touchpad and bastone versions

Technical manual Mirage

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Precaution

Installation of and maintenance on the Mirage should be done by a qualified technician. Parts of the machine can reach a temperature of close to 130 °C (266 °F). The steam/hot water boiler contains water and pressurised steam of 125 °C at 1.4 Bar overpressure (258 °F at 20 PSI), temperature and pressure in the coffee system reaches up to 96 °C at 12 Bar overpressure (205 °F at 175 PSI).

Danger

We cannot be held responsible for damage and/or injuries resulting from actions performed on our machines by non-qualified personnel.

Advice for installation personnel

We do our utmost to have the machine in optimal condition before it is crated. Unfortunately storage and/or shipment sometimes has a negative effect on the state of the machine upon arrival.

We therefore recommend to check and bench-test each machine in your workshop before installation at a client's location.

Body panels may become affected by prolonged exposure to salty air (transport by sea). Stains on shiny stainless steel and polished aluminium can be removed with silver-polish and a soft cloth. Stains on painted parts may be wiped off with wet towel, possibly with the addition of a mild detergent.

Prolonged storage may also result in deposition/crystallisation of water-dissolved minerals that can block the small openings in the machine (restrictors at the fill valve, group valves and such) thus affecting the performance of the machine.

Despite our careful packaging, handling of the crate may be so rough that the frame bends or parts get damaged during transport. It is noted that the customer is responsible for additional insurance during transport as standard compensation from the shipping company will not cover all costs.

Parts identification

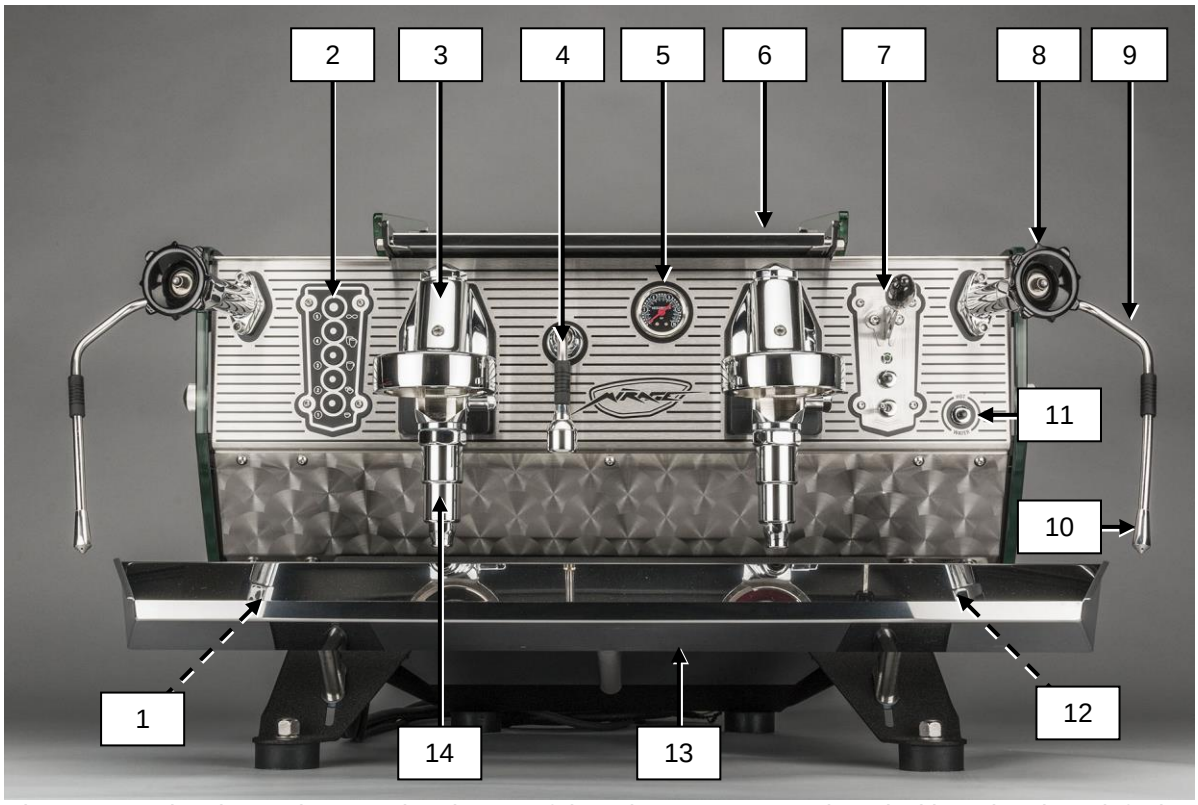
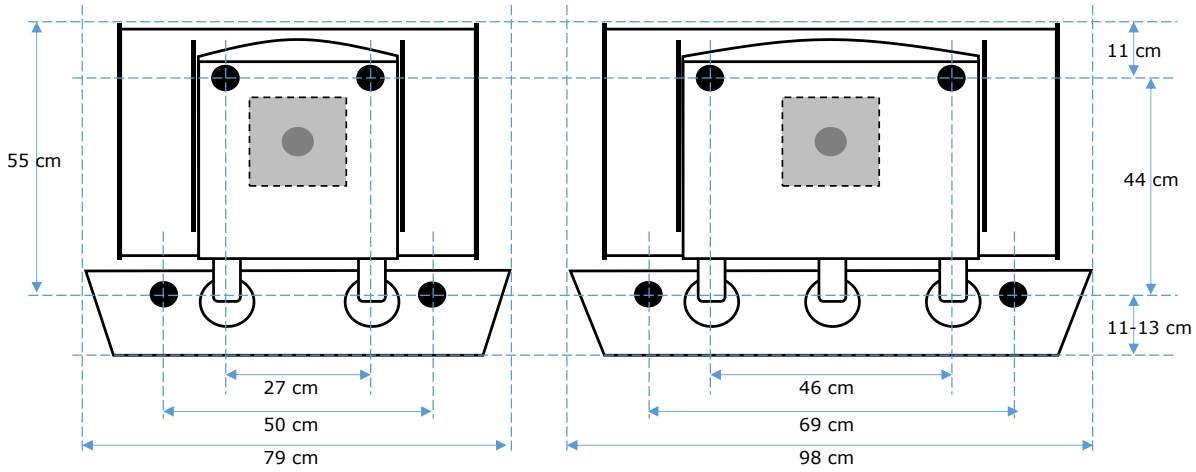


Figure W 1. Showing main operational parts of the Mirage Duette equipped with optional pre-infusion cylinders. Special show model with touchpad operation for the left group and bastone operation for the right group. The Mirage Triplette is wider since it has an extra group in between the two groups shown here but its function is identical to a Duette.

1. Mains switch, heating element indicator light(s) and fuse(s) (not visible on photo)
2. Touchpad group 1
3. Group head 1
4. Hot water spout
5. Pump pressure gauge
6. Cup-warming tray
7. Bastone unit group 2
8. Steam valve
9. Steam wand
10. Steam tip
11. Hot water switch
12. Temperature controller (not visible on photo)
13. Drip tray
14. Progressive pre-infusion cylinder (optional)

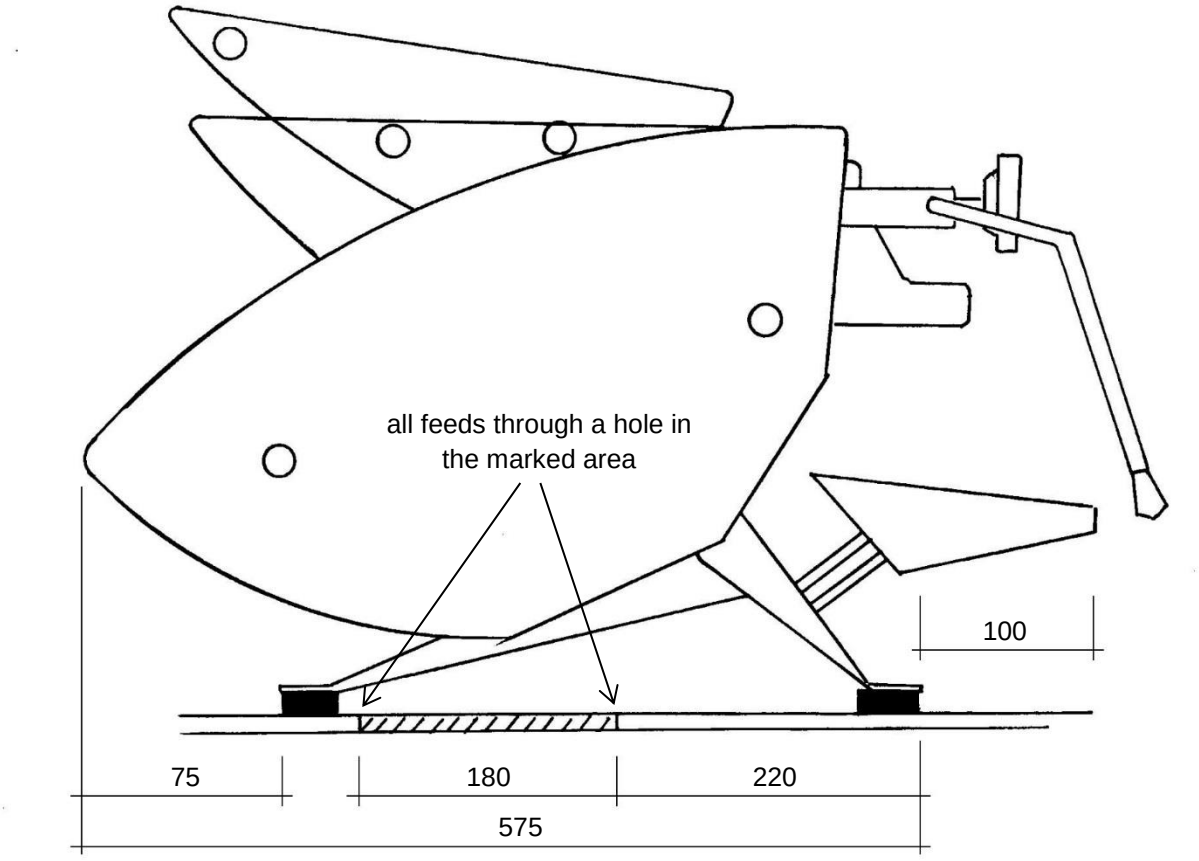
Dimensions

Footprints



Approximate footprints of Mirage Duette (left) and Mirage Triplette (right). Black circles are rubber feet. Countertop feedthrough (dark grey circle; diameter 60 mm) is optimally positioned in light grey square. Note that steam wands will protrude a few centimetres left and right from machine.

Silhouette



Side view of Mirage, measurements in millimetres.

Minimum sizes of countertop openings

Pump hose	30 mm (connector diameter is 22 mm, hose is 12 mm)
Drain hose	30 mm (outer diameter is 25 mm)
Pump + drain hoses	40 mm (insert pump hoses first)
Electric cables	20 mm (mains cable plus pump cable, no plug)
All feeds through 1 opening	60 mm (insert pump hose first)

For the **feed through of the water hoses and electrical cables** drill a hole of 60 mm (2⅜") diameter in the counter; this should be no further than 15 cm (6") (left or right) from the middle of the machine, and between 22 and 40 cm (9" and 16") behind the front feet (see machine side-view). The width of a Mirage (body without steam wand) Duette is 730 mm (28.7"), the width of a Triplette is 920 mm (36.2"). Ensure that this hole is not above the knock-box!

Where 1 or 2 optional steam foot-pedals are used: There is a hole needed for the thin rubber tube(s) from under the machine to the foot pedal on the ground. In the counter, the 60 mm hole can be used, but you need to bear the bottom and sides of the cabinet under the counter in mind and if there is a plinth then this needs to have a hole of 15 mm (⅝") diameter per hose.

Before unpacking the machine, you must be sure the area where the machine will be placed has been prepared properly. The **countertop** should be level and firm enough to carry the weight of the machine (up to 100 kg, 220 lbs), even when force is applied to it (to lock in the filter holders, tamp the coffee bed, etc.).

The handle of the filter holder will be approximately 25 cm (10") above the countertop. A countertop height of 85-100 cm (33-40") is suitable for most barista's (170-195 cm; 5'2"–6'5").

Main characteristics

	Duette		Triplette	
Dimensions	cm	inch	cm	inch
Height	52	20.5	52	20.5
Depth	67	26.4	67	26.4
Width of body	73	28.7	92	36.2
Width including steam wands	91	35.8	110	43.3
Footprint	cm	inch	cm	inch
Depth	50	19.7	50	19.7
Width, operator side	55	21.7	74	29.1
Width, rear side	32	12.6	52	20.5
Max. power consumption	kW	Amp (230 VAC)	kW	Amp (230 VAC)
Single phase	3.6	15.7		N.A.
Three-phase	5.1	22.2	6.4	27.8
Single phase, high power	5.1	22.2	6.4	27.8
Volume capacity	litre	US	litre	US
Steam boiler	12.6	3.3 gals	18.8	4.9 gals
Heat exchanger (each)	0.45	15.2 fl oz	0.45	15.2 fl oz
Weight (appr.)	kg	pounds	kg	pounds
Machine empty	65	145	80	175
Machine filled	75	165	95	210
Pump with motor	5.3	12	5.3	12

Table W 1. List of main characteristics of the Mirage.

Abridged machine performance

The Mirage functions according to the so-called single boiler system with heat exchanger and thermo-siphon system. The water in the hot water/steam boiler is heated to approximately 125 °C to achieve lasting steam power. For each group, a wide tube (the heat exchanger) runs through the hot water boiler in which the water for brewing espresso is heated up without direct contact with the water inside the boiler.

Within this heat exchanger the coffee brewing water is also heated up to approximately 125 °C, which is, of course, too hot for brewing espresso. A wide and long tube running outside the boiler connects the top of the heat exchanger to the group head and then from the group head back to the bottom of the boiler. The group head is a modified E-61 which is made from brass, a metal with high heat conductivity. This high heat conductivity means the group head easily takes up heat from the (warmer) water and sheds heat to the (colder) environment, thus cooling down the water within. Since cold water has a higher density than warm water, it will “sink” through the wide tube towards the bottom of the heat exchanger. Warm water from the heat exchanger will replace the cooled water and a circular flow is established. This is the so-called thermo siphon system.

At idle

At idle (no shot being pulled) the temperature in the group head is mainly affected by 3 parameters: the flow rate of the water, the temperature of the water coming into the group head and the heat loss to the environment (see Figure W 2). Wide conduits will lead to high flow rate and thus high temperature of the group head, narrow conduits will lead to low flow rate and thus low temperature of the group head. Flow rate in the wide conduits of the Mirage’s thermo-siphon system is controlled by a flow restrictor (or jet). The restrictor is a fitting with a small opening which is either fixed or (optional) adjustable. The conditions of the environment (the location of your Mirage) may change slightly due to room temperature, draught and air humidity. As the temperature difference between the group head and the environment is large (about 70 °C), a difference in room temperature hardly influences the temperature of the group head although a high humidity or large air flow past the group head will lead to a larger heat flow from the group head and thus lower temperature of the group head.

The flow restrictor installed in your Mirage is optimized for “normal” conditions, e.g. boiler temperature of 125 °C, a room temperature of 18-22 °C, air humidity of 70-90% and little draught, brew water temperature of 91-93 °C.

The first espresso

When a shot is being pulled, water is drawn from the thermo siphon system just before it enters the group head. The water just coming from the heat exchanger is too hot but, since the flow restrictor is located at the top of the heat exchanger and conduits are otherwise wide, flow from the lower conduit is larger than from the upper conduit and nearly all water drawn from the system comes from within the group head which has the right temperature. After passing through the group valve, which is initially a little colder, the brewing water is led once more through a chamber in the group head with large area surface such that it will adopt the group head temperature before reaching the coffee bed.

A second espresso

There is only little water contained within the group head (about 30 ml) and water from the large tubing running from the group head down to the heat exchanger is a little bit too cold for brewing coffee. This lower tubing contains about 30 ml as well. However, the large mass of the group head (approximately 4 kg) is capable of storing a lot of heat and since the conductivity and surface area are high, the cooler water from the lower tubing which flows through the group head first will rapidly heat up to the right temperature. The group valve is already heated up by the first espresso and water flows through the group head a second time to establish the proper temperature before it reaches the coffee bed.

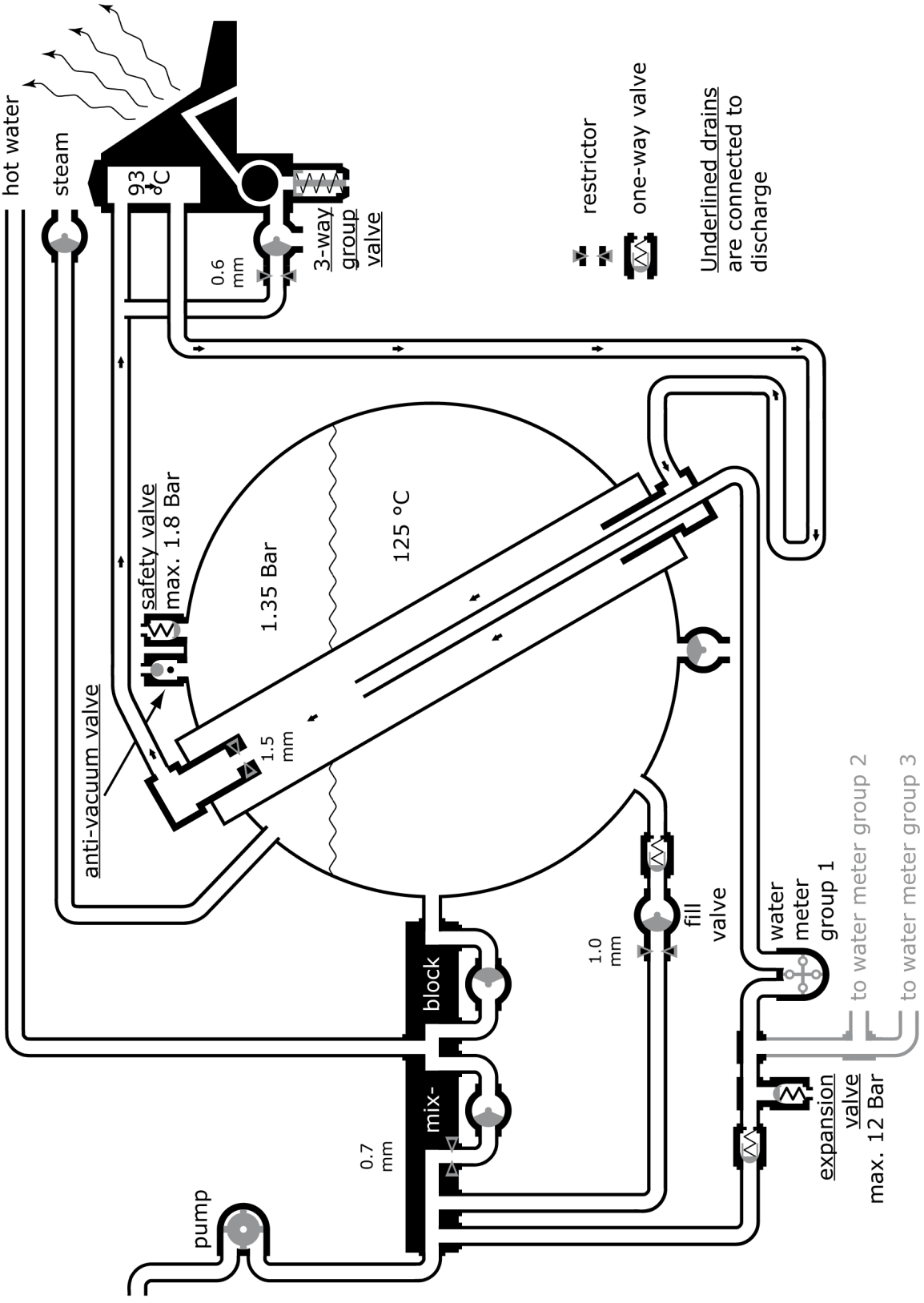


Figure W 2: Schematic hydraulics Mirage at idle. Sizes of restrictors may be different in your machine.

