



MV Airo 2 & 5

Alpine Auto

AIR HEATER

INSTRUCTION MANUAL

Ed 3.00

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Preface

Thank you for purchasing the MV Airo 2 and/or Airo 5 diesel powered hot air heater (petrol versions of the MV Airo 2 are available at special request). This instruction book describes the structures, working principles, installation, and operation of the MV Airo 2/5. For correct use of the heater, please read this instruction book carefully before installation and use. The instruction book should be saved in a convenient place for reference later.

Note

- This instruction book is subject to revision without notice, but the instruction book is in conformity to the purchased product.
- Our effort is to explain all questions you may have. If you have any doubts or find anything incorrect in this manual, please contact us directly.
- Check the heater for any damage when unpacking and contact the dealer immediately if anything is found.
- If any troubles arise during application, please contact MV Heating or other customer service stations authorized by this company. We shall do our best to provide service to you.

Comply with the operation manual for installation and operation, to ensure prolonged and reliable use.



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Introduction

The main parts of both the MV Airo 2 and Airo 5 air heaters (hereinafter referred to as 'the heater') are a small fuel furnace controlled by a single-chip micro-processor. Its furnace body (the heat exchanger) is located in the hood shaped case, which serves as an independent air passage. Cold air is drawn into the air passage by the fan, heated by the heat exchanger and blown out as hot air.

An example of how the heater operates is shown in Figure I. Hot air is supplied by the heater to the driver's cab and and/or passenger's compartment independently from the engine. The same theory applies to campervans, cranes, marine vessels etc.

The heater is fully automatically controlled. It features a compact structure, easy installation, low running costs, easy maintenance and is safe and reliable.

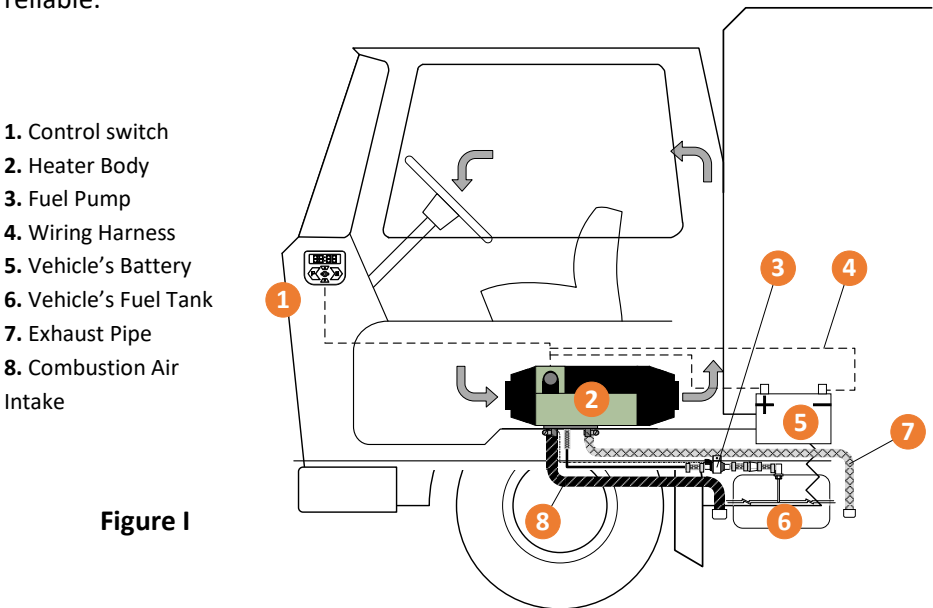


Figure I



MV Airo 2 Technical Data

Output (w)	2000	
Fuel	Petrol	Diesel
Voltage	12/24V	12/24V
Fuel Consumption (l/h)	0.14 - 0.27	0.12 - 0.24
Power Consumption	14 - 29	
Working Temperature	-40°C - 20°C	
Weight (KG)	2.6	
Dimensions (mm)	323x120x121	

Variable Output	Current Draw
Position	12V (Amps)
PO1	0.9
PO2	1.1
PO3	1.2
PO4	1.3
PO5	1.5
PO6	1.7
PO7	1.9

MV Airo 5 Technical Data

MV Airo 5	
Heat Power	5kW
Fuel	Diesel
Rated Voltage	12V24V
Fuel Consumption	0.19 - 0.60l/h
Rated Power Consumption	15 - 90W
Working Temperature	-40°C — 20°C
Weight of Main Heater	5.9Kg
Dimensions	425X148X162mm
Mobile Phone Control (Optional)	No limitation
Remote Control (Optional)	Without obstacles ≤800m

Structure

The structure of the main body is shown in Figure II.

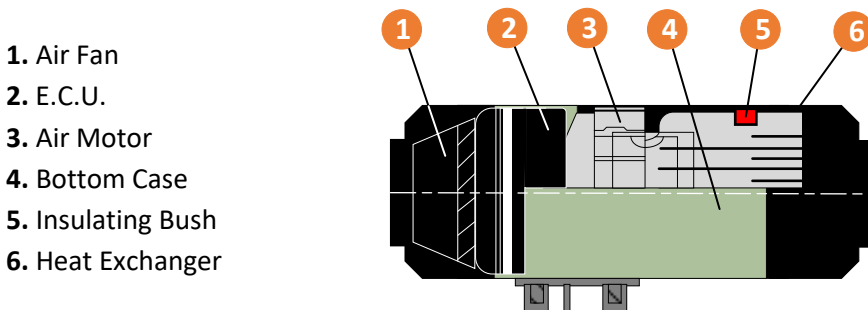


Figure II

MV Airo 2 Internal Structure

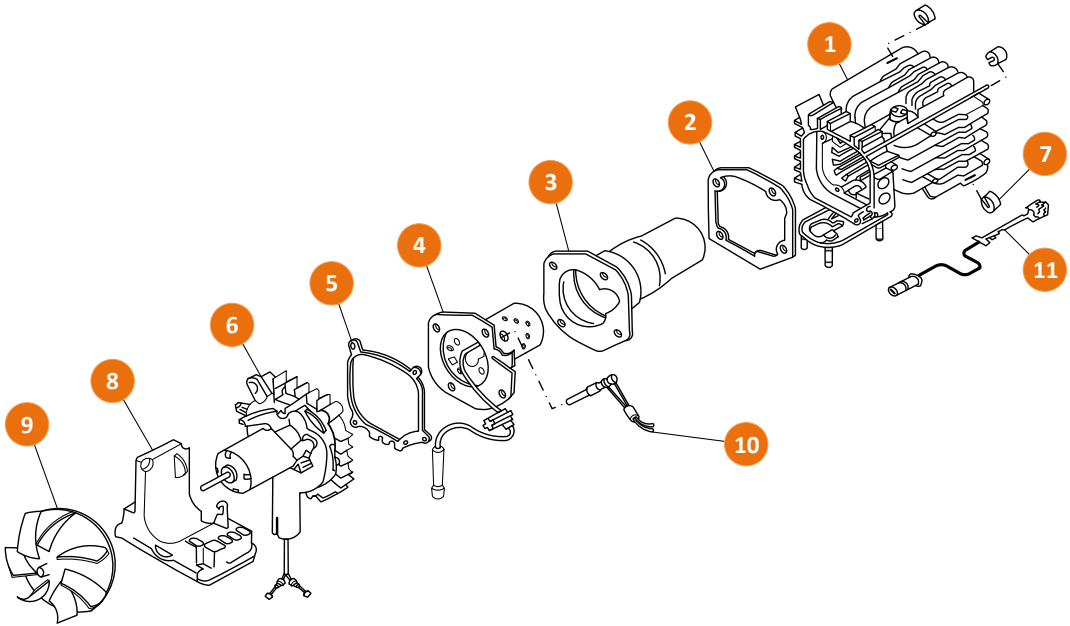


Figure III

- | | |
|------------------------------|------------------------------|
| 1. Heat exchanger | 2. Gasket 1 (4 hole) |
| 3. Combustion chamber | 4. Burner Assembly |
| 5. Gasket 2 (5 hole) | 6. Air Motor Assembly |
| 7. Insulating bush | 8. ECU |
| 9. Air Fan Wheel | 10. Glow Pin |
| 11. Overheat Sensor | |

