



**PUMA**  
AUTOMOTIVE DESIGN LTD

Fitting Instructions

# MINISTRY OF DEFENCE

## FRONT AND REAR HVAC SYSTEMS

Puma Automotive Design Ltd





# Introduction

The Puma HVAC systems developed by Ministry of Defender are a range of closed circuit Heating & AC units that recirculate cabin air for greater efficiency in raising or lowering the temperature of the interior, whilst also offering a unique 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 conditioned air back into the vehicle via the dashboard vents. This allows the unit to be fitted unobtrusively in the engine bay as a direct replacement for the old Defender heater box, with both AC and Heater operated from one set of dash controls.

## Removing the Old Heater Unit and Air Intake Ducting

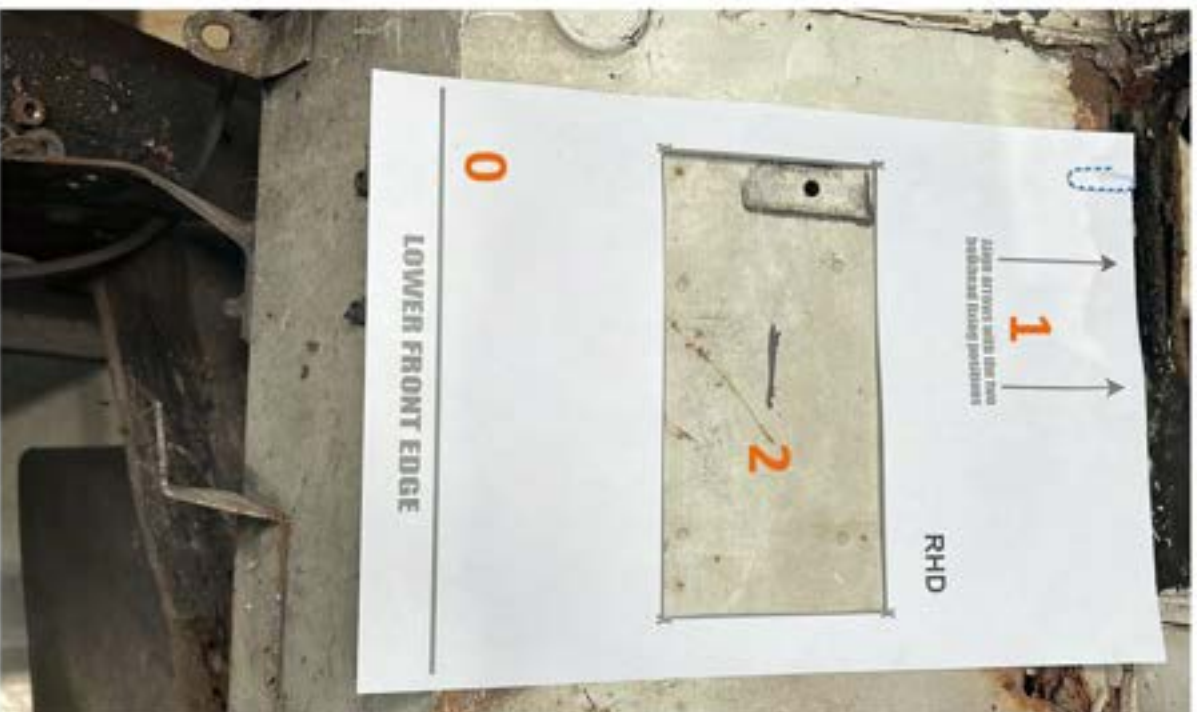
Before you start to remove the original heater unit, disconnect and tie off the two water pipes to avoid unnecessary loss of engine coolant. The electrical connector to the side should also be unplugged. As with any work on vehicle electrics, it is recommended that you disconnect the battery for safety reasons.

The heater box is held in place by two central bolts at the top, which connect the unit to the upper bulkhead, and by two smaller bolts underneath, which fix the lower part of the heater box to the passenger footwell. The top ones can be undone using a 13mm spanner, the lower ones usually require 10mm tools. It may be necessary to remove the interior carpet to gain access to the back of these two lower bolts to prevent them from spinning.

With the heater box removed, the air intake ducting can also be removed and discarded.

## Contents

- 02 Removing the Old Heater Box
- 03 Creating the Air Intake
- 04 Fitting the Box in the Engine Bay
- 05 Heater Install Notes
- 06 Electric Solenoid Water Valve
- 07 Condenser Radiator and Fan
- 08 Compressor Notes
- 09 Plumbing Diagram
- 10 Plumbing Diagram Notes
- 11 Wiring Diagram
- 12 Wiring Diagram Notes
- 13 Carling Switch Diagrams
- 14 Operational Notes
- 15 Fitting the Rear AC System
- 17 Trouble Shooting the AC
- 18 Trouble Shooting the Heater



## New Air Intake & HVAC Box Fitment

The MOD HVAC units are designed to replace the Defender's original heater box in the engine bay. Note: When removing the old heater box, retain the top two fixing bolts as these are used to connect the new HVAC unit to the Defender bulkhead.