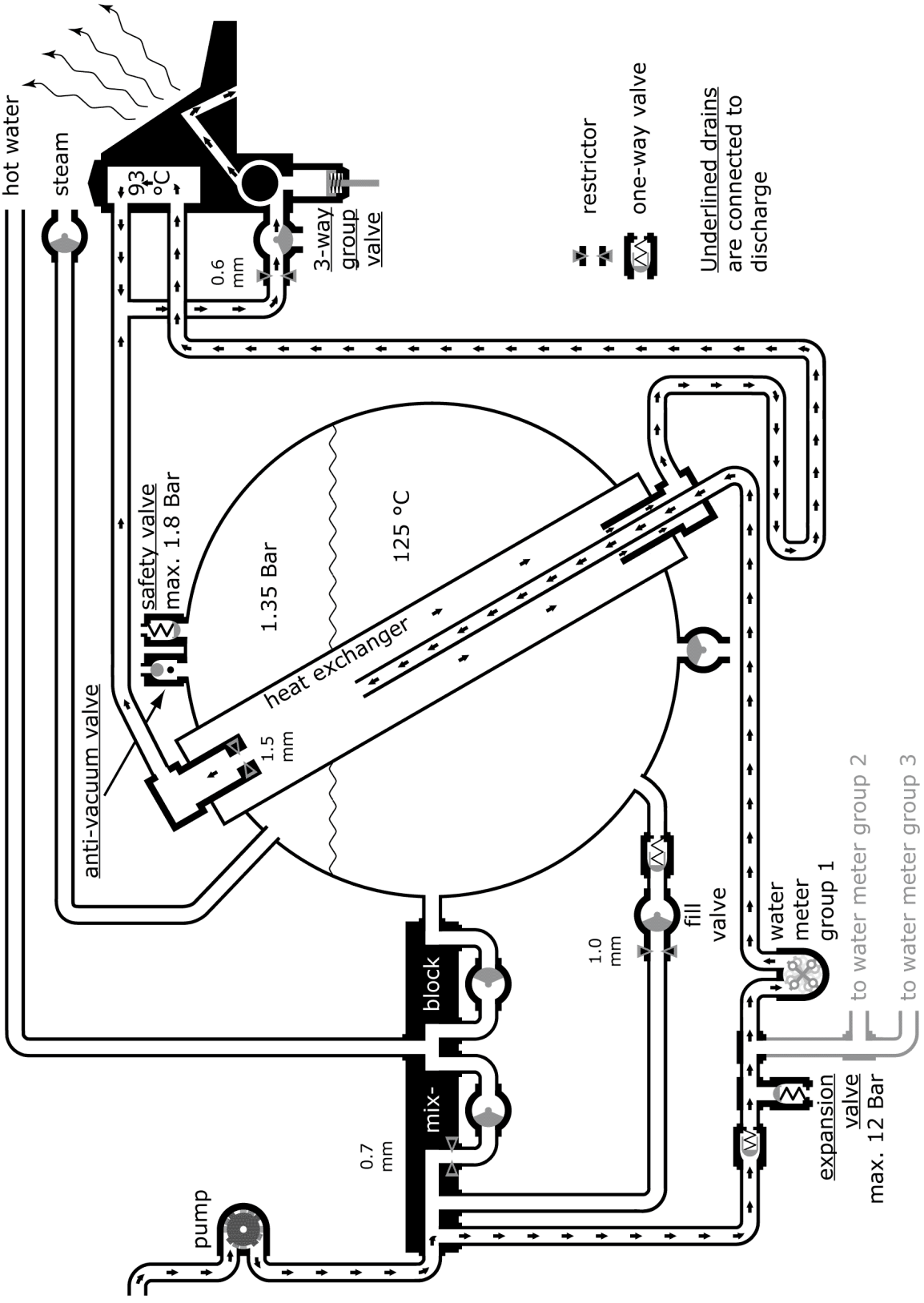


Figure W 3. Schematic hydraulics Mirage when brewing. Sizes of restrictors may be different in your machine.

A large number of espresso's
When water in the lower tube is used to brew espresso it is replaced with water from the bottom of the heat exchanger. This water is initially too hot but is cooled considerably by cross-flow with cold water flowing from the water supply into the heat exchanger. Cold incoming water is directed upwards in a copper injector tubing of approximately 20 cm where it heats up along the way. Water is drawn from the boiler through a brass fitting that completely surrounds the injector tubing such that the hot water from the boiler is cooled by the incoming cold water. When brewing volume is high, the cross-flow system, together with the flow restrictor at the top of the heat exchanger warrant a very stable temperature on the coffee bed (see Figure W 3). Fluctuations in steam boiler water temperature which result from filling have little effect on coffee water temperature as they are balanced by the large mass of brass of the group head.

Temperature stability
The entire system allows for very stable water temperature at the coffee bed with low and high brewing volumes in combination with high steam pressure. The water at the coffee bed can be adjusted to as low as 88 °C by altering the flow restrictor (either by changing the fixed-opening restrictors or by regulating the adjustable restrictors).

The temperature in the steam boiler is maintained by a very accurate electronic controller. The measuring-tip of the temperature sensor is located above the water level in the steam boiler, not in the boiler water itself. This is done on purpose: when a steam valve is opened, the subsequent pressure drop in the boiler will immediately lead to a small temperature drop (adiabatic expansion) which results in activation of the heating element. The controller allows for easy adjustment of boiler temperature.

Boiler fill
An operational level probe in the hot water/steam boiler governs automatic refilling which ensures that water level remains constant. However, the boiler will not fill when a shot is being pulled as not to disturb the brewing pressure.

Safety
A safety level probe just above the heating elements ensures that the Mirage heating shuts down when water level is becoming dangerously low, with LED's on the touchpads or bastone levers flashing as visual warning. Overheating is furthermore prevented by a separate sensor which interrupts power to the heating element when the temperature around the heating element exceeds 145°C (293°F).

The expansion valve in the coffee water system, which is adjusted to 11-12 Bar at our workshop, in combination with a safety valve of 1.8 Bar on the steam boiler ensure that pressures inside the Mirage cannot exceed safety values.

When any one of the solenoid valves within the Mirage would ever remain open for longer than 2 minutes, the complete machine will shut down. At the same time all LED's on the touch-pads will start blinking as a visual alarm.

User friendly
All group solenoid valves are located inside the machine and connected to the drain such that no electric devices are in the splash zone and there is no spattering of discharging valves.

The touchpads or bastone lever units can easily be programmed individually or simultaneously to your own shot-volume settings with the left-hand side touchpad/bastone (as seen by the barista) as governing module. A touchpad allows for 4 different volume settings and continuous flow. A bastone unit allows for 2 different volume settings and continuous flow.

The hot water flow is operated by a push-button and can be time adjusted to your needs. Hot water from the boiler is mixed with some cold to deliver non-spattering water of the correct temperature to prepare “Americanos”.

All parts in the Mirage which spill water or steam in whatever circumstances are connected to the drain pipe on the back of the drip-tray. The group valves, expansion valve, pressure safety valve and anti-vacuum valve will thus not leak any water on your counter or the Mirage’s electronics or blow steam into your working space.

These drains have a second benefit. For example: whenever a dirt particle in the boiler fill valve prevents it from closing, the boiler will keep filling. Such a malfunction will not be detected by the Mirages’ computer and continues even when the machine is turned off. During opening hours you might notice the malfunction in time. However, if it happens at the end of the day, water level in the boiler will slowly rise until it reaches the safety valve. Since opening pressure of the safety valve is probably lower than water mains pressure, the safety valve will be pushed open. The drain on the safety valve prevents your workspace from being slowly flooded.

The Mirage is also equipped with an easily operated cleaning program which pressurises and de-pressurises all groups simultaneously 8 times in a row.

The wide drain tray can be moved stepless up and down to accept any size of cup.

The elevated position of the body makes cleaning underneath the machine easy. Slightly down-sloping handles on the filter holders ensure an ergonomically better position of the barista’s wrist.

An optional pre-infusion system can be mounted on the Mirage. This “soft-start” mechanism (incorporating a progressive pre-infusion cylinder) absorbs pump pressure such that it increases gradually to 3 Bar which ensures pre-wetting and swelling of the coffee grinds before extraction starts.

As an option, one or both steam valves can be switched on and off by foot for fast and efficient milk steaming. Since the manual steam valves remain fully operable the steam flow can be adjusted to your liking.

Notice

Filled with water, a Mirage espresso machine has a large mass and produces heat. Space in the immediate surrounding should be available for coffee grinder, knock-box, tamper and other accessories. The pump and water treatment (not included) should be placed in the proximity of the machine. Water supply and discharge, as well as an AC socket with earth connection is needed. The location of your Mirage should account for these.

Water quality

Since water content in an espresso is more than 90%, the quality of your water supply is highly important for the taste of your coffee. While too much mineral content will hasten damaging lime scale build-up inside your Mirage, an absence of minerals will give your espresso a flat taste while also harming the boilers inside the machine. As a rule of thumb, the amount of total dissolved solids (TDS) in your water should be 100-150 mg/l (=ppm).

We recommend that you contact your water company for details about your water quality and have a water expert with knowledge of (local) water quality in espresso-machines help you to determine a suitable water-treatment system. Below some guiding principles.

Hard water treated with an ion exchange water softener only has calcium replaced, and so it is wise to further treat your water with an activated carbon or a carbon block water filter. These carbon filters also remove other impurities that affect taste, but, on their own, are not able to remove water hardness. Calcium and magnesium in the form of carbonates dissolved in water are the two most common minerals that make water "hard". It is recommended that water hardness is 2-4 German degrees (35-70 mg/l Ca/Mg carbonate). The water treatment system hooked up to your machine should establish these values.

The acidity (pH-value) of your water should be close to neutral (pH=7). A lower value (pH < 6.5) will make your espresso start to taste acidic and is corrosive to the metal parts in your machine. A higher value (pH > 7.5) results in bland tasting brews although it can also neutralise slightly acidic coffee grinds. You are advised to check the acidity of your water every once in a while.

Chlorine should not be present in your water since it has a highly corrosive effect on all metal parts (copper, brass and even stainless steel) inside your machine and makes your espresso smell and taste awful. Chlorine treated water should therefore not be used in your machine unless chlorine is removed from the water after the chlorine treatment (e.g. by use of an activated carbon or a carbon block water filter).

Water Quality Parameter	Target	Acceptable range
Odor	Clean/Fresh, odor free	
Color	Clear	
Chlorine	0 mg/l	
TDS	150 mg/l	75-250 mg/l
Calcium Hardness	51 to 68 mg/l	17 to 85 mg/l
Total Alkalinity	40 mg/l	at or near mg/l
pH	7.0	6.5 to 7.5
Sodium	10 mg/l	at or near 10 mg/l

Table W 2. Water properties for optimum taste. Source: SCAA Technical Standards Committee, 2009.

Any installed water treatment system should take the above into account and also prevent coarse particles and aggressive components to enter the machine. We do not favour the use of de-scaling agents in our machines and therefore recommend that the function of the water treatment system is checked regularly. Not only changes in Alkalinity and Hardness of water, but also temperature have dramatic effects on scale deposits and/or aggressiveness of water on the machine thus no single water is optimal for both steam- and coffee boiler. We favour scale deposit over corrosion and advice the use of the higher hardness value shown in the table below. Flushing the steam boiler will help to reduce scale deposit in the steam boiler. Drawing lots of hot water reduces the scale-forming induced by steaming due to removal of pure water.

°C	Alkalinity (mg/l)											
↓	33	37	40	43	47	50	53	57	60	63	67	70
90	342	250	202	166	130	110	93	77	67	59	51	46
95	280	205	166	136	106	90	77	63	55	49	42	38
115	130	95	77	63	49	42	37	31	27	24	21	19
120	108	79	63	52	41	36	31	26	23	21	18	16
125	89	65	53	43	35	30	26	22	20	18	15	14
130	75	55	44	37	30	26	22	19	17	15	13	12

Table W 3. Maximum non-scaling Hardness (mg/l) by temperature and Alkalinity. With an Alkalinity of 50, ideal hardness would be about 100 mg/l for the coffee boiler (90-95 degrees) and about 30 mg/l for the steam boiler (125 degrees). We advise to use 100 mg/l hardness at 50 mg/l Alkalinity. Source: Jim Schulman's Insanely Long Water FAQ.

For comprehensive information about water in espresso machines we refer to: *Jim Schulman's Insanely Long Water FAQ, Originally Posted on alt.coffee.*

Note on this manual

Work on the Mirage manual (touchpad version) is a continuing process. Photographs in the manual are taken in the shop from machines being built or from parts available, they range from 2012 to 2016. For that reason, body panels and/or parts from the machines on display may be missing and parts in the machine you bought some time ago may not look identical to the parts shown in the manual. Over time, sections are added and/or improved, sometimes as result of readers making comments. If you have suggestions for improvements, do not hesitate to send them to: support@keesvanderwesten.com.

Maintenance

The next section clarifies how the individual maintenance items should be carried out. Up to monthly maintenance, the tasks are relatively easy and do not require vast technical knowledge. However, checking and replacing parts inside the machine should be done only by an experienced and knowledgeable espresso machine technician.

△ Warning!

Maintenance on the machine should be done by a qualified technician. Parts of the machine can reach a temperature of close to 125 °C. The steam/hot water boiler contains water and pressurised steam of 125 °C at 1.35 Bar overpressure (257 °F at 19.6 PSI), temperature and pressure in the coffee system may reach up to 96 °C at 12 Bar overpressure (205 °F at 175 PSI).

When servicing the machine it is sometimes necessary to keep the machine connected to the AC power outlet and the machine switched “on”. In both cases there is a possibility that you touch a live wire.

Danger

We cannot be held responsible for damage and/or injuries resulting from actions performed on our machines by non-qualified personnel.

Handy items while performing maintenance

Servicing an espresso machine requires a well filled tool-cabinet, but also some special materials you might not think of initially.



Figure M 1. Loctite 542 and 243, food-safe grease, copper-ease, Teflon O-rings, PTFE tape and copper O-rings.

- Loctite 243 is used to increase friction such that bolts, nuts and fittings will not turn loose when not wanted. Loctite 542 helps to seal joined parts. A disadvantage is that it should not get on the inside of the fittings/tubing as non-hardened Loctite may be transported by the water flow and clog restrictors, solenoid valves, etc.
- Food safe grease is used to reduce friction between the nuts and the tubes when tightening the tubes to fittings, etc.
- Copper Ease is an anti-seize compound with a very high temperature tolerance (up to 1150°C. The protective coating will not wash or burn off and will help to prevent stainless steel bolts and nuts getting stuck. Stainless steel does not corrode but is very parch, if not lubricated, a nut-bold connection seems to “weld” together.
- Teflon O-rings and/or tape is used to assure sealing of joined parts that are expected to be loosened every once in a while. However, especially when warm, Teflon deforms easily and should therefore not be tightened as you would a fitting sealed with a copper O-ring.
- Two wooden blocks with approximate dimensions 15x5x20 cm (6x2x8 inch) to tilt the machine backwards for easier access to the bottom of the Mirage.

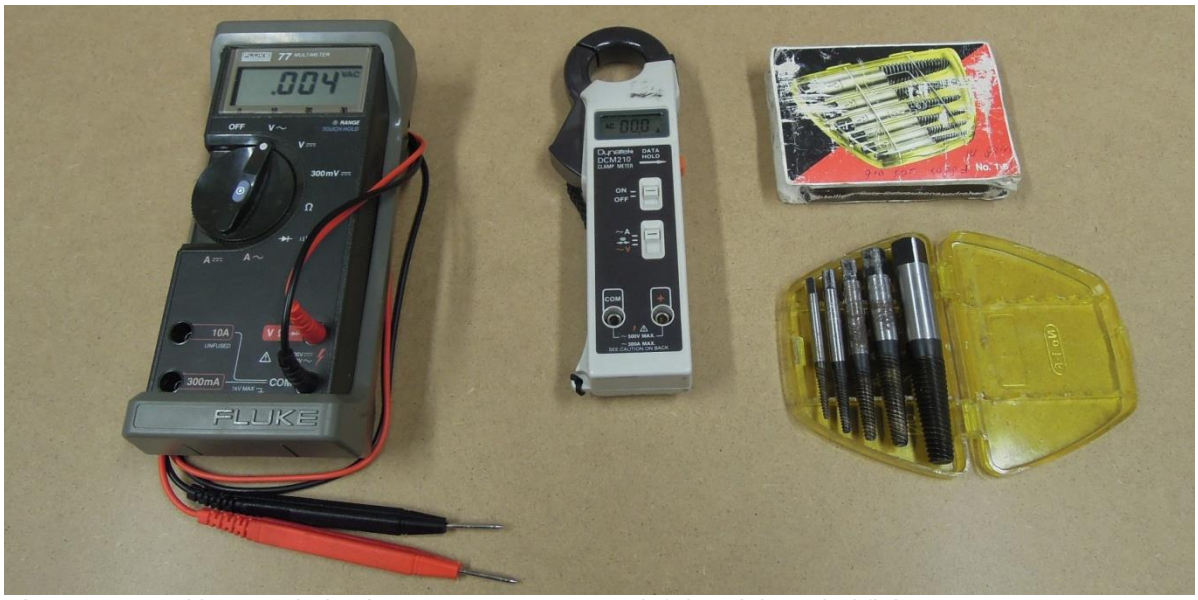


Figure M 2. Multi meter, induction type current meter, left-hand threaded fitting extractor.

- Multi-meter to check resistance, voltage, current, etc.
- An induction type current (Ampere) meter may be useful to check power through the heating elements.
- Thread extractor(s) to remove broken off fittings.



Figure M 3. Temperature meter with sensor mounted in filter holder with adjustable flow and long tip temperature sensor.

- Filter holder with controlled outflow and quick response (QR) temperature sensor, separate QR-sensor and meter to check brewing temperature and hot water temperature.

Remove body panels

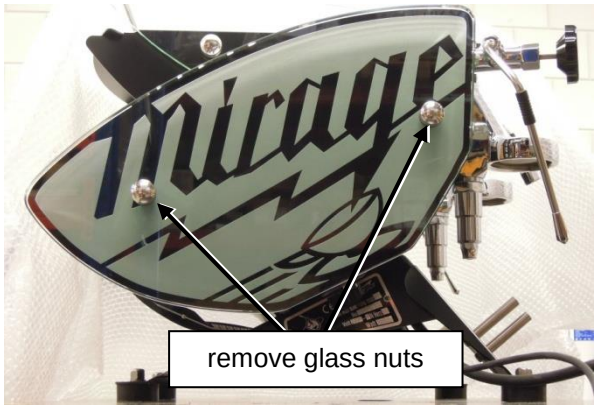
Most parts within the machine that need regular maintenance can be accessed by removing either left and/or right body panel and/or cup warmer.

Materials needed

- Spanner 11, 13 mm
- Ring spanner 8 mm
- Allen key 2.5 mm, 3 mm
- Copper ease

Procedure glass side panels

1. Unscrew the 2 large glass nuts on the side panel by hand (see Figure M 4a).
2. Carefully pull glass side panel away from the machine.
3. Remove the 2 brass mounting nuts (see Figure M 4b) with a 11 mm spanner.
4. Carefully pull plastic side panel away from the machine.
5. When re-mounting the side panels, check the silicone O-ring on the brass mounting nuts for cracks, replace if necessary. Do not over tighten the brass mounting nuts.
6. Don't forget the rubber washer between the glass side panel and the large glass nut, do not over tighten the large glass nuts.



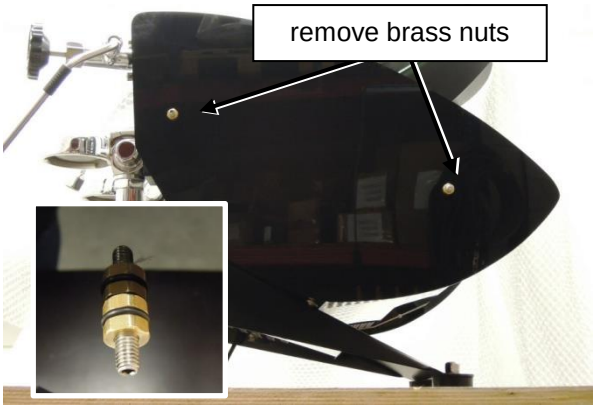


Figure M 4a (left). To remove glass panel loosen the glass nuts that hold the glass panel.
Figure M 4b (right). Then remove the 2 brass mounting nuts. The inset shows the silicone O-ring on the mounting nut.

Procedure aluminium side panels (Veloce)

The aluminium side panels do not have a (black) plastic side panel mounted.