MV Airo 5 Internal Structure

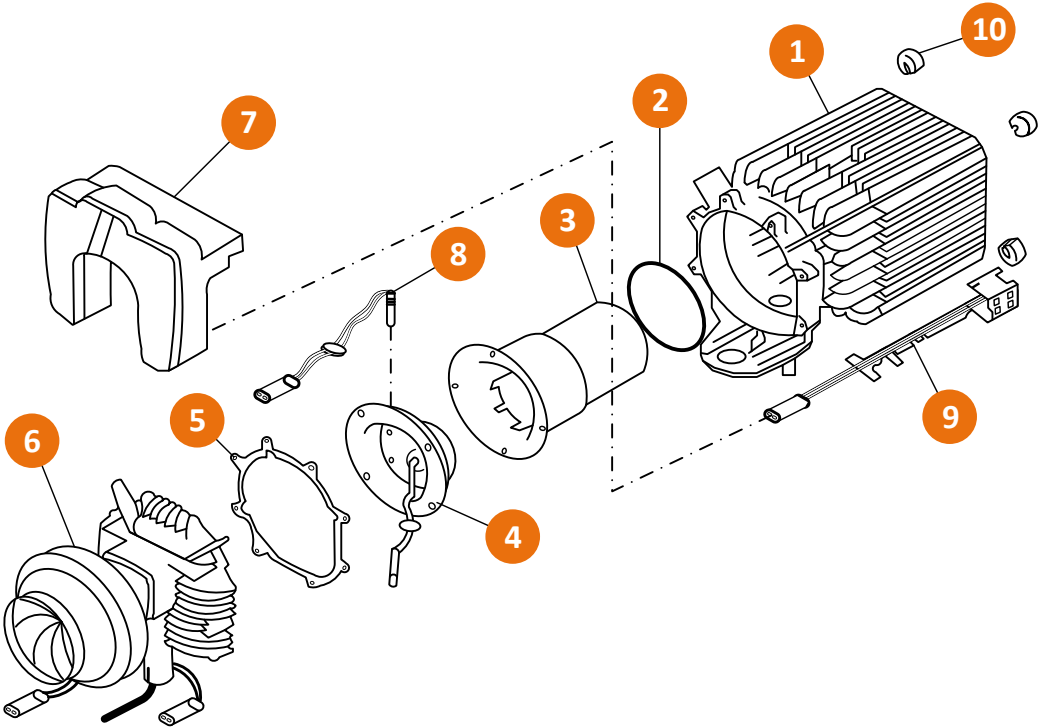


Figure IV

- | | |
|-----------------------|-----------------------|
| 1. Heat Exchanger | 2. O-ring |
| 3. Combustion Chamber | 4. Burner Assembly |
| 5. Gasket | 6. Air Motor Assembly |
| 7. ECU | 8. Glow Pin |
| 9. Overheat Sensor | 10. Insulating Bushes |

The heat exchanger is made of die cast aluminium with radiating fins around and at the rear end. The combustion tube is located inside the heat exchanger, and the burner assembly is fixed on the front end of the combustion tube. Fuel is fed to the burner assembly through the fuel inlet pipe by the aid of the fuel pump. It is ignited by the glow pin, which also serves as a flame sensor after ignition. The flame is supported in the burner assembly and sealed in the combustion tube. All combustion gases exit the heater through the exhaust port.

Combustion air is fed into the heater via the combustion air pipe and is supported efficiently by the combustion air fan, located on the rear of the air motor. Cool air enters the air inlet, is heated by the heat exchanger, and is pushed out the air outlet by the fresh air fan of the air motor assembly.

Heater Cases

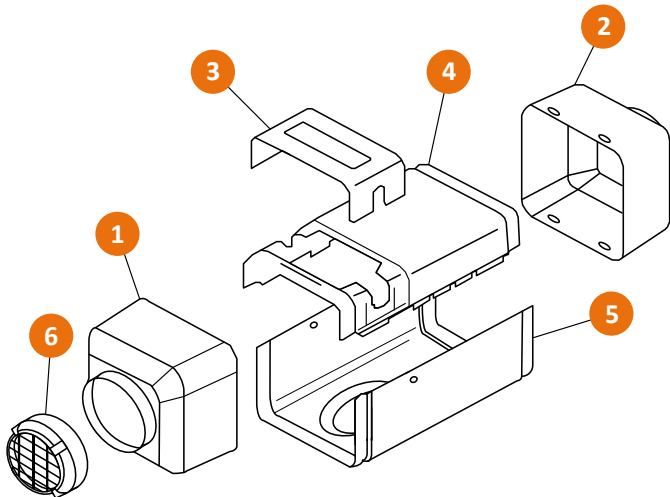


Figure V

- | | | |
|--------------|----------------|--------------|
| 1. Inlet cap | 2. Outlet Cap | 3. ECU Cover |
| 4. Top Case | 5. Bottom Case | 6. Grill |

Installation

The kit includes everything necessary for a standard installation.

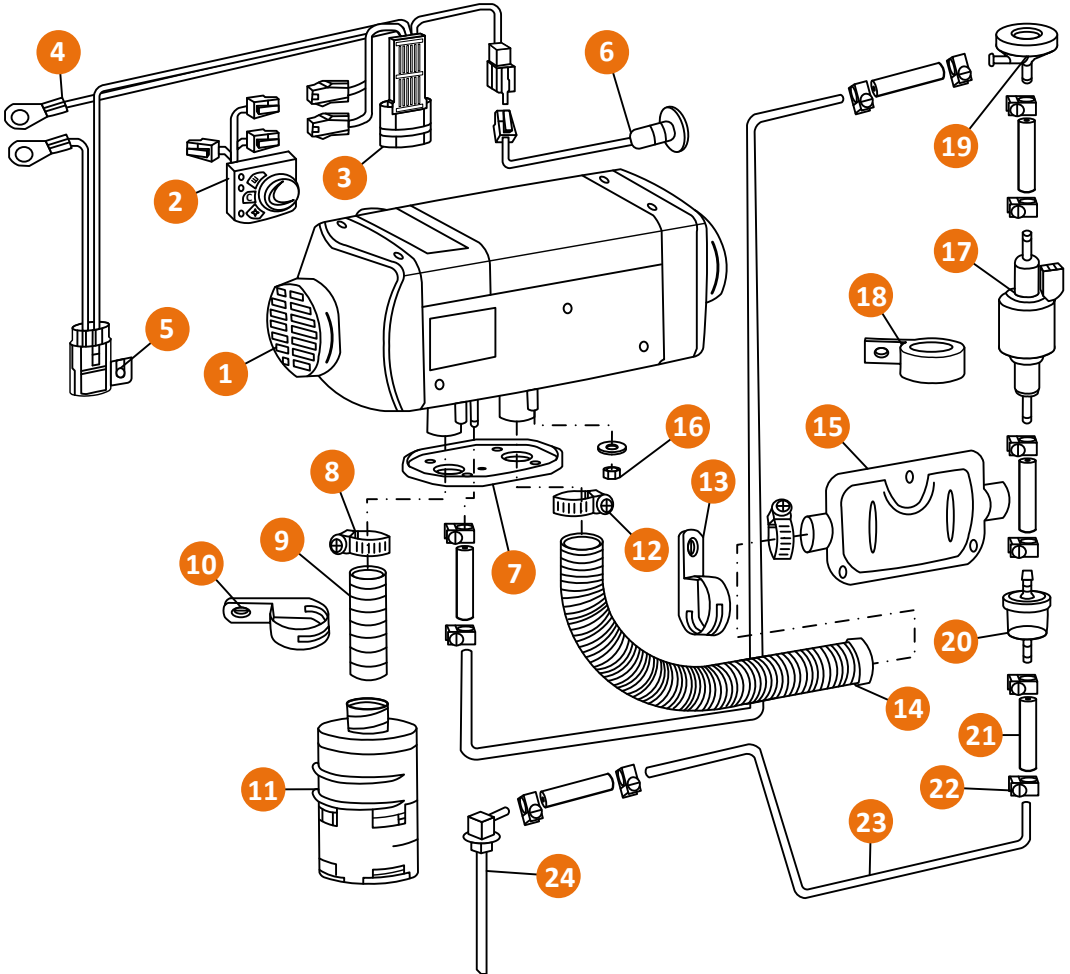


Figure VI



- | | |
|------------------------------|---------------------------------------|
| 1. Main Heater Body | 2. Control Unit (with accessory plug) |
| 3. Main Wiring Harness | 4. To Power Supply |
| 5. Fuse Holder | 6. External Temperature Probe |
| 7. Mounting Gasket | 8. Combustion Air Pipe Clamp |
| 9. Combustion Air Pipe | 10. Combustion Air Pipe Strap |
| 11. Combustion Pipe Silencer | 12. Exhaust Pipe Clamp |
| 13. Exhaust Pipe P-Clip | 14. Exhaust Pipe |
| 15. Exhaust Silencer* | 16. M6 Nut & Washer (x4) |
| 17. Fuel Pump | 18. Fuel Pump Mount |
| 19. Fuel Pump Damper | 20. Fuel Filter |
| 21. Fuel Pipe Connector | 22. Fuel Pipe Connector Clamp |
| 23. Fuel Pipe | 24. Fuel Standpipe |

*Unsealed, must be installed outside of the vehicle. When purchased with a marine kit, the silencer will be sealed, and attached to the exhaust pipe as part of a single system

Figure VI shows the diagram for an Airo 2 installation. The position and ways of fixing of various parts may vary from one vehicle/boat to another, but the general principles remain the same.

