

SEATING

DIAGNOSIS AND TESTING

PRINCIPLES OF OPERATION

For a detailed description of the Heater Mats, refer to the relevant Description and Operation section in the workshop manual. REFER to: (501-10 Seating)

INSPECTION AND VERIFICATION

CAUTION:

Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:

- If a control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.
- Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

MECHANICAL	ELECTRICAL
<ul style="list-style-type: none">• Seat heater switches	<ul style="list-style-type: none">• Fuses• Wiring harnesses and connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
Seat heating performance poor or inoperative	<ul style="list-style-type: none"> Seat heater element circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> GO to Pinpoint Test A

SEAT HEATER MAT FAULTS - DIAGNOSTIC GUIDANCE

- Seat Heater Sensor Faults** - Each seat has two heating elements: one in the base (seat cushion), and one in the back (squab). There is only one sensor, which is located in the base. This sensor controls both heating elements. If there is a fault with the sensor signal, neither element will operate. If the signal fault is traced to the sensor itself (in the base/seat cushion mat), there is no need to replace the back/squab heater mat.
- Diagnosis Of Seat Heater Elements Using Resistance Measurements** - The back/squab heater mat consists of a heating element, the base/seat cushion heater mat consists of a heating element with a sensor. Most faults can be confirmed by simple electrical resistance measurements, using the values listed below. It is possible that the sensor could develop a fault causing it to exhibit either higher resistance (resulting in the seat heaters operating at too high a temperature), or lower resistance (resulting in the seat heaters operating at too low a temperature or not at all), but these kinds of faults are uncommon. The maximum resistance of the seat elements are only about 1 ohm each under normal operation, so it is difficult to take an exact reading with a standard multimeter. However, the most likely cause of failure is breaks in a number of the heater element wires, which causes both a significant loss of heating and a corresponding significant increase in resistance. In this situation, both (seat cushion AND squab) elements produce less heat, but contrary to expectation, it is the undamaged element which will show the greatest loss of heating. Given this, suspected seat heater element failures should always be confirmed by electrical resistance tests before replacement. Do not replace components based only on temperature performance.
- Simultaneous Failure of Both Seat Heater Mats Is Unlikely** - The base/seat cushion and back/squab seat heater elements connect to the automatic temperature control module, but the control module only acts as a splice box and the elements are electrically wired in series (each drawing proportion of battery voltage). The only way for one element to operate while the other is faulty is if one of the elements has a short-circuit fault. Under normal circumstances, where short-circuit faults are present these will be detected by the automatic temperature control module which will switch off both elements. Similarly, if the sensor (in the base/seat cushion element) is faulty, the automatic temperature control module will not apply voltage to the elements and, if one element is open-circuit, then no voltage can be supplied to the other element. Given this, while it may often be the case that both elements cease to operate, it is extremely unlikely that both heater mats are faulty. Consequently, if a fault is confirmed with one of the seat heater mats, do not also replace the other.
- Seat Heater Sensor Open Circuit Faults** - Previous investigations have found the mostly likely failure mode to be associated with the seat heater sensor (in the base/seat cushion element) developing an open-circuit fault. This can be measured by disconnecting the 4-way plug from the automatic temperature control module, and (Test 1) testing the circuit into the harness; if an open-circuit fault is detected, then

test the circuit at the connector under the seat (Test 2). If the open-circuit fault is present both at Test 1 and Test 2, then suspect the seat heater sensor and replace the base/seat cushion element. If the open circuit fault is detected at Test 1 but NOT at Test 2, then the harness is most likely faulty. It may not be necessary to check for DTCs (which log in the automatic temperature control module), but if this is done: B103A-01 = Right Front Seat Heater Sensor fault; B1038-01 = Left Front Seat Heater Sensor fault.

SEAT HEATER MAT APPLICATION CHART

NOTE:

To ensure an accurate resistance reading, calibrated test equipment **must** be used.

