



# MV Airo 2 & 5

ALPINE AUTO

INSTRUCTION MANUAL

Ed 1.02

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**2 & 5kW Air Heaters**

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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 upon 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 air motor, heated by the heat exchanger and blown out as hot air.

An example of how the heater operates is shown in Figure 1. Hot air is supplied by the heater to the driver's cab 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. Its features include a compact structure, easy installation, low running costs, easy maintenance and is safe and reliable.

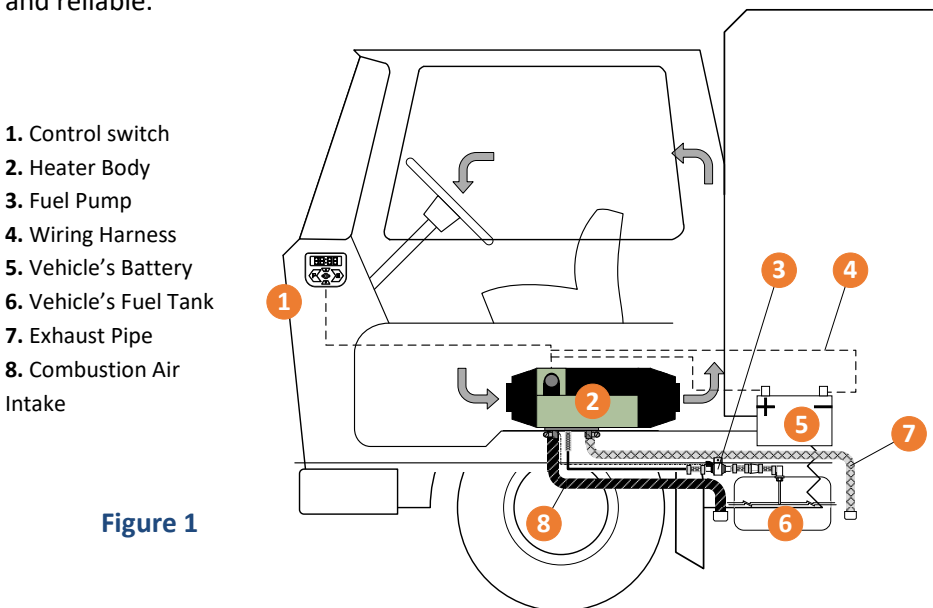


Figure 1



## Technical Data

### MV Airo 2 Technical Data

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

### Airo 2 Current Draw

<b>Variable Output</b>	<b>12V Current Draw</b>
<b>Position</b>	<b>(Amps)</b>
<b>PO1</b>	0.9
<b>PO2</b>	1.0
<b>PO3</b>	1.2
<b>PO4</b>	1.4
<b>PO5</b>	1.6
<b>PO6</b>	1.9
<b>PO7</b>	2.2



## MV Airo 5 Technical Data

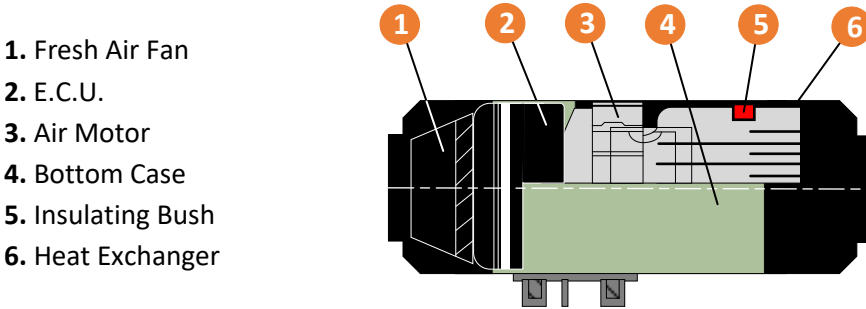
<b>MV Airo 5</b>	
<b>Heat Power</b>	5kW
<b>Fuel</b>	Diesel
<b>Rated Voltage</b>	12V24V
<b>Fuel Consumption</b>	0.19 - 0.60l/h
<b>Rated Power Consumption</b>	15 - 90W
<b>Working Temperature</b>	-40°C — 20°C
<b>Weight of Main Heater</b>	5.9Kg
<b>Dimensions</b>	425X148X162mm

## MV Airo 5 Current Draw

<b>Variable Output</b>	<b>12V Current Draw</b>
<b>Position</b>	<b>(Amps)</b>
<b>PO1</b>	0.6
<b>PO2</b>	1.0
<b>PO3</b>	1.6
<b>PO4</b>	2.4
<b>PO5</b>	3.6
<b>PO6</b>	5.2
<b>PO7</b>	7.6

## Working Principle

The structure of the main heater body is shown in Figure 2.



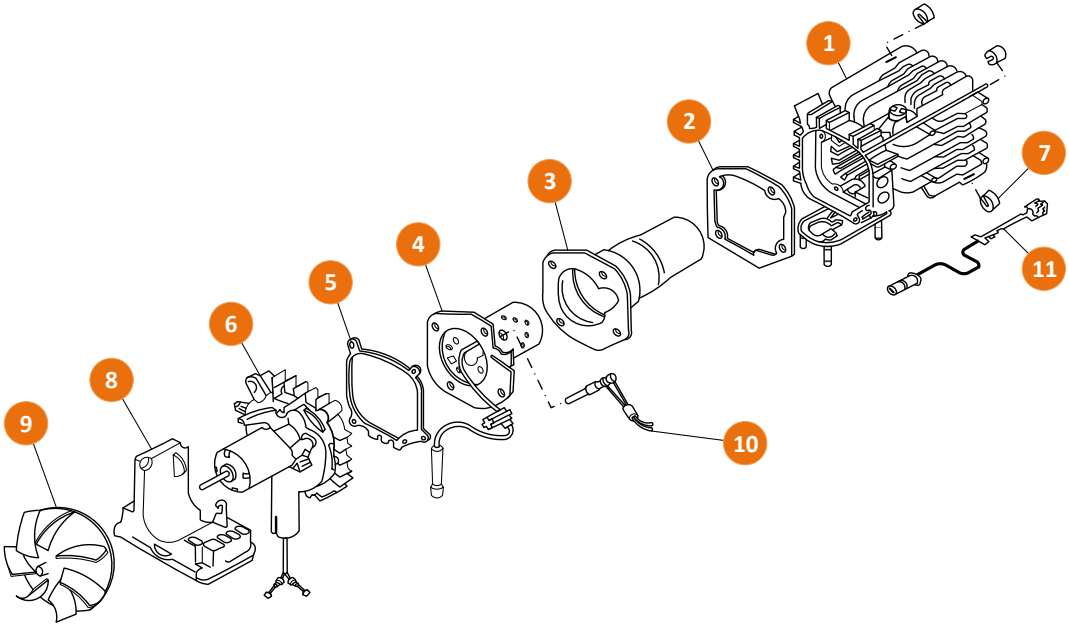
**Figure 2**

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 outlet.

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 fresh 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.