Attention:

- Do not mount the heater near any flammable sources
- Do not install the heater in closed spaces without ventilation
- Do not place the heater near anything that can cause a blockage
- Do not mount the heater near any water sources and protect it from any splashing or road debris

Installation of the Main Heater Body

For the ease of servicing, fault finding and air flow it's recommended that the main body is placed in an area with easy access. Figure VII shows the minimum distances required on the MV Airo 2 and Figure VIII shows the distances for the Airo 5.

MV Airo 2 Dimensions

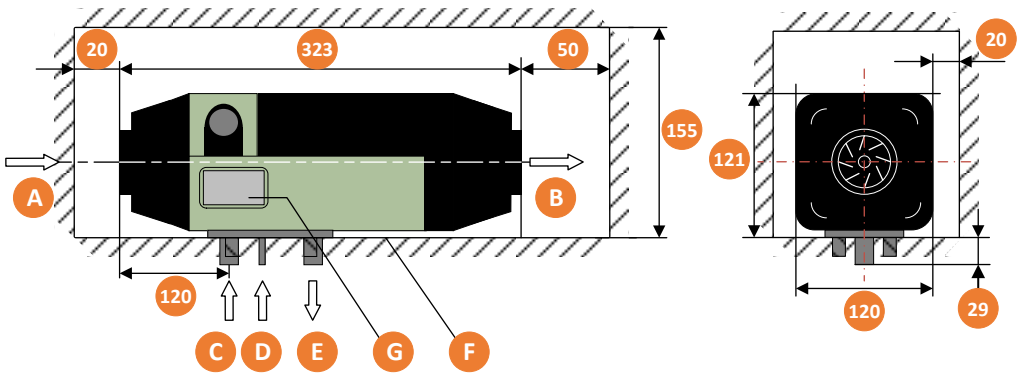


Figure VII

- | | |
|--------------------------------|---------------------------------|
| A. Air heating inlet | B. Air heating outlet |
| C. Combustion air inlet | D. Fuel inlet |
| E. Exhaust outlet | F. Non-interference area |
| G. Information label | H. Installation surface |
| I. Gasket | |

MV Airo 5 Dimensions

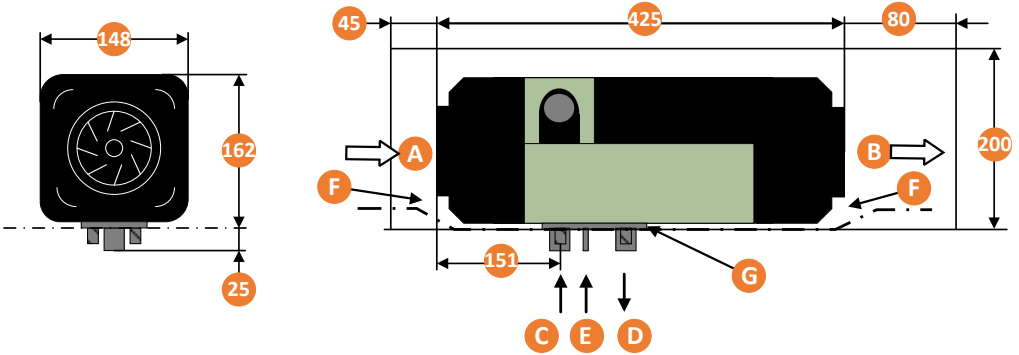


Figure VIII (Dimensions: mm)

- | | |
|--------------------------------|---------------------------------|
| A. Air inlet | B. Air outlet |
| C. Combustion air inlet | D. Exhaust outlet |
| E. Fuel inlet | F. Non-interference area |
| G. Installation Surface | |

Choose a flat installation surface, any undulations could cause the case to twist and will not ensure an even mount. Make sure there are no foreign bodies between the bottom of the heater and the installation surface itself. This will ensure a good seal between the two. File down any drill holes to again ensure an even mounting surface. Tighten the M6 bolts provided to a torque setting of 6Nm+1Nm.

Figure IX shows the position of the installation holes. If the installation area is less than 1.5mm thick a mounting plate will be required (Figure IX).

Mounting Gasket and Plate Dimensions

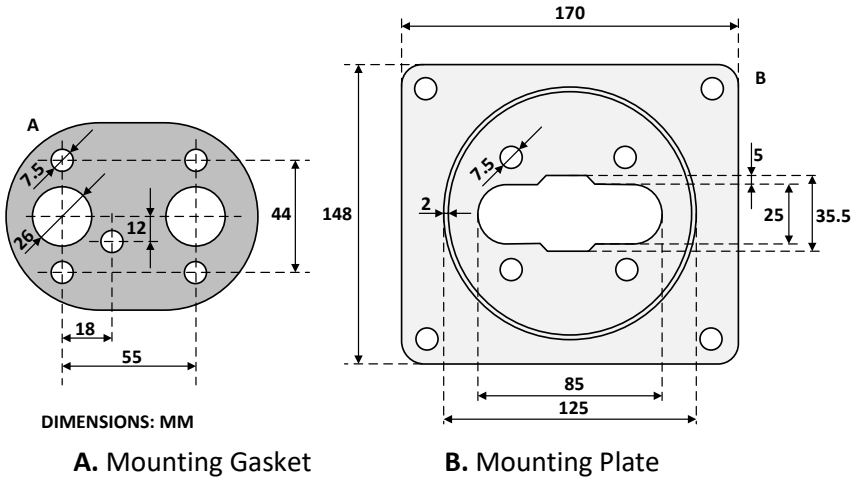


Figure IX

The mounting gasket and mounting plate required in most vehicle installations is shown above. Marine and other applications may require a bulkhead mounting bracket. These are available at MV Heating and the heater's main footprint remains the same.

If the heater is being reinstalled, a new gasket should be used.

Angle of Installation

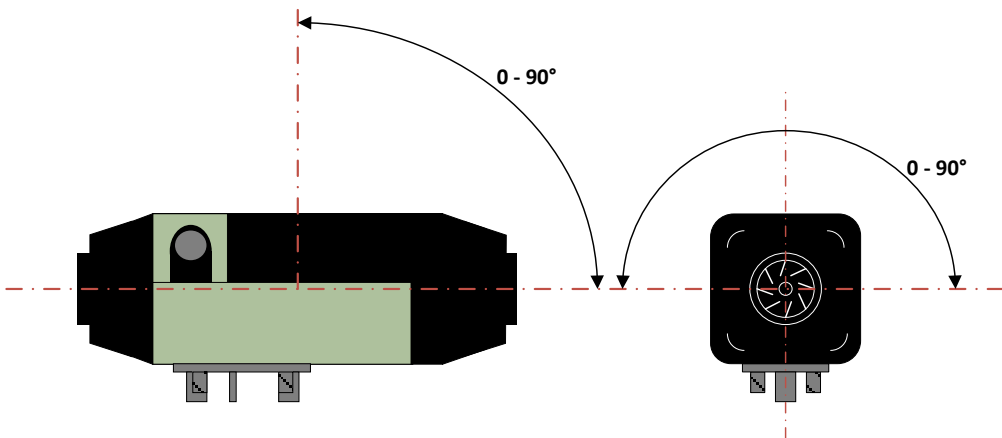


Figure X

The angle of installation is shown in figure X. Ensure you do not exceed the inclination angle or normal operation will be affected.

After installation, make sure there is no friction between the fan and other nearby parts to ensure smooth operation and make sure the heater label is clearly visible for ease of maintenance in the future.

