



Basic Fitting Instructions

# **Puma 319 HVAC System**

Puma Automotive Design Ltd



## Introduction

The Puma HVAC 319 is a closed circuit Heat/AC system that recirculates cabin air for greater efficiency in raising or lowering the temperature of the interior whilst also offering a dehumidifying capability to reduce screen fogging and enhance driver comfort.

In order to achieve a closed circuit, the cabin air is drawn into the HVAC unit from the passenger side footwell, recirculating air back into the vehicle via the dashboard vents. This allows the unit to be fitted unobtrusively and operated from one set of controls.

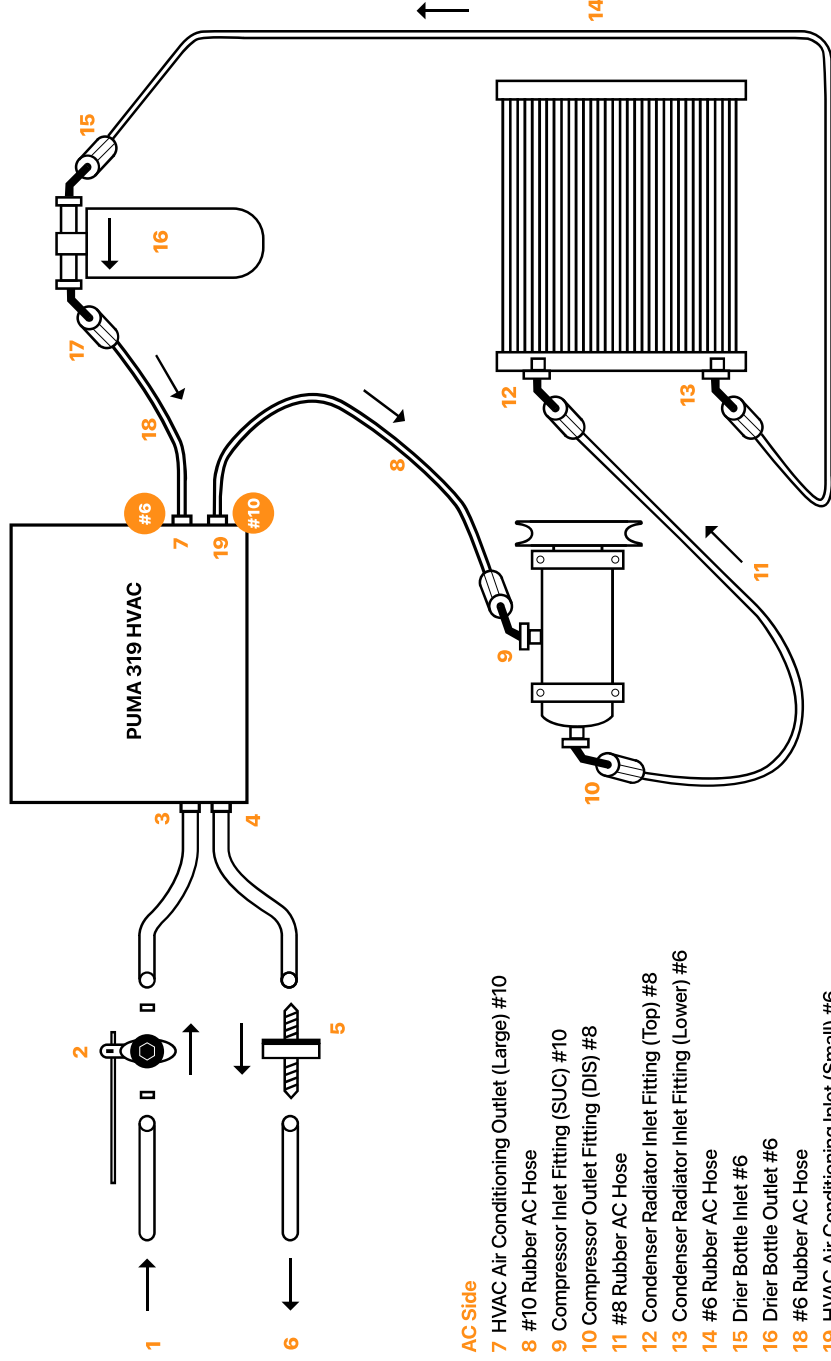
## Contents

03	HVAC Piping Diagram and Notes
05	Connecting the EVAP Pipes to the Unit
06	Creating the Air Intake
08	Connecting the Heater Section
09	Cable End
10	Puma HVAC Wiring Diagram
11	Wiring Notes
12	Installing the complete system
13	Wiring Overview (Blower Control)
14	Carling Switch Wiring Diagram
15	Compressor Notes
16	Operation your new system
17	AC Troubleshooting
20	Heater Troubleshooting

# HVAC Piping Diagram

## Hot Water Side

- 1 Hot Water Flow From Engine
- 2 Water Flow Valve (Dashboard Controlled)
- 3 HVAC Box Water Inlet (Top Connector)
- 4 HVAC Box Water Outlet (Lower Connector)
- 5 Non Return Valve (Directional IN-OUT)
- 6 Water Flow Back to Engine



