

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

Diesel heating fitting tips and hints

We took delivery of Impavidus, our Bavaria cruiser 37 in early March. We had thought that we would fit heating sometime in the spring or summer. After all with global warming and a thick duvet how cold can it be in March and April? Anyway our first few trips out we planned to stay in Marinas and use our little electric fan heater. Whoopee! Free heating.

Our first trip out (no pun intended) was actually our home berth in Port Solent. We collected the boat and brought her round. After a lot of faffing around we got on to our mooring and quickly put the 3 Kw fan heater on. It took about 2 hours to get the boat warm and toasty. But, with the outside temperature down at 4 deg and the boat sitting unheated for weeks. We thought that we would leave the heating on with the thermostat turned down. After all we were in as visitors for a week and the electric was free! I turned the water heater on too and the battery charger, lights, used our electric kettle. I do like to get my monies worth.

It must have been about 3am that I woke up. Freezing! Thinking that Cindy had been playing with the fan heater thermostat. I got up and braved the assembled penguins and frost covered floor only to find the power had tripped out. Or so we thought.

Nice to be told?

Well, the next morning after going back to bed with just about every piece of clothing I had on, I went to see the nice lady at the marina office. I explained that the power had tripped out and for some reason the electronic key-pad would not accept our code.

She politely mentioned that Premier only give you £2 of free electric when you spend a night with them after which you have to ring them with you visa number. I suggested it may be a good Idea to tell customers that, when they book in? You know just in passing? So they don't freeze at night 😊

Another frozen Night!

A second frozen night at Cowes public moorings and a second half frozen night a Swanick fighting off Polar bear attacks with frost bitten fingers saw me reaching for the internet browser on my phone and googling diesel heating!

On our previous boat I had fitted the heating while she was out on the hard following survey and the marina we were in then just metered the electric use and billed us. So there had been no rush. We were very pleased with the heater. It was effective, easy to fit and never once let us down. Only taking about 45 minutes to warm the boat even on the coldest days. We had bought it through Pumpkin marine in Northne Marina and after some discussion I think we paid about £950.00 for the complete kit.

Choices, Choices.

There is a world of choice when it comes to heating your boat. Not just the make of heater but alternatives. There are basically two forms of heating; direct and indirect heating.

Direct heating methods include oil burners, wood burners, paraffin heaters, charcoal burners, gas heaters, stoves and electric fan heaters. All of these use fuel or a power source to warm or heat air. Some heaters have large conductive surfaces where the hot air or direct flame comes in contact. This in turn heats up the air around it working like a big "heat sink" so there is indirect heating too. Fan heaters use electricity to heat an electrical element of high resistance which then transfers the heat to the air as it is sucked through the heater and blown out. Electric fan heaters are quite effective on a boat. They are controllable and can be directed. They all have a thermal cutout protection and if covered, blocked or in need of good clean will cut out as the air flow reduces and the elements get too hot. However, other than the fan heater direct heating usually involves a flame or burning. That is un-contained or contained within the device. More worryingly direct heating and the burning of fossil fuels causes both carbon monoxide and carbon dioxide. Both are lethally toxic to humans at

Heat without fuss.

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100ppm and 450ppm respectively. Which is not a lot. Neither of these two gasses have a smell. However they can be easily detected in a confined space like a boat.

Indirect heating such as electrical radiators, warm air blowers driven from the engine water system. Some systems use electric, gas. Diesel heaters blow warm air or heat water to run radiators or warm air blowers via a matrix. These use indirect heating the fuel is burned in a separate flask, chamber or apparatus this heats a plate, fins or water jacket and the conducted heat is then used to heat your boat. The air in the room is not actually used in the combustion process and no air from the combustion chamber should enter the vessel.