In order to create the primary air intake for the HVAC unit, please use the cut-out template (0) provided with your purchase. The templates are stated as LHD or RHD accordingly. This template should be placed on top of the bare passenger footwell, with arrows aligned with the top two fixing 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 from the cabin. Air drawn into the unit via the aperture (2) will be conditioned inside the unit and discharged back into the cabin via the standard bulkhead air inlet (3).

At the same time as cutting the rectangular hole, a 5mm hole should be drilled on each side of the gap (4), centrally at around 1cm out from the new cut line edge. These holes are for the lower anchor fixings.

Add the soundproofing material to the upper side of the footwell, with the insect screen sandwiched in between (5).

The HVAC unit can now be loosely fitted using the top two bolts retained from the original heater mounting (1).

With the HVAC unit in position, drill from the inside of the cabin into the underside of the HVAC unit from the holes made earlier (4). This time use a 4mm drill into the base of the unit on either side. Two self-tapping screws can now be connected to the underside of the HVAC unit to anchor it down.

The front of the HVAC unit has a foam surround in order to create an air tight seal around the bulkhead air inlet (3). As the top bolts are tightened, keep pushing the unit down and forward to create a good connection to prevent air flow loss during operation. Simultaneously tighten the underside screws until both top and bottom fixings are tight and a secure seal is formed around the inlet and outlet apertures.

**NOTE:** Failure to create a good underside seal may result in hot engine air, rather than cabin air being pulled into the box and no recirculating will occur. AC may blow warm.

With the unit now fully secure (6) all interior trim and carpet can be 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.

**NOTE:** Do not cover the air inlet from the inside.

*Further help can be found on our YouTube Videos*

## Heater Fitting Notes – (Not Applicable to AC-ONLY 410 Units)

The heater pipes connect to the HVAC unit in much the same way as with the original Defender heater box. Hot water flows from the engine's cooling system into the heater matrix, which is regulated by a flow valve controlled from the dashboard. There are two types of water control valves depending on your system. All valves are mounted to the inlet pipe to regulate water flow into the HVAC unit. The valves are float-mounted on the rubber pipe (5). They do not need to be mounted rigidly.

### Mechanical Push-to-Close Valve

The Push-to-Close brass valve is supplied with our Puma dashboard conversion and can also be used with aftermarket dash consoles where space allows. The Push-to-Close valve comes with its own Bowden cable (4) and dashboard control dial (3). The cable must be connected the right way round. One end of the cable has a silver clip (1) to mount securely into the dash control mechanism. If the cable is fitted the wrong way round the valve will not work correctly.

Note: For the mechanical valve, it is vital that it is correctly fitted and adjusted so that it fully opens and fully closes in normal operation. Failure to correctly position the operating cable (2) onto the frame will either result in the valve not opening (heater will not work correctly) or not closing (hot water will constantly flow into the core causing the system to blow warm even on the coldest AC setting).



## Electric Solenoid Water Valve

For HVAC installs where the standard OEM dashboard is retained as original, we recommend the electric water valve (6) as this does not need any adjustments and is a certain ON/OFF water flow with no risk of error. The valve is controlled by a Carling 'HEATER' switch supplied with your kit together with a factory style dashboard control panel (7).

This electric valve is incredibly simple to set up and operate. When voltage is applied to the signal wire (Blue) then the valve will open, when voltage is removed it will revert back to the normally closed position.

Please note that the Red wire needs to be connected to an Ignition Positive as this is the power source for the internal solenoid motor.

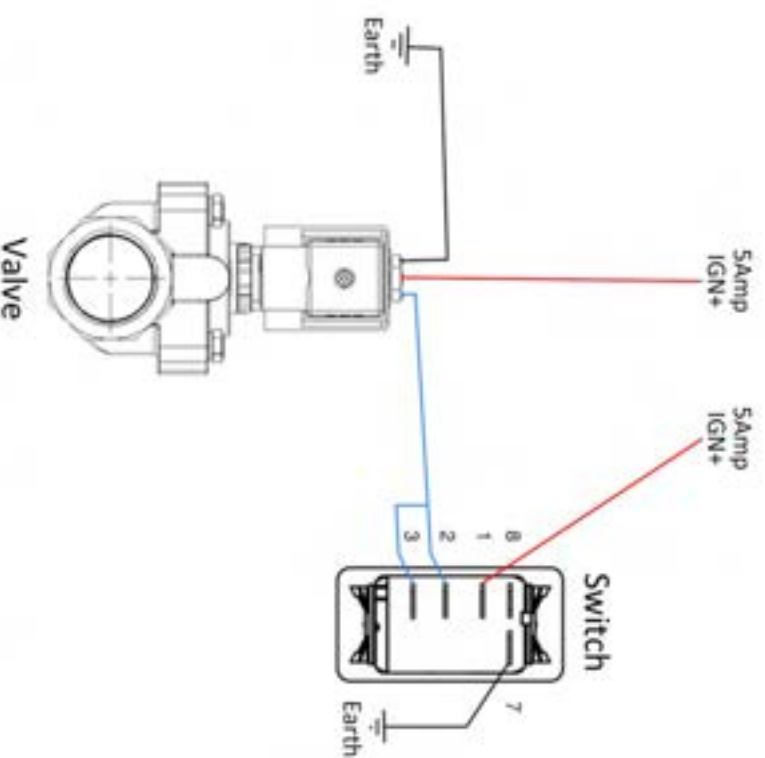
The valve is float-mounted on the rubber pipe (8). It does not need to be mounted rigidly.



