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2011.0 RANGE ROVER (LM), 412-00

CLIMATE CONTROL SYSTEM (G1222097)

DIAGNOSIS AND TESTING

PRINCIPLES OF OPERATION

For a detailed description of the Climate Control System, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Air Distribution and Filtering (412-01A Air Distribution and Filtering, Description and Operation),
Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation),
Air Conditioning (412-03A Air Conditioning, Description and Operation),
Auxiliary Climate Control (412-02C Auxiliary Climate Control, Description and Operation).

INSPECTION AND VERIFICATION

WARNING:

Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

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 that has the resolution ability to view 3 decimal places. For example, on the 2 volts range can measure 1mV or 2 K Ohm range can measure 1 Ohm. 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.

0. Verify the customer concern

1. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

MECHANICAL	ELECTRICAL
■ Coolant level ■ Hoses ■ Coolant pump ■ Cabin air filter ■ Primary drive belt ■ Air conditioning compressor ■ Thermostatic expansion valve ■ Receiver drier ■ Air conditioning condenser ■ Refrigerant pipes ■ Fuel fired booster heater ■ Fuel fired booster heater fuel pump ■ Fuel fired booster heater fuel pipes	■ Fuses ■ Wiring harnesses and connectors ■ Blower ■ Air conditioning compressor electronic control valve ■ Electric cooling fan ■ HVAC control module ■ Refrigerant pressure sensor

2. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

3. 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

4. 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

HVAC CONTROL SYSTEM SENSOR RESISTANCE VALUES

To assist with HVAC sensor diagnosis, please refer to the table below for sensor resistances. The values indicated may vary slightly from those shown due to changes in ambient temperature

SENSOR TYPE	RESISTANCE VALUE	AMBIENT TEMPERATURE
Front Evaporator Temperature Sensor	1.6 K ohms	22°C
Rear Evaporator Temperature Sensor	1.6 K ohms	22°C
Duct Air Temperature Sensor	3 K ohms	22°C
In Car Temperature Sensor (measured at pins 3 and 5)	9 K ohms	22°C
Compressor Solenoid Sensor	10 ohms	22°C
Compressor Clutch Sensor	4.3 ohms	22°C

AIR CONDITIONING SYSTEM PERFORMANCE CHECK

NOTES:

- Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low pressure system) and 11.0 bar to 15.0 bar (high pressure system).
- Normal temperature (measured at the center air vent) for a correctly charged and working system is -7°C to -2°C when the ambient temperature is 20°C.

When a failure symptom has been reproduced, refer to the symptom chart. After completing a repair, the air conditioning performance check should be repeated to confirm that the repair is successful.

0. Close the valves on the air conditioning station

1. Connect the air conditioning station to the vehicle charging ports

2. Check that the gauges register pressure

3. Open all doors and the tailgate

4. Start the engine

5. Set the temperature to the lowest setting (all zones)

6. Set the blower speed to maximum

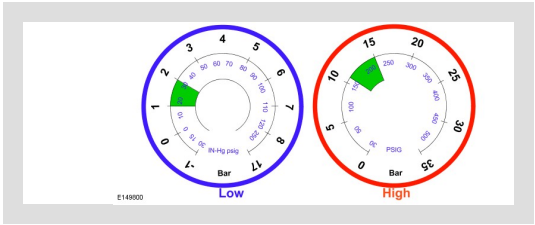
7. Set the recirculate switch to on

8. Set the air conditioning to on and check that the air conditioning compressor clutch engages and that the gauges register a change in pressure