1. Unscrew the 2 nuts on the side panel with a 13 mm spanner.
2. Carefully pull aluminium side panel away from the machine, do not lose the rubber and stainless steel washer underneath the nuts.
3. When remounting, don't forget the rubber and stainless steel washer and do not over tighten the nuts.

Procedure cup warmer

1. Lift upper cup warming tray.
2. Use a 3 mm Allen key to remove 4 bolts from lower cup warming tray (see Figure M 5).

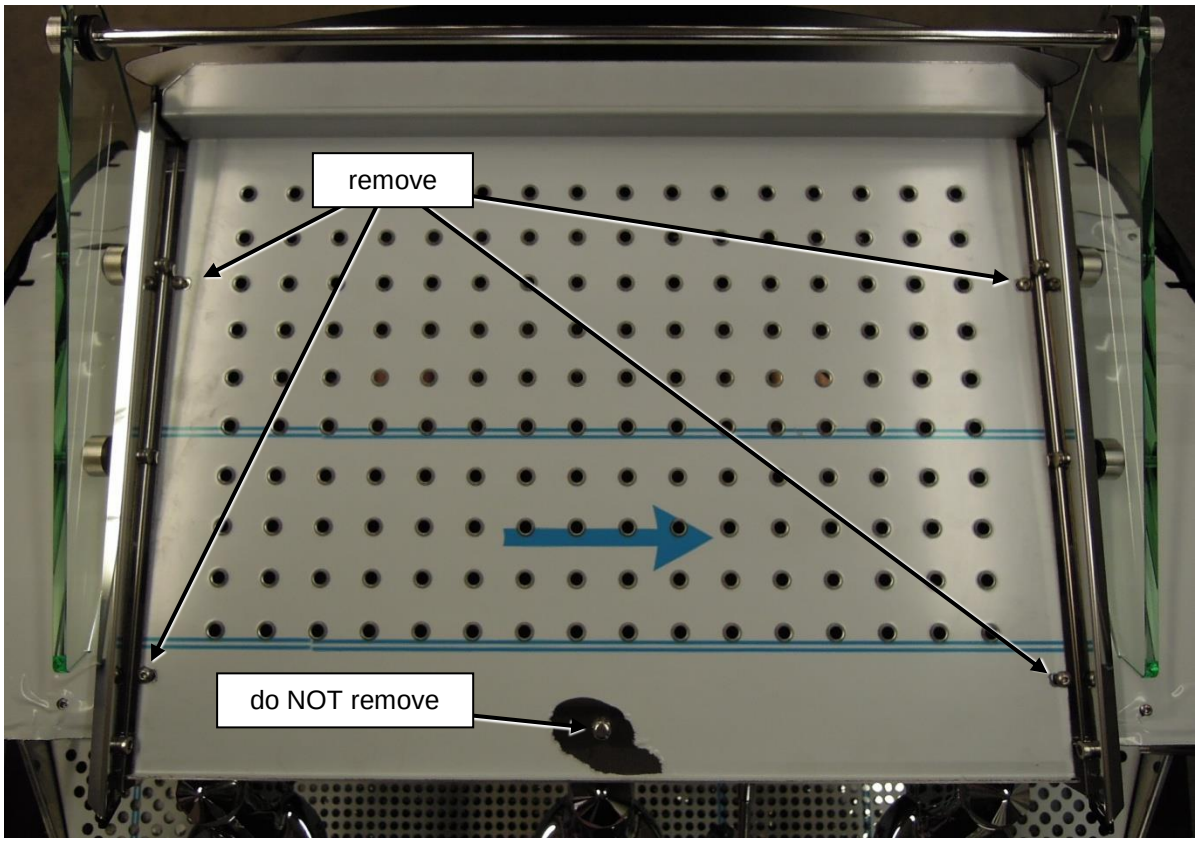


Figure M 5. Remove lower cup warming tray: remove 4 Allen bolts, then slide towards barista side and lift off. Note that protective film is still on parts of machine.

3. Carefully slide lower cup warming tray to barista side of machine, then lift up.
4. When re-mounting, make sure that the lower cup warming tray does not scratch the back end of the machine. Put a little grease on the Allen bolts, do not over-tighten.
5. Replace upper cup warming tray.

Procedure upper side panels

- Remove appropriate side panel first.

⚠ Warning!

It is essential to disconnect the Mirage from the power outlet before removing the upper side panels, especially the one on the left hand side.

1. Unscrew the 2.5 mm Allen bolts on the upper finishing strip a few turns.

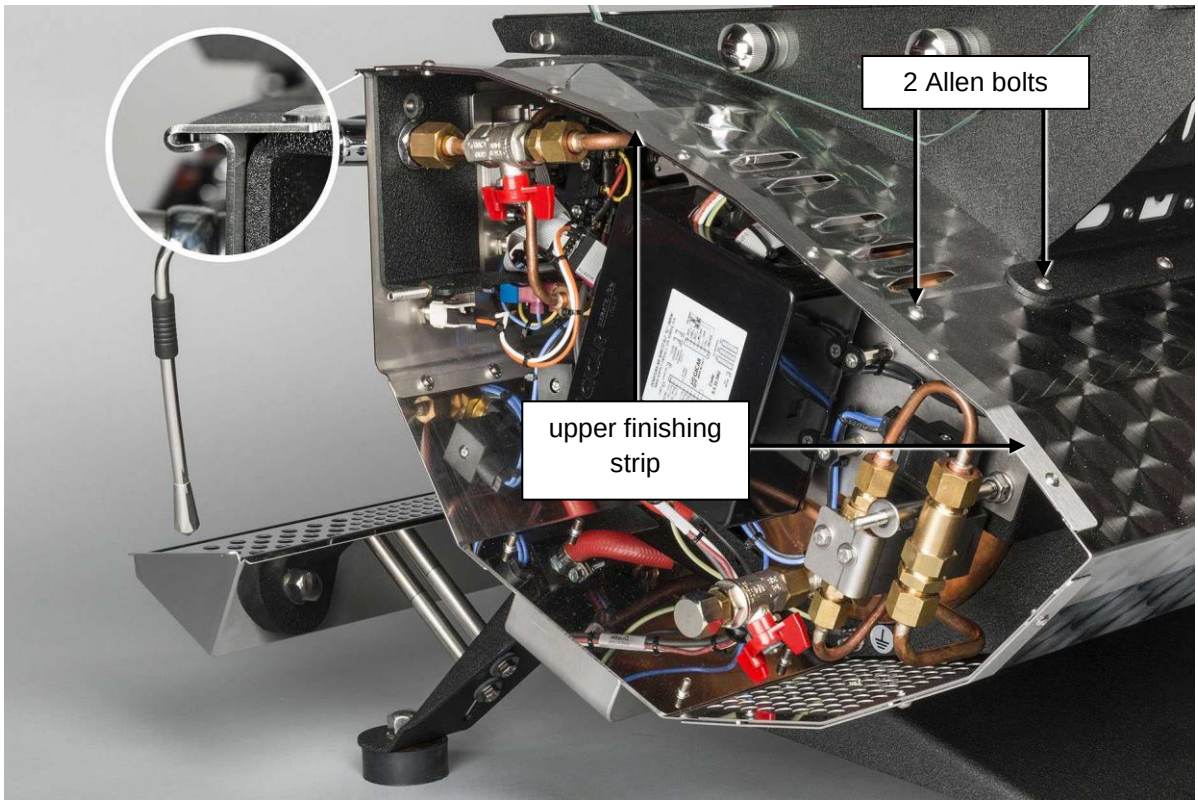


Figure M 6. Remove finishing strip first, then undo 2 Allen bolts at back of upper-side panel. Slide panel forward to unhook from front panel.

2. Pull the finishing strip sideways from machine, try not to scratch the body panels.
3. Remove the two 3 mm Allen bolts from the back of the upper side panel.
4. Slide panel forward (towards barista side) to unhook from front panel.

Remounting upper side panel

1. Place upper side panel close to frame and make sure that it hooks onto front panel.
2. Mount the 3 mm Allen bolts. Make sure the barista side of the upper side panel is pushed backwards a little and flush with the side of the front panel.
3. When remounting the finishing strip it may be useful to remove the two 2.5 mm Allen bolts on the rear completely before remounting the strip.
4. Remount these two Allen bolts but do not tighten any of the 2.5 mm Allen bolts yet.
5. Take the glass or aluminium side panel and mount with (glass) nuts and rubber rings until it touches both the front and rear body panels.
6. While tightening the bolts on the finishing strip, pull the Allen bolts and thus finishing strip towards the side panel.

Boiler temperature vs steam power

The factory settings of the steam boiler temperature is 124 or 125 °C (255, 257 °F) and is maintained by an electronic thermostat (see Figure M 7) connected to a Pt100 temperature sensor. The tip of the sensor is located in the steam boiler above operational water level.

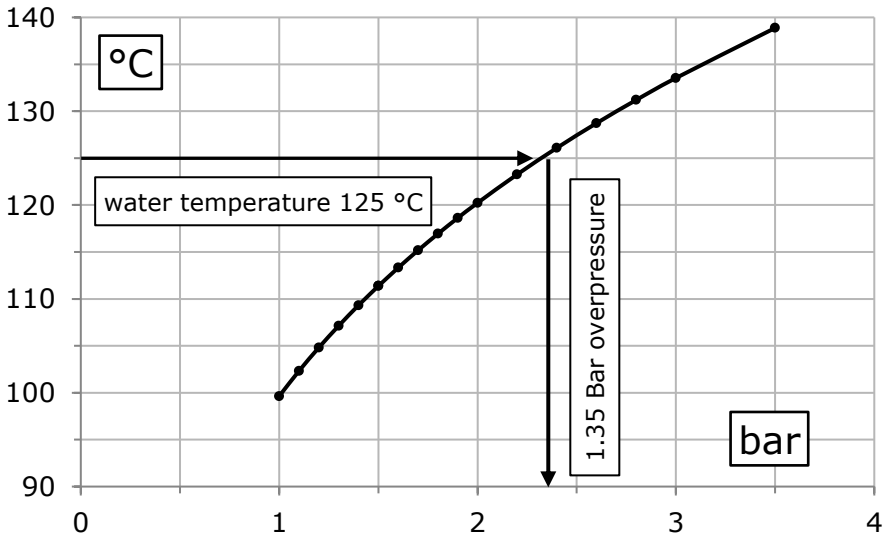
At idle, the temperature of the steam will be the same as that of the water and the heating element will be switched on for a moment every once in a while to maintain the set temperature.

By placing the sensor in the steam (instead of the water), the machine reacts quickly to heat loss. As soon as a steam valve is opened, steam pressure drops and steam temperature decreases instantly by adiabatic expansion (while water temperature remains nearly constant). Any drop in steam temperature is noticed by the controller which in turn activates the heating element. When cold water flows into the boiler after the hot water tap has been used, the small decrease in temperature immediately lowers the steam pressure and again, steam temperature drops.

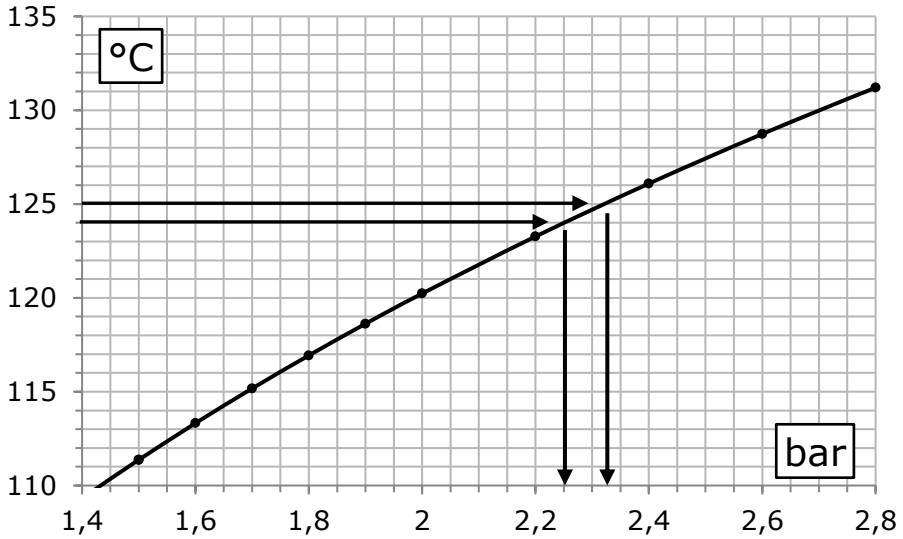
Saturated steam pressure at 124 °C is about 1.25 bar (overpressure), at 125 °C it is about 1.33 bar (see Graph M 1 and Graph M 2). This pressure is high enough for powerful and long-lasting frothing of milk.



Figure M 7. Showing the temperature controller. The indicator dot in between the 1 and 2 of the display is not lit which shows that the controller is not sending out a "heat-on" control signal.



Graph M 1. Saturated steam pressure versus temperature (data from www.engineeringtoolbox.com). Note that most pressure gauges read overpressure (pressure as compared to atmospheric pressure).



Graph M 2. Detail of graph M 1. Showing the pressure drop (from 2.33 to 2.25 bar saturated steam pressure) due a temperature decrease from 125 to 124 °C.

Note!

Changing the boiler temperature has little effect on coffee water temperature. If you want to change the temperature of the brewing process, you should alter the flow restrictor in the upper Banjo fitting (see next paragraph).

Adjust brew temperature

As mentioned in the previous paragraph, the coffee water temperature should not be set by changing the steam boiler temperature. The temperature of the coffee water is a balance between steam boiler water temperature, water circulation rate and heat loss, mainly through the group head. Since heat loss is related to room temperature, draught, etc. it may be necessary to adjust the flow rate in the thermo-siphon system. This is done by changing the aperture of the restrictor in the upper banjo.

Increasing the aperture of the restrictor has a bi-fold implication: (1) it increases the flow velocity of the thermo-siphon system at idle which increases the group head temperature and thus brew temperature, and (2) while brewing, the fraction of (hotter) water drawn from the top of the heat exchanger increases w.r.t. the fraction of (cooler) water drawn from the bottom of the heat exchanger which also increases the temperature of the brew.

If the machine is equipped with a fixed aperture restrictor (see Figure M 9a) you have to install a restrictor with a different aperture. If your machine has adjustable restrictors (see Figure M 9b) you can change the aperture by turning the knob on the restrictor-needle. Increasing the aperture of the restrictor (turn knob counter-clockwise) will increase the brewing water temperature. Decreasing the aperture (turning the knob clockwise) will decrease the brewing temperature (see Figure M 8).

The upper banjo can be reached by removing the cup warmer. When you change the restrictor in a machine that is warm, it may take about 10 minutes for the temperature to re-stabilise. Several types of restrictor-needle set-ups have been installed over the last few years. We therefore advise you to use a temperature sensor installed in a filter holder to check the brewing temperature after adjustments are made.

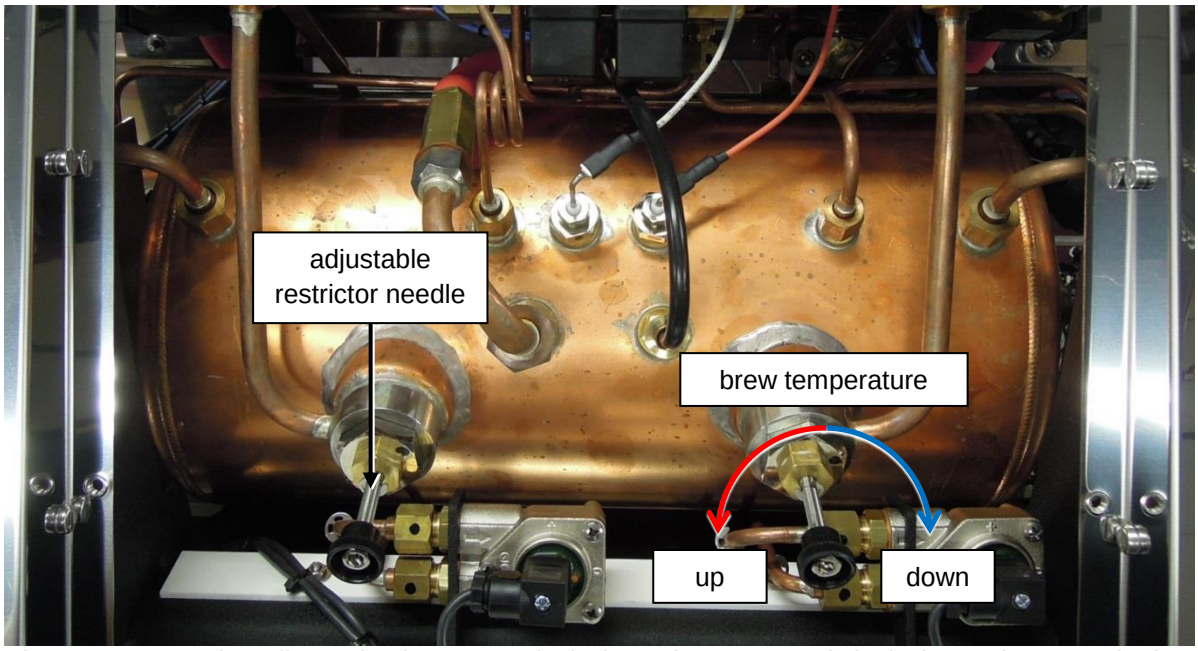


Figure M 8. Turn the adjuster-knob counter-clockwise to increase, and clockwise to decrease the brew temperature

Notes!

Despite the fine thread on the adjustable restrictors, the system is quite sensitive. Turning the needle 1 full turn will result in a temperature change of 2-4 degrees Centigrade.

When the knob is not firmly mounted on the needle, you can use a screw driver to adjust the needle.

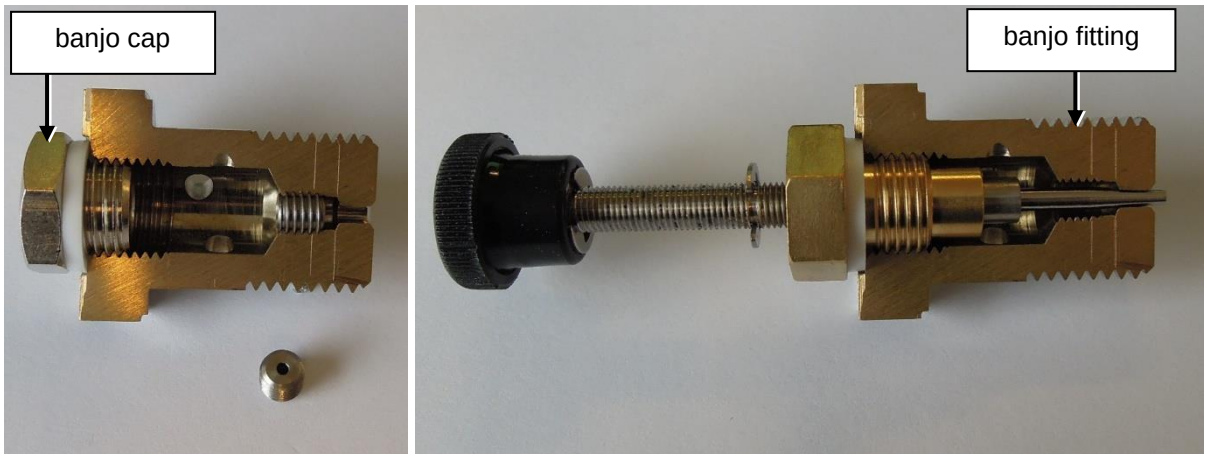


Figure M 9a (left). Upper banjo sawn in half with fixed restrictor. An extra fixed aperture restrictor (aperture diameter 1.5 mm) is shown.
Figure M 9b (right). Upper banjo sawn in half with adjustable restrictor model as installed from November 2011. Older models have different restrictor-needles (sharper point and/or shorter knob stem) and may carry a fixed restrictor as shown on the left but with larger aperture diameter.

