 60 min.**	**15 amps / 120 min.**

TABLE C — LOAD TEST

TEST LOAD	ELECTROLYTE TEMPERATURE	MIN. VOLTAGE UNDER 15 SEC. LOAD
LOAD TO 1/2 BATTERY COLD CRANKING AMPS (CCA) RATING (SEE BATTERY SPECIFICATIONS)	**70°F**	**9.6**
	60	**9.5**
	50	**9.4**
	40	**9.3**
	30	**9.1**
	20	**8.9**
	10	**8.7**
	0	**8.5**

QUIESCENT CURRENT

	INITIAL CURRENT*	STEADY CURRENT
SEDAN RANGE	**0.32 – 0.48 amps**	**40 milliamps MAXIMUM**
XJ-S RANGE	**N/A**	**18 milliamps MAXIMUM**

*The initial high current should continue for approximately the first eight minutes, then decrease significantly.
The initial high current is caused by the ride leveling system seeking its trim height and by the interior lights timing out.

QUIESCENT CURRENTS — JAGUAR APPROVED ACCESSORIES

	QUIESCENT CURRENT
ALARM SYSTEM: DIRECTED ELECTRONICS (valet switch under steering column)	**23 milliamps MAXIMUM**
ALARM SYSTEM: SCS (valet switch in center console)	**25 milliamps MAXIMUM**
TELEPHONE: PANASONIC	**8 milliamps MAXIMUM**

CHARGING SYSTEM

	SEDAN RANGE		XJ-S RANGE	
	New belt	In-service belt	New belt	In-service belt
ALTERNATOR BELT TENSION	**135 lbs load**	**115 lbs load**	**79 lbs load**	**70 lbs load**
	SEDAN RANGE		XJ-S RANGE	
	1988 – 89 MY	1990 MY – ON	(Lucas A133)	(Bosch)
ALTERNATOR OUTPUT	**90 amps**	**115 amps**	**75 amps**	**115 amps**

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