9. Insert a temperature probe into the centre air vent

10. Raise engine speed to 1500rpm and maintain this speed for 5 minutes

11. Check the pressure gauge readings



12. Check the temperature reading

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
No refrigerant in air conditioning system (no pressure registered on gauges)	■ Refrigerant leak	■ GO to Pinpoint Test **A.**
Air conditioning compressor clutch not engaging	■ Air conditioning compressor clutch circuit short circuit to ground, short circuit to power, open circuit, high resistance ■ Refrigerant undercharged	■ Refer to the electrical circuit diagrams and check the air conditioning compressor clutch circuit for short circuit to ground, short circuit to power, open circuit, high resistance ■ GO to Pinpoint Test **B.**
Air conditioning inoperative (no change in pressure when setting the air conditioning to on)	■ Climate control system fault ■ Air conditioning compressor internal failure	■ Using the Jaguar Land Rover Approved Diagnostic Equipment, check the HVAC control module for related DTCs and refer to the relevant DTC index ■ GO to Pinpoint Test **C.**
Air conditioning operates briefly and then switches off	■ Electric cooling fan inoperative ■ Air conditioning condenser airflow obstructed ■ Refrigerant overcharged	■ Check the operation of the electric cooling fan ■ Check the air conditioning condenser for external obstructions ■ Using the Jaguar Land Rover Approved Equipment, recover the refrigerant. Evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil
High and low pressure system pressures **unstable**	■ Refrigerant contaminated ■ Air conditioning compressor internal failure	■ GO to Pinpoint Test **D.**
High and low pressure system pressures **normal** and insufficient cooling	■ Excessive volume of oil in the refrigerant or refrigerant contaminated	■ Using the Jaguar Land Rover Approved Equipment, recover the refrigerant. Evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil
High and low pressure system pressures **too high**	■ Electric cooling fan inoperative ■ Air conditioning condenser airflow obstructed ■ Thermostatic expansion valve internal failure ■ Refrigerant overcharged ■ Air conditioning compressor internal failure	■ GO to Pinpoint Test **E.**

SYMPTOM	POSSIBLE CAUSES	ACTION
High and low pressure system pressures **too low**	■ Refrigerant undercharged ■ Low pressure pipe damaged /restricted	■ GO to Pinpoint Test **B.**
Low pressure system pressure **too high** and high pressure system pressure **too low**	■ Air conditioning compressor electronic control valve circuit short circuit to ground, short circuit to power, open circuit, high resistance ■ Air conditioning compressor electronic control valve internal failure	■ GO to Pinpoint Test **F.**
Low pressure system pressure **too low** and high pressure system pressure **too high** and frost present on the liquid pipe from the condensor	■ Liquid pipe from the condensor is restricted ■ Receiver drier restricted	■ Check the liquid pipe from the condensor for damage and restrictions. Install a new pipe as necessary ■ Install a new receiver drier as necessary
Noise from air conditioning system	■ Air conditioning compressor pulley bearing ■ Air conditioning compressor pulley foul condition ■ Air conditioning compressor clutch operation excessively noisy ■ Air conditioning compressor internal failure ■ Thermostatic expansion valve internal failure ■ Refrigerant undercharged ■ Refrigerant overcharged ■ Air conditioning pipe(s) fouling body	■ GO to Pinpoint Test **G.**

PINPOINT TESTS

PINPOINT TEST A : LEAK TESTS	
A1: LEAK TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

CAUTION:

When charging the system with nitrogen, the pressure should be regulated to 7.0 bar.

PINPOINT TEST A : LEAK TESTS	
A1: LEAK TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	NOTE: This test is performed with the engine **not** running.
	1 Charge the air conditioning system with nitrogen
	2 Isolate the nitrogen supply
	3 Monitor the pressure gauge and check for leaks for 30 minutes
	Has the source of the leak been identified? **Yes** Rectify the leak as necessary. Install a new receiver drier. Using the Jaguar Land Rover Approved Equipment, evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** **GO toA2**.
A2: LEAK TEST 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Using the Jaguar Land Rover Approved Equipment, evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil
	2 Using the Jaguar Land Rover Approved refrigerant leak detector, check for a refrigerant leak
	Was a refrigerant leak detected? **Yes** Using the Jaguar Land Rover Approved Equipment, recover the refrigerant. Repair the leak as necessary. Evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** Repair complete

PINPOINT TEST B : LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO LOW TESTS	
B1: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO LOW TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Stop the engine
	2 Using the Jaguar Land Rover Approved refrigerant leak detector, check for a refrigerant leak
	Was a refrigerant leak detected? **Yes** Using the Jaguar Land Rover Approved Equipment, recover the refrigerant. Repair the leak as necessary. Evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** **GO toB2**.