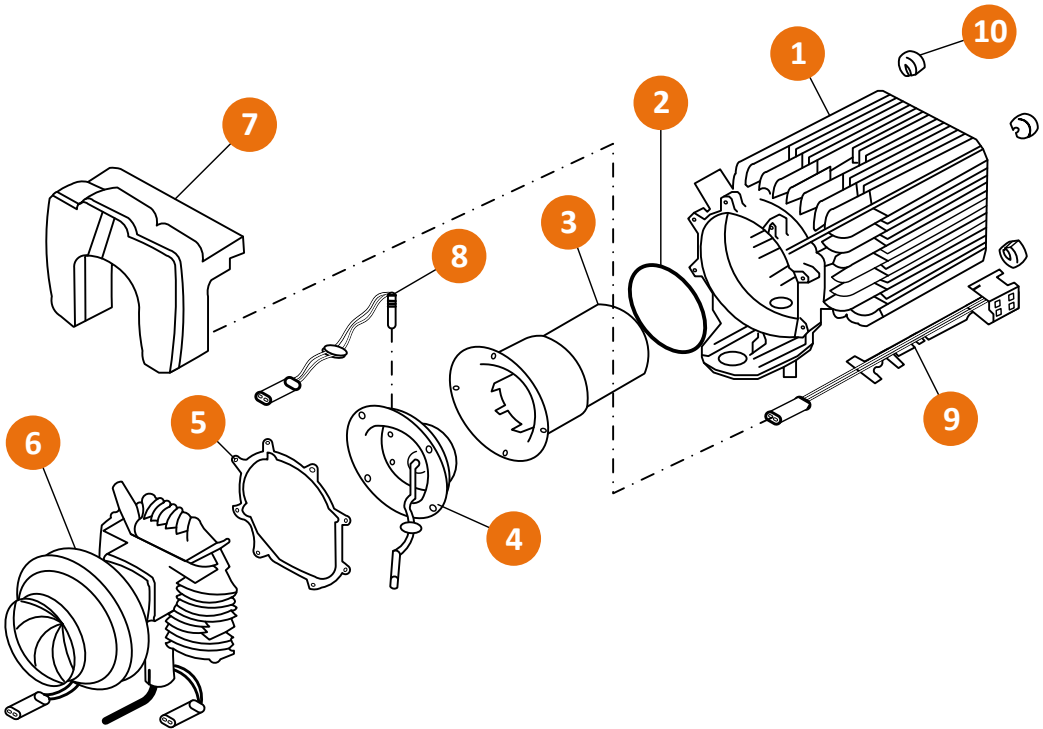
## MV Airo 2 Internal Structure



**Figure 3**

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

## MV Airo 5 Internal Structure

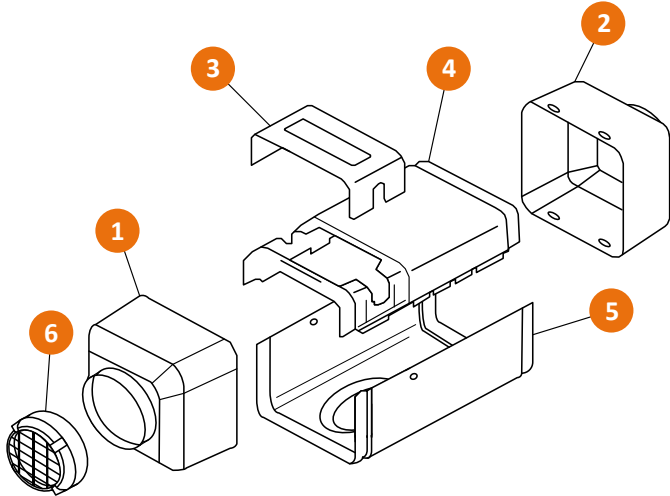


**Figure 4**

- |                       |                       |
|-----------------------|-----------------------|
| 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 |

## Heater Cases

Figure 5 shows the heater casing layout for both the MV Airo 2 and 5 heater.



**Figure 5**

**1.** Inlet cap

**2.** Outlet Cap

**3.** ECU Cover

**4.** Top Case

**5.** Bottom Case

**6.** Grill

# Installation Parts

Figure 6 shows the basic principle of parts for installation.

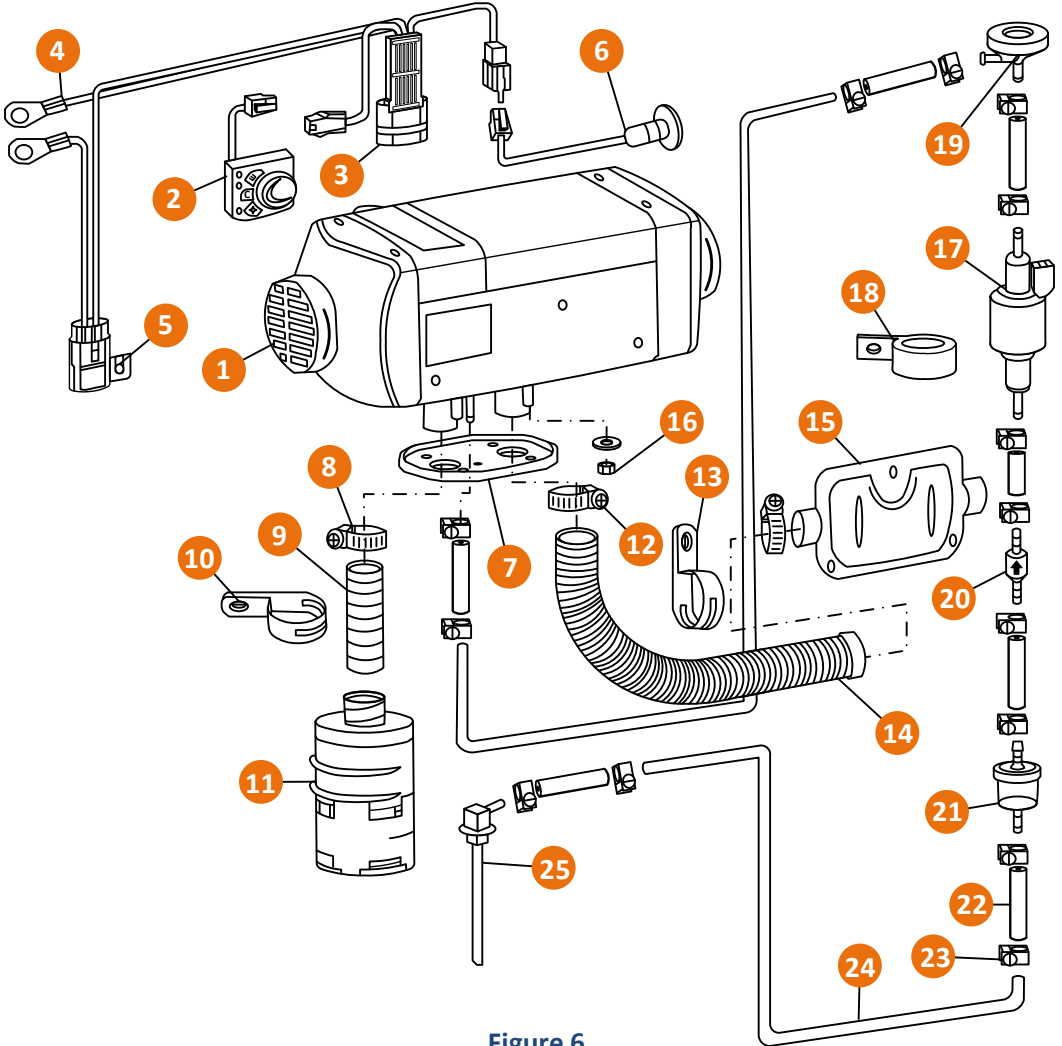


Figure 6



- |                               |                               |
|-------------------------------|-------------------------------|
| 1. Main Heater Body           | 2. Control Unit               |
| 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. Non-Return Valve**        |
| 21. Fuel Filter**             | 22. Fuel Pipe Connector       |
| 23. Fuel Pipe Connector Clamp | 24. Fuel Pipe                 |
| 25. Fuel Standpipe            |                               |

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

\*\*Not suitable for use with petrol systems

Figure 6 shows the diagram for an Airo 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 7 shows the minimum distances required on the MV Airo 2 and Figure 8 shows the distances for the larger Airo 5 model.