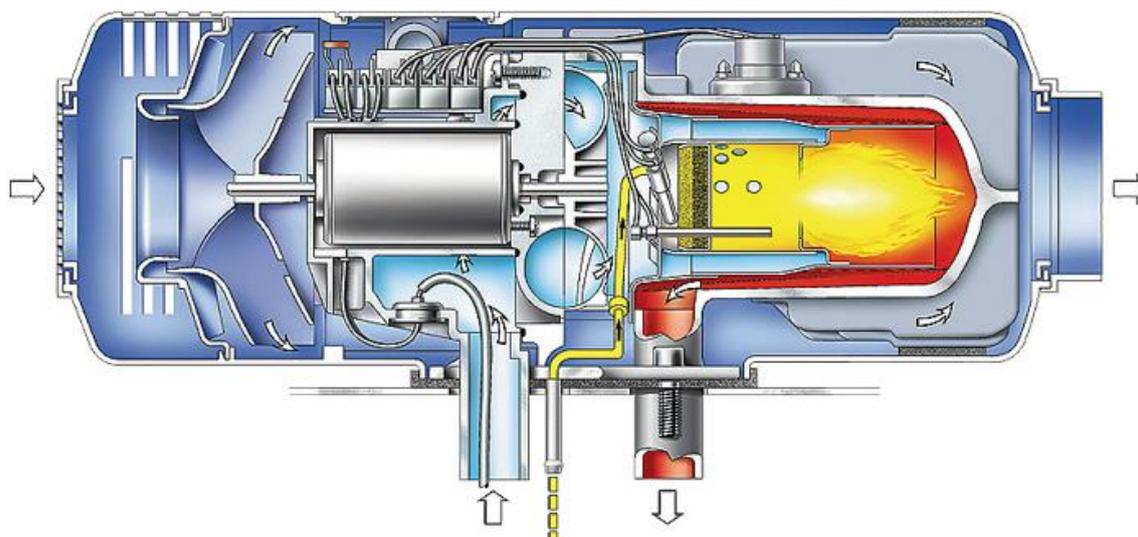


Figure 1 Diesel heater warm air

You pays your Money

On a modern Yacht we need a heating solution that is lightweight, robust and uses an available fuel. You don't really want to be carrying round another tank of water, radiators, pipework, blower matrix's pumps and ancillary's. Or another fuel.

However on a barge or big boat that is well insulated an indirect system that uses water pipes and radiators may actually be an effective way to heat.

I have never been a fan of gas heating on a boat. Apparently I am told that the gas burning heaters and water heaters work well. But I just do not like gas on a boat, although we do have a cooker and hob I suppose.....

For me the Diesel warm air heater is the way to go. The modern units are very reliable, can be controlled by rheostat or room stat. You can even add a module to turn them on remotely!

Having had a Mikuni MY30 for over 10 years without any issues I was very interested to get another for the new boat. However there were a couple of problems. The internal volume of the new boat is about 75% bigger so the 3kw heater may have problems driving 4 outlets on much longer runs. Secondly the UK distributor of the Mikuni is no longer selling new units.

Heat without fuss.

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The Webasto unit looks robust, but a boat owner next to us had nothing but issues with his. Now while that may be unfair to Webasto, when I googled Webasto boat heater problems more than 10 pages of links and forums came up asking the same questions.



Eberspache, are supposed to be the first and best but again the same thing but with massive complaints about the cost of spares (unless you buy them from Turkey from the nice man on EBay)

There were a few others on the market but I decided to go to the UK dealer of Mikuni in Southampton who is producing specialist kits for many markets, not just marine using the MV Airo unit. After a long chat and a walk round his workshop I went for the MV Airo 5 "The MV Airo 5 is a powerful but efficient heater with a variable output from 1.5kw up to 5kw".

The design means that it can be run at between 3 - 4kw output with very low current consumption and noise levels.

It has a fully marinized option with all stainless steel exhaust pipe and outlet as well as an in line exhaust silencer. Steve the owner knows his stuff. You can get a lot of confidence from someone who knows not only how something works but how each part is made. He has been in business over 20 years and is very proud of his reputation and service. Nice to hear these days when most people are only interested to the point of sale. What was even more interesting is he wanted to give advice and was willing to do me a very good price. I had been quoted just short of £2800.00 to have a Webasto fitted. I got the whole kit from MV for £1460.00 this included all the insulated pipe sections I wanted and the promise of a room sensor and outlet silencer in a few weeks (the kit runs fine without them). But they are an extra.

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

Measure twice cut once.

I wanted to get the layout right and plan all the outlet locations. To make sure that where the holes were not pre-drilled in the bulkheads there was room and they could be as un-intrusive as possible.



Figure 2 Boat layout

You know what they say about measure twice and cut once? I always measure, sketch, check, measure again, before cutting. So I planned the routes and sent the drawing and parts list to Steve. Working out where the sections of pipe needed to be insulated. Like under the rear berth and the fridge.