B2: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO LOW TEST 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Using the Jaguar Land Rover Approved Equipment, recover the refrigerant
	2 Compare the weight of recovered refrigerant to that specified for the vehicle
	Was the weight of the recovered refrigerant less than specified for the air conditioning system? **Yes** Using the Jaguar Land Rover Approved Equipment, evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** Check the low pressure pipes for external damage and restrictions. Repair as necessary

PINPOINT TEST C : COMPRESSOR MECHANICAL TESTS	
C1: COMPRESSOR MECHANICAL TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Remove the primary drive belt
	2 Rotate the air conditioning compressor shaft by hand and check for smooth rotation
	Does the air conditioning compressor shaft rotate smoothly? **Yes** Tests inconclusive **No** Install a new air conditioning compressor

PINPOINT TEST D : LOW AND HIGH PRESSURE SYSTEM PRESSURES UNSTABLE TESTS	
D1: LOW AND HIGH PRESSURE SYSTEM PRESSURES UNSTABLE TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Start the engine
	2 Set the air conditioning to on
	3 Check the pressure gauge readings
	4 Set the air conditioning to off
	5 Check the pressure gauge readings
	Do the pressure gauge readings equalise immediately when the air conditioning is set to off? **Yes** Air conditioning compressor internal failure. Install a new air conditioning compressor **No** Air or moisture present in the air conditioning system. Using the Jaguar Land Rover Approved Equipment, recover the refrigerant. Install a new receiver drier. Evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil

PINPOINT TEST E : LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TESTS	
E1: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Start the engine
	2 Set the air conditioning to on
	3 Check the operation of the electric cooling fan
	Is the electric cooling fan operating? **Yes** **GO toE2**. **No** Check for foreign objects jamming the electric cooling fan. Refer to the electrical circuit diagrams and check the electric cooling fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance

E2: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TEST 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Stop the engine
	2 Check the air conditioning condenser for external obstructions
	Are any external obstructions present? **Yes** Repair as necessary **No** **GO toE3**.

E3: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TEST 3	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Start the engine
	2 Set the air conditioning to on
	3 Check the pressure gauge readings
	4 Set the air conditioning to off
	5 Check the pressure gauge readings
	Do the pressure gauge readings equalise immediately when the air conditioning is set to off? **Yes** Air conditioning compressor internal failure. Install a new air conditioning compressor **No** **GO toE4**.

E4: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TEST 4	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Stop the engine
	2 Using the Jaguar Land Rover Approved Equipment, recover the refrigerant
	3 Compare the weight of recovered refrigerant to that specified for the vehicle

E4: LOW AND HIGH PRESSURE SYSTEM PRESSURES TOO HIGH TEST 4	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	Was the weight of the recovered refrigerant greater than specified for the air conditioning system? **Yes** Using the Jaguar Land Rover Approved Equipment, evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** Thermostatic expansion valve internal failure. Install a new thermostatic expansion valve

PINPOINT TEST F : ELECTRONIC CONTROL VALVE TESTS	
F1: ELECTRONIC CONTROL VALVE TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Start the engine
	2 Set the air conditioning to on
	3 Set the temperature to the lowest setting (all zones)
	4 Set the blower speed to maximum
	5 Set the recirculate switch to off
	6 Using the Jaguar Land Rover Approved Diagnostic Equipment, check datalogger signal - Compressor/Motor Current (0x99AB)
	Is the datalogger signal value > 0.5A? **Yes** Air conditioning compressor electronic control valve internal failure. Refer to the electrical circuit diagrams and install a new air conditioning compressor electronic control valve **No** Refer to the electrical circuit diagrams and check the air conditioning compressor electronic control valve circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Repair as necessary and retest

PINPOINT TEST G : AIR CONDITIONING SYSTEM NOISE TESTS	
G1: AIR CONDITIONING SYSTEM NOISE TEST 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Reproduce the reported air conditioning system noise
	Is the noise present only when setting the air conditioning system to on? **Yes** **GO toG3**. **No** **GO toG2**.
G2: AIR CONDITIONING SYSTEM NOISE TEST 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Reproduce the reported air conditioning system noise
	Is the noise present only when the air conditioning system to operating? **Yes**

G2: AIR CONDITIONING SYSTEM NOISE TEST 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	GO toG4. **No** **GO toG7**.