Materials needed

- Allen key 3 mm
- Spanner 17 mm, 19 mm, 30 mm (adjustable)
- Needle nose pliers (straight)
- Teflon O-ring on banjo cap (only for fixed aperture restrictor)
- Fixed aperture restrictor of wanted diameter
- Filter holder with temperature sensor

Procedure

1. Remove the cup-holder cover plate.
2. Remove the cup-holder drip tray with a 3 mm Allen wrench.
3. Use 30 mm spanner to make sure that upper banjo is tightened.
4. Fixed restrictor:
    a. Relieve pressure from heat exchangers:
        i. Turn mains switch to “1”.
        ii. Close water supply and disconnect electrics from pump motor.
        iii. Activate all groups (upper button touchpad) until LED’s on touchpad start flashing, then de-activate all groups.
        iv. Turn mains switch to “0”.
    b. Remove the banjo cap with a 17 mm spanner (retain banjo with 30 mm spanner when necessary).
    c. Use a 3 mm Allen wrench to remove the restrictor from the upper banjo. You may need needle nose pliers to pick the restrictor out of the banjo.
    d. Replace with new restrictor.
    e. Replace banjo cap with new Teflon O-ring.
    f. Open water mains and reconnect pump motor.
    g. Turn mains switch to “2”.
5. Adjustable restrictor:
    a. Use 19 mm spanner to make sure that housing of the adjustable restrictor is tight but do not over-tighten.
    b. Turn the knob clockwise or anti-clockwise to decrease resp. increase brew.
6. Replace cup-holder drip tray, do not mount bolts yet.

Note!

Replacing the cup-holder drip tray is essential to keep the heat inside the machine such that a proper reading can be made.

7. Wait for temperature to stabilise (10 minutes).
8. Check brewing temperature.
9. Repeat 4-8 or 5b-8 until desired temperature is reached.
10. Mount bolts on cup-holder drip tray, use a little grease on the threads.
11. Replace cup-holder cover plate.

Adjust pump pressure

See installation manual for explanation and procedure.

Notes!

Do not set the pump pressure with a blind filter in the filter holder. When a blind filter is used, water in the system is trapped between a one-way valve and the blind filter. For that reason, the pressure in the coffee system will not drop when the set screw is turned counter-clockwise.

When pump pressure exceeds approximately 12 Bar, the expansion valve will open. Increasing the pump pressure further will not result in higher coffee system pressure.

Check water treatment system

All tap water contains dissolved elements, one of which is calcium carbonate. While an increase in temperature normally leads to better dissolution of elements, precipitation of calcium carbonate (scale) is favoured by high temperatures. Scale in your machine will inevitably lead to costly repairs and may eventually cause your machine to break down.

△ Caution!

Do not use descaling solution (or e.g. vinegar), as you would with a consumer coffee brewing apparatus. It is very tedious to flush the descaling solution completely out of the system and only very little remains will make your coffee taste bad. Furthermore, experts are not in agreement over the possibility whether the descaling agent may or may not cause corrosion within the machine.

Calcium carbonate is taken out of your tap water and stored in the water softener (also called: ion exchanger) which will decrease its proper functioning. Some ion-exchange water softeners can be regenerated by flushing it with salt, in others the cartridge has to be exchanged.

How quickly the functioning of your water softener decreases depends mainly on the quality of your tap water and the amount of use. We advise you to check your water softener every month for proper operation. For maintenance on your system we refer to the manufacturer. Normally, a cartridge filter should be replaced at least every 12 months to prevent bacterial growth.

Note!

Our machines do not show noticeable scaling for years provided that the water softener of these machines is regenerated as often as needed.

Anti-vacuum valve

Water inside the steam boiler cools down when the machine is shut off. While cooling down, the water contracts which leads to a decreased boiler pressure. The anti-vacuum valve prohibits that under-pressure occurs in the steam boiler. The anti-vacuum valve could malfunction when the machine is turned off regularly. It is advised to replace the anti-vacuum valve every year.

Some sputter and hiss inside the drain pipe at the back of the drip tray is normal when the machine is warming up from cold when the water reaches boiling temperature and a little steam is released through the anti-vacuum valve into the discharge.

A malfunction of the anti-vacuum valve is recognised by a continuous hissing sound combined with the lack of pressure and temperature building up while the heater in the steam/hot water boiler is engaged continuously and the boiler is filled automatically once in a while. (However, a malfunctioning safety valve leads to similar symptoms.)

The machine can remain operational when checking the anti-vacuum valve for leakage. However, it must be shut down and pressure from the boiler must be fully released before the anti-vacuum valve can be replaced.

Check anti-vacuum valve

Materials needed

- Allen key 3 mm

Procedure

1. Remove cup warmer.
2. Pull black drain hose from anti-vacuum valve (see figure M 9).
3. Check for leakage, the hose should be dry and should not show evidence for leakage (detrital build-up) on the inside.
4. If necessary, replace anti-vacuum valve (see below).
5. Remount hose.
6. Remount cup warmer.

Replace anti-vacuum valve

Materials needed

- Spanner 13 mm, 16 mm, 17 mm
- Socket wrench 17 mm
- Allen key 3 mm
- Replacement anti-vacuum valve and copper O-ring ¼

Procedure

1. Turn Mirage “off”.
2. Open the steam valves, this will relieve the pressure in the hot water/steam boiler.
3. Remove cup warmer.
4. When all pressure is relieved, pull the black silicone (drain-) hose from the anti-vacuum valve (see Figure M 10). The white adapter shown on the photo hardens over time and may crack or break. For that reason the adapter is no longer installed, the hose connects directly onto the anti-vacuum valve.
5. Unscrew the anti-vacuum valve from the boiler with a 17 mm socket wrench. Loctite is used for sealing, a little extra torque may be needed.

Note!

Do not use a spanner because the boiler may deform from torque at the wrong angle. When the fitting does not come loose from the boiler, it is best to remove the upper part of the anti-vacuum valve and replace the old inside and upper parts of the valve with those from the replacement valve.

6. Clean the inner threads on the boiler, try to not let dirt fall into the boiler.
7. Replace the anti-vacuum valve with a drop of Loctite (or a few windings of Teflon tape) on the threads. Use a new copper O-ring in between boiler and valve. Do not tighten with a lot of force.
8. Remount the drain hose.
9. Close the steam valve and turn the Mirage “on”.
10. Check the anti-vacuum valve for leakage. If necessary, tighten nut a little more.
11. Mount cup warmer.

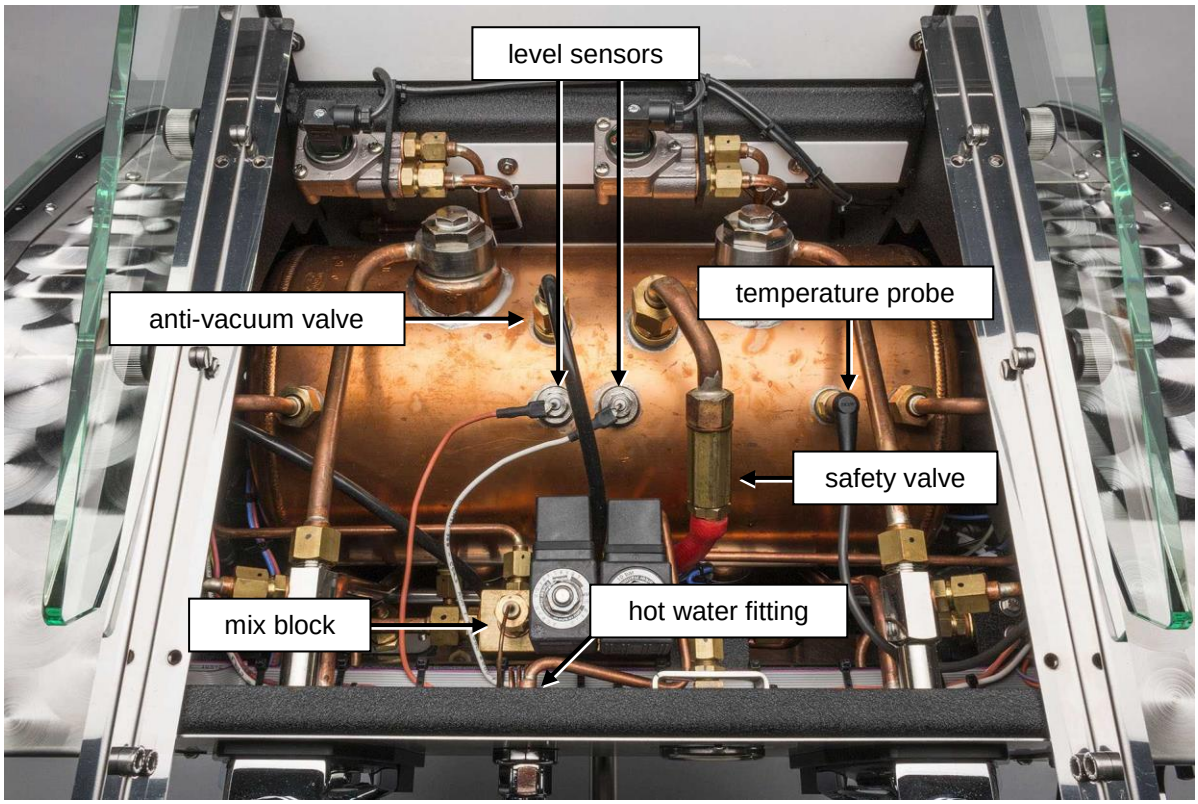


Figure M 10. Mirage Triplette without cup warmer showing location of level sensors, anti-vacuum valve, temperature probe, safety valve, mix block and hot water fitting.

Grease wands and check play between nut and ball

The ball shaped end of the steam and hot water wands is in direct contact with the conical nut and should therefore be lubricated. The conical nut is made from bronze for that reason but still needs a little grease every now and then. If not lubricated, the steel ball will erode the bronze nut and eventually the wand may “pop out” of the nut.

As long as the steam valve is kept closed and no hot water is dipensed, the machine can remain operational. When the conical nut is removed, you may just as well grease the O-rings on the brass plunger that presses against the ball.

Materials needed

- Spanner, 22 mm
- Heat resistant, food safe, grease
- Loctite
- Teflon O-ring between conical nut and valve, red silicone O-ring against ball, Viton O-rings on valve plunger when necessary



Figure M 11. Use 22 mm spanner to loosen conical nut on steam valve (or hot water fitting). The rag is used to prevent scratching.

Procedure

1. Make sure that valve is closed and valve temperature is such that it can be firmly gripped.
2. Turn conical valve nut with spanner 22 mm counter-clockwise to remove (see Figure M 11). Beware that a spring inside the valve pushes a plunger against the ball end of the wand. Take the plunger and spring out as well. A Teflon sealing O-ring will probably remain on the valve (or hot water fitting).
3. Clean the threads on the valve, do not damage the Teflon O-ring.
4. When removed, slide the nut a little over the wand towards the tip. A (red) silicone O-ring inside will be pushed out of the nut.
5. Apply grease to both sides of the ball end of the wand and a very small amount to the silicone O-ring, the rounded end of, and the two Viton O-rings (replace when necessary) on, the brass plunger in the valve (see Figure M 12).
6. Slide the spring and plunger back into the valve.
7. Slide the nut back over the wand, insert the red silicone O-ring (replace when necessary).
8. Replace the Teflon O-ring when necessary.

9. Screw the nut a few turns onto the valve.
10. Apply 2 drops of Loctite to the threads of the valve. Tighten nut with spanner, do not use excessive force.

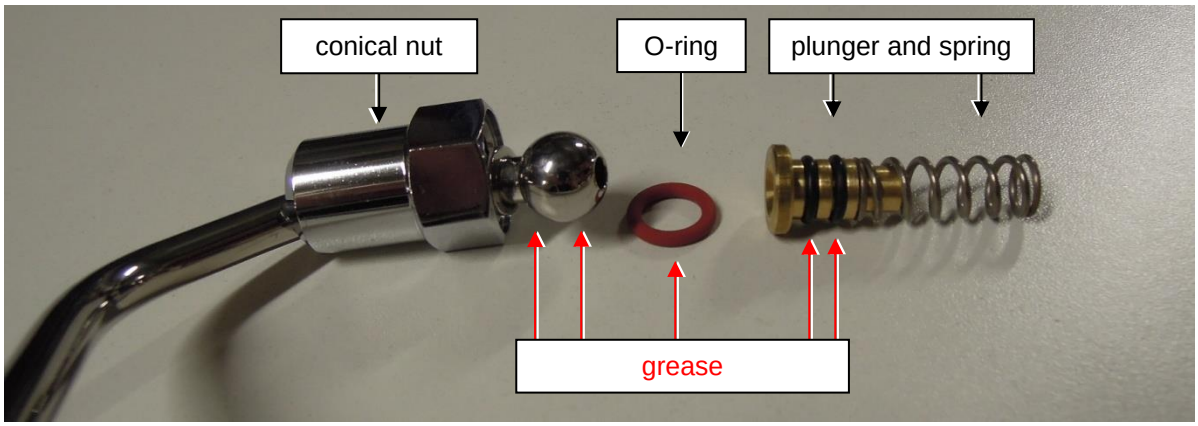


Figure M 12. Steam or hot water wand end with plunger removed. Grease parts as indicated.

Check tubing from mix-block to fitting for scale build-up

In the mix-block (see Figure M 10) cold water is mixed with hot water before being directed towards the tea spout which is “open to the environment” at the front of the machine. After dispensing hot water, the tubing from the mix-block to the tea spout remains filled with water which cools down until hot water is dispensed again. The increase in temperature of the cold water and decrease in pressure in this tubing promotes carbonate deposition and as this tube has a 4 mm inner diameter, it is easily affected by scale build-up.

Checking for scale build-up in the tubing can be done while the machine remains otherwise operational. When the tubing is affected by scale build-up it has to be de-scaled (take it out of the machine during de-scaling) or replaced.

Materials needed

- Allen key 3 mm
- Spanner 14 mm, 16 mm
- Food-safe grease
- de-scaling agent or new tubing when necessary

Procedure

1. Remove cup warmer.
2. Loosen 16 mm nut on tubing while retaining the fitting on the mix-block with a 14 mm spanner.
3. Loosen 16 mm nut from hot water fitting (see Figure M 10).
4. Remove tubing from machine.
5. Check tubing for scale build-up.
6. When necessary, replace tubing.
7. When installing a new tubing:
    a. put a little silicone grease on the nut-side of the half ball welded on both sides of the tubing.
    b. Mount the tubing on the hot water fitting, do not tighten the nut completely yet.
    c. Bend the tubing such that it fits closely to the fitting on the mix-block.
8. Mount tubing on the fitting on the mix-block, do not over-tighten.
9. Tighten nut on hot water fitting.
10. Dispense hot water and check for leakage, if necessary, tighten nuts a little more.
11. Replace cup warmer.

Check restrictor in mix-block on scale build-up

Even when you keep your water treatment system in excellent condition, a minor amount of scale will still be deposited on the inside of your Mirage. Most ducts within the machine have such dimensions that a little scale will not influence proper functioning. However, the flow restrictor, or jet, within the mix-block has an opening with a diameter of 0.7 mm and is thus easily affected by any scale build up. While scale builds up, the temperature of the dispensed hot water will increase.

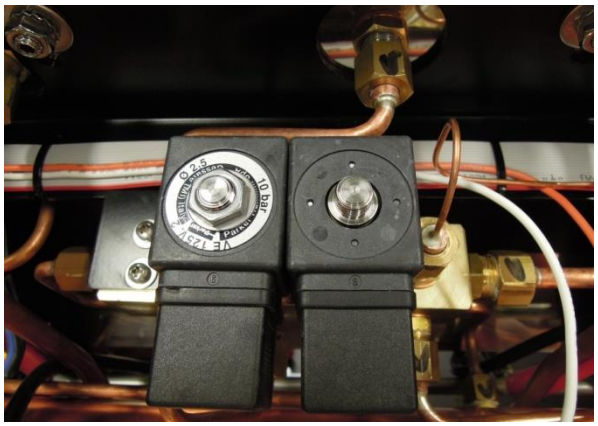
Water mains of the Mirage should be shut for this operation, the machine does not have to cool down.

Note!

Do not drill the restrictor while it is installed in the mix-block. Carbonate fragments will fall into the mix-block and may cause problems later on (clogging the restrictor or getting stuck in the solenoid valve).

Materials needed

- Allen key 3 mm
- Spanner 14 mm
- Phillips screwdriver no. 2
- Drill bit 0.7 mm
- 4 locking washers 4 mm



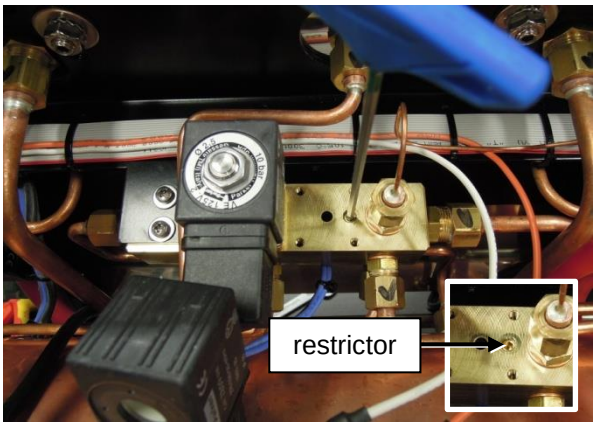


Figure M 13a (left). Showing mix-block (seen from back of machine) with both flange valves. Nut and washers on solenoid coil have been removed to illustrate top side of coil.
Figure M 13b (right). Use a 3 mm Allen wrench to remove the restrictor. The restrictor is mounted in the cold water supply side of the mix block (inset).

Procedure

1. Close the water mains.
2. Remove cup warmer.
3. Remove the coil from the cold-water flange valve (this is the right hand valve as seen from the back of the machine) with a 14 mm spanner. There is no need to remove the electrical plug from the coil (see Figure M 13a).
4. Remove the 4 Phillips bolts that hold the flange valve to the mix-block, a little water may leak at this stage. Prevent the locking washers from falling into the machine.
5. Lift the valve from the mix-block.
6. You will see the restrictor in one of the openings under the valve (see Figure M 13b-inset). Use a 3 mm Allen key to remove the restrictor.
7. Check the restrictor for scale build-up. It is advised to use a 0.7 mm drill-bit to remove scale. It is easiest to immobilise the drill and twist the restrictor by hand over the drill.
8. Remount the restrictor in the mix-block.

9. When remounting the flange valve, make sure that both Viton sealing O-rings are properly mounted on/in the valve base and that the holes in the valve base line up with the holes in the mix-block. Use new locking washers, do not over tighten the 4 Phillips bolts.
10. Remount the solenoid coil with spring washer and nut. The spring washer should be nearly flat but not over tightened as this will result in damage to the valve.
11. Remount cup warmer (put grease on Allen bolts).
12. Open water mains.

Safety valve on steam boiler

If by any malfunction the heating element is not switched off when it should be, the temperature and thus pressure inside the steam boiler will rise above it's normal operating value. To avoid dangerous situations, a safety valve is mounted on the steam boiler. This safety valve will open when pressure exceeds 1.8 Bar.

When the safety valve on the steam/hot water boiler is malfunctioning it will open at a (much) lower than operating pressure (1.35 Bar). When this occurs, the safety valve has to be replaced.

A malfunction of the safety valve is recognised by a continuous hissing sound. Pressure and thus temperature cannot reach operational levels, the heater in the steam/hot water boiler is engaged continuously and the boiler is filled automatically once in a while. (However, a malfunctioning anti-vacuum valve leads to similar symptoms.)

The machine can remain operational when checking the safety valve for leakage. However, it must be shut down and pressure from the boiler must be fully released before the safety valve can be replaced.

Check safety valve

Materials needed

- Allen key 3 mm

Procedure

1. Remove cup warmer.
2. Pull red drain hose from safety valve (see Figure M 10).
3. Check for leakage, the hose should be dry and should not show evidence for leakage (detrital build-up) on the inside.
4. If necessary, replace safety valve (see below).
5. Remount hose.
6. Remount cup warmer.

Replace safety valve

Materials needed

- Spanner 20 mm (2x)
- Allen key 3 mm
- Replacement safety valve
- Loctite or Teflon tape

Procedure

1. Turn mains switch to "0".
2. Open the steam valves to let off steam, this will relieve the excess pressure in the steam/hot water boiler.
3. In the meantime, remove cup warmer.
4. Pull red drain hose from the safety valve.
5. When pressure in boiler has dropped completely, remove the safety valve from the fitting in the boiler with a 20 mm spanner, retain the fitting with a 20 mm spanner(see Figure M 14).

Note!

The valve is mounted with Loctite to ensure sealing, you may need a little extra torque to loosen it.

6. Clean inside threads of the fitting as well as possible.

7. Apply a few drops of Loctite or a few windings of Teflon tape to the threads of the replacement safety valve and mount in fitting on boiler.
8. Turn mains switch to “2”, wait until pressure has built up.
9. Check valve and sealing for leakage.
10. Remount hose.
11. Mount cup warmer.