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

Materials list; Impavidus, Bavaria 37 cruiser 2015

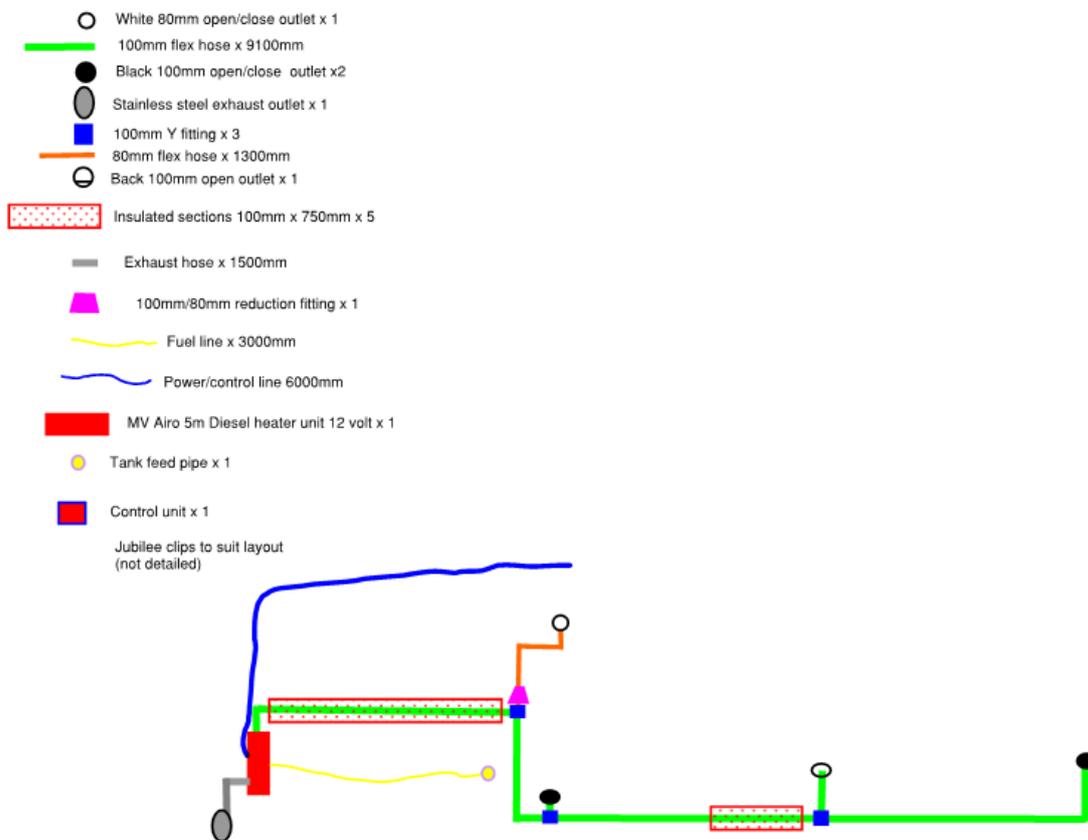


Figure 3 layout and materials

Holes and stuff

Having arrived at the boat in the morning all expectant and ready to go I realized the diesel tank was pretty full; a lot of diesel comes out of a 25 mm hole which is what I would be drilling into the plastic tank. I could not get the fuel feed pipes off the tank without cutting them so I could not pump the diesel out. I had to go and buy some 5/8 pipe and fit it to the small electric pump I have on board at one end and shove 2 meters of pipe down the filler cap. 25 liters later I calculated that there was enough clearance to drill the hole. As long as the boat stayed pretty steady. But I banded round the area I had marked for the hole with plenty of rag and grabbed my smallest rubber hole bung. Just in case.

AS we cut the opening in the tank Cindy held the hover nozzle near the hole-cutter to draw away the swarf. I used a hole-cutter because it creates most of its swarf internally. When it breaks through the hole cut piece pops inside the cutter holding the swarf above it. This worked really well.