G3: AIR CONDITIONING SYSTEM NOISE TEST 3	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Set the air conditioning on and off repeatedly and check the noise made by the air conditioning compressor clutch
	Is the noise made by the air conditioning compressor clutch excessively loud (compare to another similar vehicle for reference)? **Yes** Refer to the relevant section of the workshop manual and install a new air conditioning compressor **No** No further action

G4: AIR CONDITIONING SYSTEM NOISE TEST 4	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Check the installation of the air conditioning pipes: ■ Check that all brackets are present and secure ■ Check for foul conditions
	Is the noise caused by a problem with the air conditioning pipe installation? **Yes** Rectify as necessary. Re-test the system **No** **GO toG5**.

G5: AIR CONDITIONING SYSTEM NOISE TEST 5	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Set the air conditioning to on and check assess the duration of the noise
	Does the noise occur for a short period immediately after setting the air conditioning to on? **Yes** Refer to the relevant section of the workshop manual and install a new thermostatic expansion valve. Re-test the system **No** **GO toG6**.

G6: AIR CONDITIONING SYSTEM NOISE TEST 6	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Using the Jaguar Land Rover Approved Equipment, recover the refrigerant
	Was the weight of the recovered refrigerant different than specified for the air conditioning system? **Yes** Using the Jaguar Land Rover Approved Equipment, evacuate and recharge the air conditioning system with the correct quantity of refrigerant and oil **No** GO to Pinpoint Test **C.**

G7: AIR CONDITIONING SYSTEM NOISE TEST 7	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
	1 Assess the source of the noise
	Is the noise caused by the air conditioning compressor (bearing, contact between rotating and fixed components)? **Yes** Refer to the relevant section of the workshop manual and install a new air conditioning compressor **No** No further action

POOR HEATING AND COOLING PERFORMANCE OF THE HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

Diagnostic Procedure

A customer may express a concern of one or more of the following symptoms:

- Cycling vent temperatures, blowing warm and then cold
- Misting up of the front, side or rear screen(s) in cool ambient air temperatures (less than 15°C)
- Poor cooling performance of the Air Conditioning (A/C) system
- Warm, damp or musty smells coming from the vents on initial start-up

Cause

Low pressure recorded on the high pressure system. High pressure recorded on the low pressure system. Compressor clutch (where applicable) not working properly. A/C compressor electronic control valve worn out or sticking

Should a customer express a concern, follow the service instruction below:

CAUTION:

This procedure requires DVD 150.04 and Calibration File 275 loaded or a later version

NOTE:

The Jaguar Land Rover Approved Diagnostic Equipment will read the correct Vehicle Identification Number (VIN) for the current vehicle and automatically take the vehicle out of ‘Transportation mode’ if required

0. Connect the Jaguar Land Rover Approved battery support unit

1. Connect the Jaguar Land Rover Approved Diagnostic Equipment to the vehicle

2. Begin a new diagnostic session by reading the Vehicle Identification Number (VIN) for the current vehicle and initiating the data collect sequence

3. Follow the Jaguar Land Rover Approved Diagnostic Equipment prompts

4. Select the 'Measurement Applications' Session Type

5. Run: 'Complete vehicle - datalogger

6. Select '412-00 Climate control system

7. Select and monitor the following datalogger signals:
    1. Evaporator temperature
    2. Compressor / Motor current

8. Refer to the detailed diagnostic information below

9. When all the tasks are complete, exit the current session by selecting the 'Session' tab and then select the 'Close Session' option

10. Disconnect the Jaguar Land Rover Approved Diagnostic Equipment and the Jaguar Land Rover Approved battery support unit

DETAILED DIAGNOSTIC INFORMATION

Detailed Diagnostic Information

When monitoring the diagnostic information on the Jaguar Land Rover Approved Diagnostic Equipment note the following

Condition 1

PID	RESULT
Evaporator temperature - 995A	Reading up to 8°C
Compressor/motor current - 99AB	Value increasing

Condition 2

PID	RESULT
Evaporator temperature - 995A	Reading -4°C or below
Compressor/motor current - 99AB	Value decreasing to 0 mA

0. If any of the conditions are identified continue to step 2
    1. If none of the above conditions are identified then continue to the service instruction

1.