### MV Airo 2 Dimensions

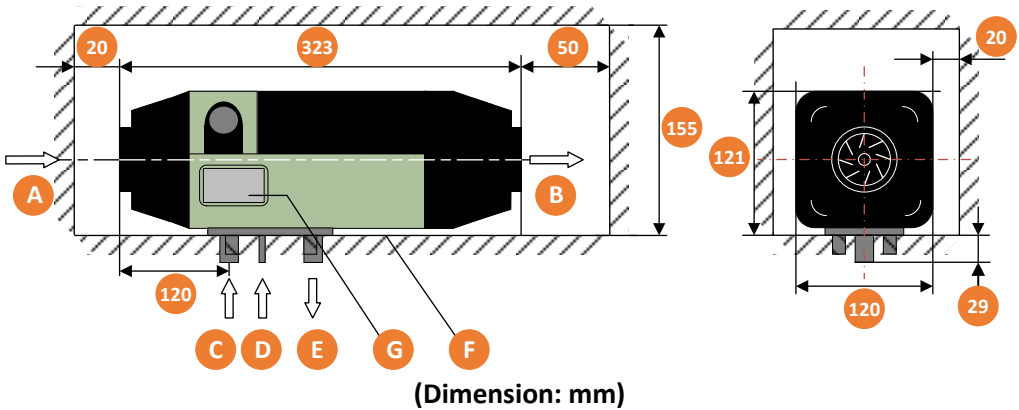


Figure 7

- |                                       |                                 |
|---------------------------------------|---------------------------------|
| <b>A.</b> Fresh air inlet (60mm)      | <b>B.</b> Hot air outlet (60mm) |
| <b>C.</b> Combustion air inlet (22mm) | <b>D.</b> Fuel inlet (5mm)      |
| <b>E.</b> Exhaust outlet (22mm)       | <b>F.</b> Non-interference area |
| <b>G.</b> Information label           | <b>H.</b> Installation surface  |
| <b>I.</b> Gasket                      |                                 |

## MV Airo 5 Dimensions

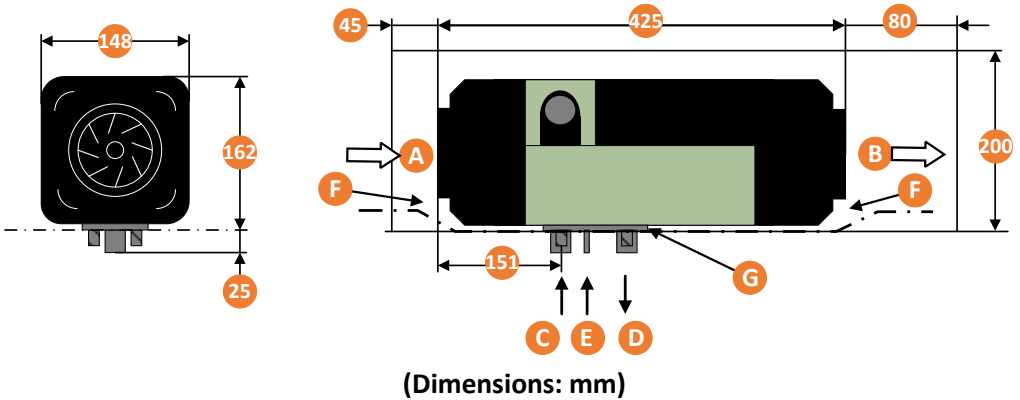
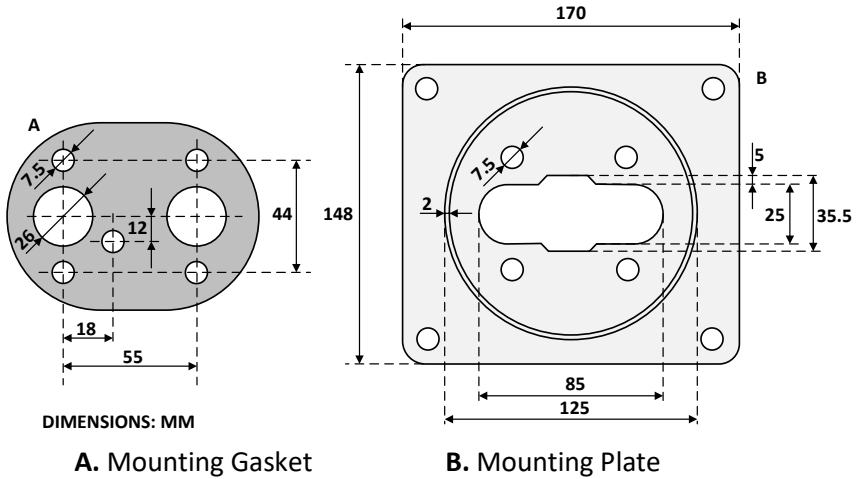


Figure 8

- A. Fresh Air Inlet (90mm)
- B. Hot air outlet (90mm)
- C. Combustion air inlet (24mm)
- D. Exhaust outlet (24mm)
- E. Fuel inlet (5mm)
- F. Non-interference area
- G. Mounting Gasket

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. Use the mounting gasket and plate provided, particularly if the mounting surface is less than 1.5mm thick. Tighten the M6 nuts provided to a torque setting of 6Nm+1Nm.

## Mounting Gasket and Plate Dimensions



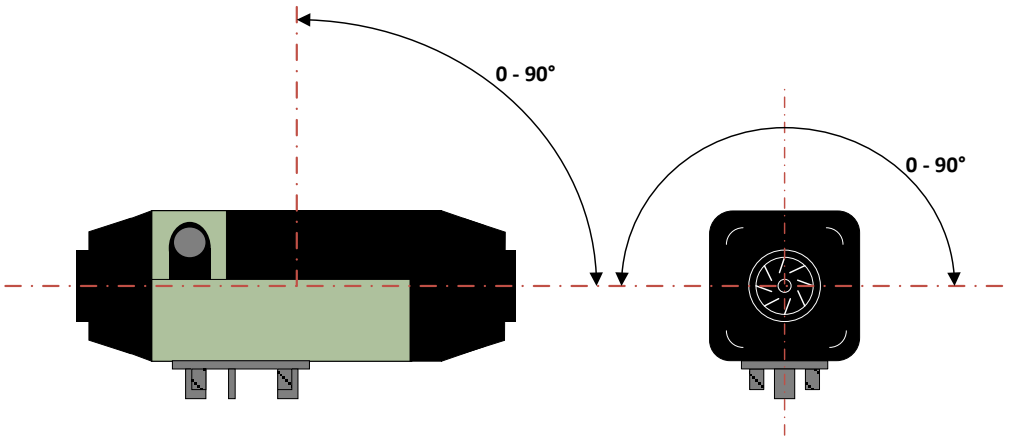
**Figure 9**

The mounting gasket and mounting plate required in most vehicle installations is shown above. Marine and other applications may require a bulkhead ('L' shaped) mounting bracket. The heater's main footprint remains the same.

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



## Angle of Installation



**Figure 10**

The angle of installation is shown in figure 10. Ensure you do not exceed the inclination angle or normal operation will be affected.