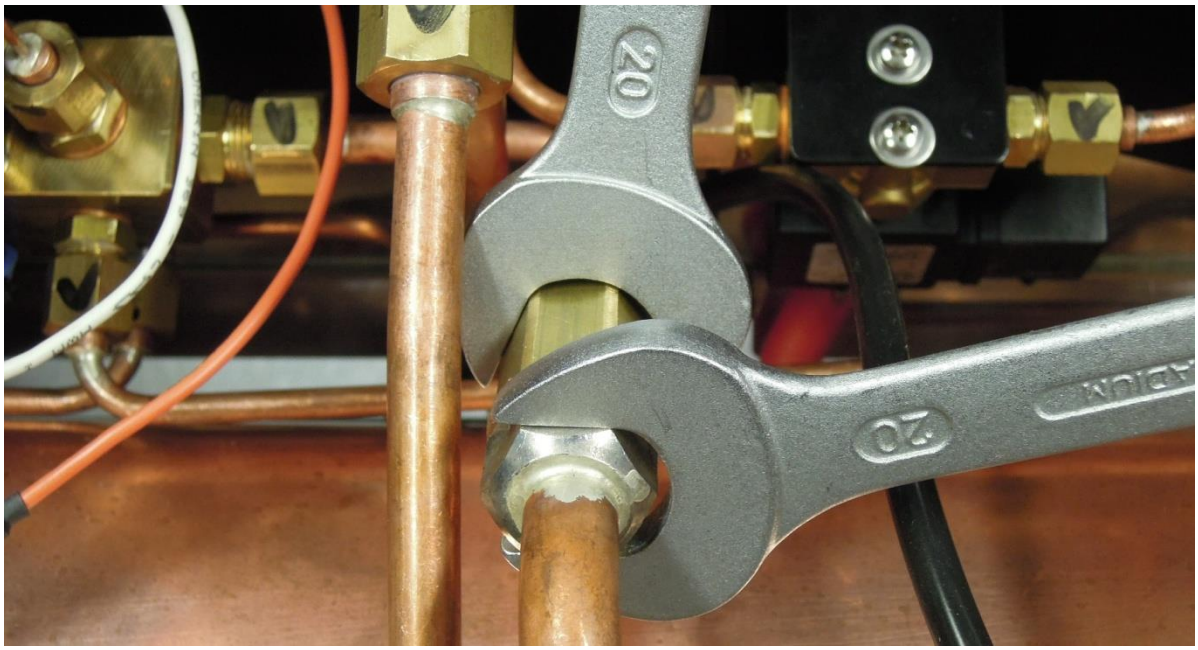


Figure M 14. Use 2 spanners to remove the safety valve from the tube.

Expansion valve on manifold

The coffee water heating system consists of 2 or 3 heat-exchangers inside the steam boiler. This entire system is filled with water only, no steam, no air. At the entrance of the coffee water system a one-way valve, or check valve, is installed to prevent hot water being pushed back into the fresh water lines.

When water is heated it will expand. As there is no room for the expanded water (no air pockets, no way out) pressure will increase. To keep this pressure within safety limits, an expansion valve is part of the system. The expansion valve will release drops of water when pressure exceeds the set value, the released water is directed into the discharge.

The expansion valve is mounted on the cold-water manifold on the left hand side of the Mirage and thus works on all groups simultaneously.

Easiest is to temporarily increase the pump pressure during this procedure. However, be careful not to exceed 15 Bar as this may damage the solenoid valves in the machine. Best is to work with 2 people: one adjusting the pump pressure and the other watching the pressure gauge and adjusting the expansion valve.

Note!

The solenoid group valves have a rating of 15 Bar. This means they will be pushed open when pressure exceeds 15 bar. The group valves thus act as a second safety, should the expansion valve fail to open.

It is also possible to check/adjust without increasing pump pressure but you only have 2 minutes for the water to expand (then the group valve is shut automatically). The machine must be close to or at operational temperature. Let both groups run without filter holders for about 30 seconds to let a lot of cold water enter the coffee system, then swiftly lock the gauged filter holder in (drain tap closed) and let group run again. When the cold water heats up it will expand thus leading to increased coffee system pressure.

The expansion valve should start to expel drops of water when the gauge reads 12 Bar.

Check expansion valve

Materials needed

- Spanner 11 mm, 12 mm or 16 mm, depending on valve model
- Towel or sponge
- Filter holder with pressure gauge (and drain tap)
- Screw driver

Procedure

1. Remove left hand side panel.
2. Pull black silicone hose from expansion valve, place towel or sponge under expansion valve opening.
3. Increase the opening pressure of the valve by turning the outer nut on the expansion valve 2 full turns clockwise (see Figure M 15).
4. Make sure that the mains switch is in position “1” (no power to heating element).
5. Mount filter holder with pressure gauge in left group
6. Activate left group, check pressure gauge on filter holder. It should read a little over 9 Bar. If it is higher, activate another group shortly (cold water in the coffee system has warmed up and expanded such that the pressure is higher than the pump pressure. The one-way valve prevents water from flowing towards the pump).

7. (keep left group activated) No water should drip from the expansion valve at 9 Bar. If it does, increase opening pressure until it stops dripping, then turn another 2 full turns. If it keeps dripping, replace the sealing disk (see below).
8. (keep left group activated) Increase the pump pressure by turning the set screw on the water pump clockwise until the pressure gauge on the filter holder reads 12 Bar. (When the expansion valve starts dripping before 12 Bar is reached, increase opening pressure of expansion valve.)

Note!

If the (pump) pressure has exceeded 12 bar, reduce pump pressure first and then shortly activate another group to reduce pressure in the coffee system.

9. (keep left group activated) Decrease opening pressure of the expansion valve by turning the outer nut anti-clockwise until the valve starts dripping water.
10. De-activate the left group. The expansion valve should stop dripping (when the machine is warm cold water warming up in the heat exchangers will result in water dripping from the expansion valve).
11. Remount black silicone drain hose on expansion valve.
12. Remount side panel.



Figure M 15. Showing expansion valve and way to make adjustments. Drain hose is removed from valve.

Replace sealing disk in expansion valve

Materials needed

- Spanner 12 mm (16 mm on new model valve)
- Replacement sealing disk
- Heat resistant, food safe, grease

Procedure

1. Turn mains switch to “1”, close water mains and remove left hand side panel.
2. Pull black silicone hose from expansion valve, place towel or sponge under expansion valve opening.
3. Relieve pressure from the coffee system (activate a group until the LED’s start flashing).
4. Turn mains switch to “0”.
5. Note how far outer nut is screwed onto valve. Remove outer part of the expansion valve completely by turning counter-clockwise with 12 mm (or 16 mm on new model valve) spanner.
6. Inside is a spring and plunger. The far end of the plunger has a sealing disk. Take out the sealing disk and replace with new, put a little food safe grease on the disk and on the Viton O-ring around the outer part of the expansion valve.
7. Turn outer part on expansion valve until approximately the same position as (6) above, then another 2 full turns.
8. Open water mains.
9. Continue with (4) in section “check expansion valve”.

Rebuild valves

When properly maintained, the steam and hot water valves have a very long life-span. Since temperatures in these valves rise up to 125 °C (257 F), the (Viton, Teflon and silicone) sealing parts inside wear out a bit quicker than in your house-hold taps.

Materials needed

- Allen key 5 mm
- Adjustable spanner
- Spanner 10 mm, 20 mm, 22 mm, 26 mm
- Rag
- Heat resistant, food safe, grease
- Replacement O-rings and disks (for both valves: 4x Viton disk, 2x plunger with Viton seal, 2x Teflon O-ring in between valve and base, 2x (red) silicone O-ring in wand, 2x Teflon O-ring under conical nut, 4x Viton O-ring on wand-plunger)





Figure M 16a (left). Unscrew self-retaining nut with spanner 10 mm while retaining knob.
Figure M 16b (right). Remove valve end nut from valve, use rag to prevent scratching. Normally, the valve knob would be removed already..

Procedure steam valve

1. Turn machine off.
2. Open steam valve until no more steam escapes the machine. This is to release pressure from hot water/steam boiler, keep valve open.
3. Remove nut with 10 mm spanner (see Figure M 16a).
4. Remove steam wand: twist off conical nut with spanner 22 mm (see Figure M 11).
5. Put rag over valve end nut (see Figure M 16b) to protect chrome, loosen with 26 mm spanner, do not remove the nut completely at this moment.
6. Remove the two Allen bolts (5 mm), a spring will push the valve from its base (the base of the valve will remain on the Mirage). Be careful not to lose any parts. The Teflon O-ring will probably remain in the valve, pry out gently.
7. Now remove valve end nut.
8. Use valve knob on square end of shaft to remove shaft from valve.

> ⚠ **Caution**!
>
> The threads on the shaft are counter-clockwise.

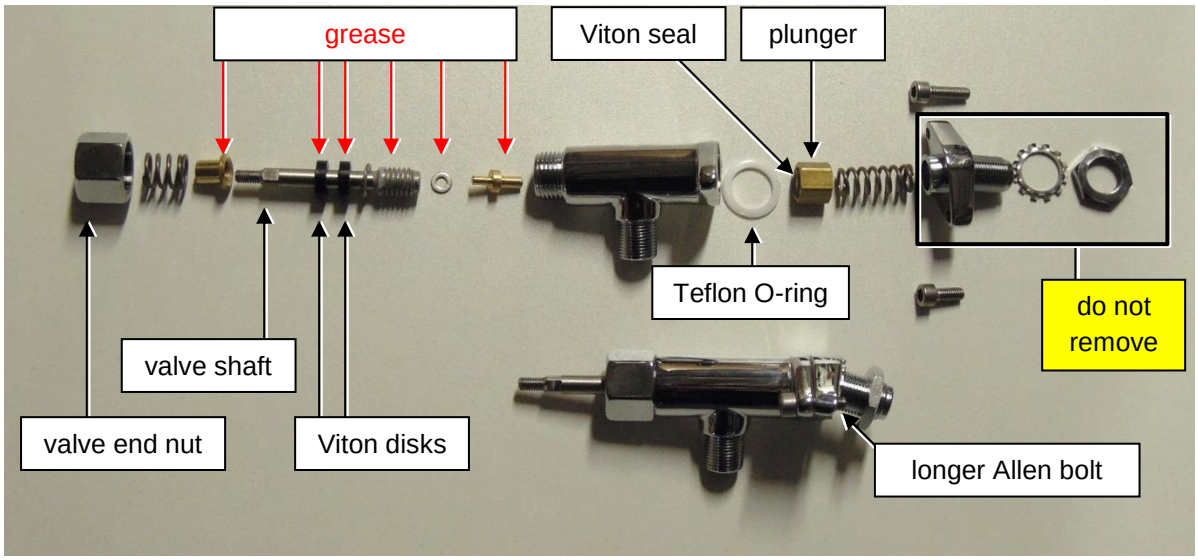


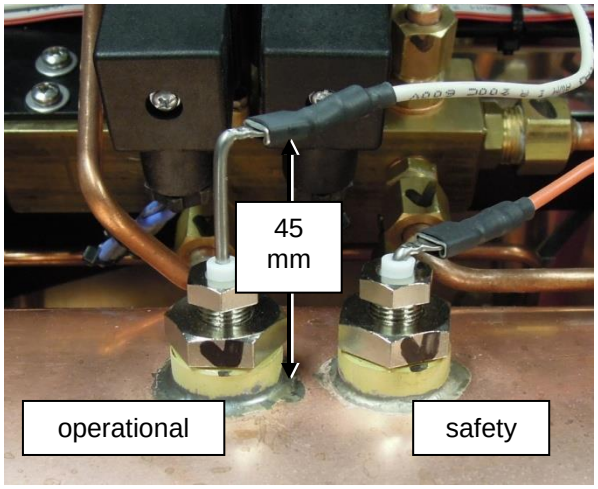
Figure M 17. Exploded view of steam valve and assembly. The base of the valve will remain attached to the Mirage. Note position of longer Allen bolt on top side of assembled valve. On the Mirage, the longer Allen bolt is the lower one on the left hand side steam valve and the upper one on the right hand side steam valve (as seen from the Barista's side). In this figure, the Viton disks are not removed from the valve shaft.

9. Replace the 2 Viton O-rings on the plunger and (red) silicone O-ring (use grease; see Figure M 12), and Teflon O-ring at rear of conical nut of steam wand.
10. Replace the 2 Viton disks on the valve shaft and the plunger with Viton seal (use grease; see Figure M 17).
11. Re-assemble valve and remount on machine, note position of longer Allen bolt (left hand steam valve: lower bolt is longest; right hand steam valve: upper bolt is longest).
12. Remount valve knob on valve shaft. Close valve.
13. Remount steam wand with a drop of Loctite.
14. Switch machine on.
15. When machine is heated up, use valve and check for leakage.

Clean probes, level and safety

Two probes are mounted in the hot water/steam boiler. The probe with the orange wire checks the water safety level. Power to the heating elements in the Mirage is disconnected when water level is lower than this probe. The probe with the white wire checks the water level in the steam boiler for normal operation; when water level is below the probe, the boiler will start filling with the pump engaged, provided that no shot is being pulled. The boiler stops filling when water level reaches the probe.
The controller sends an electrical current (appr. 1.2VAC high frequency) to the probes and checks if water in the boiler "closes" the electrical circuit or not. Precipitation on the probes may act as (electrical) insulation which prevents proper functioning of the probes.

Cleaning the probes requires that pressure is released from the steam boiler.



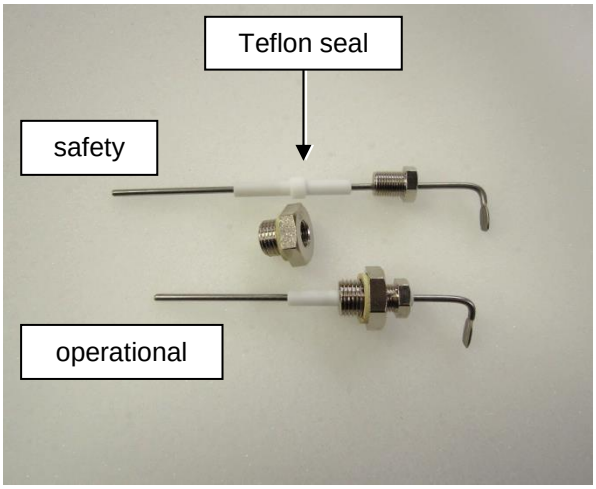


Figure M 18a (left). Water level probes as seen from back of machine. The probe with the white wire (operational level) protrudes 45 mm above the boiler, the probe with the orange wire (safety level) is pushed down as far as possible.
Figure M 18b (right). New water level probes. The upper (longer) probe is the safety level probe and has been taken apart to show the Teflon sealing. The lower (shorter) probe is the operating level probe.

Materials needed

- Allen key 3 mm
- Spanner 12 mm, 17 mm

Procedure

1. Switch power off.
2. Open steam valve(s) until no more steam escapes the machine. This is to release pressure from the steam boiler, shut valve(s) when pressure is fully relieved.
3. Remove cup warmer.
4. Pull electrical connections from probes, then remove probes from boiler.

Note!

Loosen the inner fittings (small nuts). The inner nut squeezes a Teflon seal on the probe. When the probes are not too dirty, they can probably be pulled through the Teflon seal, otherwise, the Teflon seal will be pulled out of the outer fitting, either one is O.K.

5. Clean the metal end of the probes with a well-used plastic scrub pad. Scale and dirt adheres better on a rough surface: try not to scratch the probes.

6. Either push the probe through the Teflon sealing or push the probe with Teflon sealing back into its fitting.
   The short probe (operational level) should raise 45 mm above the outside of the boiler.
   The longer probe (minimum safety level) should be pushed in as far as possible.
7. Fasten the inner nut of the probes. Do not use a lot of force as the Teflon will just give in and you may keep on fastening.
8. Connect the electrical wires to the probes: orange is safety level, white is operating level.
9. Switch Mirage “on”, the boiler may start to top up automatically.
10. Check for proper operation:
    a. no power to heating element until safety level is reached (pull orange wire from probe to check, the elements should be disengaged now)
    b. boiler stops filling when operation level is reached
    c. leakage.
11. Remount cup warmer.

Note!

When the probes are mounted “in reverse”, the machine may react “normal” until water level drops below the short (upper) probe (which now acts as safety level probe). While checking/cleaning the probes, no water has been used and it is possible that the short probe is touching the water in the boiler after remounting. When water level decreases below the upper probe, the heating elements will be disengaged as the controller gets the signal that water is below the safety level. The machine will not fill up at this stage because the long (lower) probe (now acting as operational level probe) sends a signal to the controller that water level in the boiler has reached operational level.

Replace all solenoid valves

To be sure that the solenoid valves inside your Mirage keep operating properly, it is advised that you replace them every 5 years. The electrical coil outside, and spring and Viton sealing inside the valve are prone to wear and tear.

Replacement of the solenoid valves requires that the water mains is disconnected, pressure in the boiler and heat exchangers is relieved, the machine is shut off, and preferably cooled down.

Materials needed

- Allen key 3 mm
- Spanner 14 mm, 16 mm, 20 mm, 21 mm
- Loctite and/or Teflon tape
- Food safe grease
- Phillips screw driver no.1, no.2
- Socket wrench 7 mm with (Triplette only) very long extension or very long Phillips screw driver no. 2
- Replacement flange valves (mix-block: 2x)
- Replacement locking washers M4 (mix-block: 8x)
- Replacement 3-way valves (group valves: Duette 2x or Triplette 3x)
- Replacement 2-way valve (fill valve; different from steam valve)
- Replacement 2-way valve (steam valve; different from fill valve)
- Replacement copper O-rings ¼ inch (Duette 6x, Triplette 8x, 1 per steam valve)

Procedure for all valves

1. Close water mains.
2. Remove filter holders.
3. Disconnect pump motor from electrics.
4. Relieve pressure from coffee water system by activating groups until the LED's start blinking
5. Relieve pressure from steam boiler by opening steam valve(s) until steam flow stops.
6. Switch machine off.
7. Remove both side panels and cup warmer.
8. Remove screw from electrical plugs on valve with Phillips screw driver no. 1.
   (Turn the group valve coil and plug such that you can access the screw, if necessary loosen the flat nut on top of the coil a little with spanner 14 mm.)

Flange valves on mix-block

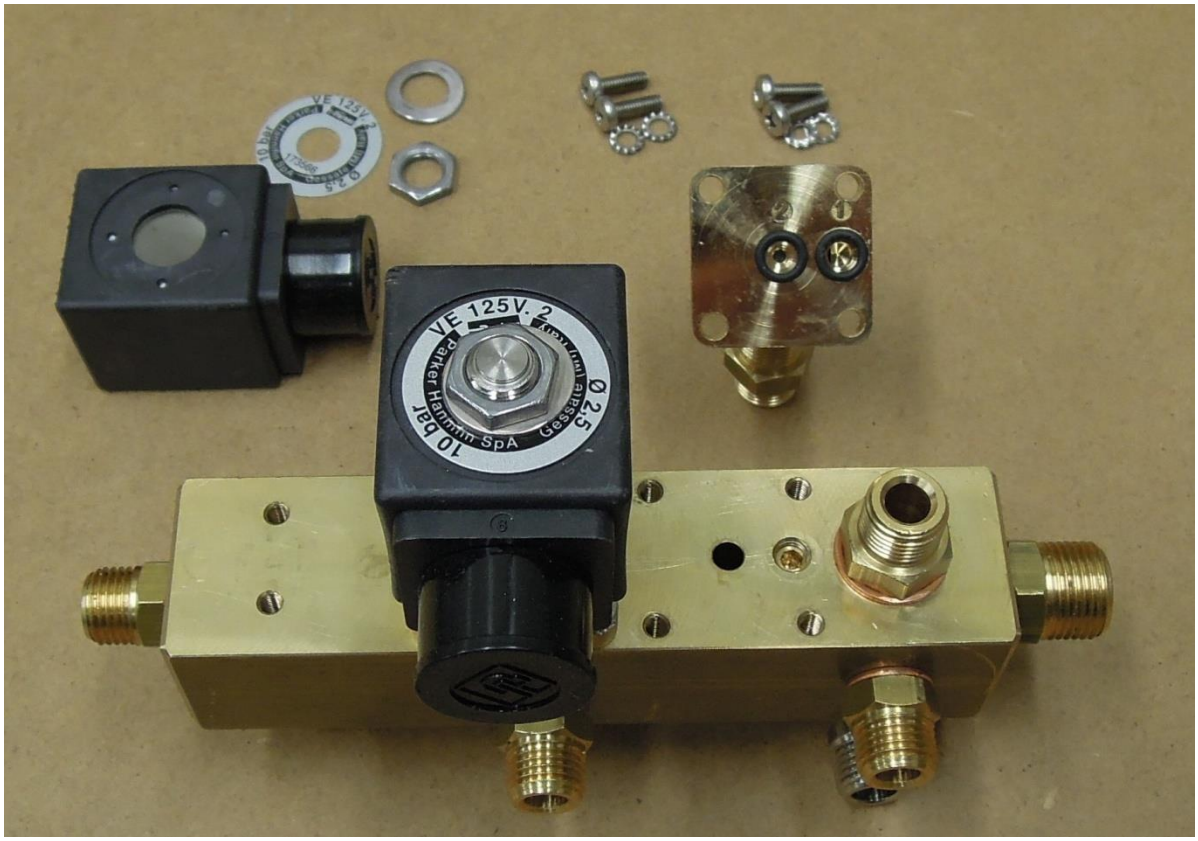


Figure M 19. The mix-block is removed from the machine for clarity. Shown here are brass flange valves, these can be exchanged with stainless steel flange valves although these need other screws (6mm thread). The cold water valve is already removed from the mix-block to show bottom of flange. Note the position of the off-centre hole in the dismounted cold water valve (off-centre hole in the hot water valve is to the left) and make sure that the two Viton O-rings are in place before (re-) mounting. Electric pins on coils are covered with protective cap.