## Water Bleed Valve

Once the heater is installed it is important to make sure that the water system is bled correctly to remove any air that remains in the pipework. To assist, a bleed valve (9) is supplied and can be fitted to the high point on the heater system along the outlet pipe. (see plumbing diagram p8)

**Note:** Failure to remove all air may cause the system to air-lock resulting in ineffective heating.



## Condenser Radiator and Cooling Fan

The condenser radiator supplied with the Mod HVAC system is an ultra-slim design with a large surface area to maximise the condenser flow rate. The narrow profile of the condenser sometimes makes it possible to add air conditioning without having to buy the extended nosecone section for the Defender grille, although this will depend on your model and intercooler layout.

The condenser may be mounted to the two diagonal A-Frame cross member bars at the front of the vehicle, either in front (1) or behind (2) depending on space. Pictured are two variations on how to mount the radiator without the need for any further carry/support frame. However, each install is different and some fabrication may be required for the condenser mounting on your Defender.

**Note:** If using the mounting kit, please make sure to use the neoprene washers provided as this will create a barrier between aluminium and steel to help prevent galvanic corrosion.

The location of your engine's compressor will dictate which way round you fit your condenser. It can be mounted left or right but should be done so in a way that makes the connection pipe from the condenser top (#8 Fitting) to the compressor discharge port (#8 fitting) as short as possible for maximum efficiency.

**Note:** The condenser **MUST** be mounted with the larger #8 connection at the top and the smaller #6 connection at the bottom (as pictured).

The condenser fan is direct mounted to the condenser radiator using the fan mounting kit provided. You will need to mount the fan to the condenser radiator before fitting the condenser.

**Note:** If sourcing your own condenser and condenser fan, please use our following recommendations:

*Condenser:* Core Size 525 x 304mm, 0-Ring Female (3/4"-16 UNF & 5/8"-18 UNF)  
*Condenser Fan:* 12v DC, 305mm Push Fan, Minimum 856cfm



## Compressor Notes

The positioning and type of compressor used will be determined by your engine model. The compressor itself is normally belt driven from the engine with a magnetic clutch, which engages the compressor pistons when needed. Without electrical power to engage the clutch the pulley will spin freely. Once correctly operational the larger #10 compressor pipe fitting (1) will frost over to signify that the AC Evaporator core is cold.

### Mounting:

At MOD, we can supply our own mounts for fitting a belt driven compressor to the 200/300 diesel models. The EFI and Td5 engines require no additional bracket as those engines are pre-fitted with a compressor mount. Mechanical compressors are usually self-grounding on the engine mount, which means that only a single wire is required to power it from Compressor Relay Pin 87 (see wiring diagram page 11)

We recommend genuine Sanden or Denso compressors.

If fitting the HVAC box into an existing AC system, the old drier bottle must be replaced. This is because when a drier bottle has been in use on a system for a number of years, there is a possibility that the desiccant may be close to its moisture capacity. Also, when a system is taken apart for service, the desiccant in the drier will be directly in contact with moisture. Failure to replace the drier bottle may invalidate any warranty.

