CARS

SERVICE BULLETIN CLASS 4

Date: 06.03.2019 **Model: All Models Fitted with an Optional Lithium Battery Pack** **Number: 2019/04**

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Service Manager		Service Reception		Lotus Technicians		Parts Manager	

TITLE:
Importance of lithium battery maintenance and adhering to the stages required for performing the correct charging and test procedures.

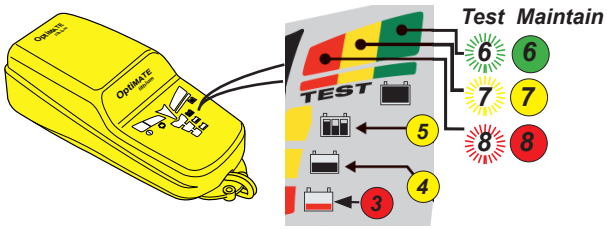
REASON:
It is possible that some lithium batteries have been irreparably damaged because of they have not been maintained whilst the vehicle is in storage or have been diagnosed as irreparably damaged because the correct charging procedure has not been carried out.

Background
Lithium batteries continue to slowly self-discharge when not in use (such as when the vehicle is in storage), but compared to standard lead-acid type batteries, the rate of discharge will remain reasonably stable between 13.2V down to 10V, but then will rapidly discharge as the battery voltage falls below 10V.

Although the battery protection voltage device will activate at this time, so isolating the battery from the vehicle, (refer to Technical Service Bulletin TSB 2018/17) the lithium battery will continue to self-discharge, but potentially at a more rapid rate than an equivalent lead-acid type battery.

ACTION:
From the time of delivery from the factory and whilst the vehicle is in storage, Lotus recommends:

- The LED status indicator light located on the top of the battery protection device is monitored to ensure that it remains illuminated. With the battery connected or disconnected from the vehicle, use the lithium battery tester/charger supplied with the vehicle to perform a 'Maintenance Charge Cycle'.



- Once connected, LED status indicator #6, 7 or 8 light on the tester/charger will initially flash for 10 seconds as a 'Pre-Qualification Test' is being carried out to assess the batteries condition prior to beginning the 'Maintenance Charge Cycle'.

- If the LED status indicator #6 light is then constantly illuminated, then this means that the initial nominal battery voltage and condition was satisfactory to begin the 'Maintenance Charge Cycle';

  But;

- If indicator #6 light is extinguished and indicator #3,4 or 5 lights are illuminated instead, then this means that the battery charge has dropped below the recommended nominal voltage and that a full battery recovery/deep charge/retention test cycle (shown as stages 2 - 5 on the following pages), is in progress to confirm the battery overall condition. During this period the battery **IS NOT BEING CHARGED, DO NOT** remove the tester/charger from the battery as this process **MAY TAKE MORE THAN 24 HOURS TO COMPLETE!**

The battery is only going through a 'Maintenance Charge Cycle' when LED status indicator #6 light is constantly illuminated and only being 'Charged' when the LED 'Charge' indicator #4 light is illuminated.

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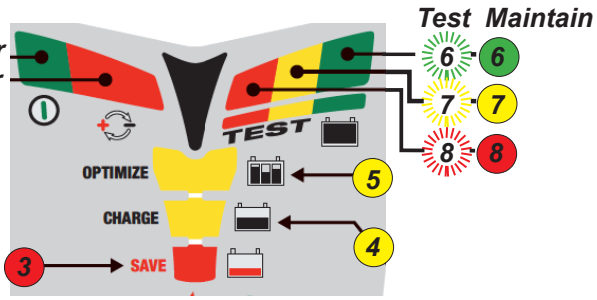

The following procedure describes the testing and charge cycle stages carried out by the tester/charger in the event that the initial battery charge has fallen below an acceptable level.

Time period: 10 seconds

Stage 1. Pre-Qualification Test

Dependent upon the battery condition*, any of test indicator lights #6, 7 or 8 will flash, testing the: - Battery condition prior to charging
- Ambient temperature acceptable for charging to commence

Pass ***Fail***

*Note: A pre-qualification test ***Pass*** = Indicator light #6 constantly illuminated.

Time period: 2 - 6 hours (cumulative)

Stage 2. Safe Low Voltage Recovery

This mode will automatically engage option 1 or 2 if the battery is more that 90% discharged or the voltage is below 12.8V. The red SAVE **indicator light #3** will illuminate and the charge current is adjusted to the battery voltage and ambient temperature readings taken during the 'Pre-Qualification Test'.