Air Inlet & Outlet

Make sure that the hot air outlet does not exit onto any parts affected by heat and that it isn't directed toward the flow of anything that can cause a blockage, near splashing water or near the vehicle's exhaust.

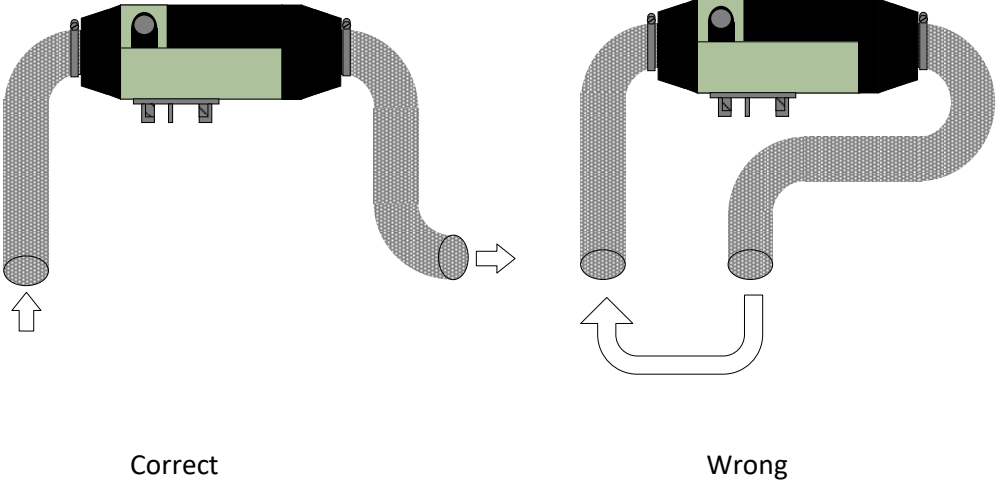


Figure XI

Avoid re-entering of the supplied hot air into the inlet port (as shown in Figure XI). If no inlet pipe is required, make sure the grill is installed at the inlet port instead (Figure V no. 6).

Ducting can be configured in various ways as shown overleaf. The **MV Airo 2 uses 60mm ducting**, and the **MV Airo 5 uses 90mm**, but can be reduced down to 80mm if desired as shown in Figure XIII on the next page.

Additional Ducting

Quantity of ducting can be purchased according to needs.

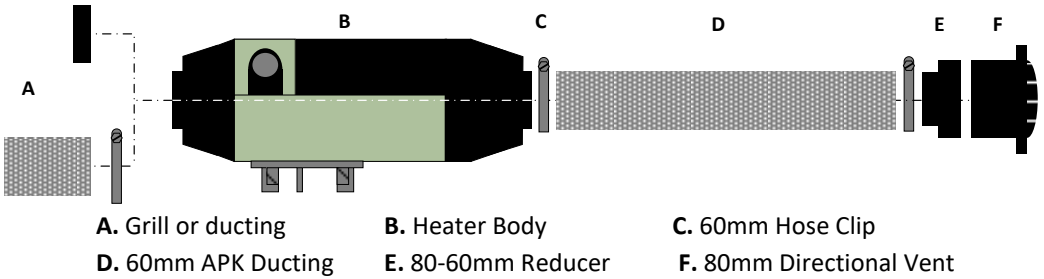


Figure XII

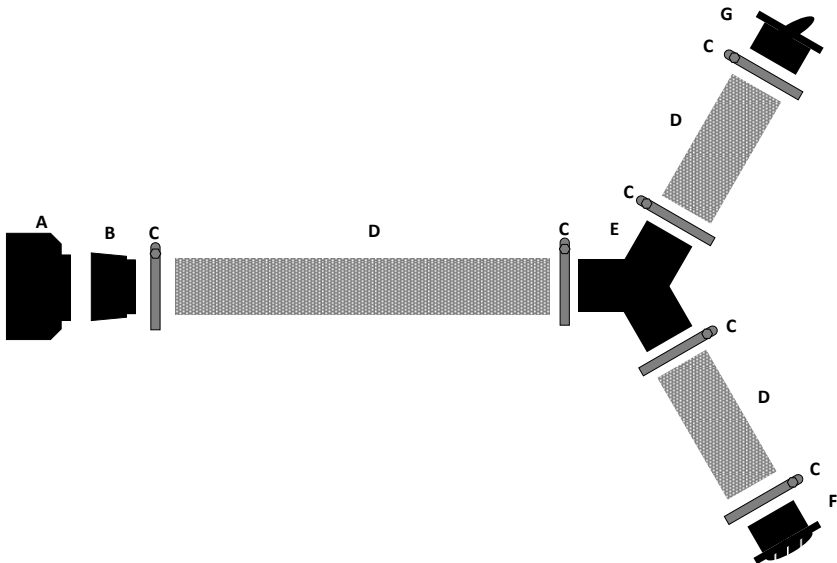


Figure XIII

Installation of Combustion Air Pipe and Exhaust

The combustion air inlet pipe sucks in fresh air from outside of the vehicle and the exhaust discharges fumes outside of the vehicle. Measures must be taken to avoid the fumes from re-entering the vehicle.

The pipes should exit at the bottom of the vehicle, ensuring that the openings are far enough away from any splashing water or dirt that can clog them.

Figure XIV shows the right and wrong way to install the pipework.

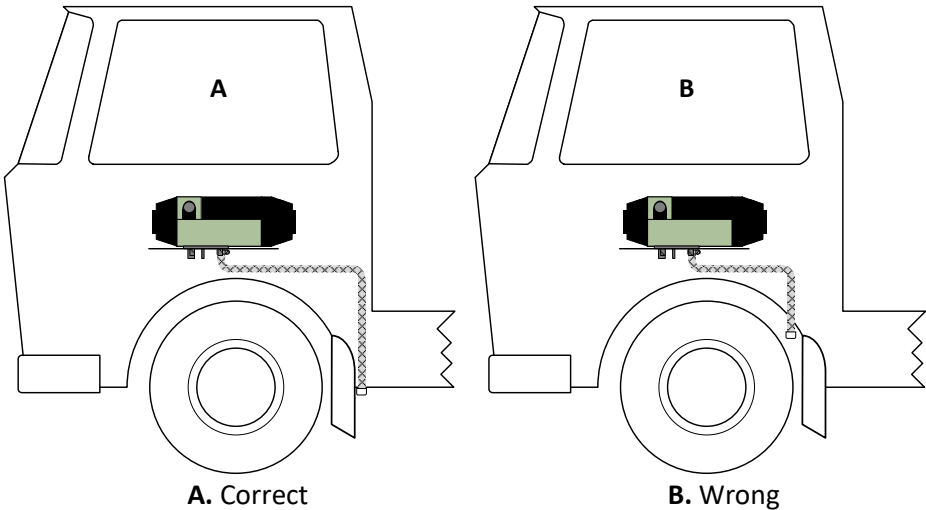


Figure XIV

Only use the inlet pipe and exhaust provided with the kit for installation. The exhaust pipe is made of corrugated stainless steel while the combustion pipe is aluminium covered in paper and plastic. **Do not** confuse the two. Use the supplied clamps to fix them securely to the combustion air inlet and the exhaust outlet on the heater. The protective end cap on the outlet of the

combustion air pipe and exhaust pipe should be kept in good condition. Do not damage or remove them.

Both the combustion air pipe and exhaust pipe should come downward from the heater and face opposite to the vehicle's direction of travel. If the pipe cannot avoid a curve, make sure the radius is no smaller than 50mm and the sum of all curves does not exceed 270°. Figure XV shows the right and wrong way to install the combustion air intake. Note that it is the same for the exhaust too.