C3542-2 and C3542-3 C3543-1 and C3543-2 NTC resistor

VEHICLE /YEAR	CUSHION / BACKREST	HEATER MAT / NTC RESISTOR	LEFT HAND DRIVE		RIGHT HAND DRIVE		MINIMUM RESISTANCE	MAXIMUM RESISTANCE
Discovery 3 (L319) 2006	Cushion	Heater element	C2950-1 and C2950-4	C0085-1 and C0085-4	C2950-1 and C2950-4	C0085-1 and C0085-4	0.75	1.00
		NTC resistor	C2950-2 and C2950-3	C0085-2 and C0085-3	C2950-2 and C2950-3	C0085-2 and C0085-3	4000	10000
	Backrest	Heater element	connected in series	connected in series	connected in series	connected in series	0.44	0.59
Discovery 4 (L319) 2010	Cushion	Heater element	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	0.70	1.00
		NTC resistor	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	4000	10000
	Backrest	Heater element	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	0.40	0.70

VEHICLE /YEAR	CUSHION / BACKREST	HEATER MAT / NTC RESISTOR	LEFT HAND DRIVE		RIGHT HAND DRIVE		MINIMUM RESISTANCE	MAXIMUM RESISTANCE
Range Rover Sport (L320) 2010	Cushion	Heater element	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	0.93	1.25
		NTC resistor	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	4000	10000	
	Backrest	Heater element	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	0.43	0.60	
Freelander 2 (L359)	Cushion	Heater element	C3HS08 C-1 and C3HS08 C-4	C3HS03 C-1 and C3HS03 C-4	C3HS08 C-1 and C3HS08 C-4	C3HS03 C-1 and C3HS03 C-4	0.80	1.00
		C3HS08C-2 and C3HS08C-3	C3HS03 C-2 and C3HS03 C-3	C3HS08 C-2 and C3HS08 C-3	C3HS03 C-2 and C3HS03 C-3	4000	10000	
	Backrest	Heater element	C3HS08 B-1 and C3HS08 B-2	C3HS03 B-1 and C3HS03 B-2	C3HS08 B-1 and C3HS08 B-2	C3HS03 B-1 and C3HS03 B-2	0.50	0.70
Range Rover (L322) 2010	Cushion	Heater element	C0969-1 and C0969-4	C2090-1 and C2090-4	C2090-1 and C2090-4	C0969-1 and C0969-4	0.67	0.90
		NTC resistor	C0969-2 and C0969-3	C2090-2 and C2090-3	C2090-2 and C2090-3	C0969-2 and C0969-3	4000	10000

VEHICLE /YEAR	CUSHION / BACKREST	HEATER MAT / NTC RESISTOR	LEFT HAND DRIVE		RIGHT HAND DRIVE		MINIMUM RESISTANCE	MAXIMUM RESISTANCE
	Backrest	Heater element	C0971-1 and C0971-2	C2091-1 and C2091-2	C2091-1 and C2091-2	C0971-1 and C0971-2	0.53	0.71
	Rear Seat Cushion	Heater element	C2043-2 and C3030-1	C2042-2 and C3030-1	C2042-2 and C3030-1	C2043-2 and C3030-1	0.74	0.99
		NTC resistor	C2043-1 and C2043-3	C2042-1 and C2042-3	C2042-1 and C2042-3	C2043-1 and C2043-3	4000	10000
	Rear Seat Backrest	Heater element	C3030-1 and C3030-2	C2993-1 and C2993-2	C2993-1 and C2993-2	C3030-1 and C3030-2	0.74	0.93
Range Rover Evoque (L538)	Cushion	Heater element	C3HS07 BBM-1 and C3HS07 BBM-4	C3HS02 ABM-1 and C3HS02 ABM-4	C3HS07 BBM-1 and C3HS07 BBM-4	C3HS002 ABM-1 and C3HS02 ABM-4	1.10	1.48
		NTC resistor	C3HS07 BBM-2 and C3HS07 BBM-3	C3HS02 ABM-2 and C3HS02 ABM-3	C3HS07 BBM-2 and C3HS07 BBM-3	C3HS02 ABM-2 and C3HS02 ABM-3	4000	10000
	Backrest	Heater element	C3HS06 ABM-1 and C3HS06 ABM-2	C3HS01 ABM-1 and C3HS01 ABM-2	C3HS06 ABM-1 and C3HS06 ABM-2	C3HS01 ABM-1 and C3HS01 ABM-2	0.77	1.03
Discovery	Cushion	Heater mat	C3HS07 BBM-1	C3HS02 ABM-1	C3HS07 BBM-1	C3HS002 ABM-1	1.10	1.48