### Compressor Limited Warranty

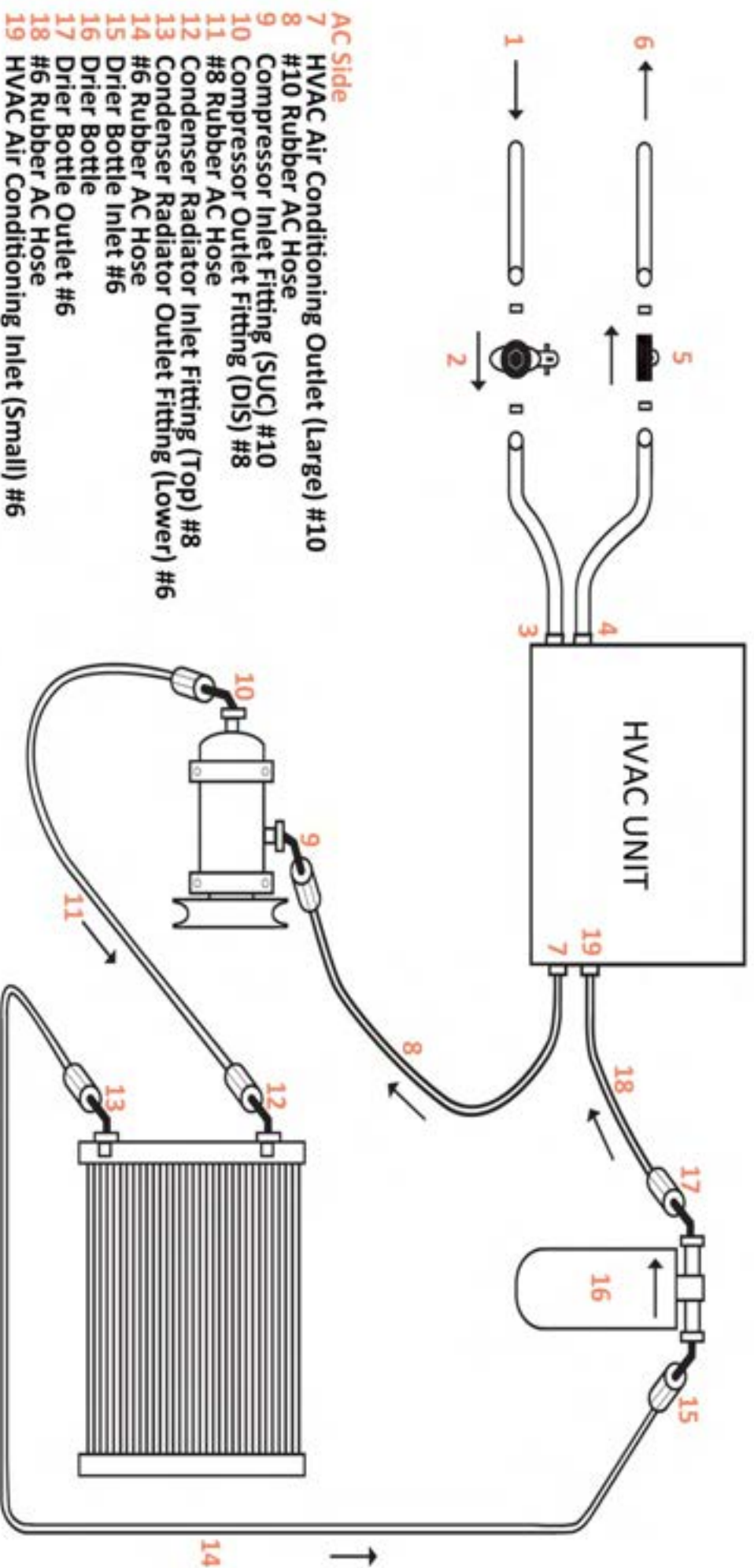
Ministry of Defender warrants its supplied compressors to be free of defects in material and workmanship for 12 months from the date of sale to the original end user. This limited warranty covers the compressor only and does not include labour of any kind or parts not furnished by the manufacturer or distributor. This warranty does not cover defects or malfunctions which result from causes beyond Ministry of Defender's control, including, without limitation:

- Alteration in any way that negatively affects the integrity of the compressor.
- Misuse, abuse or accident, neglect or other abnormal use.
- Damage due to incorrect refrigerant, or improper installation.
- Installation must be performed by a certified professional
- The system must have had an approved flush prior to installation
- Must replace the drier receiver bottle
- DO NOT ASSUME THE COMPRESSOR COMES FILLED WITH OIL.
- Please check the oil level due to possible loss in transit.
- Must use R134A refrigerant specific only.



# HVAC Plumbing Diagram

(Front HVAC only, if fitting Front and Rear HVAC see p 15)



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

- 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 Outlet Fitting (Lower) #6
- 14 #6 Rubber AC Hose
- 15 Drier Bottle Inlet #6
- 16 Drier Bottle Outlet #6
- 17 Drier Bottle Inlet #6
- 18 #6 Rubber AC Hose
- 19 HVAC Air Conditioning Inlet (Small) #6

# Plumbing Notes

## Heater Side Plumbing

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

A length of 16mm (5/8) water pipe is included in your kit, which matches the connectors on the HVAC box and water valves provided. If your engine uses larger 19mm (3/4) water pipe, then please use the adapter connector provided. Each adapter can be cut in half to serve both inlet and outlet pipes.

The hot water supply pipe should be connected to the HVAC Box water inlet (3) via the water flow valve (2). The water flow valve can be either electric or cable operated depending on your provided system. When fitting the water valve, ensure that it is not installed backwards and is correctly adjusted so that it completely closes the water flow in the 'shut' position.

Note: Failure to correctly fit and adjust the water valve will result in hot water entering the core at all times, which will compromise AC cooling.

The HVAC Box water outlet (4) carries cooler water out of the heater core and back to the engine (6).

## 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 (11) 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 (15). 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.