1. Remove electrical plug from coil.
2. Remove flat nut retaining coil to valve with spanner 14 mm, remove coil.
3. Remove 4 screws that hold the flange valves to the mix-block with Phillips screw driver no. 2.
4. Replace flange valve. When mounting, make sure that the new valve has both Viton sealing O-rings and that you position the openings in the flange over the openings in the manifold (see Figure M 19). Use new locking washers (M4) on flange screws.
5. (While at it, check the 0.7 mm restrictor underneath the cold water valve.)
6. Mount new coil with correct side up and electrical connectors in the proper position. When mounting, tighten the flat nut on top just enough to flatten spring nut. Too much strain on the coil-tube will separate it from the valve.
7. Mount electrical plug on coil with rubber seal and screw.

Group valves

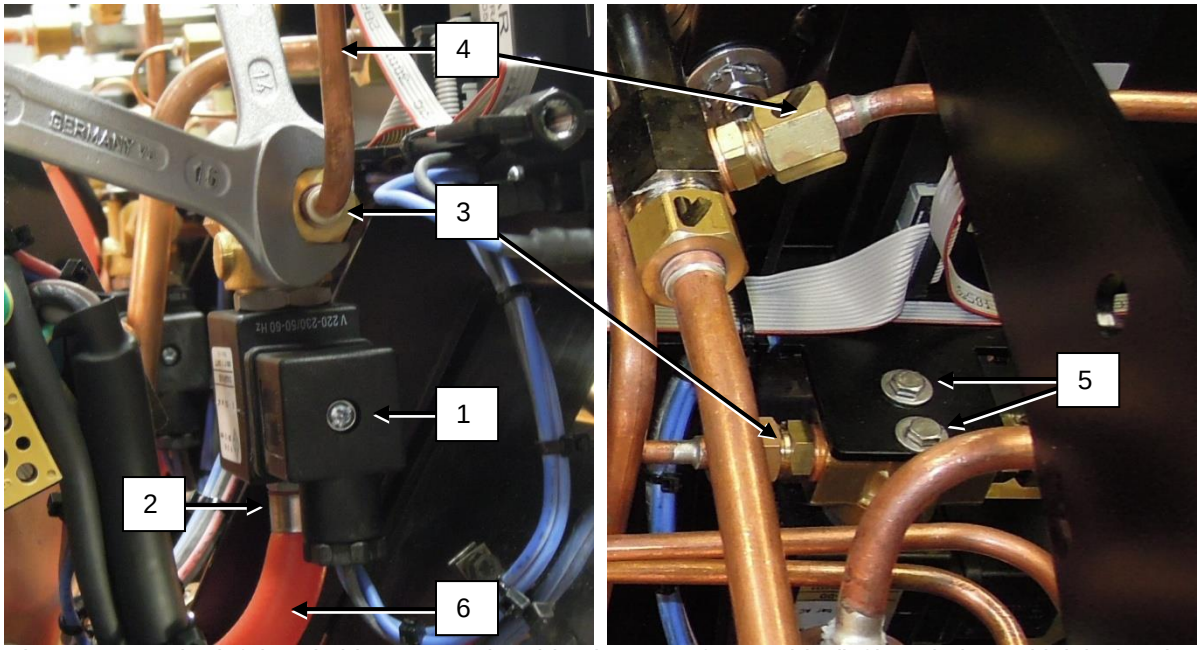


Figure M 20. The left hand side group solenoid valve seen from aside (left) and above (right) showing the steps to remove a 3-way valve. Start with plug (1), then hose clamp (2), then loosen the tubes on both sides (3), then remove the copper tubing (4), remove from frame (5) and finally pull from hose (6).

1. Remove electrical plug from coil.
2. Remove flat nut retaining coil to valve with spanner 14 mm, remove coil.
3. Loosen hose clamp on bottom side (discharge) of group valve with 7 mm socket wrench or Phillips screw driver, slide the clamp down over the hose. The hose clamp on the middle group valve of a Triplette is difficult to access, it may be useful to completely loosen the valve first such that you can twist it a little.
4. Loosen 16 mm nuts on both sides of the valve, retain the fittings with a 14 mm spanner (see Figure M 20).
5. To get extra space, remove the copper tube that leads water from the upper group duct to the valve completely, again retain the fitting with a spanner.
6. Remove the two bolts (7 mm) that hold the valve to the frame (Phillips no. 2 for middle group valve on Triplette).
7. Pull the valve from the drain hose.

Note!

Try to keep the drain hoses attached to the drain pipe. These hoses are difficult to remount once the machine is assembled.

8. Remove fittings from old valves.
9. Clean fittings, check particle screen and restrictor (normally 0.6 mm, some machines are ordered with 1.0 mm group valve restrictors), clean or replace when necessary.
10. Mount fittings on replacement valves with drop of Loctite, use new copper O-rings.

△ Caution!

The entrance to the valve is indicated by a little arrow pointing inwards, the fitting with particle screen and flow restrictor must be on this side.

11. Apply a little food safe grease to the fittings on the valve and on the back side of the half ball end of the tubings.
12. Mount the coil “right side up” on the valve and screw nut tight enough. However, you should be able to turn the coil by hand without too much difficulty.
13. Mount replacement valve on discharge hose first, tighten hose clamp as high on hose as possible.
14. Mount valve first on tubing that leads to bottom of group, do not tighten yet.
15. Mount valve on frame with bolts.
16. Mount tubing leading from upper group duct to group valve.
17. Now tighten all nuts with spanner 16 while retaining fittings with spanner 14.
18. Mount electrical plug on coil with rubber seal and screw.

Fill valve

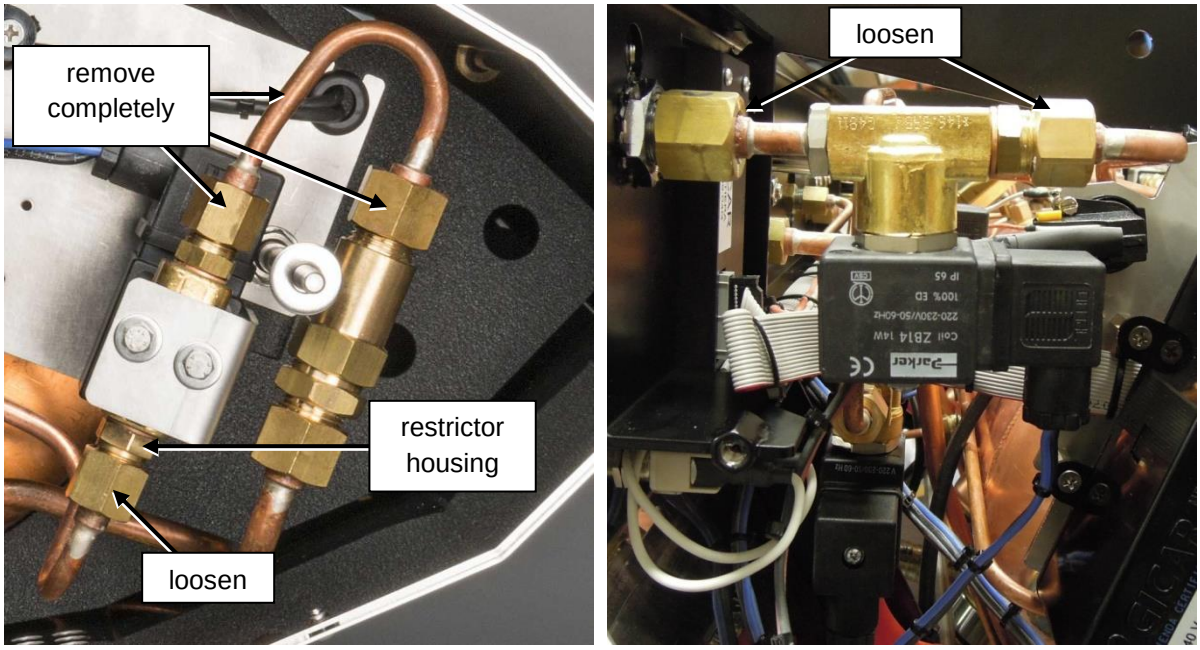


Figure M 21a (left). Solenoid fill valve. Remove upper tubing completely with one-way valve, then remove fill valve from (sub-) frame.
Figure M 21b (right). Solenoid steam valve. Remove 21 (or 20) mm nut from steam valve and 20 mm nut from tubing to boiler.

1. Remove the tubing on the top side of the valve completely (see Figure M 21a), retain the fittings with proper spanners (14 mm and 21 mm resp.).
2. Loosen the nut from the ingoing lower tubing.
3. Remove the 2 small bolts holding the valve to the frame with a 7 mm spanner.
4. Take valve from frame.
5. Now remove electrical plug and coil.
6. Remove fitting and restrictor housing from valve.
7. Clean fittings, check particle screen and restrictor (1.0 mm), clean or replace when necessary.
8. Mount fittings on replacement valve with drop of Loctite, use new copper O-rings.

△ Caution!

The entrance to the valve is indicated by a little arrow pointing inwards, the fitting with particle screen and flow restrictor must be on this side.

9. Mount new solenoid coil valve, note direction of electrical connection. When mounting, tighten the flat nut on top of the coil just enough to flatten spring washer. Too much strain on the coil-tube will separate it from the valve. Mount and electrical plug with rubber seal on coil.

10. Apply a little food safe grease to the fittings on the solenoid valve and on the back side of the half ball end of the tubes.
11. Mount solenoid valve on bottom tubing first (the fitting with the restrictor and screen is the lower one; the arrow on the valve should point upwards), do not tighten yet with spanner.
12. Mount upper tubing.
13. Tighten all nuts, retain fittings while tightening.

Steam valve (solenoid steam valve is optional)

1. Remove electrical plug from coil.
2. Loosen 21 (sometimes 20) mm nut from steam valve (see Figure M 21b).
3. Loosen 20 mm nut on tube to top of boiler, retain the fitting with a 17 mm spanner.
4. Take out valve with fitting and short copper tubing.
5. Remove fitting and short copper tubing from valve and clean.
6. Mount fitting and copper tubing on new valve with a drop of Loctite, check the flow direction of the new valve (little arrow), use a new copper O-ring on the fitting.
7. When not already mounted: mount new coil with metal ring on coil at side of valve, do not over tighten the 14 mm nut.
8. Remount valve with fitting and tubing, let coil point down, use a little food safe grease to the fittings on the valve and on the back side of the half ball end of the tubes.
9. Mount electrical plug on coil with rubber seal and screw.

Check your work, solve problems

1. Connect pump motor to electrics, open water mains, switch machine “on”, check for leakage and proper functioning. Use a blind filter to pressurise the tubings on the group valves.
2. Tighten nuts and/or fittings when necessary. When tightening a fitting to a valve, loosen the tubing first, tighten fitting and then re-tighten the tubing. Do not over tighten fittings on a valve.
3. If a fitting keeps leaking, remove tubing from fitting and take the fitting out of the valve. Use a new copper O-ring when remounting. If this does not have the desired result, use a drop of Loctite or a few windings of Teflon tape between fitting and valve for better sealing.
4. If a tubing keeps leaking, unscrew the nut from the fitting (retain fitting with a spanner) and check the half-ball on the end of the tubing. You may have tightened the nut with the half-ball askew to the fitting. Apply a little food safe grease to the back end of the half-ball, position the tubing correctly to the fitting and tighten nut. If the damage to the half-ball is not too severe, the tubing will seal, if it does not seal: replace tubing.
5. Remount body panels and cup warmer.

Drain all water when freezing is possible

Because boiler freeze-up will lead to the need of replacing the boiler your Mirage should never be in a freezing environment unless all water is drained from it. Cargo bays in ships and planes are normally not temperature controlled and cannot be trusted to remain above freezing at all times.

Materials needed

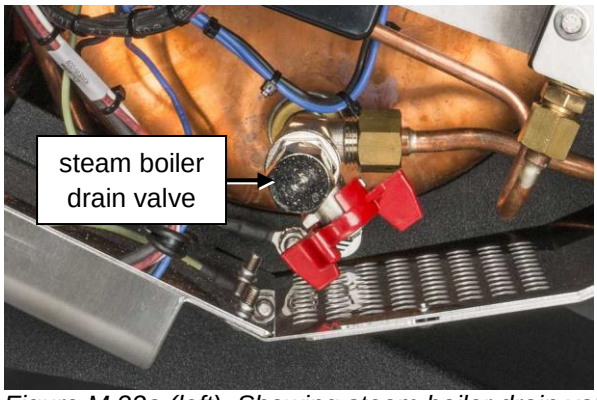
- Spanner 10 mm, 13 mm, 16 mm, 20 mm (maybe 30 mm/adjustable)
- Philips screw driver no.2
- Drain-hose with fitting 3/8 that fits on drain valve
- Bucket, towel and/or sponge
- Loctite or Teflon tape

Procedure

1. Turn mains switch of Mirage to “1”.
2. Shut off water supply to your machine.
3. Fully open steam valve.
4. Disconnect pump motor from electrics.
5. Remove right hand side panel.
6. Wait until pressure is fully released from the steam/hot water boiler.
7. Activate all groups (upper button on touchpad; program button on bastone) until LED’s start blinking, then de-activate groups.
8. Turn mains switch to “0”.

Steam boiler

9. Remove cap from the steam/hot water boiler drain valve with a 20 mm spanner (see Figure M 22a).
10. Attach drain hose to drain valve, dangle the other end in the bucket.
11. Open drain valve on steam/hot water boiler.
12. When water flow stops, tilt the Mirage by lifting the left side (e.g. by placing a block of wood under the front-left foot of the machine) to drain remaining water from the steam/hot water boiler until flow stops.
13. Close steam valve.
14. Close drain valve and remove drain hose from the steam/hot water boiler.
15. Put a little food safe silicone grease on the cap and replace on drain valve, use only little force to tighten (a spanner is not really necessary).



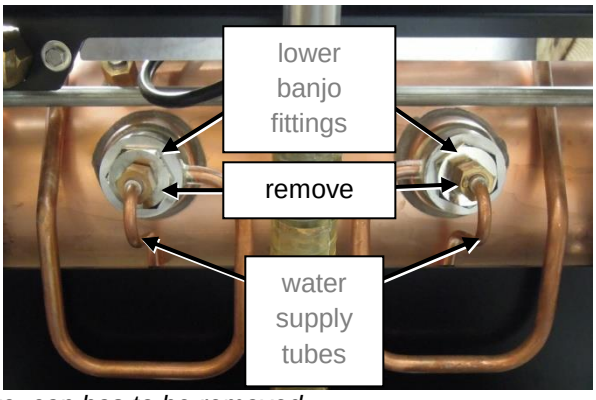


Figure M 22a (left). Showing steam boiler drain valve, cap has to be removed.
Figure M 22b (right). Showing bottom of Duette with bottom panel removed. Nuts to remove for draining heat exchangers are indicated.

Heat exchangers

16. Tilt machine backwards, e.g. by placing blocks of wood under front feet.
17. Loosen clamp on drain hose, pull drain hose from drip tray.
18. Remove bottom panel from machine with a 13 mm spanner.
19. Loosen the 16 mm brass nut from the lower banjo fitting (see Figure M 22b); it may be necessary to retain the banjo-fitting with a (30 mm) spanner.
20. Remove the water supply tube from the heat exchanger. A little water may drip from the opening.
21. Stick a very small screw driver in the injection tube in the lower banjo-fitting and wiggle it such that the injection tube comes loose.
22. Pull the injection tube approximately 5 cm (2 inch) from the banjo-fitting to let air into the heat exchanger. **Do not remove the injection tube from the heat exchanger yet** since that will restrict air from flowing into the heat exchanger. The heat exchanger will now drain, it contains approximately 450 cc of water.
23. When the heat exchanger stops dripping, wiggle the injection tube a little to ensure that all water has drained.
24. Drain the other heat exchanger(s) similarly.
25. Push the injection tubes back into the heat exchanger and remount the water supply tubes. **Do not over tighten the 16 mm nuts onto the banjo-fitting** as you might cut/tear the flare from the injection tube (rather check for leakage next time the machine is filled and pressurised, then tighten when necessary).
26. Remount bottom panel. The discharge hose will probably remain loose when you want to transport the Mirage.