- AC Side**
- 7 HVAC Air Conditioning Outlet (Large) #10
  - 8 #10 Rubber AC Hose
  - 9 Compressor Inlet Fitting (SUC) #10
  - 10 Compressor Outlet Fitting (DIS) #8
  - 11 #8 Rubber AC Hose
  - 12 Condenser Radiator Inlet Fitting (Top) #8
  - 13 Condenser Radiator Inlet Fitting (Lower) #6
  - 14 #6 Rubber AC Hose
  - 15 Drier Bottle Inlet #6
  - 16 Drier Bottle Outlet #6
  - 18 #6 Rubber AC Hose
  - 19 HVAC Air Conditioning Inlet (Small) #6

## HOT WATER SIDE PLUMBING

First establish which way your engine's hot water system flows. Of the two engine pipes formerly connected to your old Defender heater box, one will supply hot water from the engine to the heater with the second acting as a return pipe for water flowing back to the engine.

It is vital that the hot water supply pipe from the engine is connected to the HVAC Box Water Inlet (3) via the Water Flow Valve (2). When fitting the water flow valve, ensure that the valve is not installed backwards. Check the flow direction carefully and take time to adjust the cable so that the valve is fully closing from the dashboard control dial.

**NOTE:** Failure to correctly fit and adjust the water valve and cable will result in hot water flowing into the core and AC Cooling will be compromised.

The HVAC Box Water Outlet (4) carries water out of the heater core and back into the Engine (6) via the Non-Return Valve (5). When fitting the non-return valve, check the flow direction arrow on the valve for correct operation. The valve itself should be fitted as close to the engine, thus as far away from the HVAC box as possible.

# HVAC Piping Diagram Notes Continued...

## AC SIDE PLUMBING

The AC system is designed as a universal retro-fit install across all models and ranges of Land Rover Defender from 1983 up to 2006. Both LHD and RHD versions are available. Due to the vast variations in engine options over this 23 year period, it is not possible to create specific hose kits, so the rubber hose supplied will need to be measured and cut according to your own installation. Beadlock Crimp fittings are supplied to create a fully sealed circuit.

Working out from the HVAC unit (7), the larger of the two hoses is the #10 pipe (8), which connects to the Compressor suction port (9), marked SUC on the compressor with a 7/8" size. The smaller 5/8" port on the compressor (10) is the discharge port marked DIS, which runs from the compressor to the top condenser radiator connection (12). This #8 pipe between the compressor and the condenser (8) should be as short as possible when selecting a suitable plumbing route.

Out from the bottom of the condenser radiator (13) is the smaller #6 connection, which runs through to the Drier Bottle (16). The drier bottle is directional. Please check the flow direction arrow on the bottle for correct installation. The caps on the drier bottle should not be removed until you are ready to fit the system. If left exposed, the

desiccant inside the bottle starts pulling moisture from the ambient air, reducing the effectiveness of the new receiver-drier. If left exposed for a period of time the bottle becomes totally ineffective.

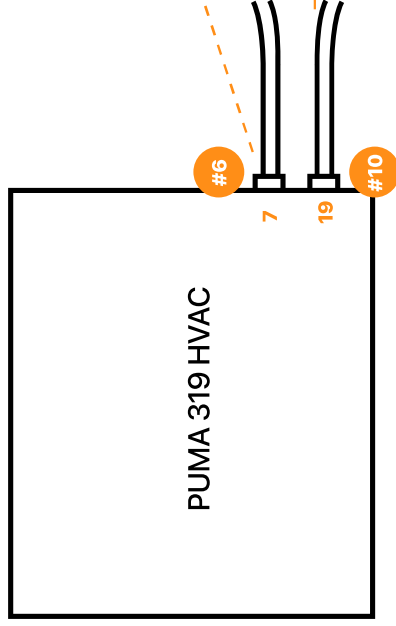
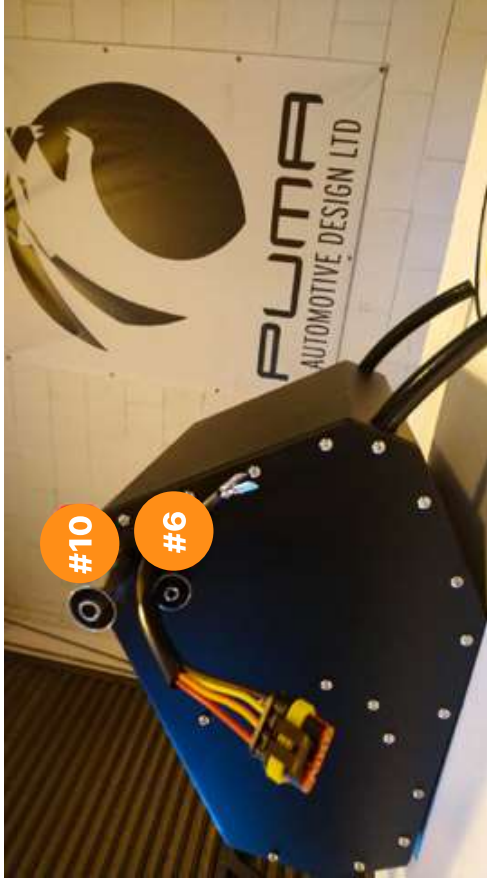
The drier bottle connections are both 45 degree #6 connections (15 & 17). It is important to find a safe and secure mounting point for the drier before cutting and crimping the connecting pipes. The exit pipe from the drier bottle (18) runs back to the HVAC unit (19) to complete the circuit. This system requires professional or experienced fitting AC pipe crimping tools required Must be flushed and tested prior to initial charge.