VEHICLE /YEAR	CUSHION / BACKREST	HEATER MAT / NTC RESISTOR	LEFT HAND DRIVE		RIGHT HAND DRIVE		MINIMUM RESISTANCE	MAXIMUM RESISTANCE
Sport(L550)			and C3HS07 BBM-4	and C3HS02 ABM-4	and C3HS07 BBM-4	and C3HS02 ABM-4		
		NTC resistor	C3HS07 BBM-2 and C3HS07 BBM-3	C3HS02 ABM-2 and C3HS02 ABM-3	C3HS07 BBM-2 and C3HS07 BBM-3	C3HS02 ABM-2 and C3HS02 ABM-3	4000	10000
	Backrest	Heater mat	C3HS06 AAM-1 and C3HS06 AAM-2	C3HS01 AAM-1 and C3HS01 AAM-2	C3HS06 AAM-1 and C3HS06 AAM-2	C3HS01 AAM-1 and C3HS01 AAM-2	0.77	1.03
Defender (L316)	Cushion	Heater mat	C0237-1 and C0237-2	C0237-1 and C0237-2	C0237-1 and C0237-2	C0237-1 and C0237-2	1.26	1.54
		NTC resistor	-	-	-	-	-	-
	Backrest	Heater mat	-	-	-	-	-	-

DTC INDEX

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

PINPOINT TESTS

NOTE:

On full power the seat should be hot to touch

NOTE:

The seat heater power supply cycles on and off dependant on the seat and cabin temperature and may only switch on for 5 seconds in 30 seconds.

NOTES:

- Ensure the multimeter used is calibrated and a resistance reading of 0 ohms is shown when the test leads are connected together. Alternately, subtract any resistance shown from the result.
- The heated seat element circuits should be checked at the seat heater module connector (where possible).
- Refer to the electrical circuit diagrams and to confirm the total resistance of the circuit the cushion and backrest are connected in series.

PINPOINT TEST A : HEATED SEAT TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>1 Using the manufacturer approved diagnostic system, check the climate control system for related DTCs (where possible)</p>
	<p>Are any heated seat DTCs set? Yes Perform the relevant corrective actions. Clear the DTCs and retest. If the fault persists, Go to A2. No Go to A2.</p>
	<p>1 If necessary, operate the vehicle air conditioning on full for 10 minutes to reduce the temperature of the vehicle interior</p>
	<p>2 Operate the heated seats on full power</p>
	<p>Do the heated seats operate correctly? Yes Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest. If the operation of the heated seats is correct no further action is necessary No Go to A3.</p>

PINPOINT TEST A : HEATED SEAT TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>1 Refer to the electrical circuit diagrams and the Seat Heater Mat Application Chart (see above) to identify the connector</p>
	<p>2 Disconnect the connector</p>
	<p>3 Refer to the electrical circuit diagrams and check the heated seat element circuit for short circuit to ground</p>
	<p>Is there a short circuit to ground? Yes Repair the circuit or install a new heated seat element as necessary. Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest No Go to A4.</p>
	<p>1 Refer to the electrical circuit diagrams and check the heated seat element circuit for open circuit, high resistance</p>
	<p>Is the heated seat element circuit resistance within specification? Yes Go to A5. No Repair the circuit or install a new heated seat element as necessary. Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest</p>
	<p>1 Reconnect the connector</p>
	<p>2 If necessary, operate the vehicle air conditioning on full for 10 minutes to reduce the temperature of the vehicle interior</p>
	<p>3</p>

PINPOINT TEST A : HEATED SEAT TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	Connect an inductive ammeter (current clamp) to the heated seat element circuit
	4 Operate the heated seats on full power
	5 Use the Seat Heater Mat Application Chart to calculate a typical current value (using $I=V/R$, Current equals Volts divided by Resistance). For example: <ul style="list-style-type: none"> • 12 volts / 0.5 ohms = 24 amps • 12 volts / 1 ohms = 12 amps • 12 volts / 2 ohms = 6 amps
	Does the heated seat circuit draw the correct quantity of current? Yes Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest. If the operation of the heated seats is correct no further action is necessary No Go to A6
	1 Refer to the electrical circuit diagrams and the Seat Heater Mat Application Chart (see above) to identify the connector and terminals
	2 Disconnect the connector
	3 Using a multimeter, perform resistance measurements of the heated seat element circuit and the NTC resistor circuit (where possible)
	4 Compare the results to the Seat Heater Mat Application Chart
	Are the results within specification at the given ambient temperature? (tolerance ± 0.5 ohms) Yes

PINPOINT TEST A : HEATED SEAT TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>Reconnect the connector. Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest. If the fault persists, refer to electrical circuit diagrams and check the power and ground circuits</p> <p>No</p> <p>Repair the circuit or install a new heated seat element as necessary. Using the manufacturer approved diagnostic system, clear the DTCs (where possible) and retest</p>