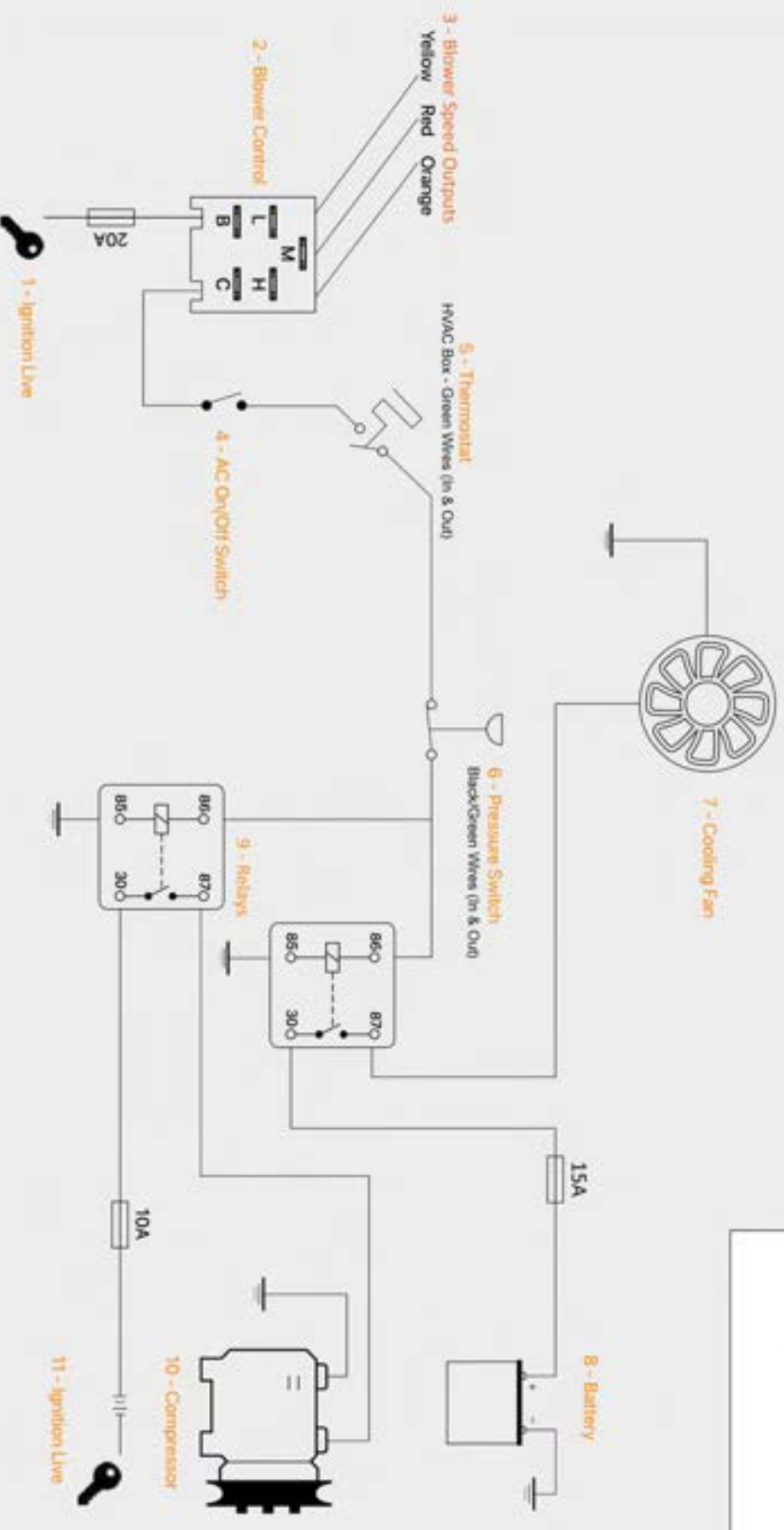
AC pipe crimping tools required.

Must be flushed and tested prior to initial charge.

R134a Refrigerant: 650g /22oz ± 5%

# Puma HVAC Wiring Diagram

(Front HVAC only, if fitting Front and Rear HVAC see p 15)



**Note:** When connecting the blower speed outputs to the blower control, take care to use shielded terminal connectors to avoid different wires touching. If power is sent down two or more Blower Speed Output wires at the same time, this can damage the blower resistor. Blower will then only work on max setting.

NOT TO SCALE - Please Refer to Wiring Diagram Notes

# Puma HVAC Wiring Diagram Notes

**1 Ignition Live Power IN:** This wire is an ignition feed that powers the three speed blower and also triggers the compressor and cooling fan relays. This wire must be minimum 20A rated wire, fused to a 20A safety level. This input wire connects to Pin B on the blower control.

**2 Blower Control:** This is the three speed blower control that mounts to the interior dashboard. The back of this switch has five Pins. Pin B is for the input power from the ignition line (see 1 above). There are then three Blower Speed Output Pins (see 3 below) and a final Pin C, which is the power supply line to the dash mounted AC ON/OFF switch (see 4 below). Pin C will only give Power Out when the blower is turned on. This safeguards the AC core from potential damage.

**3 Blower Speed Outputs:** These three lines control the speed of the blower and thus the volume of air to the dashboard vents. The connection to the HVAC lines are as follows:  
Pin L is Low Speed (Yellow)  
Pin M is Medium Speed (Red)  
Pin H is High Speed (Orange)  
**Note:** From the HVAC box, the black wire is ground/earth. This wire should be grounded safely in the engine bay area and does not need to connect to the dashboard control.

**4 AC ON/OFF Switch:** This is the dashboard mounted ON/OFF switch to activate the AC system. If using Carling switches, please refer to page 11 for wiring guides. If using a round ON/OFF switch, the Power IN is PIN 1, Power OUT is Pin 2, Ground/Earth is the gold Pin.  
**Note:** Power IN must come from Pin C on the Blower Control (see 2 above)

**5 Thermostat:** The AC control thermostat is housed inside the HVAC unit itself, with the seasonal control dial located on the outside side panel. The thermostat monitors the internal temperature of the Evaporator Core and thus the temperature of the air flowing through into the cabin. The two green wires extending out from the side of the HVAC box are the thermostat control lines IN and OUT. One of these wires should be attached to the power line coming from the AC ON/OFF switch. The second wire goes on to the pressure switch (see 6 below). It does not matter which way round these two green wires are attached.

**6 Pressure Switch:** The pressure switch is used to protect the system from high pressure overloads and low pressure/dry running, both of which can damage the AC components. The switch itself is mounted on top of the Drier Bottle and has two black/green wires as well as two blue wires. When fitting the MOD HVAC systems, the blue wires are not used.