Technical information

Electric scheme Mirage 1-phase, Duette

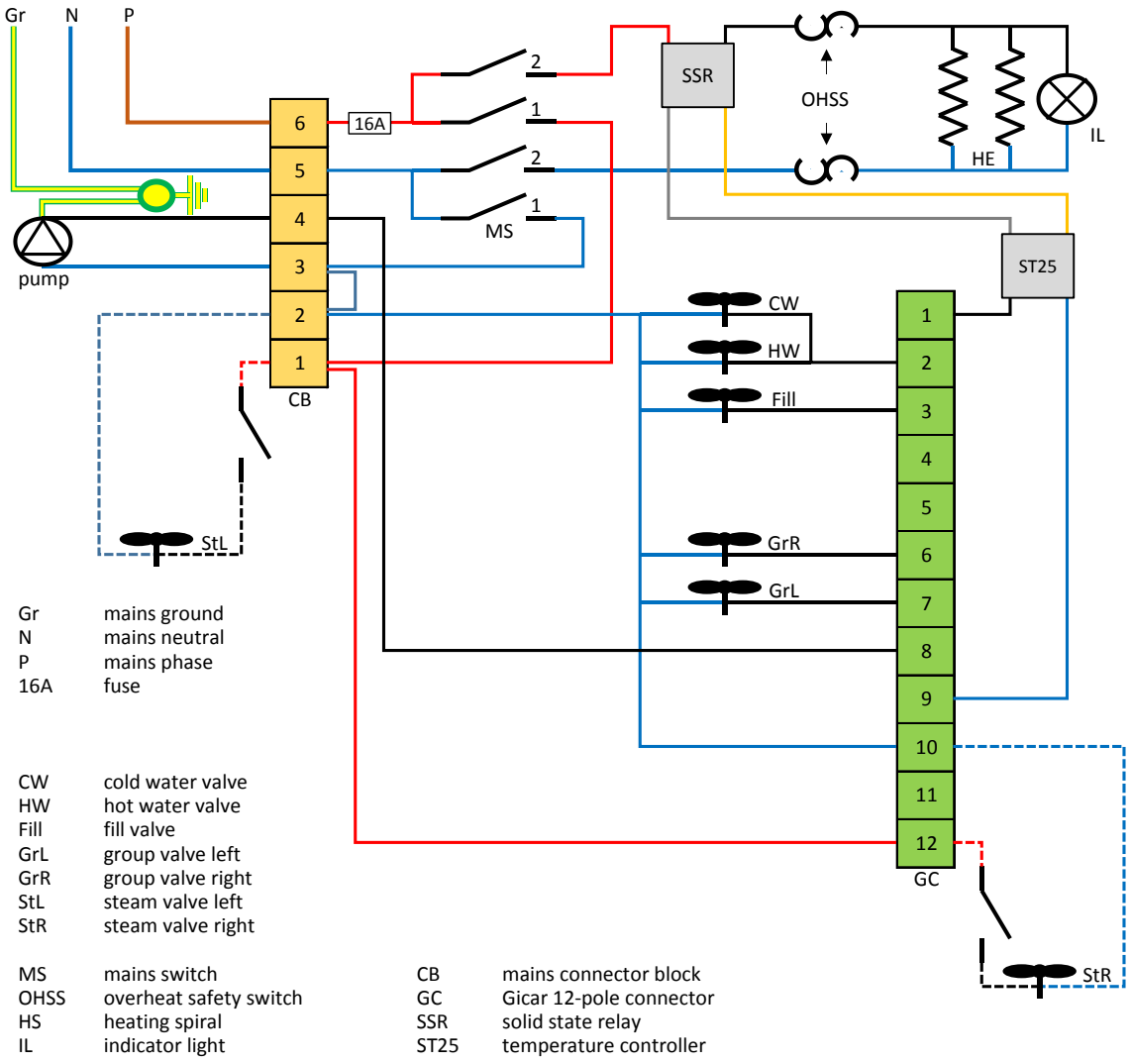
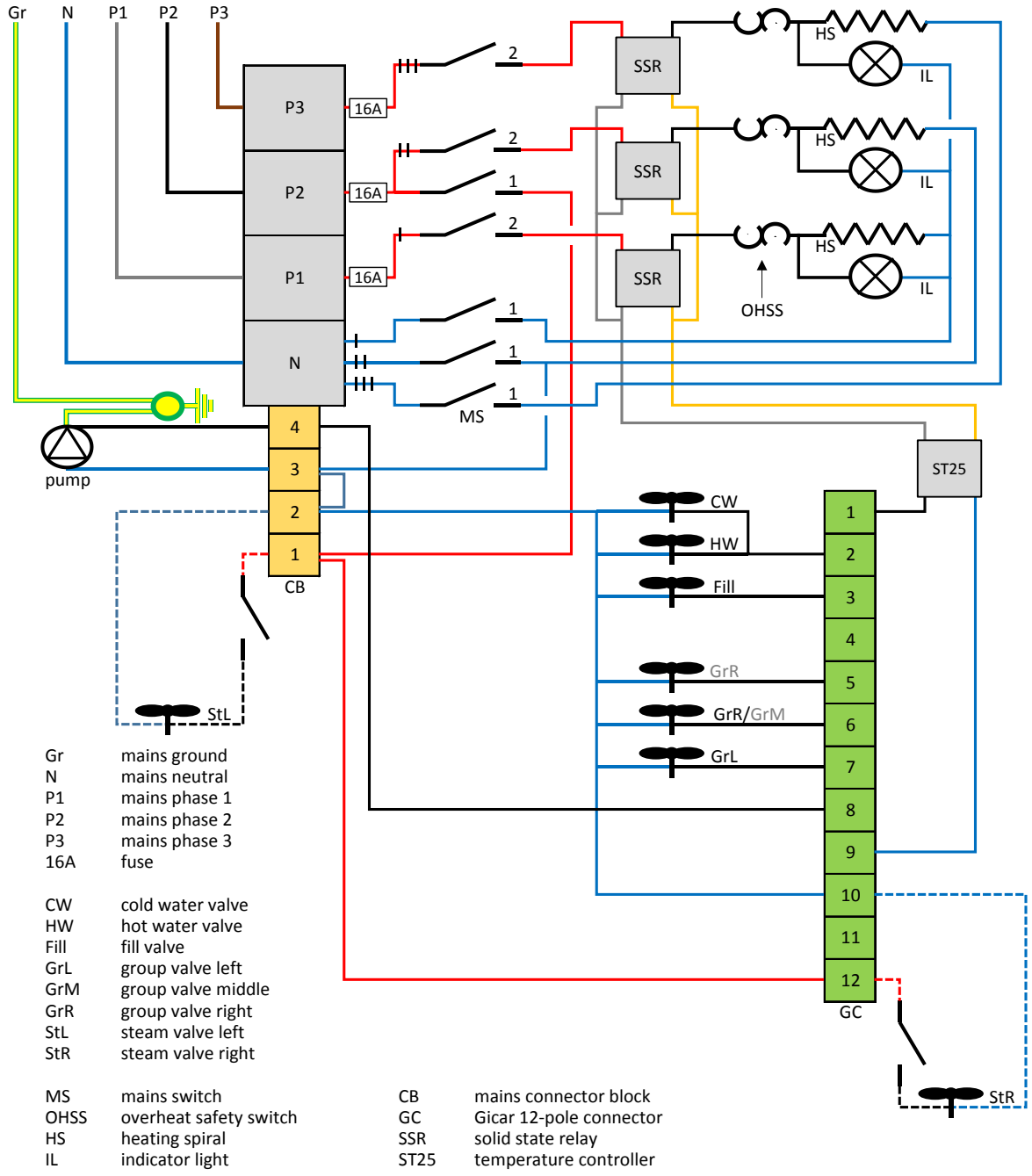


Figure T 1. Schematics of the 230VAC circuit in a Mirage Duette (3600W). NB: the control power from ST25 to SSR is 12VDC.

Electric scheme Mirage 3-phase: Duette high power/Triplette



Gr	mains ground
N	mains neutral
P1	mains phase 1
P2	mains phase 2
P3	mains phase 3
16A	fuse
CW	cold water valve
HW	hot water valve
Fill	fill valve
GrL	group valve left
GrM	group valve middle
GrR	group valve right
StL	steam valve left
StR	steam valve right
MS	mains switch
OHSS	overheat safety switch
HS	heating spiral
IL	indicator light
CB	mains connector block
GC	Gicar 12-pole connector
SSR	solid state relay
ST25	temperature controller

Figure T 2. Schematics of the 230VAC circuit in the Mirage Duette high power (5200W) and Mirage Triplette (6400W). Wires on grey connector block are marked "I". "II" or "III" according to individual circuit. Compare to Figure T 5 and Figure T 6. NB: the control power from ST25 to SSR's is 12VDC.

Level control and water meters

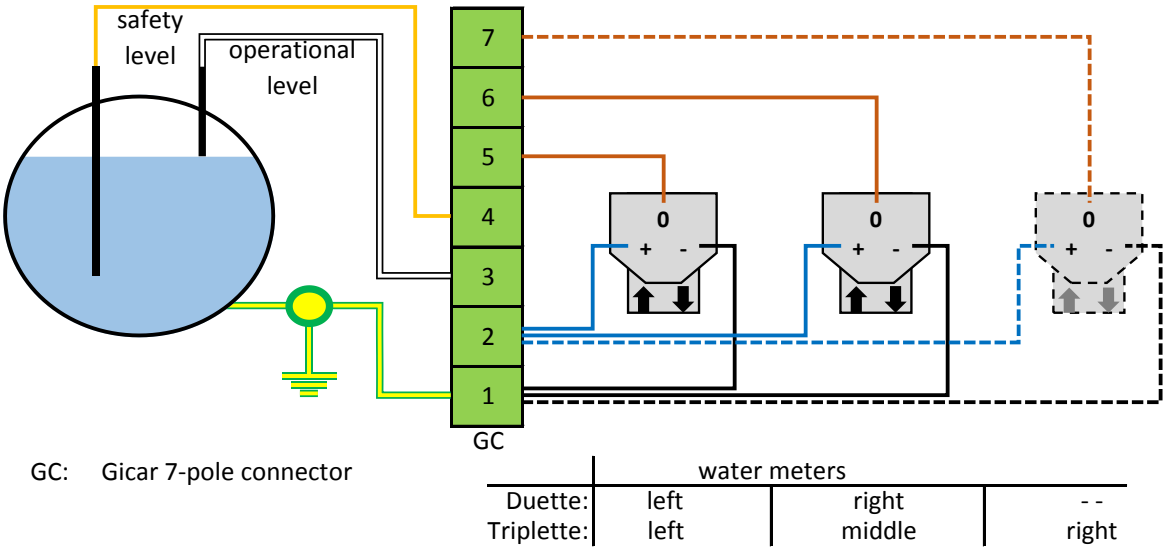


Figure T 3. The low voltage circuits that control water level (left) and pass water volumes towards the Gicar controller (right) via the 7-pole connector. Note that in position 1 three (Duette) or four (Triplette) individual leads are grouped. Similar for position 2.

Mains switch Duette

The 3x 3-way mains switch disconnects both neutral and phase from the power mains in position "0". In position “1”, power is fed to the main controller but not to the heating element. The machine is only fully functional in position "2" of the mains switch. Position "1" is very useful for testing and checking various functions in the machine.

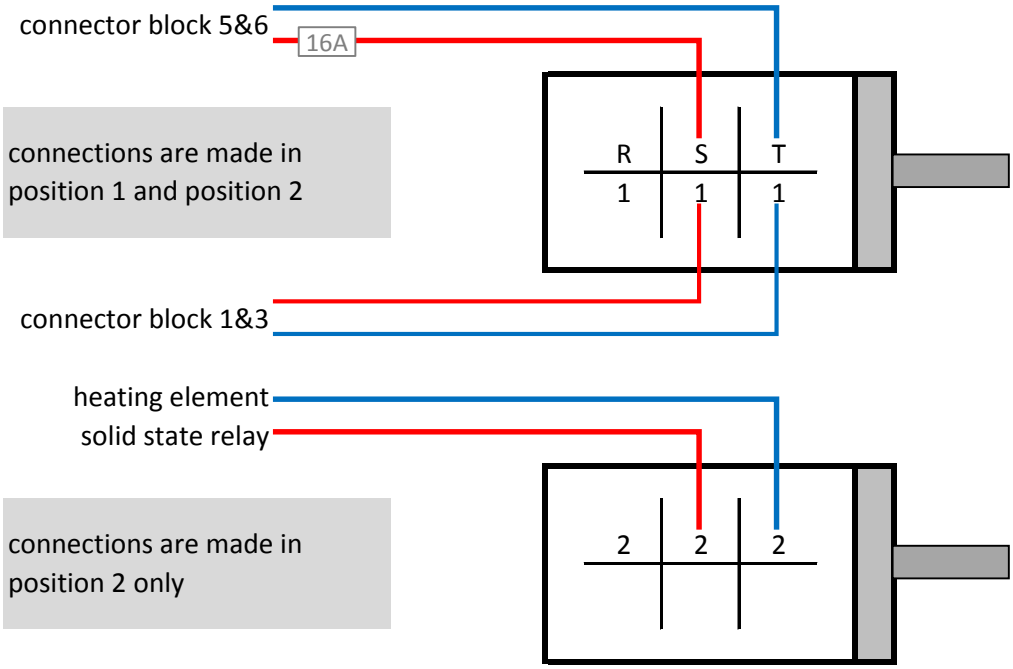


Figure T 4. The 3x 3-way switch used in the Mirage Duette 1-phase. In position 1 power is fed onto the machine, but not onto the heating element. Only in position 2 is the element also connected to the power mains (phase via the SSR).

Mains switch Duette high power/Triplette

On the high power Duette and the Triplette a 4x 3-way switch allows for switching the phases apart from the neutral leads in the machine while preserving the function of position “1” of the mains switch (power to the main controller but not to the heating element). The wiring of this switch is shown in Figure T 5.

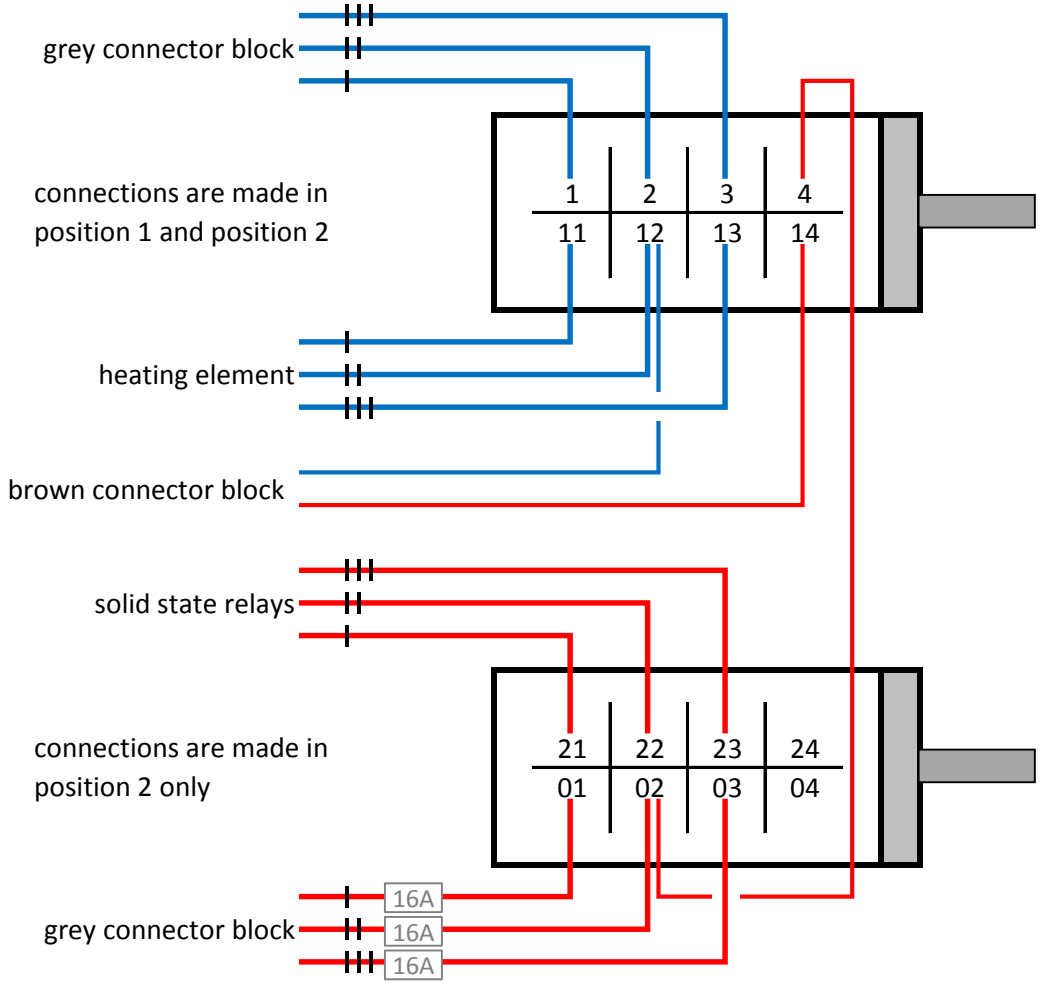


Figure T 5. The 2x 4-way switch used in Mirages where all 3 spirals of the heating element (and 3 SSR’s) are in use. In position “1” connections are made between 1 and 11, 2 and 12, etc. In position “2” connections are made between 01 and 21, 02 and 22, etc. as well.

Triplette connector block: 3-phase or 1-phase

The set-up with the 4x 3-way switch makes it possible to establish 3 completely separate circuits within the machine and, in combination with a large connection block, allows for easier switching to "single phase" power when necessary. Figure T 6a and b show the difference between the 3-phase and 1-phase layout on the grey connector block.

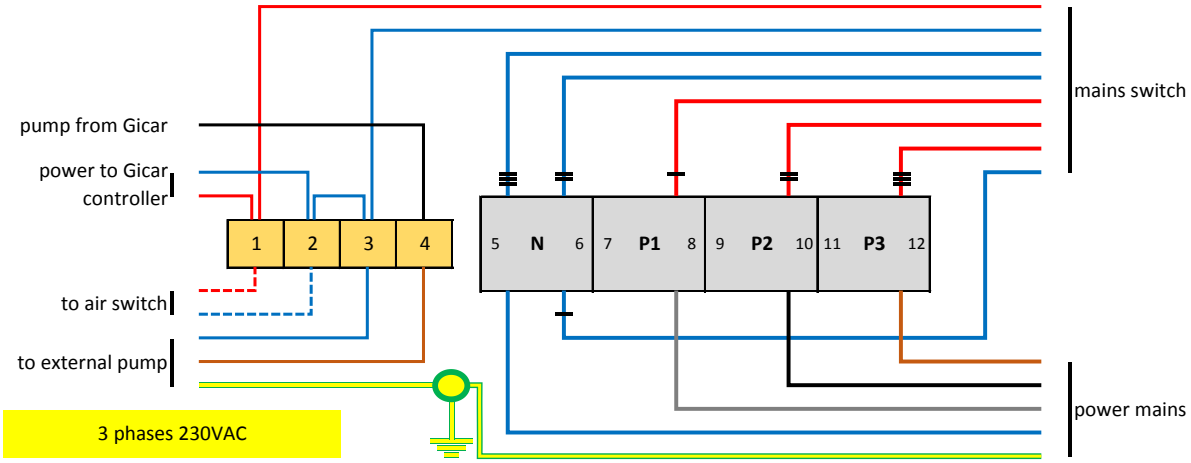


Figure T 6a. Showing the connections made on the brown and grey connector blocks when the machine is wired to triple phase 230VAC power mains.

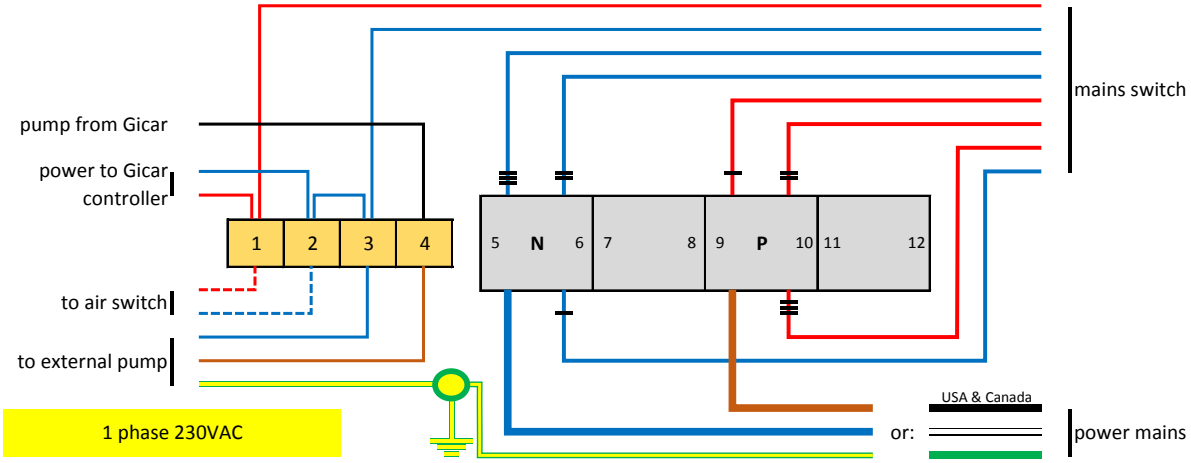


Figure T 6b. Showing the connections made on the brown and grey connector blocks when the machine is wired for single phase power mains. In machines for most countries the mains cable is brown (phase), blue (neutral) and green/yellow (earth). Also shown is the USA/Canadian mains cable (split phase: 2-phase 115VAC with 180 degrees phase shift. Black is phase, white is counter-phase, green is earth.).

Problem solving

Although we take the utmost care to include the best possible parts in the Mirage, some parts have been known to malfunction more often than others. Below we describe the most common electro-mechanical failures in the Mirage and the behaviour displayed by the machine when that part breaks down.

Controller

The Gicar controller is located behind the right hand side panel and combines several functions in one.