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

As shown in the instructions supplied I cut the pipe to the right length Top Tip! **I tied a piece of cord to the pipe on the outside portion to prevent it falling in the tank should I let go.**

I maneuvered the feed pipe into position and secured it. It's important that you position the pipe and fitting correctly and tighten the locking nut while holding the body of the fitting. It's worth taking a bit of time on this and setting things up properly. No one wants a leaky tank fitting so be sure to work through the process in your head before you start

Pumps and Pipes

I then fitted a section of feed hose on to the pipe then the small filter and all the hose clips to the pump. But, left the last section undone. I then gently sucked the end of the pipe until I could see the red diesel traveling up the feed pipe. This was then connected to the pump so that the pump and line to it were virtually primed. These pumps supply very low levels fuel by electromagnetic pulse. From experience I knew to fill the whole 6 meters of fuel line one drip at a time could take hours, so I elected to pre prime the whole thing.



Figure 4 Tank, Supply tube, filter and pipes

The pump was secured to a mounting plate with a rubber anti vibration fitting. Held on M6 nuts and bolts. The pump and a clip that holds the pump at the desired angle attach to the pump body. I left the power supply cables loose until the remainder of the loom was fitted. I also had

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

some other cables I wanted to run along the same route, so I could tie these in at the same time. Mounting the pump bracket where I did ensures that the click, click of the pump when running is deep inside the boat and below the bedding. If you chose to use a similar location make sure that the fixings used do not penetrate the timber bulkhead. As the rear fresh water tank is tight against the other side.



Figure 5 Pump and loom, insulated pipe in foreground

Job for a small person!

The next bit was supposed to be really easy, all I had to do was cut a ply board 150mm x 225mm and glass it on to the inside of the rear transom. Easy? I had the board with me but on closer inspection it really wanted to be 22 mm ply not the 19 mm I had.

So off to find a 150mm x 225mm x 22m piece of WPB! The round trip took 2 hours and I had eventually ended up at B&Q routing through the scrap bin like a skip rat. Normally I have a bit of something laying around the workshop but 22mm ply is something I never use.

Timber found, I grabbed a tube of grip fix/no more nails and headed back to the boat. The pad was secured in place with a blob of the grip fix/no more nails, but it refused to set even after an

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

hour!!! So I ended up scraping off the so called “instant adhesive” using araldite rapid. I then applied Then 3 layers of chopped strand mat, layered on top. Doing this squeezed through the access hatch, in the back of the rear cabin proved to be a bit of a challenge. The space is pretty big but the access is small and there are a number of things that are just sitting there waiting to bite you, burn you, stab you, or poke you in the eye. I used the old blanket trick. (lay a thick old blanket over the space your squeezing in to. You can slide about without ending up like the man who fights with cats). The smell of the resin, the confined space and the difficulty of applying the mat and resin was what we call a challenge! This job should really have gone to a smaller person, one with 360 swiveling arms and by-fold elbows. You can never find a boy-scout when you need one 😊

Cut and Shut

While the Glass resin was drying I looked at the routes for the ducting in more detail and started to pull the ducting in from the position the heater would be in when mounted. This was a relatively east job. Most of the duct holes along my chosen route were already cut. The exceptions were the route to the heads outlet where we wanted to fit it, and the 3 bulkheads below the starboard seat in the saloon. The bulkheads were quickly cut. I used a template of the 100mm hole cutter to get the holes exactly where I wanted them. The outlets were positioned and cut the same way with a smaller cutter to suit the outside diameter of the various type of outlet.

It’s important to choose the right type of outlet for the space you are heating. For example, the aft cabin is a space we don’t often use. It is usually for guests so we don’t actively need to heat it all the time. When guests are aboard they may not want the heat on or may want more than the forward cabin. So a directional, adjustable vent is best for this part of the boat.

One outlet in the system has to be open when the heater is on. Otherwise the hot air has nowhere to go and this is a problem for the unit. Therefore, we chose to put the permanently open vent in the main saloon. At the widest point, away from where our feet would be when sitting at the table. We wanted the heads outlet to be in the front of the heads away from the toilet and shower, off the floor and not behind the shower door. The route for this was impossible to run in the same size duct as the feed to the forward cabin. So the size was reduced for this branch. Even so the duct route from the centre of the boat behind the drive leg and

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

engine, around the front of the rear water tank and into the heads was impossible through the tiny gap that the cables and wires had been laid. I could not find a route around the port side of the boat that would not involve a lot of faffing about.