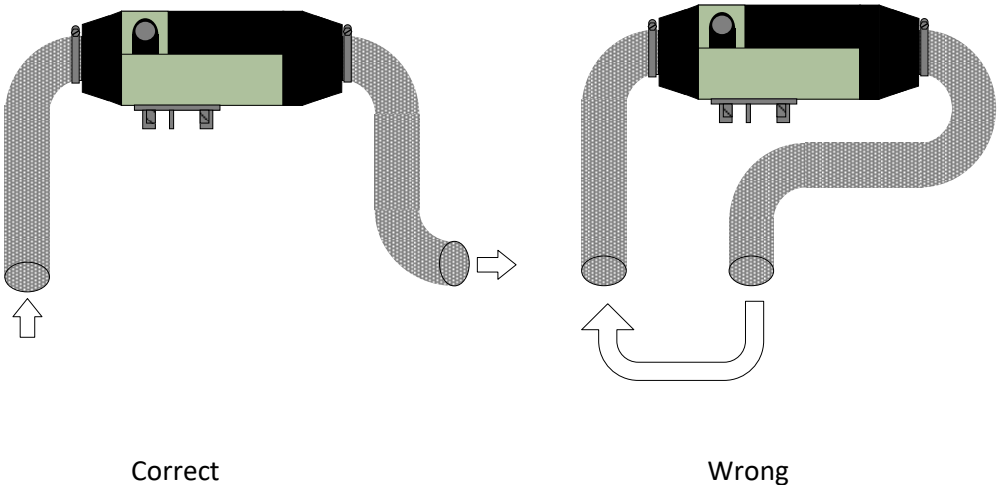
After installation, make sure there is no friction between the fan and other nearby parts to ensure smooth operation and make sure the heater label is clearly visible for ease of identification and maintenance in the future.

## Air Inlet & Outlet

**Ducting Size Airo 2 – 60mm**

**Ducting Size Airo 5 – 90mm**

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 vehicles exhaust.



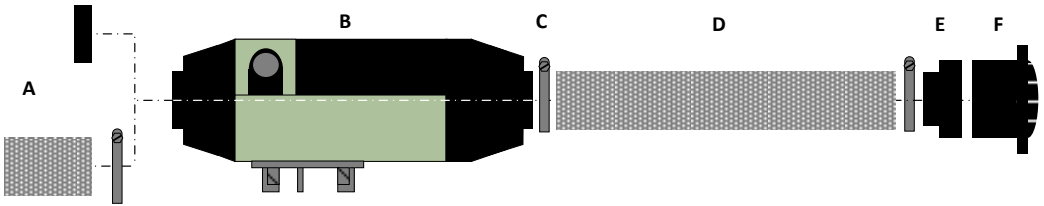
**Figure 11**

Avoid re-entering of the supplied hot air into the inlet port (as shown in Figure 11). If no inlet pipe is required, make sure the grill is installed at the inlet port (Figure 5 no. 6) to prevent blockages.

Ducting can be configured in various ways as shown overleaf. Larger ducting sizes like the Airo 5 can be reduced in some applications but care must be taken not to cause overheating if reduced considerably.

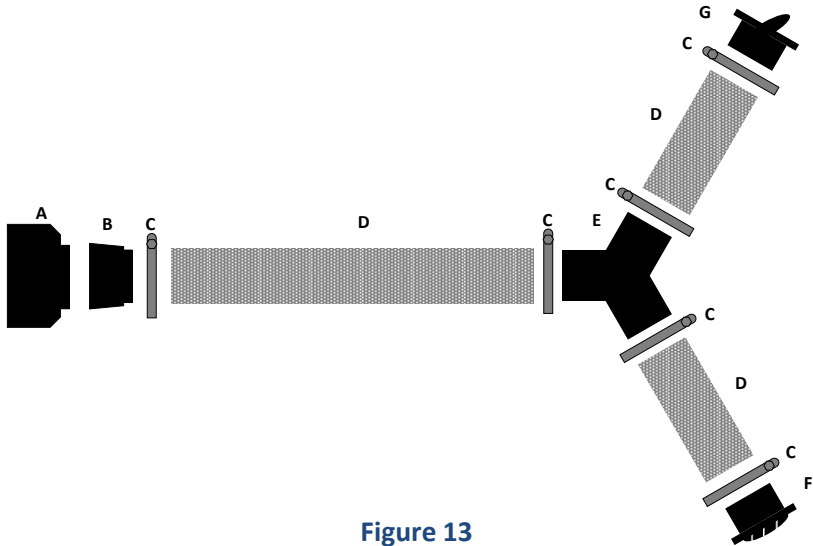
## Additional Ducting

Quantity of ducting can be altered according to needs, but over excess will cause poor air flow or possible overheating.



- A.** Inlet Grill or ducting    **B.** MV Airo 2 Heater Body    **C.** 60mm Hose Clip  
**D.** 60mm APK Ducting    **E.** 80-60mm Reducer    **F.** 80mm Directional Vent

**Figure 12**



**Figure 13**

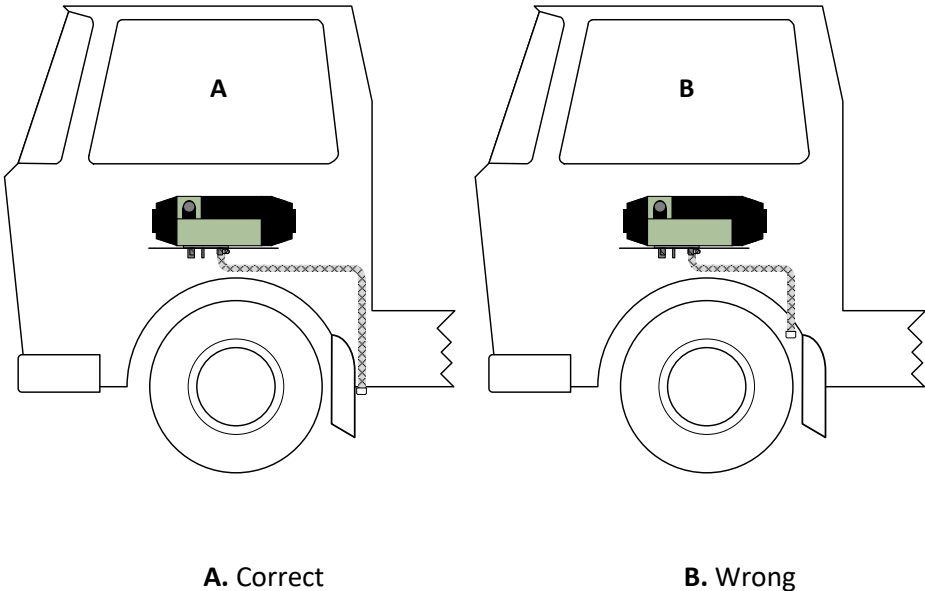
- A.** Outlet (90mm)    **B.** 90-80mm Reducer (Optional)    **C.** 80mm Hose Clip    **D.** 80mm APK Ducting  
**E.** 80mm 'Y' Branch    **F.** 80mm Directional Vent    **G.** 80mm Open/Close Vent

## Installation of Combustion Air Pipe and Exhaust

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

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 14 shows the right and wrong way to install the pipework.



**Figure 14**

## Airo 2 Combustion and Exhaust Pipe Size – 22mm

## Airo 5 Combustion and Exhaust Pipe Size - 24mm

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 wrapped 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 face 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 15 shows the right and wrong way to install the combustion air intake. Note that it is the same for the exhaust too.