The black/green wires are used to trigger both the compressor and the condenser cooling fan simultaneously, resulting in greater efficiency.

One of the black/green wires should be attached to the Thermostat OUT wire (see 5 above). The second of the black/green wires should go on to trigger both the compressor and cooling fan relays (Pin 86 on both). It does not matter which way round these two black/green wires are attached.

**Note:** The Pressure Switch will not operate and connect power to the compressor and the cooling fan until the system is gassed and safe operating pressure is reached

**7 Cooling Fan:** The Cooling Fan provided is a high output PUSH fan that fixes directly to the front of the condenser radiator. The blue wire on the fan is for the positive (+) Power IN, which comes from the Cooling Fan Relay Pin 87. The second black wire is a negative (-) and should be grounded securely.

**Note:** The fan has a DC motor, meaning that if the unit is wired backwards the motor will spin in reverse and PULL hot air into the condenser substantially reducing efficiency.

**8 Fan Power (Battery):** The Cooling Fan power line should be taken from a live feed such as the battery or other constant live wire. This wire goes to Cooling Fan Relay Pin 30 and should have a 15A wire and fuse.

**9 Relays:** The two relays provided activate the compressor's magnetic clutch and also the cooling fan (one relay for each). Pin 86 on both relays receive their feeds from the black/green wire coming from the Pressure Switch (see 6). If the system is working within normal tolerances, this will trigger the relays and activate the compressor and fan simultaneously. Pin 85 are earth wires and should be grounded securely. Pin terminals 30 are lines IN for the fan power (see 8) and compressor power (see 11).

**10 Compressor:** The compressor is belt driven from the engine and has a magnetic clutch, which engages the compressor pistons when needed. Without electrical power to engage the clutch the compressor pulley will spin freely. The compressor is self-grounding on the engine mount, which means that the single wire available is the Power IN from Compressor Relay Pin 87.

**11 Compressor Power:** This is the ignition live Power IN to Compressor Relay Pin 30. This must be minimum 10A rated wire and fuse.

## Operational Safety Sequence:

If the Blower Control is ON, this sends power to the AC switch, which will pass on power to the Thermostat, which will pass on power to the Pressure Switch, which will pass on power to the two relays, which will activate the Compressor and Cooling Fan.

## Four Safety Elements in Operation:

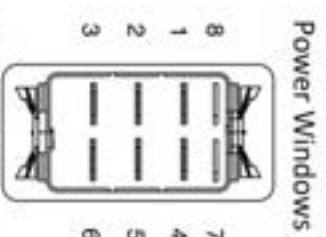
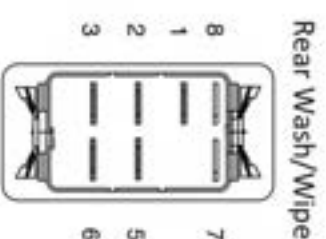
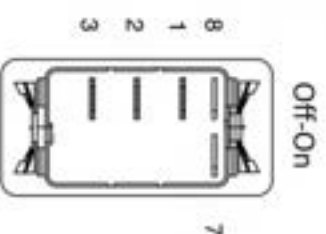
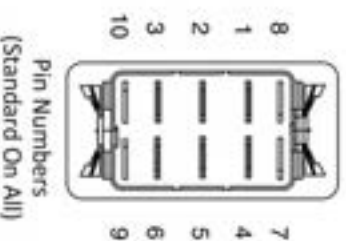
- 1) The Blower must be turned on to generate air flow through the HVAC core. Blower activation sends power from Pin C.
- 2) AC switch must be activated only from Pin C. Power from the AC switch will engage the thermostat.
- 3) If core temperatures are within operational range, the Thermostat will send power forward to engage the Pressure Switch.
- 4) If Pressures are within operational range, the Pressure Switch will trigger both relays and engage the Compressor and Cooling Fan simultaneously.

**Note:** If any tolerances are breached, the AC system will not engage. This is in order to protect the system. It is therefore vital that your new AC system is wired in accordance to the provided notes and diagrams to provide maximum protection and efficiency.

# 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-On [EU]           | Power Out 2             | Power In              |                               | Power Out 1                   | Power In 2                                   |                               | Earth                   | Sidelight                                  | Earth                                        | Link Pin 4 |
| On-Off-On [EU & US]      | Power Out 1             | Power In              | Power Out 2                   |                               |                                              |                               | Earth                   | Sidelight                                  | Earth                                        | Link Pin 1 |
| Power Windows            | Power In                | Power Out 1           | Earth                         | Earth                         | Power Out 2                                  | Power In                      | Earth                   | Sidelight                                  | Not used                                     | Not used   |
| Off-Mom [Mom] [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   |
| Rear Wash/Wipe           | Brown w/<br>green trace | Red w/<br>green trace | Green (Live)<br>also to pin 5 |                               |                                              | Green (Live)<br>also to pin 3 | Black w/<br>green trace | Black<br>[Earth]                           |                                              |            |
|                          |                         |                       |                               |                               |                                              |                               |                         | Red/white-<br>sidelight/<br>dashboard feed |                                              |            |
|                          |                         |                       |                               |                               |                                              |                               |                         |                                            |                                              |            |
|                          | Pin 1                   | Pin 2                 | Pin 3                         | Pin 5                         | Pin 8                                        | Pin 10                        | Pin 17                  | Pin 18                                     | Note:                                        |            |
| Hazard [EU & US] Td5     | White w/<br>green trace | Light green           | Purple                        | Light green w/<br>brown trace | Red/white<br>sidelight/<br>dashboard<br>feed | Black                         | Green w/<br>red trace   | Green w/<br>white trace                    | 9th link wire on factory<br>switch is unused |            |
| Hazard [EU & US] Pre Td5 | Green                   |                       |                               |                               |                                              |                               |                         |                                            |                                              |            |