R134a Refrigerant: 600g / 21oz ± 5%  
Uses 16mm heater hose:  
Adapters included if required

## Connecting the EVAP Pipes to the Unit

The two AC pipes [#6 and #10] attached to the unit come pre-fitted with straight connectors for easier fit. The connecting pipes will need to be measured within the engine compartment. As there are different engine variants, we are unable to supply pre-cut or pre-connected pipes. The length of the pipes should be determined on site and then the pipes crimped accordingly.

Pipe #10 should be connected directly to the #10 inlet on the compressor. Pipe #6 should be connected directly to the drier bottle.



7 HVAC Air Conditioning Inlet (Small)



19 HVAC Air Conditioning Outlet (Large)

## Creating the Air Intake

The Puma 319 is designed to replace the Defender's original heater box in the engine bay. When removing the old heater box, retain the top two connector bolts [1] as these are used to connect the Puma 319 back to the Defender bulkhead.

In order to create an air intake for the HVAC unit, please use the cut-out template provided with your purchase. This template should be placed on top of the bare passenger footwell top, in direct line with the two retaining holes [1]. The rectangle on the template indicates where the hole is to be made [2]. This hole will match the aperture on the underside of the HVAC unit and will act as an air intake. Air drawn into the unit via the aperture [2] will be conditioned inside the 319 unit and discharged back into the cabin via the standard Defender bulkhead air inlet [3].

Once the hole has been created, you should add the soundproofing material to the upper side of the footwell and then the 319 unit can be fitted using the two retaining bolts at first [1]. The front of the 319 unit has a foam surround in order to create an air tight seal around the bulkhead air inlet [3]. As the two bolts are tightened, keep pushing the unit down and forward to create a good connection to prevent air flow loss during operation.

Continued...



Creating the Air Intake

## Continued

Once the two bolts are tightened, and the unit is in the correct position on top of the footwell plate, you should drill two small holes [4] from the inside of the vehicle to pass through the footwell wall and then through the underside of the Puma unit to connect the two sections together using two small bolts/screws. This is just to hold the unit in place and create a better inlet seal.

With the unit now fully secure, the insect screen should be placed over the newly created air inlet in the footwell and all interior trim and carpet replaced. Please ensure that all trim and carpet pieces have apertures no less than the air inlet. There must be a clear air path for the inlet to draw air. Do not cover the air inlet.



## Connecting the Heater Section

The heater pipes connect to the HVAC unit in much the same way as with the original Defender heater box. Hot water is passed into the 319 unit from the engine in exactly the same way, but the actual water flow will now be controlled from the dashboard. One 'push-to-close' valve is provided. This should be inserted into the rubber heater hose at a point prior to the water entering the 319 unit.

The valve comes complete with the cable connector and does not need to be mounted rigidly. The Bowden cable provided is operated by the rotary dashboard control. The inlet water connector is at the top of the unit, the outlet is the lower. There should be a free flowing return path for the water leaving the 319 unit.

Continued...