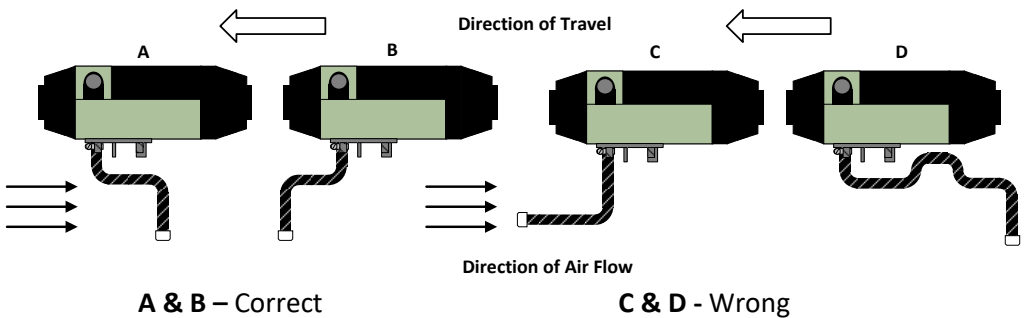
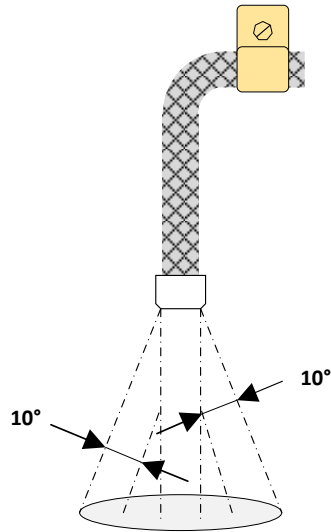


Figure 15

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. In vehicle applications 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 16**

In marine application the exhaust will exit out of the hull of the vessel via the skin fitting. It is important that the end of the exhaust exits in a 'swanneck' to prevent any water from traveling up the exhaust and into the heater.

## Installation of Fuel Lines

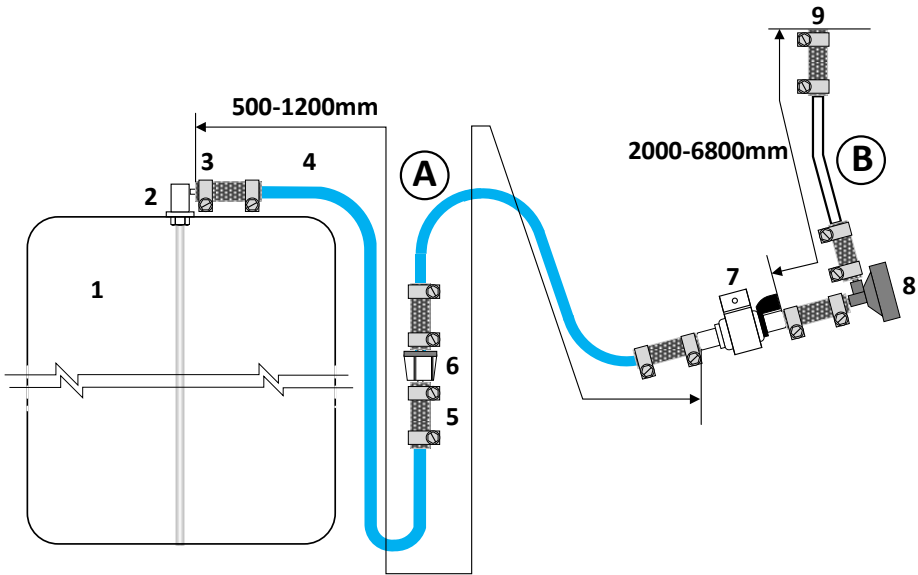


Figure 17

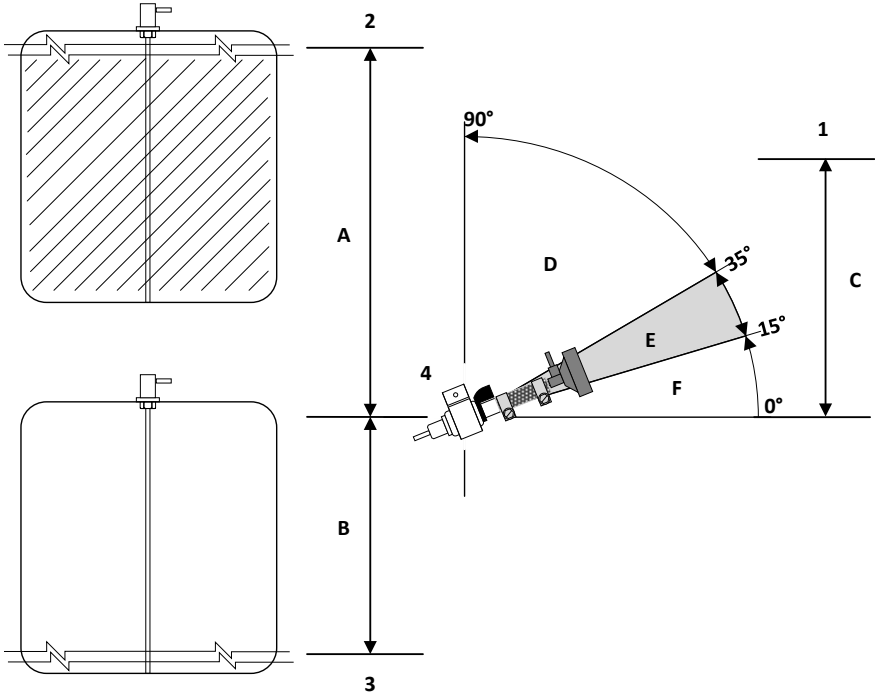
- |                           |                            |                                  |
|---------------------------|----------------------------|----------------------------------|
| 1. Fuel Tank              | 2. Fuel Standpipe          | 3. Fuel line connector hose clip |
| 4. Fuel Line              | 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 ideal angle is shown in figure 18.

Where possible the fuel line should ideally be placed uphill to the fuel pump to ensure ideal bleeding of the fuel line. Avoid installing the heater below the fuel level to prevent automatic siphoning and flooding of the heater.



- 1. Heater Body
- 3. Min. Fuel Level

- 2. Max. Fuel Level
- 4. Fuel Pump

### Fuel Pump Angle & Suction Height

- A. 3000mm
- C. 2000mm
- E. Acceptable (between 15-35°)
- B. 500mm
- D. Not acceptable
- F. Not acceptable

Figure 18





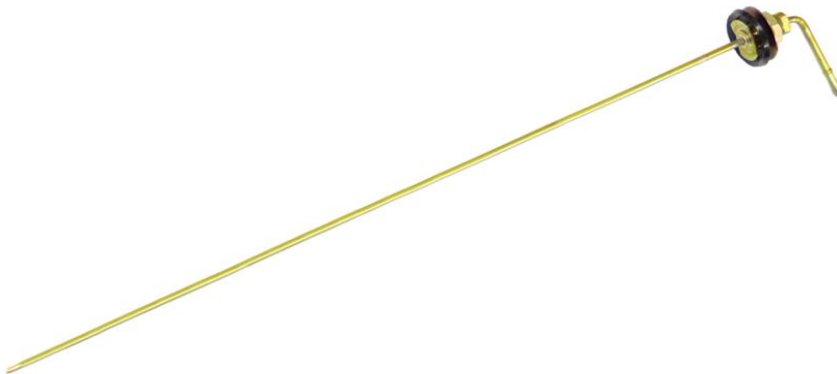
## Fuel Standpipe

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 20**



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 21**

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.

## Main Wiring Harness Connections

### Airo 2 Main Connector

The main connector of both the Airo 2 & 5 heaters inserts into the ECU of the main heater body. To install the main multi plug into the heater, first remove the ECU cover (figure 5 no. 3) using a small flat bladed screwdriver to allow access to the ECU. Plug the multiplug (figure 22) into the X6 of the ECU (figure 29) ensuring the long flat tab faces the ECU. **WARNING:** If inserted incorrectly, the ECU will be destroyed upon initial startup.