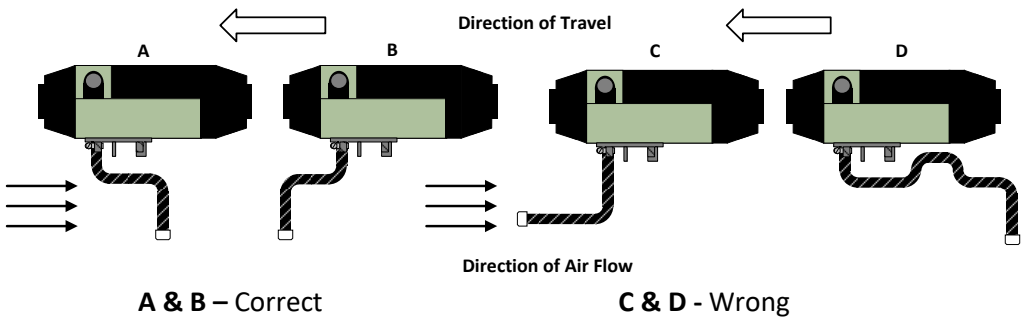
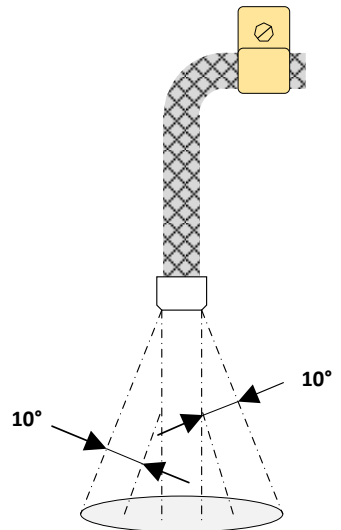


Figure XV

When the heater is operating, the exhaust will get hot, so make sure it is installed away from any parts that could get damaged by high temperatures. The exhaust vent should also point downward to the road surface with an angle of $90^{\circ} \pm 10^{\circ}$. This is best achieved by fixing a clamp 150mm from the pipe end.

Any exposed exhaust should be covered with a heat shield to prevent scalding.

Figure XVI



Installation of Fuel Lines

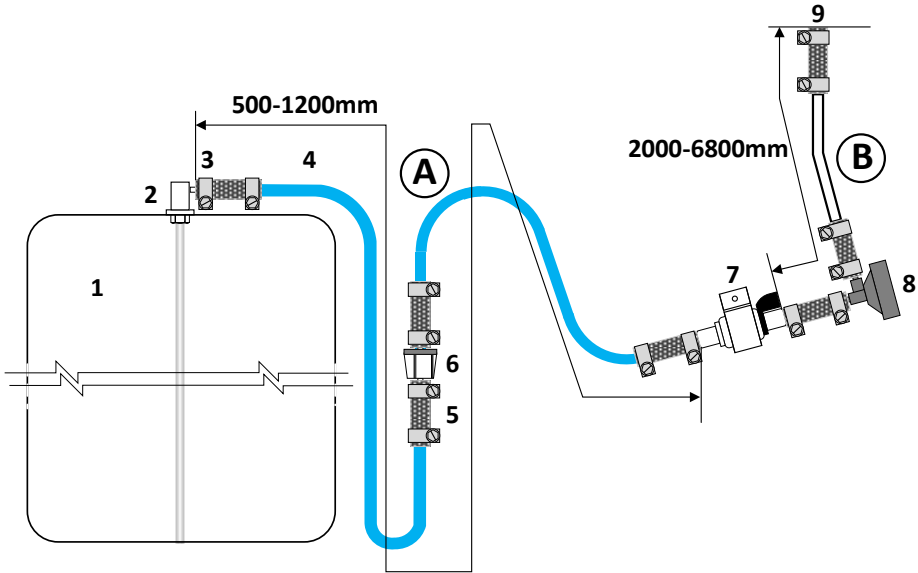


Figure XVII

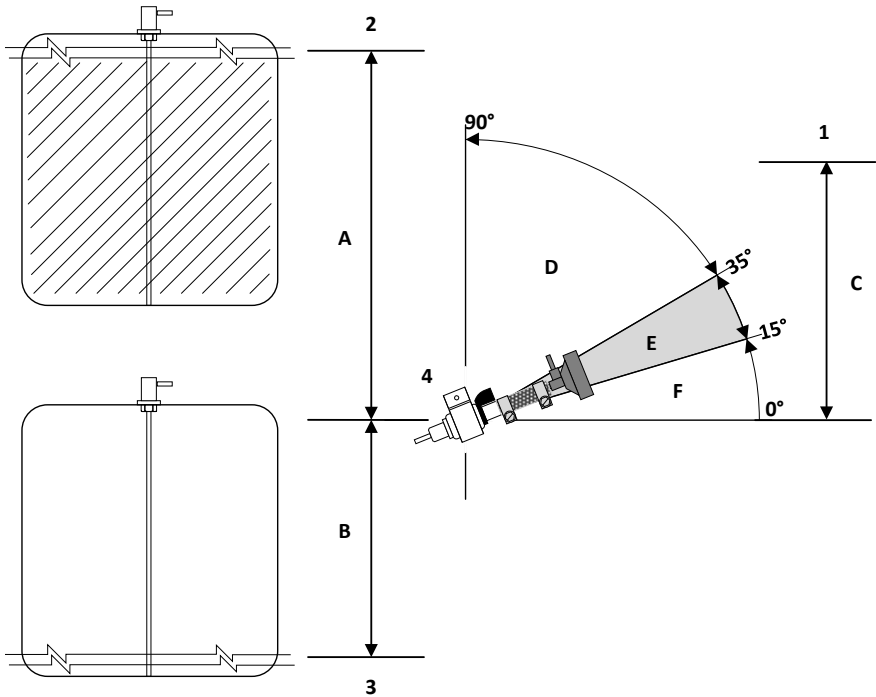
- | | | |
|---------------------------|----------------------------|----------------------------------|
| 1. Fuel Tank | 2. Fuel Standpipe | 3. Fuel line connector hose clip |
| 4. Fuel Line | 5. Fuel line connector | 6. Fuel Filter |
| 7. Fuel Pump | 8. Damper | 9. Heater Body |
| A. Blue Plastic Fuel Line | B. Clear Plastic Fuel Line | |

NOTE: Copper fuel should be used for inland waterways vessels.

The vehicle's own fuel tank can be used to supply fuel to the heater, a separate tank can be used if necessary. If a separate tank has been used, please ensure that it is not installed in the driver or passenger cab and is away from anything that could cause a fire risk or inhaling of toxic fumes.

Always fit the fuel pump on the anti-vibration mount securely onto the vehicle. Ensure the outlet of the fuel pump tilts upward. The correct angle is shown in figure XVIII.

Where possible the fuel line should ideally be placed uphill to the fuel pump to ensure ideal bleeding of the fuel line.



1. Heater Body

3. Min. Fuel Level

2. Max. Fuel Level

4. Fuel Pump and Damper

Fuel Pump Angle & Suction Height

A. 3000mm

B. 500mm

C. 2000m

D. Not acceptable

E. Acceptable (between 15-35°)

F. Not acceptable

Figure XVIII

Figure XVIII shows the ideal angle to mount the fuel pump

The fuel pump's outlet should tilt upward at an angle between 15°-35° (as shown above). Only use the fuel line provided, ensure the pipe is placed away from any possible debris and avoid any sagging in the line. Make sure the fuel line does not flow downward toward the fuel pump. This will prevent correct fuel flow and produce air bubbles in the line.

The fuel filter, fuel pipe and clamps should all be replaced after 2 years of us

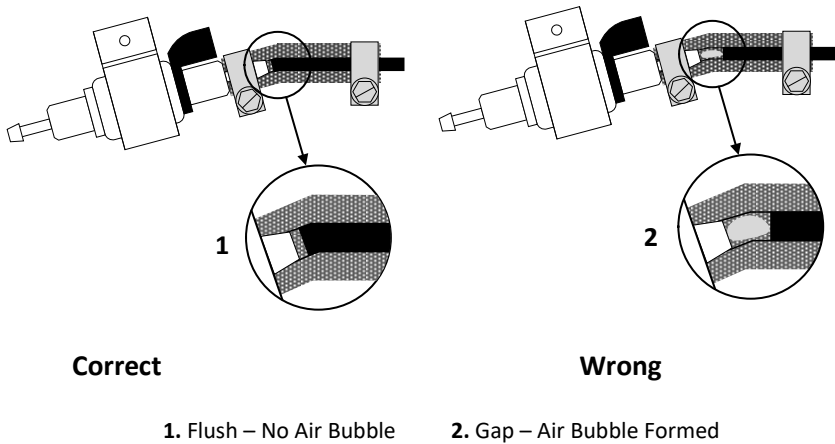


Figure XIX

Figure XIX shows the correct way to connect fuel lines to prevent the build-up of air bubbles. Ensuring they are flush and minimising bends.

When the fuel is being sucked from the vehicle tank, or an independent tank, a suction pipe is required. Make sure all the openings are appropriate for the installation and a tight seal is maintained for the base of the suction pipe.