## Cable End

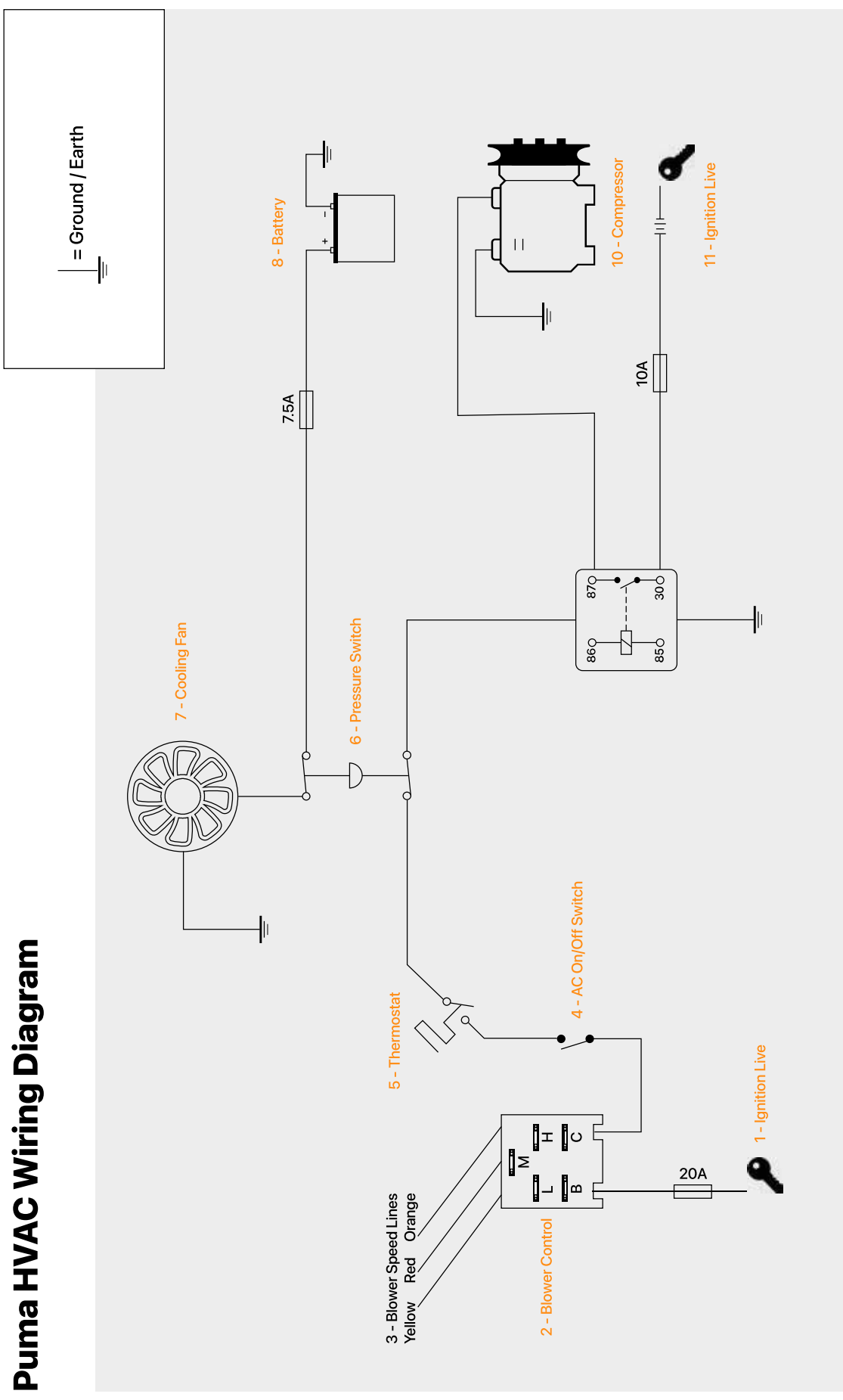
When installing your air conditioning system into a standard Land Rover Defender dashboard (Non-Puma style), the existing hot/cold lever is retained to open/close the water valve supplied.

The valve supplied for the OEM dashboard is a 'pull-to-close' valve. When fitting the valve, please ensure that the valve is adjusted so it is fully closed when the HOT/COLD lever is in the COLD position, or the hot water from the engine will flow into the HVAC core and the AC will not function correctly.



When fitting the water control valve using the standard cable from the dashboard, the end of the cable needs to be bent as per the picture (above) for the correct function and fitting.

# Puma HVAC Wiring Diagram



# Schematic Notes to Accompany Wiring Diagram

**1 Ignition Live Power In:** This is an ignition feed that powers the three speed blower and also the compressor relay. This must be 20A inline fused and be minimum 20A rated wire. This input wire connects to Pin B on the Blower control switch.

**2 Blower Control:** This is the three speed blower control mounted on the dashboard. The rear of the control unit has five pins: Pin B is for Power In (see 1 above). There are then three Blower Speed Output Pins (see 3 below) and a final Pin C which acts as a Power Out for the AC On/Off Switch.

Note: For system protection, Pin C will only give line Power Out when the blower is turned on. This safeguards the AC core from potential freezing.

**3 Blower Speed Outputs:** These three lines control the speed of the blower and thus the volume of air to the dashboard vents. These three lines run through to the HVAC box in the engine bay as follows:

Pin L is Low Speed Out (Yellow Wire), Pin M is Medium Speed Out (Red Wire) and Pin H is High Speed Out (Orange Wire).

Note: Please ensure that the blower is safely earthed/grounded via the Black Wire.

**4 AC On/Off Switch:** This is the dashboard mounted AC switch to activate the Air Conditioning. If using the Carling switch in your kit, please follow the correct wiring instructions as provided. Power In to this switch MUST come from Pin C on the Blower Control (see 2 above).

**5 Thermostat:** The thermostat is housed inside the HVAC unit itself, with the seasonal thermostat control dial on the side of the box. The thermostat controls the temperature of the Evaporator Core and thus the temperature of the air flowing into the cabin. Two green wires extending out from the side of the HVAC box are the thermostat lines In and Out. It does not matter which way round these green wires are attached. One green wire should be attached to the Power Out line from the AC switch. The second green wire out goes to the pressure switch (see 6 below).

**6 Pressure Switch:** The Pressure Switch is used to protect the system from high pressure overloads or blockages, and from low pressure/dry running. Both of which can damage the

compressor. The switch itself is mounted on top of the Drier Bottle and has two black and two blue wires. The two black lines on the Pressure are used as part of the compressor power circuit. One black wire should be attached to the Thermostat Out line (see 5 above). The second black wire should go to the Compressor Relay Pin 86. It does not matter which way round these black wires are attached. The blue wires are for activating the condenser radiator Cooling Fan (see 7 below). Note: The pressure switch will not operate correctly until the system is charged.