Option 1 (if required) Very Low Voltage Save: A low charging current is applied, the Tester/Charger will monitor the progress of the battery voltage, increasing the charge rate if the battery voltage rises within an acceptable time period. If the battery voltage does not increase and rise above 8.8V within 2 hours, charging will stop and the red TEST *Indicator light #8* will flash indicating the battery may be permanently damaged.

Option 2 (Mandatory) Low Voltage Save: if the battery voltage has risen or was originally above 8.9V (but below 12.8V), a higher charge rate is applied to the battery, again the Tester/Charger will monitor the progress of the battery voltage and battery condition. If the battery condition is acceptable the Tester/Charger will start a 'Charge' mode within 4 hours. If the battery condition is not acceptable then again, the red TEST **Indicator light #8** will flash indicating the battery may be permanently damaged.

Time period: up to 12 hours (cumulative)

Stage 3. Normal Charge

If the Tester/Charger determines the battery condition is acceptable after stage 2 has concluded, the battery will now begin the charge procedure and the yellow CHARGE **Indicator light #4** will illuminate. The rate of charge is determined by the ambient air temperature, current vehicle charge, battery condition and battery capacity (Ah).

Time period: up to 18 hours (cumulative)

Stage 4. Optimize

Once the battery voltage reaches 14.3V during 'Charge' mode the Tester/Charger will begin 'Optimize' mode and **Indicator light #5** will illuminate. The current control program within the Tester/Charger will apply pulses of current resulting in the battery voltage to vary and equalize the individual cell charge levels within the battery. If, after this procedure the battery charge level is deemed:

- Acceptable - No further charging, the Tester/Charger will begin the Voltage Retention Test.
- Unacceptable – The battery will be charged further, maximum charging time period during 'Optimize' mode will not exceed half the time the battery was in 'Normal Charge' mode.

Continued...

Time period: up to 30 hours (cumulative)

Stage 5. Voltage Retention Test

With the Tester/Charger still connected, charging ceases for 12 hours to determine the if battery can retain the charge. At the beginning of this test the green TEST **Indicator light #6** will flash. Note: During this test, a small load is applied to the cells to remove surface charge and improve the accuracy of the test results.

- For batteries in good condition, the green TEST **Indicator light #6** will continue to flash for the full duration of the test and once completed, the maintenance **Indicator lights #6, 7 or 8** will remain constantly illuminated to show that the battery is now in the 'Maintenance Charge Cycle' stage.
- If the voltage decreases below 12.8V within the 30 minutes of beginning the test, then the test will be suspended and the red TEST **Indicator light #8** will flash indicating the battery may be permanently damaged.

Stage 6. Maintenance Charge

For batteries in good condition **Indicator light #6** will remain constantly illuminated with the battery being maintenance charged until the Tester/Charger is disconnected.

NOTE: Even once charged, if the LED on the top of the voltage protection device IS NOT illuminated, then this indicates that the voltage protection device requires manually resetting because it is still isolating the battery from the vehicles electrical system.

The charging stages shown in this bulletin are revised extracts taken from the manufacturers' (Optimate) Tester/Charger instruction manual which are also supplied with any vehicle originally fitted with a lithium battery, an manufacturers instruction manual is also available on-line.

IMPORTANT POINTS TO CONSIDER

- The battery is only going through a 'Maintenance Charge Cycle' when **LED status indicator #6 light** is constantly illuminated.
- The battery is only going through a 'Charge Cycle' when **LED 'Charge' indicator #4 light** is illuminated.
- **If the battery fails the initial stage 1 'Pre-Qualification Test' it may take up to 30 hours to fully recharge the battery to an acceptable state before a 'Maintenance Charge Cycle' can be applied.**
- **The lithium battery of any vehicle (new or otherwise) which is being stored within the dealership for any length of time, should be connected to the tester/charger to maintain satisfactory battery performance.**
- **A lithium battery that becomes too deeply discharged the only solution will be to replace it, which may not be covered under the terms of the vehicle warranty.**

Warranty Pre-Authorisation requests should not be submitted until the battery has been subjected to the complete testing/charge cycle as described in this bulletin, the results of readings taken and charging duration times may also be requested from the Warranty Department before authorisation for replacement under warranty is considered.

CHARGES:
No warranty charges are associated with the contents of this bulletin.

Ends.