The bottom of the suction pipe should be about 30-40mm from the bottom of the fuel tank so as to avoid sucking impurities or sediment from the bottom of the fuel tank.

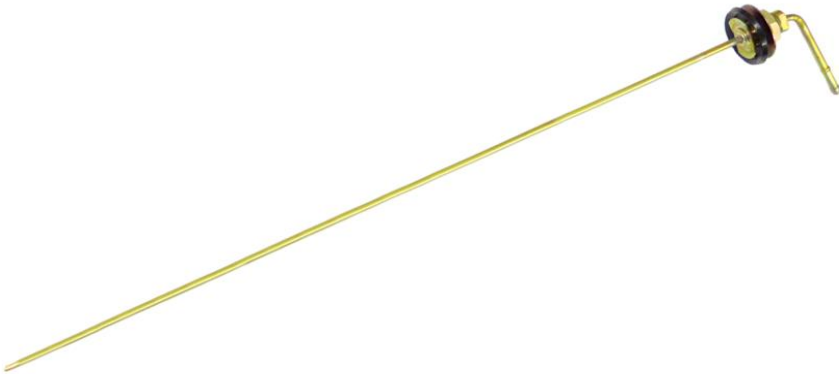
Fuel Standpipe

A fuel standpipe (or suction pipe) will need to be installed in the vehicle's fuel tank or an independent fuel tank depending on what the installation calls for. Sealant is not required to fit the standpipes.

Depending on the standpipe provide in the kit you will need to install the standpipe in one of two ways.

Standpipe 1: (**Part No:** AHZ-034)

Figure XX



Usually supplied in Marine kits and supplied bent, this standpipe is installed like so:

- Drill a hole in the top of the vehicle's fuel tank $\Phi 22 \pm 0.2\text{mm}$ in size. Ensure it is smooth and clean of burrs
- Remove the top nut and washers and bend the standpipe straight
- Cut the standpipe down to size if necessary
- Fit the standpipe by tilting it into position into the newly drilled hole
- Place the rubber and metal washers back on top followed by the nut and tighten it securely on top

Standpipe 2 (Sender Unit Pipe): (**Part No:** AHZ-035)



Figure XXI

Supplied mainly in vehicle kits, this standpipe (or sender unit pipe) is installed like so:

- If possible; remove the sender unit from the vehicle's fuel tank, this will make it easier to attach the nut securely back onto the standpipe
- Drill a $\Phi 6 \pm 0.2\text{mm}$ hole into the sender unit
- Remove the nut from the standpipe and feed it through the hole ensuring the rubber 'o' ring remains on the standpipe 'head' side
- Replace the nut on the standpipe to secure it safely to the sender unit.
- Replace the sender unit into the fuel tank.
- Alternatively, to use in a marine application, simply tap an M6 hole into the fuel tank, and screw the fuel standpipe with O-ring inside.

The bottom of the fuel standpipe should be 30-40mm from the bottom of the fuel tank to allow enough suction of fuel and at the same time not allow impurities and sediment to be drawn up the standpipe.

MV Airo 2 Wiring Diagram

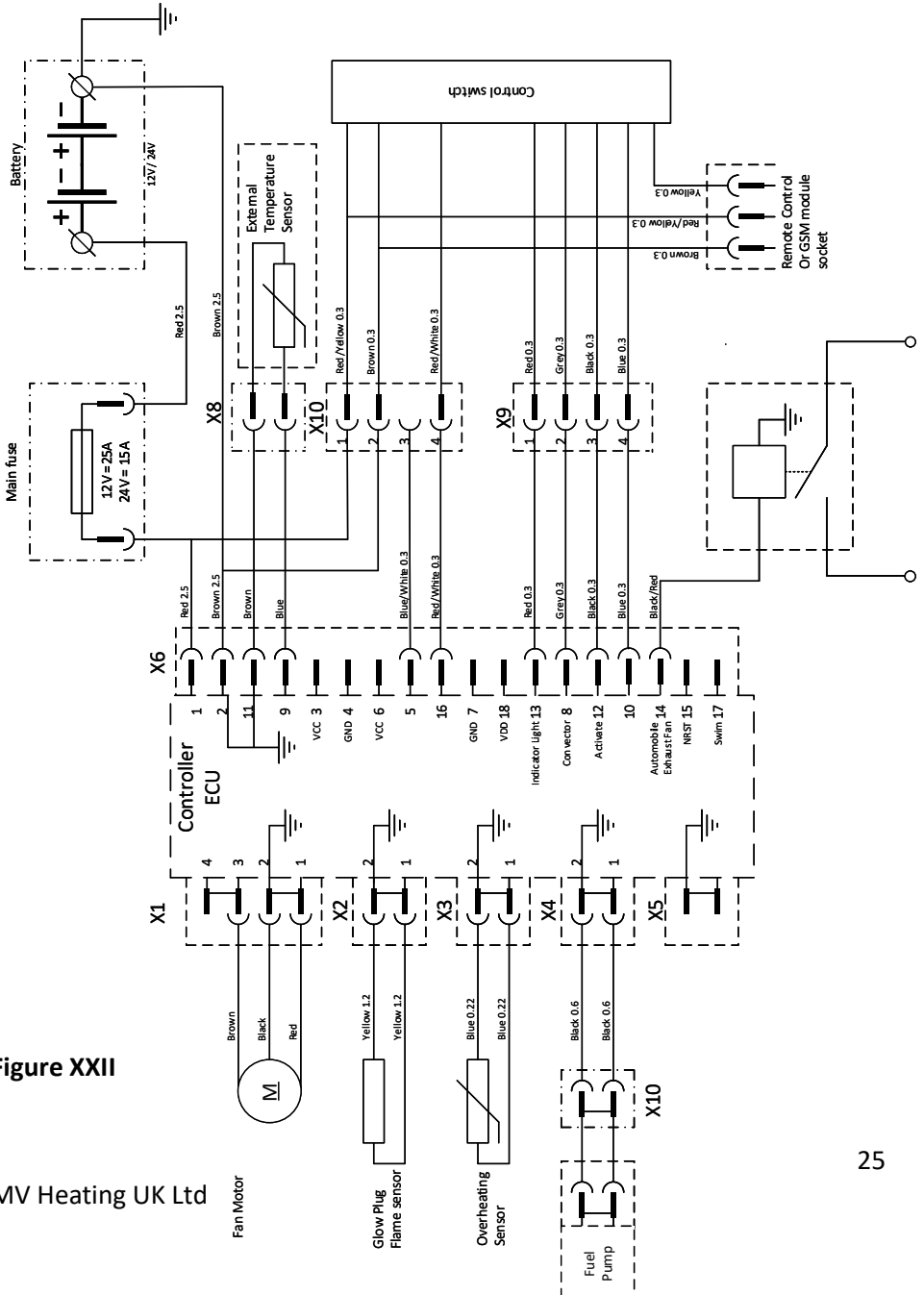


Figure XXII



The previous page shows the wiring diagram for the heater.

The wires of the main heater have been made into bundles. They can be laid according to the positions of various components and should be fixed to the proper locations. The distance between two fixing points should not exceed 300mm.

Note: Any exposed wire outside the vehicle should be protected so as not to be ripped by any road debris or similar.

Connect the main wiring harness to the heater by gently removing the junction box cover. Connect the 12-wire connector of the main wiring harness to the controller socket (X7). The main harness can exit the heater to the left or to the right. Then replace the cover ensuring a good seal is kept all the way round. A fuse will already be inserted into the fuse holder (20A for 12V heaters and 15A for 24V versions).

Connect the 2.5mm² red wire and the 2.5mm² brown wire in the wire harness to the spring terminals and then to the positive and negative of the vehicles battery.

Straighten the fuel pump leads (two 0.6mm² black wires) and put them through the opening on the wall of the air inlet pipe. They can then be connected via the spring plug straight to the fuel pump or using the fuel pump extension loom if more length is required.