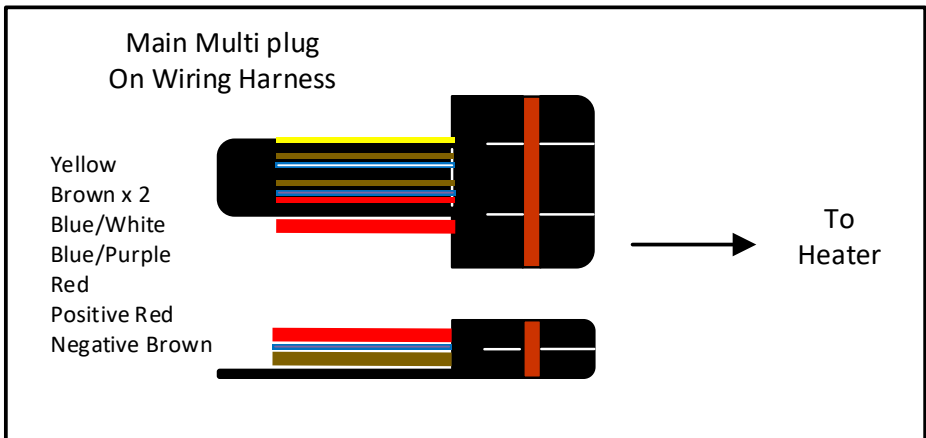


Figure 22

**Note:** The wiring harness for both heaters can exit to the right or left cutout of the heater's top case. Ensure that the rubber grommet is located inside the top case to prevent water damage.

## Airo 5 Main Connector

To install the main multi plug into the heater, first remove the ECU cover (figure 5 no. 3) using a small flat bladed screwdriver to allow access to the ECU. Plug the multiplug (figure 23) into the ECU ensuring the tab faces upward and clips into X7 (figure 33) of the ECU. **WARNING:** If inserted incorrectly, the ECU will be destroyed upon initial startup.

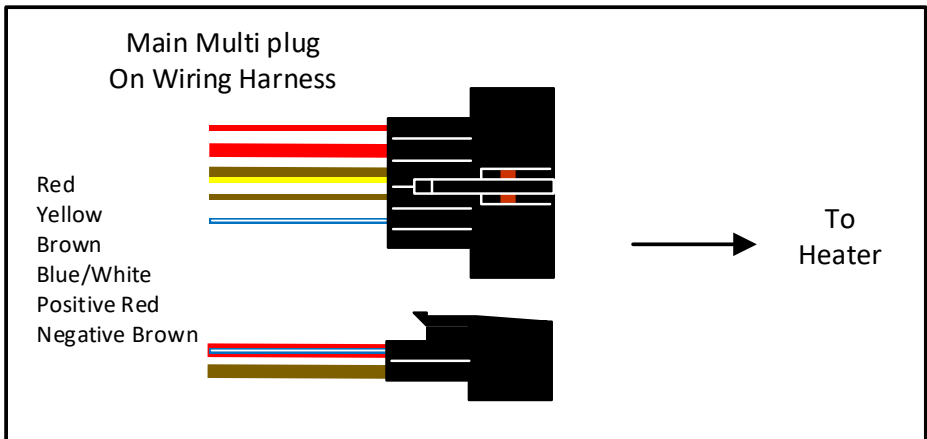


Figure 23

At the same time insert the temperature probe plug into X5 (figure 33) of the ECU paying attention to the orientation (cut-outs) of the plug.

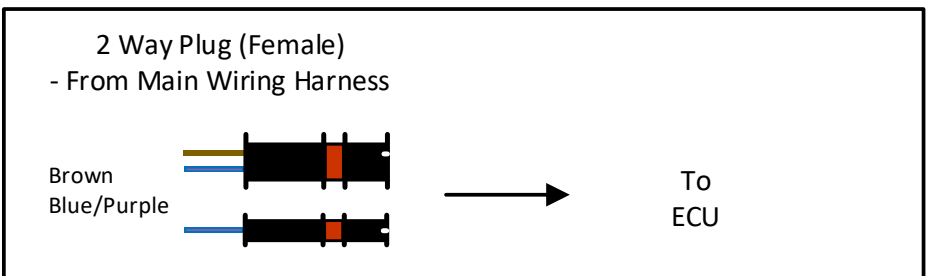


Figure 24

## Control Unit Connector

Fix the control unit in place using the methods provided in their respective manuals. They are best installed so that they can be seen and operated easily to identify working conditions and for easy access.

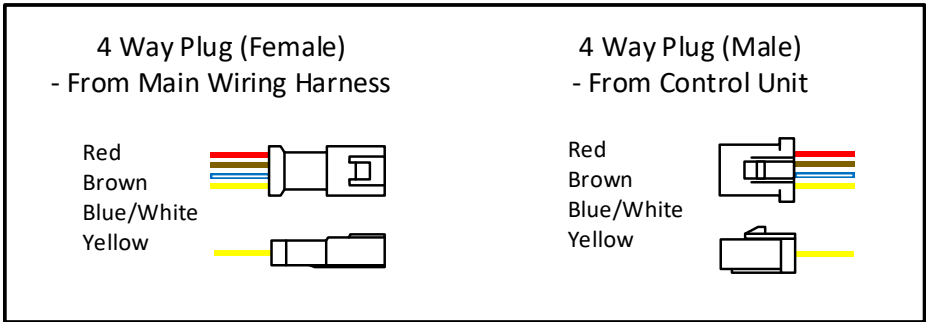


Figure 25

## Accessory Plug Connector

The accessory plug is used for optional parts like the mobile phone GSM module. If no such accessory is being used, then this can remain safely unplugged.



Figure 26

## Auxiliary Unused Connection

The following plug on the loom can remain safely disconnected.

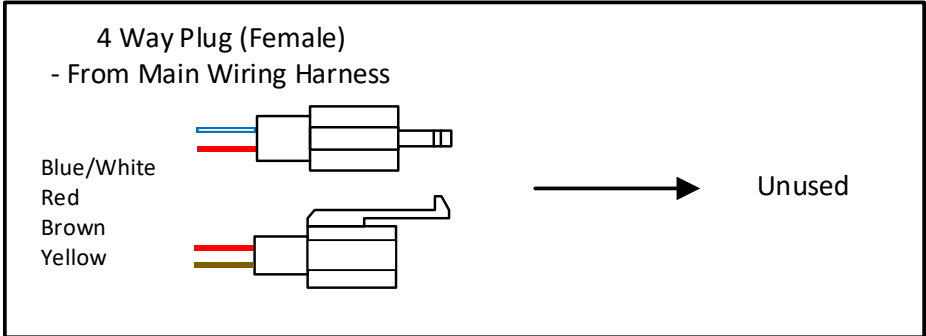


Figure 27

## Temperature Sensor Probe Connector

The temperature probe is for use in the controller's thermostatic mode. It measures the ambient temperature and relays the information to the control unit.