I was also keen to ensure that the design had one single pipe with branches off it and those branches were as short as possible. In the end the best route actually turned out to be through the engine bay. The duct is away from the engine and does not interfere with the any maintenance items. Clipped back and held firmly it is a good fit and keeps the engine warm 😊

Figure 6 Heads outlet Engine bay



Interestingly you can get a hair drier attachment that will plug in to the heater system, not that it's of any use for me, but the wife may be interested. So once again the choice of outlet is important, Steve at MV heating is happy to talk you through the choices and make suggestions both in the type of outlet and the duct size.

As with all pipe work and ducting you need to keep the number of bends and directional changes to a minimum. Air flow can be dramatically reduced if you put loads of bends and loops in your system.

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

Figure 7 Aft cabin



Heads



Figure 8

Tricky bits

The really tricky places to fit the duct were where you would least expect it. As the duct goes into the aft section of the boat it has to pass through the rear bulkhead. In fact, under it with the engine exhaust and the fresh air feed and return to the engine bay. The air pipes are 100mm dia and take up a lot of room. The 65mm exhaust hose and various cables and pipes don't leave a lot of room. It's a tight squeeze and I ended up having to cut all the tie wraps securing these various bits and bobs and re arrange them to get the ducting in. Then re securing them all in place. The second tricky bit was under the fridge cabinet on the starboard side. The holes are pre-cut so the ducting passes under the cooker through a cupboard and in to the seat box.

Figure 9 Under the galley



Heat without fuss.

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The section under the fridge needs to be insulated, the wraparound insulated pads/panels that are supplied by MV are brilliant. They simply wrap around the duct and are held with Velcro stitched in to the panel. You can cut them down from the supplied length of 750mm with a good pair of scissors. I also insulated under the aft cabin bed and the rear bulkhead. So what's tricky?



Figure 10 Forward cabin outlet

Bavaria have put the fridge compressor under the fridge box and basin. It is accessed through a small louvered panel under the sink, in the cupboard, behind the bin. About 600mm inside the opening. The duct runs behind this. There are pipes, cables, tubes, wires and waste pipes all running in this spaces that you can only just get an arm into up to the elbow. Just as you do, the razor sharp cooling fins of the compressor work like thousands of sharks teeth up your arm. What a daft place to put the compressor! They should have put it under the bunk like they did on the 32 I had. Anyway it was not that much blood and at the time of writing the scars do appear to be healing ok.....

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

Exhausted!

The glass fiber work was dry within a couple of hours and I was able to fix the heater mounting bracket on it with stainless steel screws. The heater unit position is under the rear step of the transom bulkhead. This location gives the best access and keeps the exhaust route simple to the back of the boat on the starboard quarter.

The combustion air intake is from low in the space through a tubular filter that is fixed near the rear cross stringer. There are two very important things to remember about the heater exhaust. Firstly it gets hot, very hot. Secondly the hot exhaust fumes are poisonous.

Figure 11 Heater fitted in the aft of the boat



There are a couple of things that are common sense but worth saying. Don't fit heating until you have fitted a carbon monoxide/dioxide detector and a smoke alarm. These things are very reliable if fitted correctly and maintained properly. The sea is a harsh environment and even big boats get thrown around sometimes. So should something go wrong or break or get damaged. The first thing you want to be sure of is its not going to kill you? And you know about it.

The kit from MV has a set of hoses for the combustion air and exhaust. It has a small silencer on the exhaust which is not really necessary but does make a difference to the exhaust note. The unit we chose is 5 Kw and has a brushless DC motor. When running at full tilt it does move a lot of air and of course exhaust. Having a brushless DC means that the service life of the motor is longer. There are no brushes to wear out and/or change, a great feature. To my knowledge MV are the only company innovating with these motors. They have also developed a silencer for the

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

hot air duct again a great innovation. The exhaust hose is stainless steel and flexible, it has an insulated silicone sleeve, as does the silencer. This clips to the exhaust port on the heater, I always smear a little high temperature silicone around the exhaust joints on the male side of the joint, before doing up the hose clips, then I am then certain that I have a robust gas tight joint.

Cutting the hole for the exhaust outlet in the transom of a new boat can be a bit daunting. Especially as the hole needs to be elliptical. It's not difficult but, I always fit a long series bit to the centre of the hole cutter, mark out the hole and put a pilot hole at the centre point. With the long series bit you can quite literally drill at an angle to form the ellipse. If you draw the hole/ellipse on outside before you drill its much easier. You can then finish the hole with a good quality half round file if it needs it.