**7 Cooling Fan:** The Cooling Fan keeps the condenser radiator at the correct operating temperature for optimum efficiency. The fan

itself is activated via the blue wires on the Pressure Switch. One blue wire should act as Power In and be attached to a constant live feed (see 8 below) via a 7.5A fused line. The second blue wire should be attached to the Power In line on the Cooling Fan (+). It does not matter which way round these blue wires are attached. The remaining negative (-) wire on the Cooling Fan is the Earth wire and should be grounded securely.

**8 Battery:** It is important that the Cooling Fan power input is taken from a constant live wire, rather than from an ignition live feed. This is so that when the vehicle is turned off, the Cooling Fan still has direct power to run the fan for long enough to reduce temperature and pressures in the system.

**9 Relay:** The Relay is used to activate the Compressor's magnetic clutch and thus engage the AC system. Pin 86 on the Relay receives its power from the Pressure Switch black wire (see 6 above). If the system is operating within normal tolerances then this wire will trigger the Relay and activate the compressor correctly. Pin 85 on the Relay is the Earth wire and should be grounded securely. Pin 30 is ignition Power In and should be 10A inline fused using 10A rated wire. Pin 87 on the Relay goes out to the compressor positive (+) line.

**10 Compressor:** The Compressor pulley is belt driven from the engine, and has an electro-magnetic clutch which engages the compressor pistons when needed. Without power in to engage the clutch the compressor pulley will spin freely. The wire from the Relay

output Pin 87 connects to the Compressor positive (+). The remaining negative (-) wire on the Compressor is the Earth wire and should be grounded securely.

**11 Ignition Live:** This is the Ignition Live feed to the relay. This must be 10A inline fused and be 10A rated wire. This input wire connects to Pin 30 on the Relay.

## Operational Safety Sequence (Under Normal Tolerances):

If the Blower Switch is on, power will go to the AC Switch, which will go through the Thermostat line, which will go through the Pressure Switch, will go through the Relay, which will activate the Compressor.

## The four safety elements are as follows:

- The Blower must be activated to send power to the Switch
  - The Switch must be ON to send power to the Thermostat
  - If temperatures are within operating range, the Thermostat will send power to the Pressure Switch
  - If Pressures are within operating range, the Pressure Switch will send power to the Relay
- The Relay will then engage the compressor.

If any of the tolerances are breached, the power line is interrupted and the compressor disengaged. It is therefore vital that your new AC system is wired in accordance to the above to provide maximum protection and efficiency.

## For installing the complete system, the following notes are relevant...

### Condenser Radiator:

The condenser radiator supplied for the Puma 319 installation is a new generation design with an ultra slim profile but a large surface area. This is to increase the flow rate and reduce the reliance on the condenser fan.

The narrow profile of the condenser makes it possible to add air conditioning without having to buy the larger nose-cone section for the Defender bodywork. The condenser can be mounted directly to the two diagonal cross members at the front of the vehicle. **Please be sure to use rubber/heoprene washers and rubber/foam barrier strips when connecting the condenser as oxidation and corrosion will occur if aluminium and steel are in contact.**

The location of the AC compressor will depend on your engine choice. The condenser can be mounted left or right but should be done so in a way that makes the connection pipe from compressor outlet #8 to condenser inlet #8 as short as possible for greater efficiency. The condenser must be mounted with #8 at the top and #6 at the bottom.

#6 from the bottom of the condenser radiator should run to the drier bottle to complete the full circuit.



## Wiring Overview (Blower Control)

To adapt the existing two-speed blower (Lever Mounted) to the Puma Dashboard blower control (Rotary Dial) you need to extend and connect the wires accordingly:

The existing blower control is Earth/Ground activated, meaning that there is a constant ignition power feed to the blower itself, and the lever engages and connects the Earth/Ground wires to create a circuit and power the blower.