## Example Pin Layouts



Note: Pin 2 & Pin 5 connect directly to the window motor. To reverse polarity, swap wires

# Operational Notes

Use only R134a Refrigerant:

650g (approx) Front System

820g (approx) Front & Rear Systems

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 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 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.

## Operating your new system

The Puma HVAC 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:

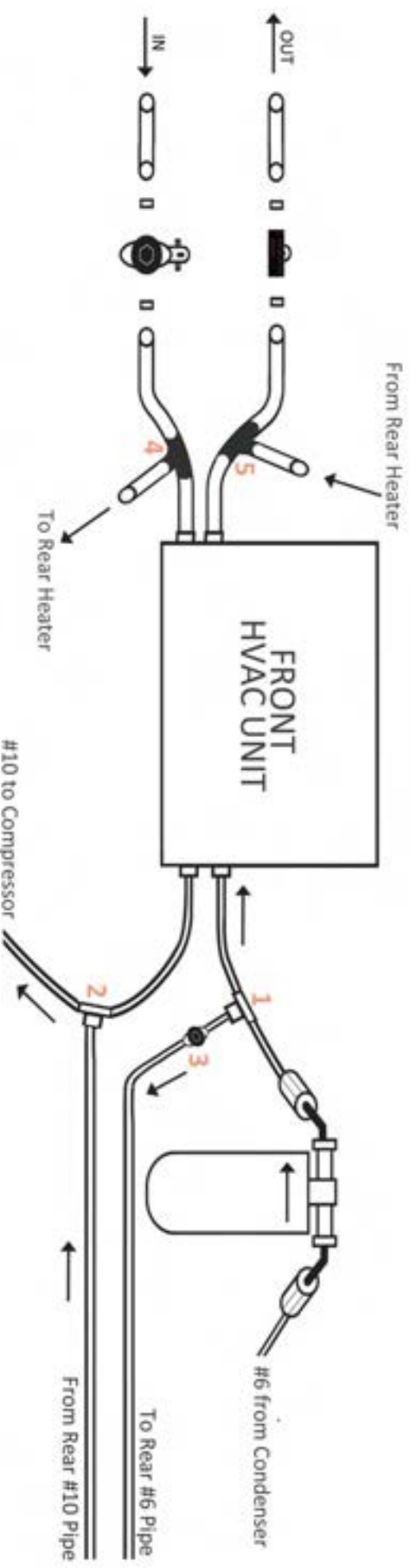
|                   |                   |
|-------------------|-------------------|
| AC ON / HEAT OFF  | Cold Air          |
| AC ON / HEAT ON   | Dehumidified Warm |
| AC OFF / HEAT ON  | Warm/Hot Air      |
| AC OFF / HEAT OFF | Ambient Air       |

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 system serves you well for many years.

# Installing a Second Row/Rear AC System

Note: Front and Rear System R134a = 820g



## Defender Second Row Air Conditioning

One of the biggest headaches when trying to cool the interior of a Defender is poor circulation of air into the rear cabin area, especially so in the longer wheelbase 110 and 130 models. Fitting our secondary HVAC unit to directly service the rear passengers is something that makes a massive difference to the overall cabin environment. Sitting neatly between the front seats of your Defender, this powerful unit incorporates its own Evaporator and Heater cores. Linked to a powerful 3 speed blower, our second row HVAC is not simply a way to transfer cold air from the front into the rear, but is an actual secondary AC, working specifically for the rear seat passengers. Note: A rear AC relies on the front AC system for refrigerant supply. The rear AC will therefore only work when the front AC is also activated.

## Rear HVAC Plumbing

Connect the #6 T section into the Front AC system (1), between the drier bottle and the HVAC unit. This will be the refrigerant supply line to the rear AC unit.

Connect the #10 T section into the Front AC system (2), between the HVAC unit and the Compressor. This will be the refrigerant return line from the rear AC unit.

Connect the Flow Solenoid (3) to the Rear HVAC #6 supply line. IMPORTANT: The Solenoid is directional, please note the direction arrow on the valve case.

Connect the Rear Heater using the T-Piece provided (4) onto the inlet water pipe between the flow valve and the HVAC unit. This will be the hot water supply line. Connect the Rear Heater using the T-Piece provided (5) onto the water return pipe between the HVAC unit and the bleed valve. This will be the water return line.

Note: Remove all air from the heating system prior to use.

## Rear AC Wiring Installation

Electrical installation depends on whether the rear unit is to be added to a Defender that already has an existing front AC system, or whether this rear unit is to be fitted as part of a complete new install of both front and rear HVAC systems supplied by Ministry of Defender.