MV Airo 5 Wiring Diagram – Brushless Version

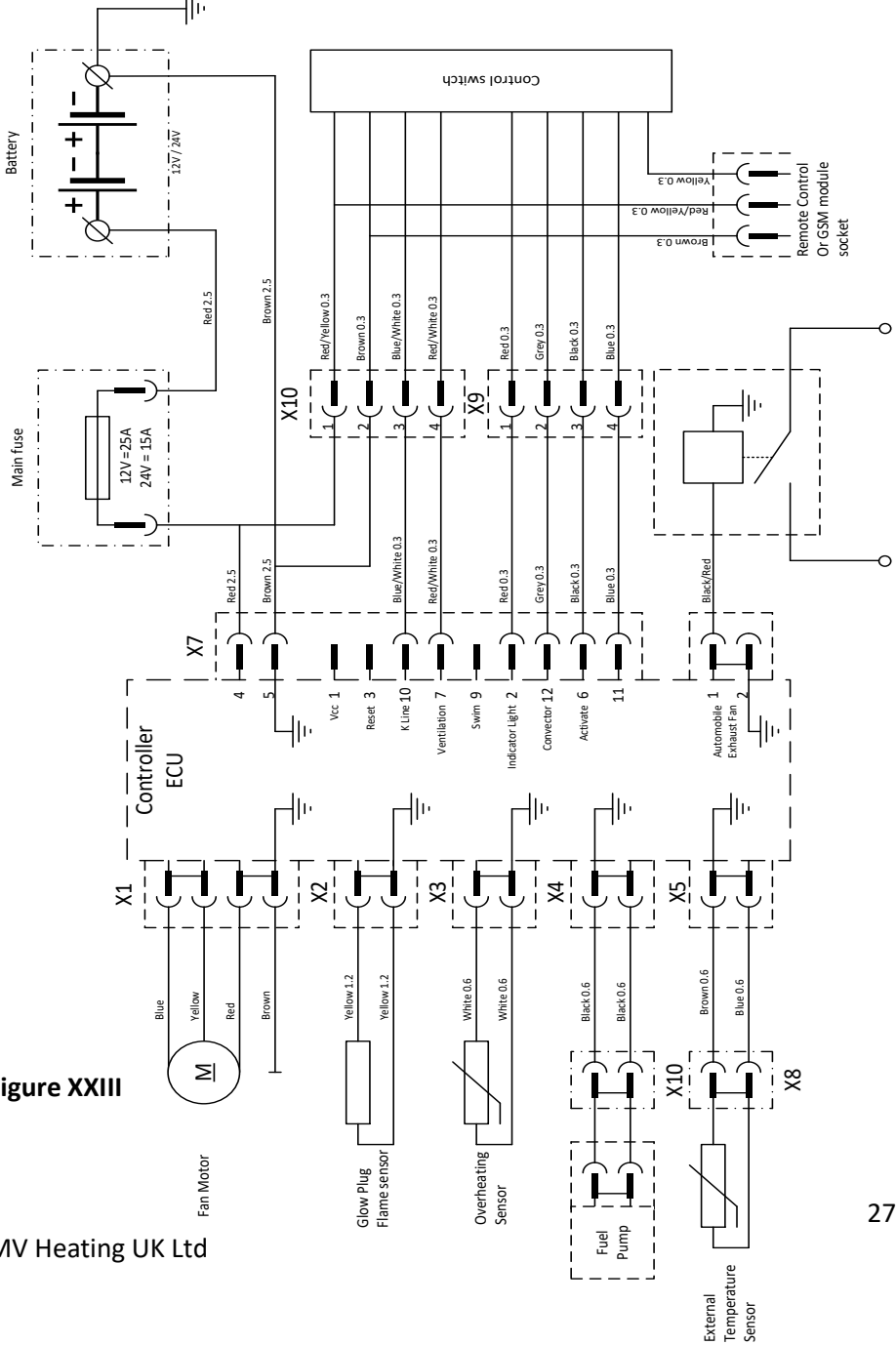


Figure XXIII



Figure XXIII shows the wiring diagram for the MV Airo 5. The wires of the main heater have been made into bundles. They can be laid according to the positions of various components and should be fixed to the proper locations. The distance between two fixing points should not exceed 300mm.

Note: Any exposed wire outside the vehicle should be protected so as not to be ripped by any road debris etc.

Gently remove the Airo 5's junction box cover and insert the main connector of the wiring harness into the E.C.U. at X7 (figure XXV). **WARNING:** The tab on the main connector should be facing upright when connected, as the E.C.U. will become damaged if plugged the incorrect way in. Next connect the temperature probe plug into X5. The loom can either exit to the right, or left of the heater body, depending on preference. The junction box cover can now be replaced into position, ensuring the rubber grommet sits neatly in the cut out of the ECU cover.

A bladed fuse will already be inserted into the holder 'F' (20A for 12V versions and 15A for 24V). Use a screw to fix it in a suitable position on the vehicle.

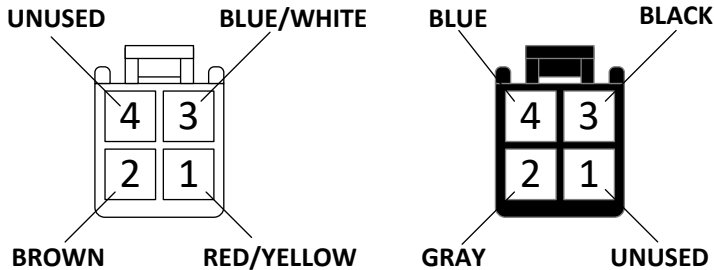
Connect the 2.5mm² red wire and the 2.5mm² brown wire in the wire harness to the spring terminals and then to the positive and negative of the vehicle's battery.

Straighten the fuel pump leads (two 0.6mm² black wires) and put them through the opening on the wall of the combustion air inlet pipe of the heater. Then insert the plug to the spring terminals of the fuel pump connector.

Timer and Rheostat Control Plugs

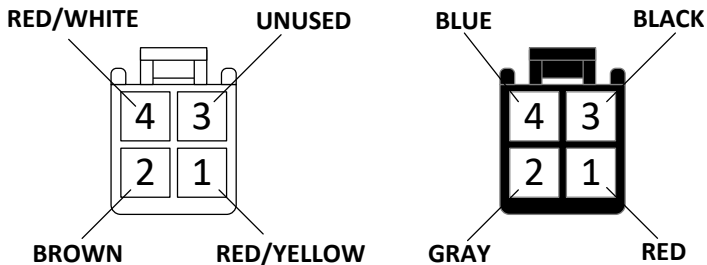
Use a single screw to fix the timer control or rheostat control in place. They are best installed so that they can be seen and operated easily to identify working conditions and for easy access. The black and clear plugs connect to the corresponding plugs on the loom (below). The remaining three-pin socket on the timer or rheostat control plugs into the remote-control receiver if one is installed. An adaptor cable may be necessary.

Timer Control Plug



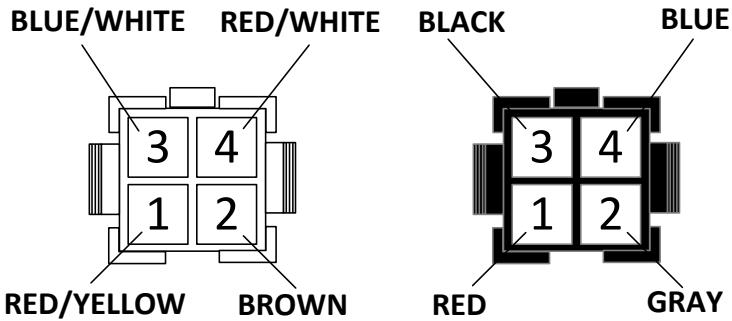
To Timer Control
Figure XXIV

Rheostat Control Plug



To Rheostat Control
Figure XXV

Wiring Loom Plug for Timer and Rotary Control



To Main Wiring Harness

Figure XXVI

Any surplus wires should be kept in good condition and wrapped in electric tape to avoid short circuiting.

External Remote Temperature Sensor Probe

The remote temperature sensor probe is best installed at shoulder height whilst sat down, ensuring ample air flow and a clear ambient temperature reading

It is inserted into the corresponding blue and brown wire plug just off from the main E.C.U. connection X6 (Figure XXVII) on the Airo 2, or into X5 (Figure XXVIII) on the MV Airo 5.

ECU Connections – Airo 2

The connection parts on the controller case are designed in such a way that wrong connections are impossible to make.