Figure 12 exhaust hose

It is also a good idea to plan where the route of the exhaust is going to run well in advance. Fix the support clips provided in the kit and try to keep the pipe a good 75mm from the walls floor transom etc. Where it is within 75mm I put some aluminum foil tape on the adjacent surface. This helps radiate any heat away, not that the hose gets particularly hot once the silicone cover is on. This may sound daft but the outlet in the transom releases hot gas. Fender meltingly hot!

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

If your rafted alongside a smaller vessel, you could be filling their cabin with nasty fumes without realizing. So always check before you switch on.

Cut the blue wire.

The final stage was to route the harness, mount the controls and connect the plugs. Before testing the heater. Note; I did not say clip all the harness in and tidy the wires up. My experience is that you only do that when everything is working and your happy. Otherwise, you can end up trying to fault find or trace a cable that's wrapped in loom of spaghetti and usually buried behind some vital equipment that takes 2 hours to remove. The MV system is all pre wired with a plugs at the end of each cable run. The control box and power feed cables needed to be extended but Steve provided these as part of the kit. I had given all the dimensions and lengths in the plan so it was easy for MV to see that the loom needed to be extended. This was done by simply plugging in a loom extension and the extra 5 meters I needed to reach the power supply and the control module. There are a number of extra plugs that allow you to upgrade the standard system with room stats and sensors even a dial up remote so you can call the heating and start it up before you get there!



Figure 13 Control

The control module is simple and easy to use, there are a good set of instructions on how to set everything up. No cutting of wires and taping of joints everything on the wiring side is simply

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

plug and play. Really impressive. I set the control at waist height next to the chart table. It's away from the vents and a good place to be with all the other electrical controls.

Let there be heat

Having fitted and connected all the electrical system I went through checking all the combustion and exhaust again and checked all the duct was insulated where it should be and the vents were open. The heater when switched on went straight in to a high speed fan mode and then the motor ramped down in steps. Clearly this is a pretty powerful motor it has a different sound to a conventional brushed motor. After a few seconds the pump started to click and this went on for a few minutes. The heater then went through a cool down cycle and back the start-up mode. It did this a couple of times until the diesel got up the pipe and into the burner.

On the next cycle the heater started to burn fuel and that unmistakable low roaring sound started coming from the transom. Within a few minutes the temperature in the boat was climbing fast. In just 20 minutes the temperature in the saloon went from 8° to 20°

Summary not summery

When a supplier is passionate about their product you know your going to get good service. When your invited in to the workshop and talked through the installation you know good service is important to them. Steve at MV went out of his way to help and advise it does not happen that often these days. Having talked through the installation MV extended the wiring loom with easy push fit connectors to suit the route I had chosen for the cable runs. All the wiring was plug and play and housed in a heat resistant coating.

Everything fitted exactly as it should do. The installation manual while not a big glossy publication was useful and full of good tips.

Fitting the system yourself means you get to know where all the components go and you learn a lot about parts of your boat you normally do not get see, or look in to.

The engineering behind the installation is very simple and mostly common sense. I suggest that if you can wire a plug or change a fuse you will not struggle to undertake the installation yourself.

Plan what you are going to do, especially before cutting holes. The hole cutters are readily available from places like Axminster tool or even Machine mart. You will need a good power drill

Heat without fuss.

Fitting Bavaria Cruiser 37 with MV Airo 5 warm air diesel heating

as hole cutters need more torque than most battery drills can supply. Stock up on tie wraps and those sticky pads that allow you to mount or support them. Once completed you can then clip things in position to stop them vibrating when the boats under power or cranked over. Use small stainless screws to fix the pads as the glue does deteriorate over time. Keep the exhaust run away from the sides of the boat and be sure to support it using the clips and bands provided. You may wish to do as I did, and glass some extra strong points in to the boat to fix the support band to. Double check the exhaust fittings they have to be secure and air tight. And finally, make sure someone has not inadvertently hung a fender or rope over the outlet every time you switch it on.

I took two lazy days to fit the system but I think two people working together could do it in less than a day. I had been quoted £2800. To have a similar system fitted. Having all the tools and the time to do it the cost came in at less than £1500. Help and advice from Steve at MV was priceless!