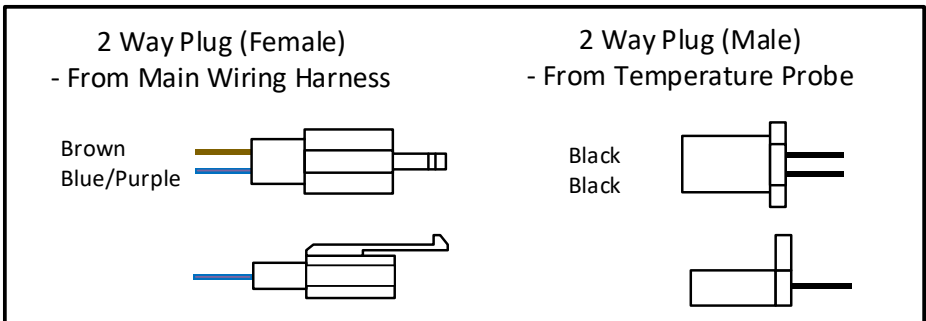


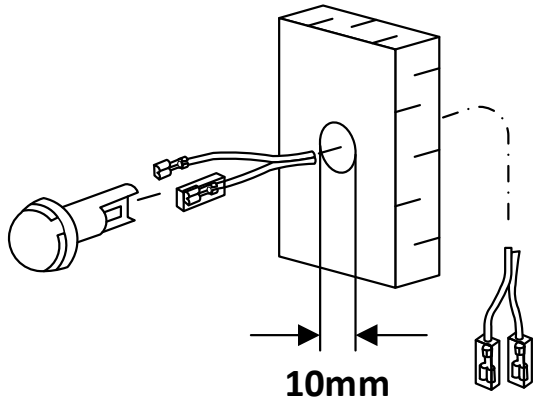
Figure 27

## Installing Temperature Probe

We recommend installing the temperature sensor in the following way to maintain a steady room temperature:

- Do not subject it to direct heat.
- Install it at shoulder height when sat in vehicle
- Install it on a vertical wall. The room temperature sensor must be completely exposed to the ambient air.
- Avoiding any external heat sources like stoves, fridges, or direct sunlight.

1. Drill a 10mm hole.
2. Feed the end of the cable with the one insulated connector through the drill hole.
3. Connect the cable to the sensor, regardless which side, as polarity is not an issue.
4. Insert the room temperature sensor. Plug into the main wiring harness as per figure 25.



**Figure 28**

If necessary, the connector cable can be extended using cables (2 x AWG 20 (2 x 0.5 mm<sup>2</sup>)). However, the overall length must not exceed 10m (33ft).



## ECU Connections – Airo 2

The plug sockets on the ECU are designed in such a way that wrong connections are difficult to make. Pay attention to the tabs (cut-outs) on each plug to ensure correct orientation and proper location. Each plug should require a smooth push fit. If force is required, then it is not located correctly!

Figure 29 shows the correct connections and their wire colours:

- X1: Air motor (red, yellow, brown, blue)
- X2: Glow pin/flame sensor (yellow, brown)
- X3: Overheat sensor (Blue x 2)
- X4: Leads to fuel pump (Black x 2)
- X5: Unused
- X6: Main Wiring Harness (See figure 22)

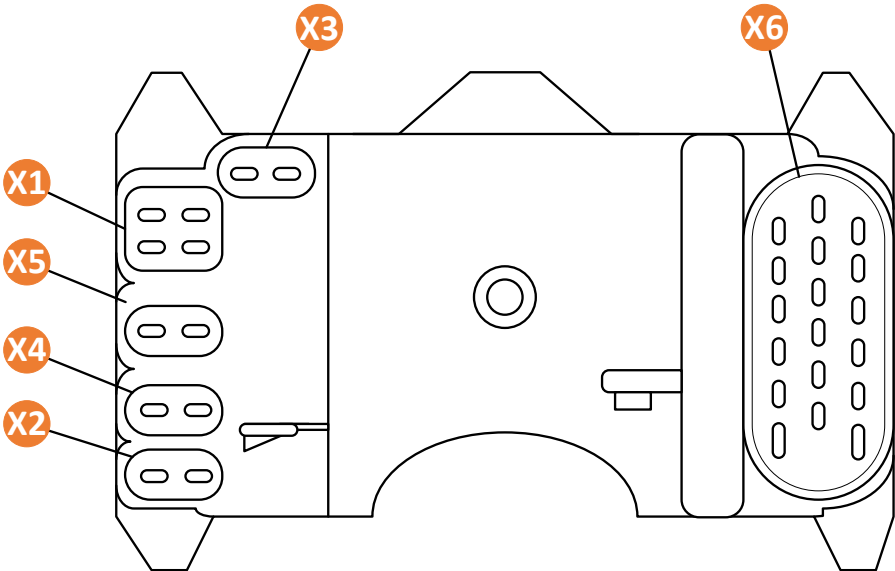


Figure 29

## ECU Connections – Airo 5

The plug sockets on the ECU are designed in such a way that wrong connections are difficult to make. Pay attention to the tabs (cut-outs) on each plug to ensure correct orientation and proper location. Each plug should require a smooth push fit. If force is required, then it is not located correctly!

Figure 30 shows the correct connections and their wire colours:

- X1: Air motor (red, yellow, brown, blue)
- X2: Glow plug/flame sensor (brown, yellow)
- X3: Overheat sensor (blue x 2)
- X4: Fuel pump (black x 2)
- X5: Temperature sensor (brown, blue/purple)
- X6: Unused
- X7: Main wiring harness (see figure 23)