The following circuit interfaces can be found on the controller case; these are:

- X1: Fan motor
- X2: Glow plug
- X3: Overheat sensor
- X4: Leads to fuel pump
- X5: Unused
- X6: Main Wiring Harness

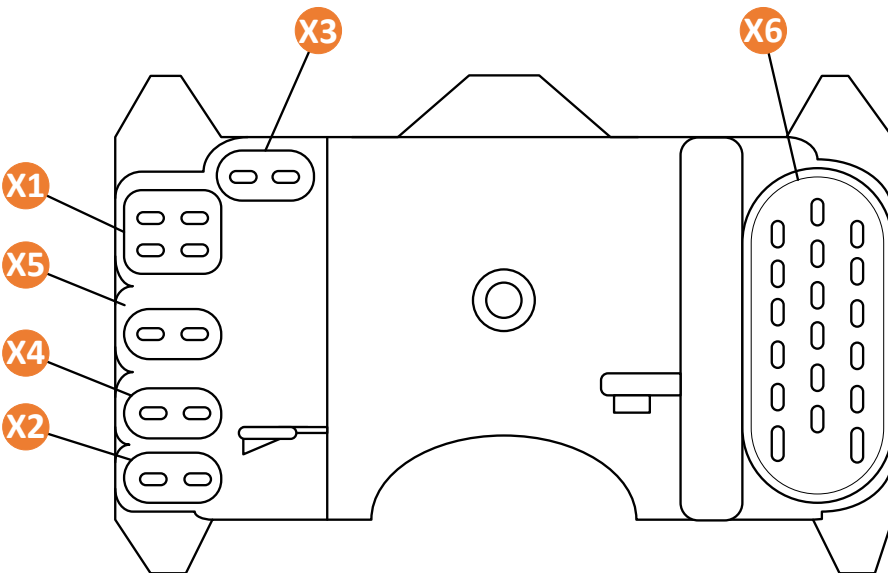


Figure XXVII

ECU Connections – Airo 5

The connections on the ECU are made so that plugging the wrong connector in is difficult due to the orientation points inside the connectors. If you pay attention to these, then each plug will be a nice push fit, and no force should be required.

Figure XXV shows the correct connections and their wire colours:

- X1: Air motor (red, yellow, brown and blue)
- X2: Glow plug/flame sensor (brown and yellow)
- X3: Overheat sensor (2 x blue)
- X4: Fuel pump (2 x black)
- X5: Temperature sensor (brown and blue/purple)
- X6: Convector Motor (empty)
- X7: Main wiring harness (bulk)

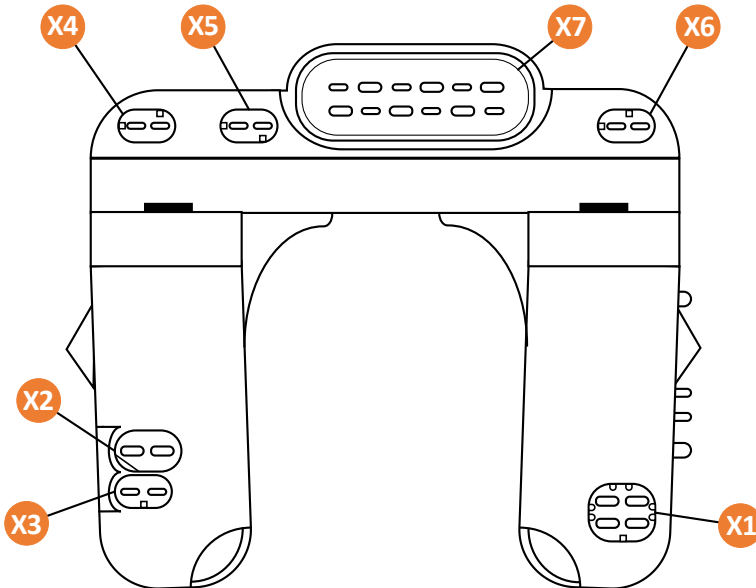


Figure XXVIII

Operation

Rheostat Control

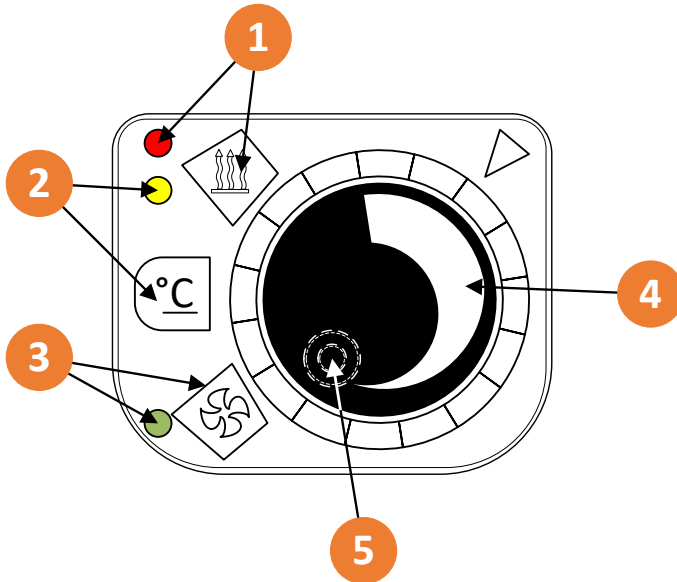


Figure XXIX

1. Variable Output Button and Indicator Light
2. Temperature Button and Indicator Light
3. Fan Only (Cold Air) Button and Indicator Light
4. Control Knob
5. Fixing Screw Hole (Located underneath control knob)

The rheostat (or rotary) control works by twisting the control knob to the desired heat setting, and using the buttons listed to determine the heaters function. The Alpine Auto model of heaters have a fully automatic altitude function that operates up to 5000m, allowing the user to take their vehicle almost anywhere!



On/Off

- 1)** Press the top button to turn the heater on, and the red light will appear.
- 2)** Use the rotary knob to control the heaters fan speed from high to low (the higher the fan speed, the quicker the vehicle will get warmer!)
- 3)** Press the top button again, to switch the unit off (the unit will go into a two-minute cool-down cycle).

Thermostatic Mode

- 1)** Press the middle button to turn the heater on, and the yellow light will appear.
- 2)** Use the rotary knob to control the temperature from high to low.
- 4)** Once the heater reaches the temperature set on the rotary knob, it will shut itself down.
- 5)** Once the temperature has dropped again, the heater will turn back on, and start to heat again.
- 3)** This process will continue until you press the middle button again, to switch the unit off (the unit will go into a two-minute cool-down cycle).

Fan Mode

- 1)** Press the bottom button to use the fan only mode.
- 2)** Press the bottom button again to turn the fan off.



Maintenance

Once the heater is installed, it should ideally be turned on a few times to remove any air trapped in the fuel lines. Also ensure there is no leaking from the lines and that all electric terminals fit securely together.

You should also regularly:

- Check the air inlet and outlet for any pollution or foreign matters
- Clean the externals of the heater
- Check for corrosion or loose connections of the circuits
- Check the combustion air inlet and exhaust pipe for damage and clogs
- Check the fuel line for leaks

To ensure a long life of the heater it is advised that you run it for at least 10 minutes every month, to prevent malfunction of mechanical parts.

After 10 years the heat exchanger, overheat sensor and exhaust should be replaced by a professional.

If any welding is being attempted on the vehicle, please remove the positive power supply wire and earth it to protect the controller from any damage.



Fault Codes

Rheostat Control

When the ECU had discovered a fault, the rheostat control will flash a fault code. The control should therefore be ideally placed where it can be clearly seen and accessed.

The faults will be displayed as flashes. Count the flashes to determine the code.

Number of Flashes	Cause of Problem
1	Failure of second start
2	Termination of the third time of combustion
3	Voltage power out of specified range
4	Glow plug temperature increases slowly
5	Air heaters will not flash 5 times
6	Temperature sensor: Broken circuit or short-circuit
7	Fuel pump: Broken circuit or short-circuit
8	Fan motor: Broken circuit, short-circuit or clogged
9	Glow pin: Broken circuit or short-circuit
10	Overheated
11	Overheat sensor: Broken circuit or short-circuit
12	Control switch: Broken circuit or short-circuit



Timers

1E-02 : Overheat – Check for obstruction or damaged ducting

1E-10 : Ignition failure – Check fuel supply, blocked supply or fuel pump

1E-30 : Voltage too high

1E-31 : Voltage too low – check battery or voltage drop in supply cable

1E-52 : Overheat sensor failure

1E-70 : Fuel pump open circuit or ECU failure

1E-80 : Air motor failure

1E-90 : Glow pin failure

1E-d3: Maintenance Reminder

Thank you for purchasing the MV Airo 2

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