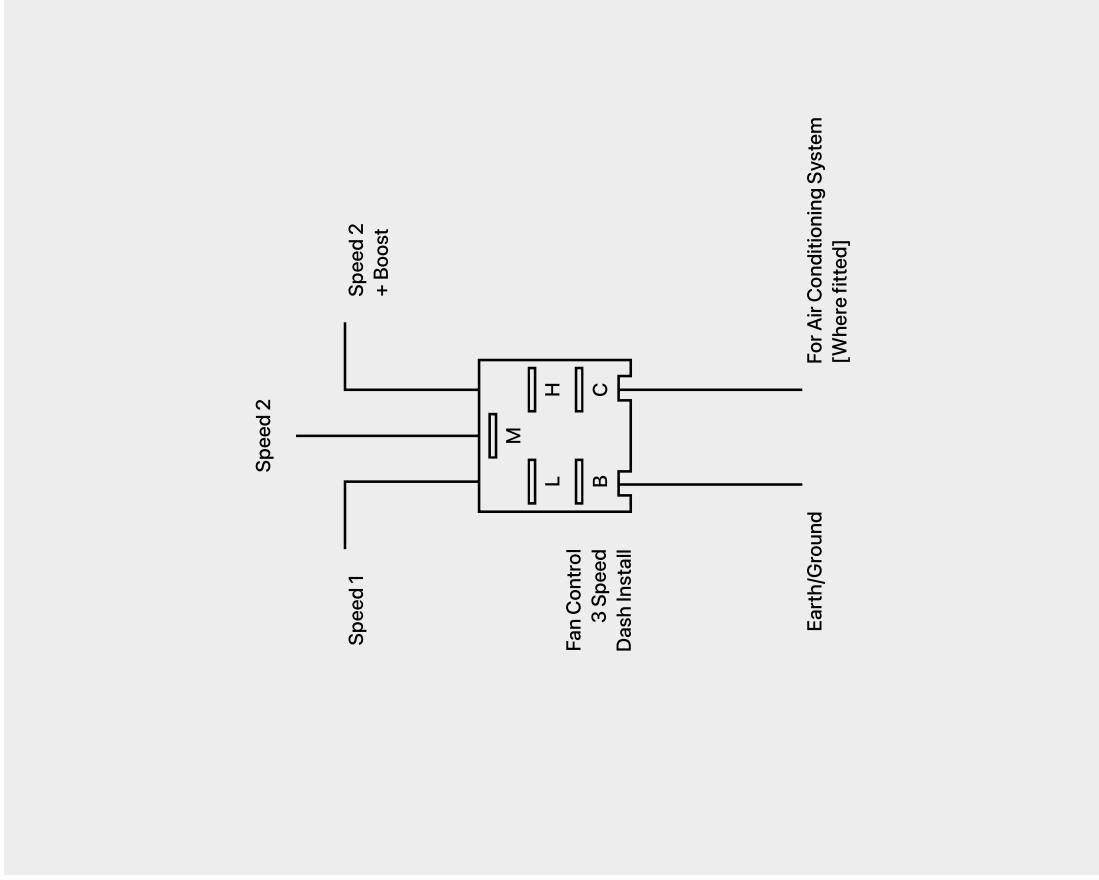
On the existing lever control will be one Black wire (Earth/Ground) which needs to be extended and connected to Pin B on the Puma blower control.

On the existing lever control will be one Green/Yellow (Slow Speed) which needs to be extended and connected to Pin L on the Puma blower control.

On the existing lever control will be one Green/Slate (High Speed) which needs to be extended and connected to Pin M on the Puma blower control.

On the standard 2-speed conversion, Pin H is unused

On vehicles without the Puma AC system, Pin C is unused.



# Carling Switch Wiring

Carling Switch Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
Off-On [EU]	Power In	Power Out	Link to pin 2				Earth	Sidelight		
Off-On [US]		Power In	Power Out				Earth	Sidelight		
On-On [EU & US]	Power Out	Power In	Power Out				Earth	Sidelight		
Off-On-On [EU]	Power Out 2	Power In		Power Out 1	Power In 2		Earth	Sidelight	Earth	Link Pin 4
Off-On-On [US]		Power In 1	Power Out 1		Power In 2	Power Out 2	Earth	Sidelight	Earth	Link Pin 6
On-Off-On [EU & US]	Power Out 1	Power In	Power Out 2				Earth	Sidelight	Earth	Link Pin 1
Mom-Off-Mom SP [EU & US]	Power Out 1	Power In 1	Power Out 2				Earth	Sidelight		
Mom-Off-Mom DP [EU & US]	Power In 1	Power Out 1	Earth	Earth	Power Out 2	Power Out 2	Earth	Sidelight		
Off-Mom [Horn] [EU]		Power In	Power Out				Earth	Link Pin 3	Earth	Power In
Off-Mom [e.g. Fog] [EU]		Power In	Power Out				Earth	Relay	Earth	Power In
Off-Mom [Horn] [US]		Power In	Power Out				Earth	Power In	Earth	Link Pin 3
Off-Mom [e.g. Fog] [US]		Power In	Power Out				Earth	Power In	Earth	Relay
ARB Off-On [EU]	Power Out	Power In					Earth	Sidelight	Earth	Link Pin 1
ARB Off-On [US]		Power In	Power Out				Earth	Sidelight	Earth	Link Pin 3
Locking Off-On [EU]	Power Out	Power In					Earth	Link Pin 1		
Locking Off-On [US]		Power In	Power Out				Earth	Link Pin 3		
Locking Mom-Off-Mom [EU & US]	Power Out 1	Power In 1	Power Out 2				Earth	Sidelight Feed		
RWW [EU & US]	Brown w/ green trace	Red w/ green trace	Green-Link to pin 5		Green-Link to pin 3	Black w/ green trace	Black [Earth]	Red/white- sidelight/ dashboard feed		
	<b>Pin 1</b>	<b>Pin 2</b>	<b>Pin 3</b>	<b>Pin 5</b>	<b>Pin 8</b>	<b>Pin 10</b>	<b>Pin 17</b>	<b>Pin 18</b>	<b>Note:</b>	
Hazard [EU & US] Td5	White w/ green trace	Light green	Purple	Light green w/ brown trace	Red/white sidelight/ dashboard feed	Black	Green w/ red trace	Green w/ white trace	9th link wire on factory switch is unused	
Hazard [EU & US] Pre Td5	Green									

## Initial Test & Charge

The installation of the AC system should be carried out by an experienced or professional AC engineer. The initial test and charging should be conducted with due care and diligence. Refrigerant Compatibility R134a.