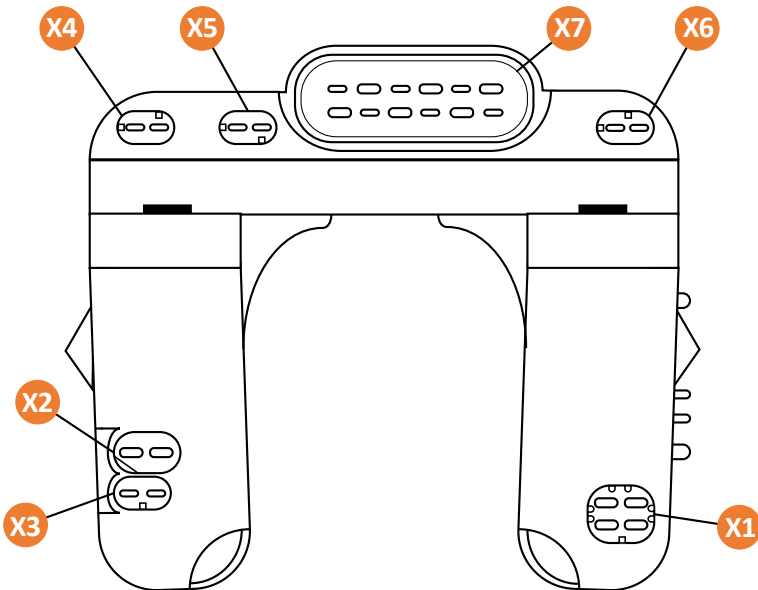


Figure 30

# MV Airo 2 Alpine Auto Wiring Diagram

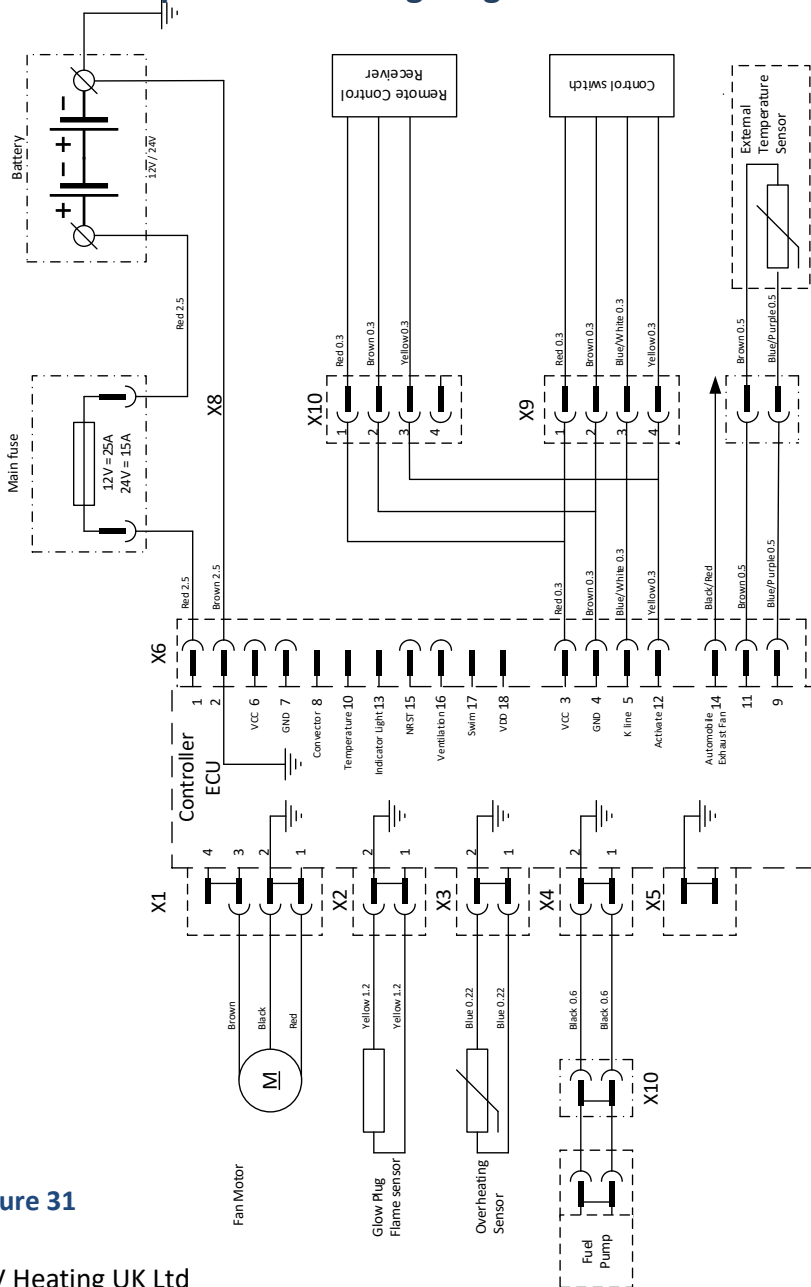


Figure 31



# MV Airo 5 Alpine Auto Wiring Diagram

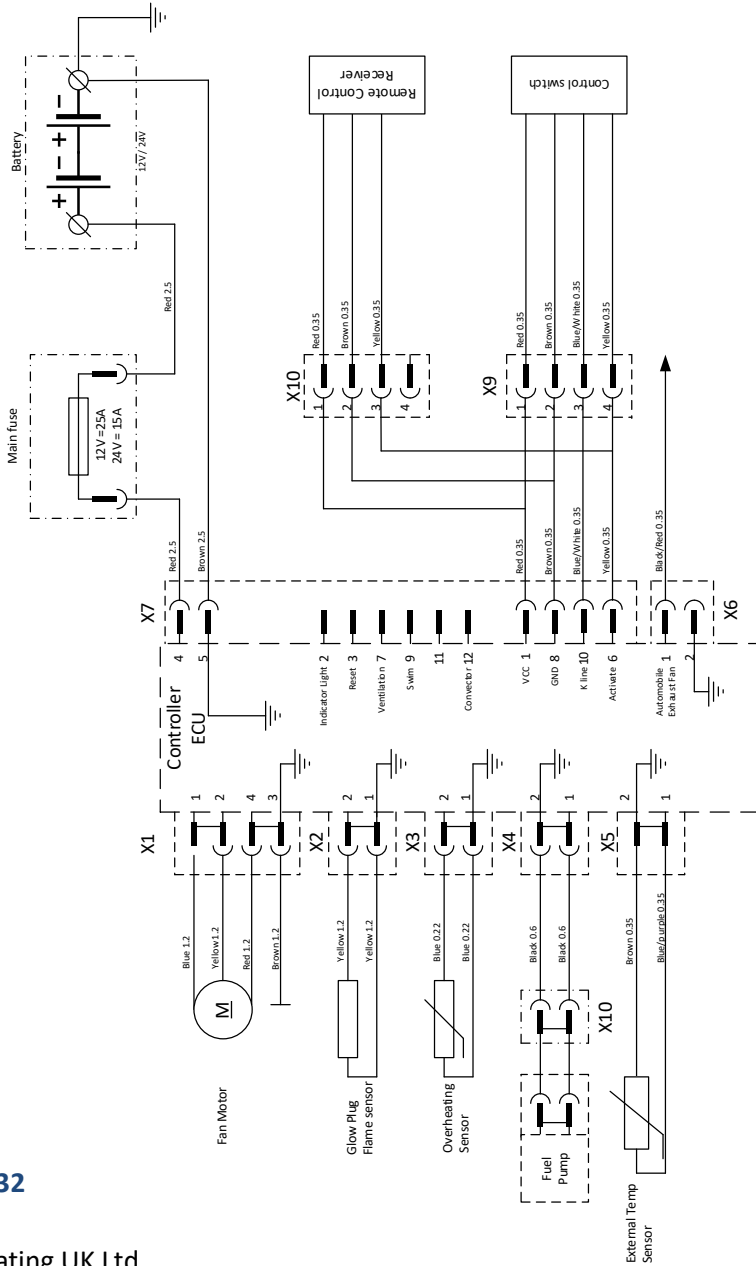


Figure 32



Figures 31 and 32 show the wiring diagram for the Airo 2 & Airo 5 heaters. 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.

The wiring harness for both heaters can exit to the right or left cutout of the heater's top case. Ensure that the rubber grommet is located between the heaters top case and ECU cover to prevent water damage.

A fuse will already be inserted into the fuse holder (20A for 12V heaters and 15A for 24V versions).

Connect the 2.5mm<sup>2</sup> red wire and the 2.5mm<sup>2</sup> brown wire in the wire harness to the positive and negative of the vehicle's battery respectively.

Straighten the fuel pump leads coming from the heater body (two 0.6mm<sup>2</sup> black wires) and put them through the opening on the wall of the air inlet pipe. They can then be connected to the fuel pump by pushing the spring clip down on the plug and pushing shut. Use the fuel pump extension loom if more length is required to reach the fuel pump from the heater.

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



## 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 objects.
- Clean the externals of the heater.
- Check for corrosion or loose connections of the circuits and connections.
- 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 on the highest output 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 and damage to the heater and controller.



## Fault Codes

Code on Digital/OLED Control	Error Description	Error Light (Flashing Light) on Rotary Control
00	No Fault	
10	Second start failure	F01
20	Heater does not light in time	F02
21	Combustion termination	
30	Voltage too high	F03
31	Voltage too low	
A9	Voltage too low	
41	Overheated	F10
50	Flame sensor open circuit	F05
51	Flame sensor short circuit	
52	Hot air sensor open circuit	
53	Hot air sensor short circuit	
54	Hot air sensor overheated	
65	Inside temperature sensor broken circuit	F06
66	Inside temperature sensor short circuit	
68	Outside temperature circuit broken circuit	
69	Outside temperature circuit short circuit	
70	Fuel pump short circuit	F07
71	Fuel pump broken circuit	
80	Fan broken circuit	F08
81	Fan short circuit	
82	fan speed too low	
83	Fan speed too high	
84	Fan speed measurement fault	
85	Fan motor failure to start	
90	Glow pin open circuit	F09
91	Glow pin short circuit	
92	Glow pin high resistance	
93	Glow plug drive open circuit	
a2	Overheating	F10
b4	Overheating or sensor fault	F11
b5	Overheat sensor fault	
c0	Hydro only - blower relay open circuit	F12
c1	Hydro only - blower relay short circuit	
c4	Preheating temperature broken circuit	
c5	Preheating temperature short circuit	
d0	Crystal oscillator in ECU broken	F13
d1	Fault information storage failure	
d3	Maintenance reminder	
-	Earthing Issue	Constant Flash
-	Connection/Communication Error	Traffic Light



## Notes

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