Recover the air conditioning system (see TOPIx Workshop manual section 412-00: Climate Control System - General Information - Air Conditioning System Recovery, Evacuation and Charging)

1. Record the total refrigerant recovered from the air conditioning system. Compare the quantity of refrigerant recovered against the specifications for the vehicle (see TOPIx Workshop Manual section 412-00: Climate Control System - General Information - Specification)
2. **NOTE:**

   If the air conditioning system has lost more than 150g of refrigerant the root cause of the leak must be investigated and submitted as a separate claim (see TOPIx Workshop manual section 412-00: Climate Control System - General Information - Specification)

   If the air conditioning system has lost more than 150g of refrigerant, recharge the system and repeat the diagnostic procedure
3. If the air conditioning system has lost less than 150g of refrigerant, continue to the service instruction below

SERVICE INSTRUCTION

NOTE:

The Direct Pressure Sensing (DPS) valve is also known as the electronic control valve

0. Remove the Air Conditioning (A/C) compressor (see TOPIx Workshop Manual section 412-03: Air Conditioning - Air Conditioning Compressor)

Follow the control valve replacement procedure - all vehicles

CAUTION:

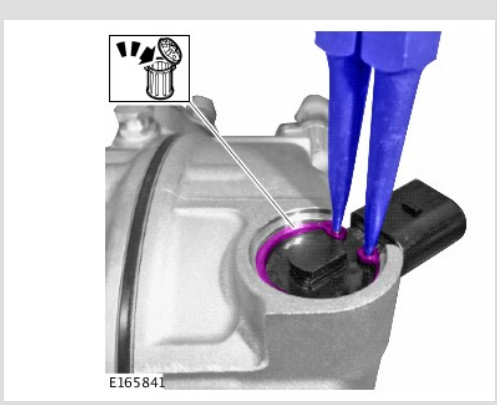
Make sure to avoid foreign material entering the DPS valve opening on the cylinder head when the DPS valve is removed

1. Using compressed air or similar, remove all foreign materials from around the DPS valve/A/C compressor cylinder head

CAUTION:

Make sure not to damage the circlip housing in the A/C compressor cylinder head

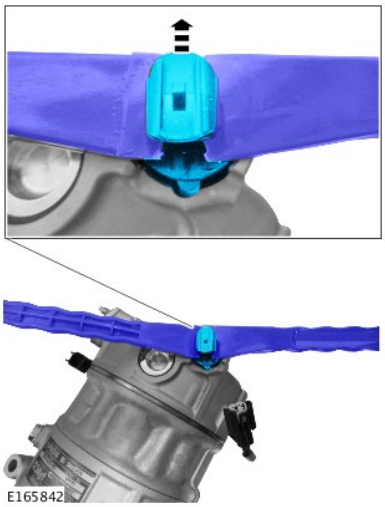
2. Place the A/C compressor on a clean flat work surface
    1. Using a suitable tool, remove and discard the circlip that retains the DPS valve in the A/C compressor cylinder head



CAUTION:

Make sure not to damage the housing in the A/C compressor cylinder head

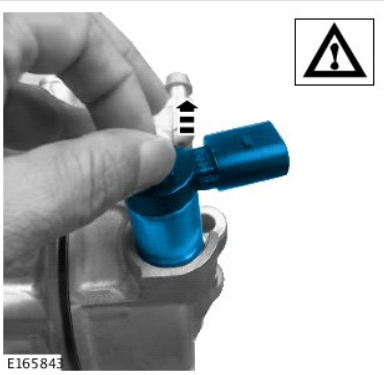
3. Using suitable tools, release the DPS valve



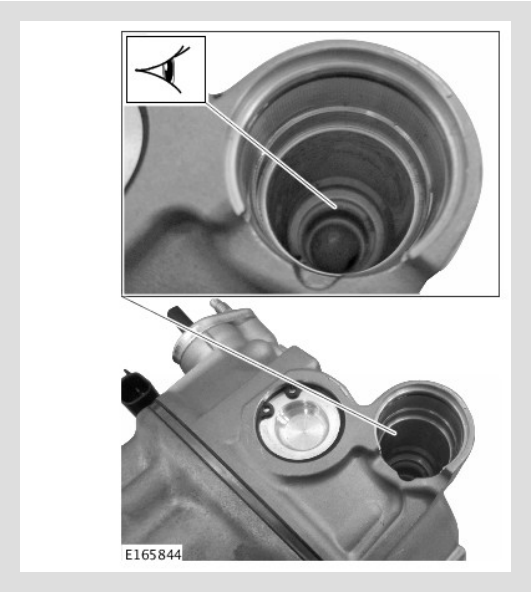
NOTE:

Take care to remove the DPS valve in a vertical direction to avoid damage to the inside wall of the A/C compressor cylinder head

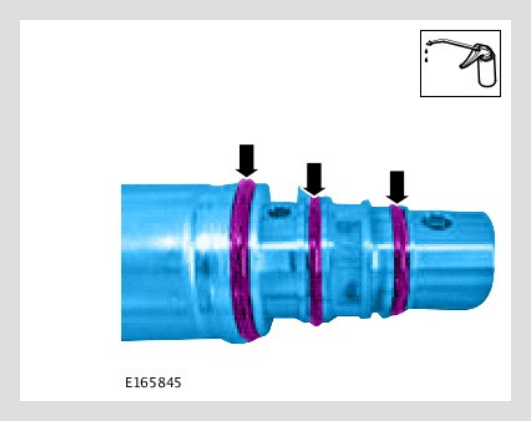
4. Remove DPS valve from the A/C compressor cylinder head and discard



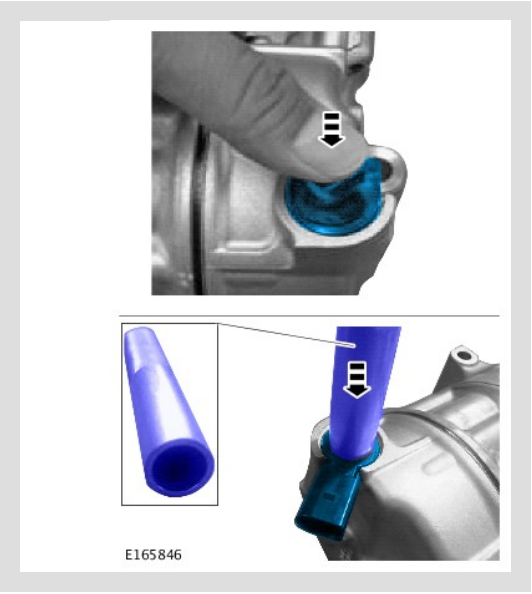
5. Inspect the inside wall of the A/C compressor cylinder head for scratches, scoring, or foreign material



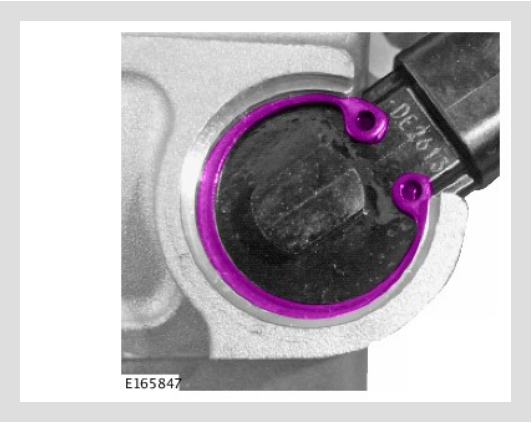
6. Apply compressor oil (Polyalkylene Glycol (PAG SPA2 Oil) to the O-rings of the new DPS valve



7. Install the DPS valve, apply a downward pressure by hand. Using a suitable tool if required, press fully into position to allow installation of the new circlip



8. Using a suitable tool, install the new circlip supplied in the kit



9. Install the Air Conditioning (A/C) compressor (see TOPIx Workshop Manual section 412-03: Air Conditioning - Air Conditioning Compressor)

10. Repeat the diagnostic procedure to confirm the issue is resolved

DTC INDEX

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

Diagnostic Trouble Code Index - DTC: Module Name: Climate Control Module (Description and Operation),
Diagnostic Trouble Code Index - DTC: Module Name: Rear Climate Control Module (Description and Operation).