## Compressor Notes

Any work carried out on your AC System should be undertaken by a competent person who has a full understanding of how the system works.

If swapping / exchanging a compressor, use certified equipment to remove the old refrigerant.

New compressors from Puma Automotive Design Ltd are usually supplied with a full system charge of oil. However, some jurisdictions restrict the import and export of goods that contain oil so it is vital to check on the correct oil level prior to fitting.

If you are integrating a hybrid AC system, where only the Puma 319 HVAC unit and drier bottle are being replaced, it is vital that you flush out the rest of the system to remove any excess oil or debris from the condenser and pre-existing hoses.

Correct flushing of the system can only be achieved by using the correct equipment, such as a dedicated flushing kit. Do not flush through the receiver drier.

When fitting a new Puma 319 HVAC unit into a pre-existing AC system, the receiver drier bottle must always be replaced and the system must be vacuumed for a minimum of 45 minutes. Failure to replace the drier bottle will invalidate any warranty.

## Operation your new system

The Puma HVAC 319 is completely unique in the world of Defenders, designed as an all year round system, combining heat and cold in one unit and on one set of dashboard mounted controls.

In operation, it has four settings:

AC ON / HEAT OFF	Cold air
AC ON / HEAT ON	Dehumidified air
AC OFF / HEAT ON	Hot Air
AC OFF / HEAT OFF	Ambient air

The three speed fan operates on all four settings.

Running AC and heat in the winter therefore dehumidifies the air creating a better driving environment and prevents screen fogging. The side control thermostat can be altered in different seasons for more precise control of the interior temperature.

Thank you for your purchase and we hope that your new Puma 319 system serves you well for many years.





## Troubleshooting

In the vast majority of cases, your Puma 319 HVAC system will work without an issue. However, it is important to follow a few basic guides for install and initial charge to avoid damage to the system.

The mechanical installation of the system can be undertaken by any experienced / competent mechanic, but specialist hose crimping tools will be required to create seals to the required tolerances. The fitted system, once installed, must be flushed, pressure tested and charged by a professional AC technician before first use. Failure to observe these pre-charge checks could invalidate your warranty as debris left in the system from the install can be destructive.

Contamination is the main cause of system failure, so a complete flush before initial charge is essential. A nitrogen test will also check for system leaks which may need to be addressed before use.

Note: It is vital to bear in mind that your Puma 319 HVAC system is a dual core upgrade with both a heater and AC, meaning that both elements have to be installed correctly to allow each side to work to full efficiency. Parts used in the manufacture of this system conform to standards that are in the public domain or are widely licensed, meaning that replacement parts are easily available under universal platforms.

## AC Trouble shooting:

### AC ON BUT NOT BLOWING COLD?

**As your Defender 319 system is dual core (Heater and AC) then failure to correctly fit and adjust the hot water valve and bowden cable will result in hot water flowing into the core and AC cooling will be compromised.**

Check that the water flow valve is fully closed from the dash dial. Make sure that the valve is not installed backwards. Check the flow direction carefully and take time to adjust the cable so that the valve is fully closing from the dashboard control dial.

The easiest way to check if hot water contamination is causing the issue is to check the water inlet and outlet pipes on your Puma 319 box when the engine is at operating temperature. If the hoses are hot then water is creeping into the core, meaning that the heater is on at the same time as the AC.

### WATER FULLY OFF AND STILL NOT COLD

**If the air conditioning thermostat dial (side of box) is set fully to the right (Summer) and fans on high, but is only blowing moderately cool air:**

Check to see that the cooling fans for the condenser or radiator are running when the air conditioning is on. If utilising the Defender's engine fan, check that the fan is not damaged and the viscous coupling is not worn. Your AC condenser needs good airflow.

Look for any restrictions like leaves, bugs or dirt that would keep air from passing through the condenser.

Check the pressures in the system using a manifold gauge set. The recommended high-side is 200-225 psi and low-side pressure should be 30-40psi

### START WITH THE AC COMPRESSOR

**When diagnosing an air conditioning issue, it's easiest to begin at the compressor:**

- Is the compressor engaging? With the engine running turn on the A/C and the engine note should drop a little if it engages the compressor. Turn the fan on high and make sure that the clutch is engaging correctly on the compressor. Note: this is not the pulley itself, but the magnetic centre piece that engages the pulley to the compressor shaft.
- If the clutch is not engaging then there could be an electrical issue or no refrigerant in the system.
- If the clutch is engaging and disengaging rapidly, the refrigerant may be low.
- If the clutch is not engaging, use a multi-meter to check for power getting to the compressor.
- If there is power - the clutch may be bad.
- If there is no power - a cycling switch may be bad, a fuse may be blown, and the system may not have enough refrigerant pressure to trip the low pressure cut-off switch that cycles the compressor.
- If the clutch is engaging for a few minutes and disengaging for a while, then it is cycling correctly.



## MANY PROBLEMS ARE CAUSED BY LEAKS

Leaks are one of the most common problems associated with the air conditioning system. R134a refrigerant will easily escape, so it is vital to have your system, pressure tested before adding refrigerant. Your refrigerant can escape very rapidly within hours of being charged.