### Simple Wiring when Adding Rear AC to an Already Fitted Front HVAC System:

- |                  |                                                                      |
|------------------|----------------------------------------------------------------------|
| Blue 20a Wire:   | Ignition feed for Blower                                             |
| Orange 10a Wire: | Trigger line to #6 Solenoid (3)                                      |
| Grey 10a Wire:   | Backlight Feed from Dashboard Sidelights to illuminate the AC Switch |
| Black 20a Wire:  | Ground/Earth                                                         |

### Combined Front and Rear HVAC Install

If installing both front and rear MoD units at the same time, a complete Plug-and-Play wiring harness (7) will be supplied along with a relay box/control module. The control module (6) is designed to sit in the Defender battery box and can be wired directly to the battery terminals. All other plugs on the MoD loom are labelled for ease of fitting. It is recommended that you familiarise yourself with the wiring loom by laying it out on the floor first. This will give you a proper understanding of where each component fits on the electrical circuit and can aid installation and loom routing.





## Troubleshooting

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.

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?

We need to determine if it is the AC that's at fault or bad air circulation into the cabin.

The first obvious point is to check the thermostat dial on the side of the HVAC box. It should be turned fully clockwise to 'Summer' mode. If that is correct then start up the engine and run the AC for a few minutes. Once running please check how the larger metal #10 fitting on the compressor feels to touch; it should be ice cold. The #10 pipe is the suction back from the actual core, so is a good indication of what's happening inside the AC box. If cold, then the compressor should be cycling in and out every few minutes. It will engage the compressor to reduce the internal core temp down to around 1°C then disengage (so as not to freeze it), which allows the internal temp to rise. Once above 8°C it will re-engage the compressor to bring it back down to 1°C, and so on in a cycle.

If the thermostat is correctly set, the #10 fitting is ice cold and the compressor is cycling then the AC is working perfectly and it must be air flow contamination (see next page).

However, if the pipe is not cold to touch and/or the compressor is constantly engaged then this means that the temperature is not coming down and there's an AC issue.

An AC system is pretty simple, so if it's not working then there's a simple reason:

**No Gas** - This is a basic starter point but it does happen where the gas escapes. Was the system Nitrogen tested before it was initially gassed? If it was only vacuum tested then this exerts a negative pressure of -2 bar, which does not simulate operating pressure of +15 bar. Sometimes a vacuum test will suck in and seal a small gap in the system, which will give the impression that all is good, but this is then exposed under positive operating pressure and the gas escapes. Nitrogen testing simulates correct operating pressures.

**Condenser Mounting** - Is the condenser the correct way up? It should have the larger #8 entry fitting at the top and the smaller #6 pipe coming out of the bottom. We've seen them fitted upside down. It's easily done.

**Condenser Fan** - Is the condenser fan fitted correctly and wired up to 'PUSH'? The fan should push the air through the radiator but it's possible to wire it up backwards and thus reverse polarity. This will spin the DC motor in reverse and suck the hot air from the engine rad, compromising the condenser's efficiency.

Does the electric fan engage when the compressor is engaged?

**Drier Bottle** - Is the direction flow correct?

**Hot water in the HVAC box** - If the water flow valve is slightly open it will allow hot water into the matrix to compromise the temperature. You would basically have heater and AC on together. Check that the cables are correctly adjusted / the wires are correctly connected on the valve to make sure no water can pass into the HVAC box.

## Air Flow Contamination

If all the above are tested and checked then there's no reason for the AC not to be cold inside the actual HVAC box so it could be an air circulation issue.

Our system, like all AC systems, is designed to recirculate the cabin air and provide compound decreases in internal temperature over time. Air Circulation can be compromised by the following:

**Doors and windows open** - I know this sounds basic, but people often sit in their cars with AC on and the windows open. If the ambient temperature is +30°C and the windows and vents are open then the AC is basically fighting against a constant high ambient temperature and will never blow cold. Doors and windows must be imperatively closed so that only internal air is cycled.

**Poor footwell seal** - On the bottom of the HVAC box is the footwell aperture which has a foam seal. The bottom of the box must be securely clamped down to the footwell top to create a proper seal. This way, only cabin air is drawn into the unit. If there is a bad lower seal then the HVAC unit will instead draw some hot engine air into the unit and this will cause the unit to not blow cold.

## Heater Trouble Shooting:

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

Heaters depend on receiving hot water from the engine's cooling system. Many Defender engines, particularly the 200/300 models, are known to be cool running engines where it takes a long time to reach operating temperature. The HVAC heater lines flow directly to the thermostat housing so the heater won't get warm until the engine's thermostat is open. Please check your thermostat to ensure that your engine is running at the correct operating temperature.

**Water Flow Valve:** Check that the water flow valve is fully open. Make sure that the valve is not installed backwards. Check the flow direction carefully and take time to check that the valve is opening correctly from the dashboard control.

**Non-Return Check Valve:** If you have a non-return valve fitted to the exit pipe, check that this is mounted correctly and is free flowing. If this valve is not allowing the cold water out of the matrix fast enough, the hot water can't enter and internal temperature drops.

**Air Lock:** Sometimes air can become trapped inside the heater core causing an air lock. Flush the system and be sure to mount the inlet and outlet the correct way.



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