Using a UV A/C leak detection kit is the easiest way to find a leak.

- Check around all fittings to verify that they are all secure.
- Check hose manifolds on the compressor.
- Check the front seal and the O-rings sealing the pressure switches on the back of some compressors.
- Check where the hoses are crimped onto the fittings.
- Check for pin holes in the condenser.
- Check where the evaporator drains condensation with UV light. Sometimes oil or dye can be seen.

Note: The dye check will not work if the system is too low and the compressor is not cycling.

STILL NOT WORKING? CHECK THESE COMPONENTS:

## COMPRESSOR AND CLUTCH

The AC compressor is a rotating pump that circulates refrigerant (R134a) throughout the system.

Common Problems: Leaks in one or more seals or the compressor itself can occur. Particle contamination from worn parts inside the compressor are a frequent culprit. The engagement clutch, called an AC clutch, can also fail rendering the compressor inoperative.

What to look for: If the refrigerant is low, check for visible system leaks that appear green and oily. Failing internal components caused by normal wear or low AC Oil levels caused by leaks. Failed AC clutch. Failed power supply to the AC clutch caused by a blown fuse, bad pressure control switch, dash control module or a broken circuit wire. Inspect and test before replacing!

## RECEIVER DRIER BOTTLE

The Receiver/Drier bottle collects and absorbs moisture. Moisture is like poison to the internal system components and can damage the AC Compressor as well.

Common Problems: Internal failure allowing desiccant material to enter the AC system. Like sugar in your fuel, this material in the wrong places can cause major problems. Leaks can result in over-saturation of the desiccant material that can lead to compressor damage.





### **EXPANSION VALVE (INTERNAL)**

**The expansion device filters and regulates the flow of refrigerant through your air conditioning system.**

Common Problems: Contamination is the main cause of failure. If the system pressures are too high and/or too low, the expansion device could possibly be the issue. But first, ensure the refrigerant levels are correct and the radiator/A/C Condenser fan(s) are working properly. Remember, inspect and test before replacing!

### **CONDENSER**

**The AC condenser looks similar to a radiator and works in conjunction with the radiator fan(s). Air flowing across the AC condenser tubes cool the hot (gaseous) refrigerant that absorbed heat from inside the vehicle. This returns the refrigerant back to a liquid state where it will once again enter the evaporator core and absorb more heat from the interior.**

Common Problems: Refrigerant leaks. Contaminant particles from the AC Compressor or AC Accumulator/Drier restricting the flow of refrigerant can lead to poor cooling. While checking the AC Condenser, inspect the Radiator / AC cooling fan motor(s).

### **EVAPORATOR CORE (INTERNAL)**

**The AC evaporator acts like a huge ice cube. It contains the cooled off refrigerant that absorbs heat from inside the passenger compartment. The cool air felt from the dash vents is provided by the AC heater blower motor assembly.**

Common Problems: The number one cause of failure is a leak due to age and wear. An electronic leak detector is the best way to check for leaks. Give attention to the AC evaporator box water drain tube. Use the tester to search for a leak. A green and oily substance may appear in the drain tube if larger leaks are present.

### **AC WORKS PERFECTLY BUT I HAVE DROPS OF WATER IN THE PASSENGER SIDE FOOTWELL**

**Your AC system draws out moisture from the air and extracts the water as condensate. This condensate leaves the unit via the two drain pipes at the rear of the unit and deposits the water onto the ground.**

If you find water is dripping into the footwell. Then it could be that one or both of the condensate pipes are restricted. Blowing them out with an airline should remove any temporary blockage and allow the water to run freely.

If water is still dripping into the footwell and the two condensate pipes are running freely, then it could be that you are in a high humidity setting and the unit is extracting more water than the pipes can cope with. Try running the unit on a lower blower setting or turn down the HVAC thermostat 10% to adjust for high humidity settings.

## Heater Trouble Shooting:

### HEATER ON BUT THE AIR IS NOT GETTING HOT

The heater element in the PUMA 319 HVAC, as in any car, depends on receiving hot water from the engine. Some engines may run colder than others. Please check your engine thermostat to ensure that your engine is running at the correct operating temperature.

Check that the water flow valve is fully open from the dash dial. Make sure that the valve is not installed backwards. Check the flow direction carefully and take time to adjust the cable so that the valve is opening correctly from the dashboard control dial.

The easiest way to check for hot water in the core is to feel the water inlet and outlet pipes on your Puma 319 HVAC box once the engine is at operating temperature. If the hoses are hot then water is flowing into the core correctly.

### HOT WATER IS FLOWING BUT THE VENT AIR IS STILL NOT WARM

If there is hot water in the heater core, but no hot air at the vents, then the AC could be switched on at the same time with the thermostat on the wrong setting.

During cold months, you can run your ventilation system with both AC and Heater at the same time. This combination system allows you to dehumidify the cabin air and reduce windscreen fogging. To run this efficiently, the thermostat dial on the side of the HVAC box should be turned fully to the left ("Winter") which will dehumidify the cabin air without cooling down the heater element.