1) For brewing coffee.
   The controller converts the touchpad or bastone unit instructions to open the appropriate group valve and close the boiler fill valve in case it is open at the time, engages the water pump motor, measures the amount of pulses from the corresponding water meter, and closes the group valve and water pump when the set volume of water has passed through the water meter (or any of the buttons on the active group touchpad/bastone is pressed before the set volume is reached).
2) For hot water dispension.
   When the hot water button is pressed, the pump motor is engaged, both hot- and cold- water flange valves on the mix-block are opened and a timer starts to run. When the timer reaches the set value (or when the hot water button is pressed again before the set time is reached), the valves are closed and the pump motor disengaged.
3) For keeping the water in the steam boiler up at operational level.
   The controller converts the 230 VAC into an appr. 1.2 VAC (high frequency) tension which is sent to the operational level probe. When the water inside the boiler touches the probe, a small current will run through the operational level circuit. When no current exists in the operational level circuit (i.e. the water in the boiler does not touch the operational level probe), the water pump motor is engaged and the boiler fill valve is opened with the condition that no group valve is open at the same time. As soon as the circuit is closed (water inside the boiler touches the probe), the pump motor is disengaged and the fill valve closed.
4) For shutting down the heating elements when water level becomes dangerously low. The controller converts the 230 VAC into a 1.2 VAC (high frequency) tension which is sent to the safety level probe. When water touches the safely level probe, a small current will run through the safety level circuit. When no current exists in the safety level circuit (i.e. the water in the boiler does not touch the safety level probe), the governing current to the solid state relays is shut off.
5) For shutting all solenoid valves in case one of them remains open for more than 2 minutes.
   As soon as a solenoid valve is opened, an individual timer for that valve is started from zero. When any of the timers reaches 2 minutes, all solenoid valves are shut and the LED's on the touchpads/bastone units start flashing.
6) For giving alarm and eventually disengaging the corresponding group when the water meter does not send out pulses on an engaged group.
   If the water meter on an engaged group does not send any pulses to the controller for more than 5 seconds, the LED on the corresponding dose starts blinking. If no action is taken and the water meter does not send any pulse for more than 4 minutes, the group is disengaged automatically.

Failure characteristics of the controller

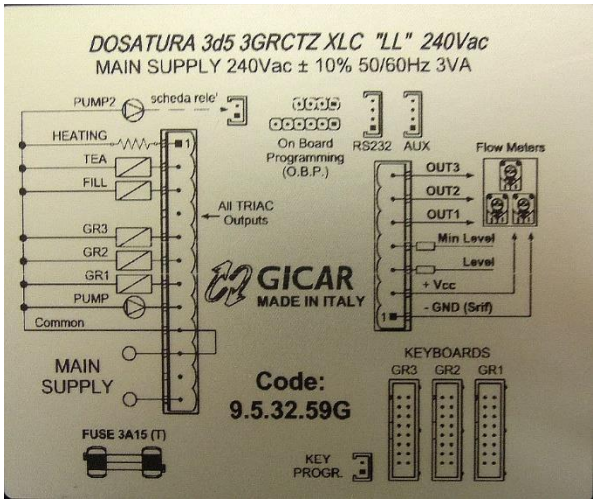
If erratic behaviour of the machine is encountered, check if the individual leads (black, blue and brown) of the water meters have not broken off at the 7-pole connector in the Gicar controller or in the water-meter plugs. Be careful when stripping these leads to make a new connection, the metal strands in the leads are very easily cut.

The transformer in the controller is most likely to fail. When this occurs, there is no power for the controller's internal electronics and the machine will not function at all. With transformer failure, 230

VAC can be measured at the “entrance” of the controller (the red wire on position 12 of the large green plug in the controller). When the transformer breaks down, the entire controller should be replaced.

Replace controller

Different versions of controllers are used in the Mirage which are not always compatible. When installing a new controller, make sure that you have the correct replacement. A new controller (the so-called LLv version, see Figure P 1) ordered from KvdW will have an installation leaflet to set different functions according to machine model.



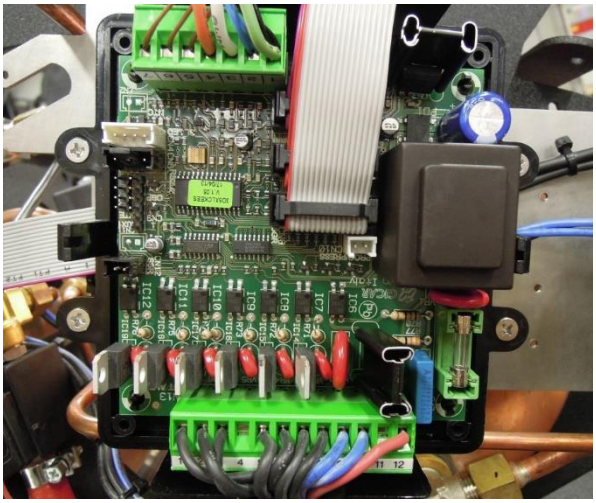


Figure P 1a (left). Model tag of the LLv version of the Gicar controller. It is identified by the "PUMP 2" indication above-left.
Figure P 1b (right). Cover taken from controller. 12-pole green connector on bottom, 7-pole connector above.

1. Turn mains switch to "0".
2. Remove right side panel.
3. Remove top of controller cover by pushing the lateral snaps inwards while pulling the cover from its base.
4. Unplug all electrical connectors.
5. Either remove the card together with base by removing the 4 Philips screws from the base or remove only the card by removing it from the 4 self-blocking columns in the cover base.
6. Mount the new controller, either with base or just the card. When the base was removed as well, make sure that the wiring is positioned correctly behind the base.
7. Remount all electrical plugs, they only fit in one position.
8. Replace controller cover.
9. Turn machine “on” and check for proper operation.
10. Remount side panel.

Steam boiler temperature controller

The steam boiler temperature controller is a Stork ST25 modified for Kees van der Westen espresso machines. The ST25 can function both as PID and as thermostat. In the Mirage it is used as a user-friendly, very precise thermostat. Fast response is obtained by measuring the temperature in the steam (instead of the water).

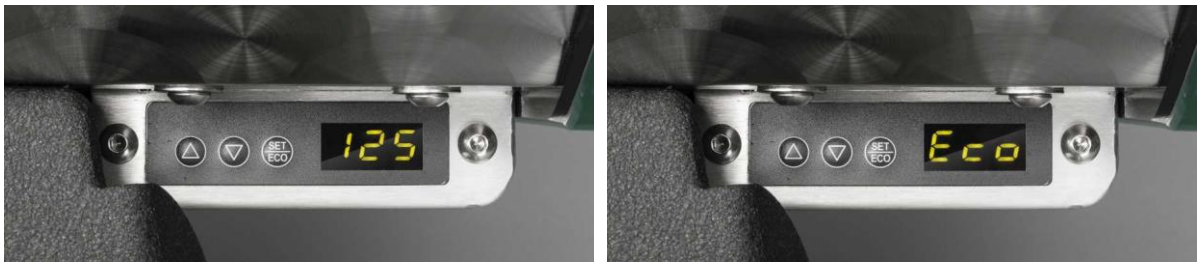


Figure P 2. Showing the Stork ST25 temperature controller at operational temperature (left) and in Eco-mode (right) where control temperature drops to 70 degrees Centigrade (158 °F).

Power to the Temperature controller comes from the Gicar main controller, but only when water in the steam boiler is above security level.

Temperature information to the controller comes from a Pt100 sensor located in the steam above the water in the steam boiler. A Pt100 sensor is a so-called PTC sensor which means that with increasing temperature the electrical resistance of the sensor increases. The resistance value of the sensor is converted to a temperature value inside the controller.



Figure P 3. Different dots in the display mean different things.
Left: the lower dot is a decimal point. The display indicates a measured temperature of 12.4 degrees, control signal to heat is off.
Right: The upper dot is related to the output control signal. The display indicates a measured temperature of 124 degrees and control signal to heat is on.

Nearly all parameters in the controller can be adjusted by the user, the most likely to change are:

C1	operational temperature
C2	eco temperature
C5	hysteresis
H13	display brightness

H15	°C or °F
H51	50 or 60Hz
A2	value correction (offset)

See "Stork ST25 ECO comprehensive manual" for detailed information about the parameters.

Failure characteristics

Although little problems are known with the controller, a few observations have been reported:

1. The display of the controller does not light up.
   a The machine does not get power (mains switch in position "0" or problems with electrical mains):
   Check: when the machine does get power, the groups will work and the pump may run.
   b The temperature controller does not get power:
      - Fuse in Gicar controller blew out.
      Check: replace fuse in Gicar (3.15 Amp).
      - Water level in the steam boiler is below safety level.
      Check: pull the connector (on the orange wire) from the safety level sensor and make electrical contact to the machine; push bare metal of connector against boiler. After a few seconds, the controller will get power if water is indeed below safety level. If so, check fill-up of steam boiler.
   c Temperature controller is malfunctioning:
      - Replace controller.
2. The display shows E IH or E IL.
   a E IH means that measured resistance value is outside (higher than) sensor-range. It normally means that the circuit is open.
      - Check if all connections between controller and sensor are OK.
   b E IL means that the measured resistance is outside (lower than) sensor-range. It normally means a short circuit.
      - Check for a short in the connections.
      - Exchange sensor when resistance of sensor is lower than about 90 Ohm (room temperature).
3. The display shows incorrect (too high) or erratic (quickly changing) temperature value.
   a Bad electrical connection of sensor on controller:
      - Check: pull connectors from sensor, squeeze faston connectors a little tighter, remount on sensor.
      - Check: remount sensor cable leads on controller.
   b Controller malfunction:
      - Replace controller.
4. Pressing the buttons of the controller has no effect.
   a Printed circuit board (PCB) inside the controller has shifted w.r.t. its casing, or switch on the PCB has bent out of reach of the push button.
      - Check if PCB can be shifted back, otherwise replace controller.

Solid state relay

The solid state relay (SSR, see Figure P 4) in the Mirage is a normally open electric relay without the moving parts found in an electro-mechanical relay. When a (small) control voltage is applied to the SSR, a LED illuminates which in turn switches on a photo sensitive diode. The diode current turns on a back-to-back thyristor to switch the load. The optical coupling allows the control circuit to be electrically isolated from the load.

Note!

The LED visible on the front of the SSR is an indicator light which is lit when a control current is applied to the SSR. It is not the LED that triggers the diode.

A single-phase normal power Mirage Duette has 1 SSR which switches on 2 of the 3 heating spirals in the heating element.
Triple-phase and high power single-phase Mirages have 3 individual SSR's: one for each of the three heating spirals in the heating element.
See also "electric scheme Mirage heating 1 phase" and "electric scheme Mirage heating 3 phase".

In most cases when a SSR malfunctions, the load connectors are continuously coupled even when there is no control voltage applied. This means that the heating element remains switched on even when the temperature controller does not transmit a control voltage.
However, it has been known to happen that the SSR fails with the load connectors not coupling or only occasionally coupling when the control voltage is applied.



Figure P 4. A solid state relay (left) as used in the Mirage and the heat transfer sticker (right) that should be applied on the back of the SSR before mounting.
Upper connections (1, 2) are the load (connecting mains switch to safety overheating switch); Lower connections (3, 4) are for control voltage (from the Stork ST25 temperature controller).

Failure characteristics when the SSR load is continuously coupled

Element indicator light(s) remains lit

In a single phase, normal power, Duette the lower 2 heating spirals are paired (parallel) and fed by a single SSR. In other Mirages, each heating spiral is fed by an individual SSR.

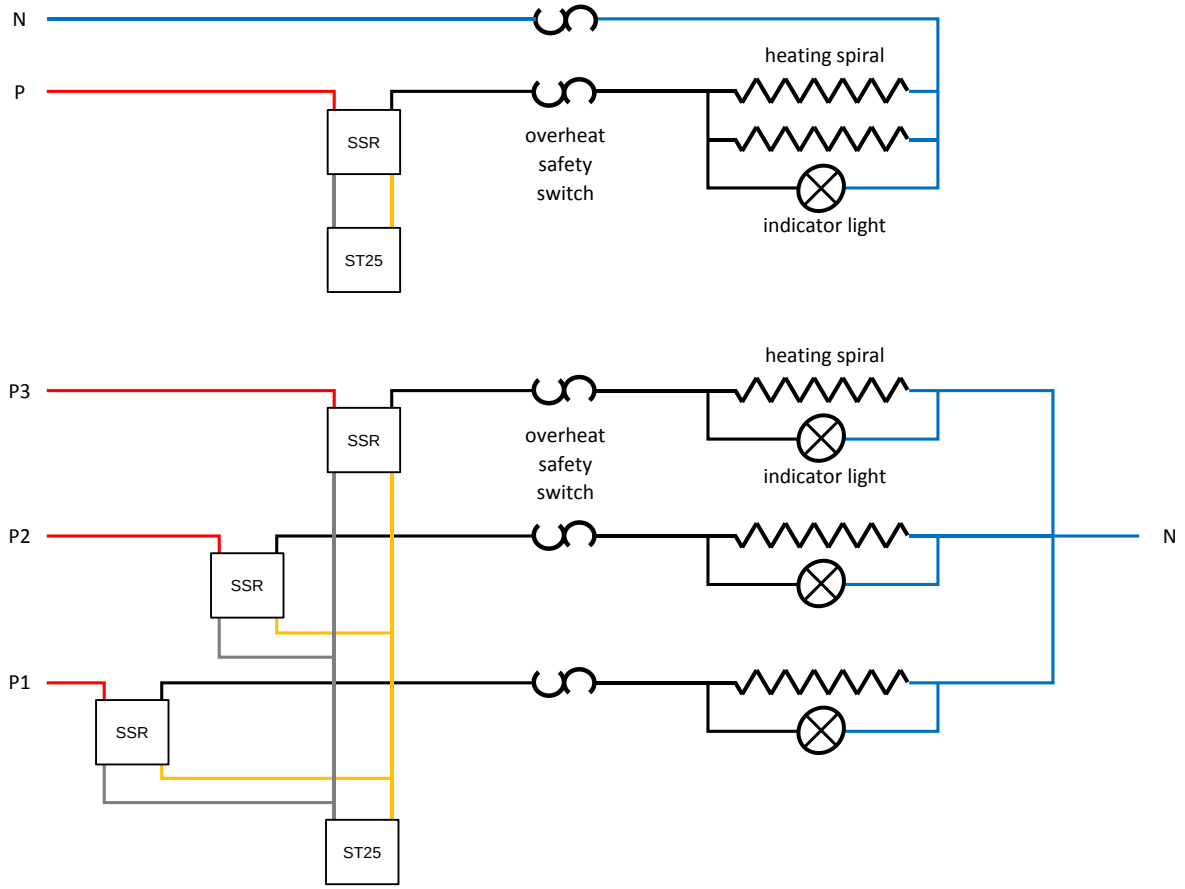


Figure P 5. Simplified heating circuits for Mirage Duette with two active heating spirals (above) and Mirage Triplette or Duette high power with three heating spirals.

The heating spiral(s) connected to the failing SSR keep on heating, even when the indicator LED on the SSR is not lit. The element indicator light will be lit continuously and boiler water temperature (and thus pressure) will keep rising (unless you use an extreme amount of hot water). Eventually the overheat safety switch is activated and/or the safety pressure valve will open.

Problem solving

Single-phase, normal power, Mirage Duette

The Mirage only has 1 SSR which you have to replace immediately.

Procedure to replace SSR

1. Turn mains switch to “0”.
2. Remove left hand side panel.
3. Pull cover from SSR.
4. Remove all 4 connectors from the SSR.
5. Remove the 2.5 mm Allen bolts that hold the SSR to the heat sink. A heat transfer sticker is applied to the back of the SSR, make sure that no parts of this sticker remain on the heat sink.

6. Mount new SSR with the 2 Allen bolts. Make sure that the heat transfer sticker is applied to the back (if you ordered your spare from Kees van der Westen Espressonistic Works B.V., the sticker is mounted before shipment).
7. Remount the electrical connectors.
8. Replace the cover on the SSR.
9. Turn mains switch to “2”.
10. Check functioning of machine.
11. Remount left hand side panel.

All other Mirages
The Mirage is equipped with three SSR’s so you have to determine which SSR is failing first. This is easily checked as the indicator light of the corresponding spiral will not dim.

Procedure
EITHER:
1. Replace the failing SSR (see above).

OR:
If you don’t have a replacement SSR available, you can still use the Mirage but it will operate using 2 of the 3 heating spirals.

2. Disconnect the failing SSR from the mains (connector no.2, the mains supply to the SSR), make sure that you isolate the disconnected wire properly.
3. Turn mains switch to “2”.
4. Check functioning of machine.

Note!

When you have disconnected a single SSR, the element indicator light will not function although the machine is operational.

5. Remount left hand side panel.

Failure characteristics when the SSR load is (semi-) continuously uncoupled

Single-phase, normal power, Mirage Duette
First check if a fuse is blown, if not:

There is no power to the heating element, even when the indicator LED on the SSR is on. The machine will not warm up. The SSR has to be replaced immediately, see above for procedure.

Note!

Similar characteristics occur when the safety overheating switch has been activated. The difference is that no mains voltage is measured on connector no.1 when the SSR is failing while voltage is measured on connector no.1 when the safety overheating switch has been activated.

All other Mirages
Power to the heating element is limited to 2 of the 3 heating spirals. With low to moderate use you may not even notice that the SSR has failed unless you have observed that the corresponding indicator light never lights up. Heating up from cold will take a little longer than normal and the machine may not keep its operational pressure when heavily used.

Use a voltage meter to check if connector no.1 on the SSR gets mains power when the indicator LED on the SSR is lit. Use a 2-probe voltage meter with one probe on a neutral wire (blue) on the

connector block. If the no.1 connector on the SSR does not show mains voltage, the SSR is failing and has to be replaced.

Problem solving

1. First verify if safety overheating switch has not been activated (single-phase machines only): Turn mains switch to “0”, remove left hand side panel, press red button on safety overheating switch[1], turn mains switch to “2”, check functioning of machine.

If that did not have the desired result:

2. Turn mains switch to “0”.
3. Check fuse(s), then check machines' functioning.

If no result:

4. Replace the SSR (see above).
5. Turn mains switch to “2”.
6. Check functioning of machine.
7. Remount side panel.

[1] When the machine has actually overheated, it must cool down to appr. 105°C before the overheat safety switch can be re-set.

Heating element

Every Mirage has a heating element that holds 3 resistor spirals. Single-phase machines use 2 of the 3 spirals in parallel connection, 3-phase machines use all 3 spirals where each spiral is connected to a separate phase. Single-phase high power machines use 3 spirals in parallel connection but with each spiral operated by its own solid state relay (see also previous section).



Figure P 6. Heating elements and mounting materials of a Triplette (top) and Duette (bottom). Note shorter bolt for upper hole in flange; this bolt has inner threads to hold the element-cap bolt. The Teflon ring can be replaced with an O-ring and spacer (see Figure P 9). Machines equipped with a TRIAS (custom) element flange only need an O-ring as seal (no spacer, Teflon ring will NOT seal, see Figure P 10).

The heating element of a Triplette has 3 spirals with a rating of 2000 Watt each, in a Duette, the spirals are shorter and have a rating of 1600 Watt each (see Figure P 6). Each spiral has a manufacturers tolerance of -10% / +5% and resistivity depends on temperature of and amount of current through the spiral.

When you check the individual heating spirals of the element, they should have a resistance of 25-32 Ω (Triplette) or 32-40 Ω (Duette). A spiral with less resistance is short-circuited, a spiral with much larger resistance has burned out. Table T 1 shows the values to be measured for different types of machines.

Type	Power (Watts)	Resistance (Ohms)	Remark
Triplette	2000	25-32	Individual spiral
Duette	3200	15-20	Single-phase machine (2 spirals)
	1600	32-40	Individual spiral

Table T 1. Resistance values for the different heating elements or individual heating spirals. Machine is room temperature, measurements are made on heating element connectors.

Heating spiral short circuit

A heating spiral which causes a short circuit should be disconnected immediately as it will cause your mains breaker to disengage the power and/or do damage to the solid state relay that it is connected to. If only one spiral has a short circuit, you can rig your Mirage such that it will operate on the remaining 2 heating spirals until you can change the heating element. You must disconnect both leads of the failing spiral on the heating element itself since the short circuit will persist via the common neutral (the right hand side connectors). A 4800W Duette or 6000W Triplette will of course miss 1/3rd of its heating power with one heating spiral disconnected, a 3200W Duette will operate normal with one failing spiral disconnected and the “spare” spiral connected.

Heating spiral burn out

A burnt out spiral normally has infinite resistance such that there is no immediate need to disconnect it but we recommend to do so anyway. The machine can operate (close to) normal on the remaining 2 heating spirals. Remove the appropriate bridge(s), connect the neutral of the 2 remaining spirals with a self-made connection (2.5 -or more- mm^2 cable with 4 mm ring terminals).



Figure P 7. Side view of heating element with mounting materials. The connectors pair up horizontally for each individual spiral. Shown here is a Teflon ring as seal, other sealing mechanisms exist on our machines (see Figure P 9 and Figure P 10).

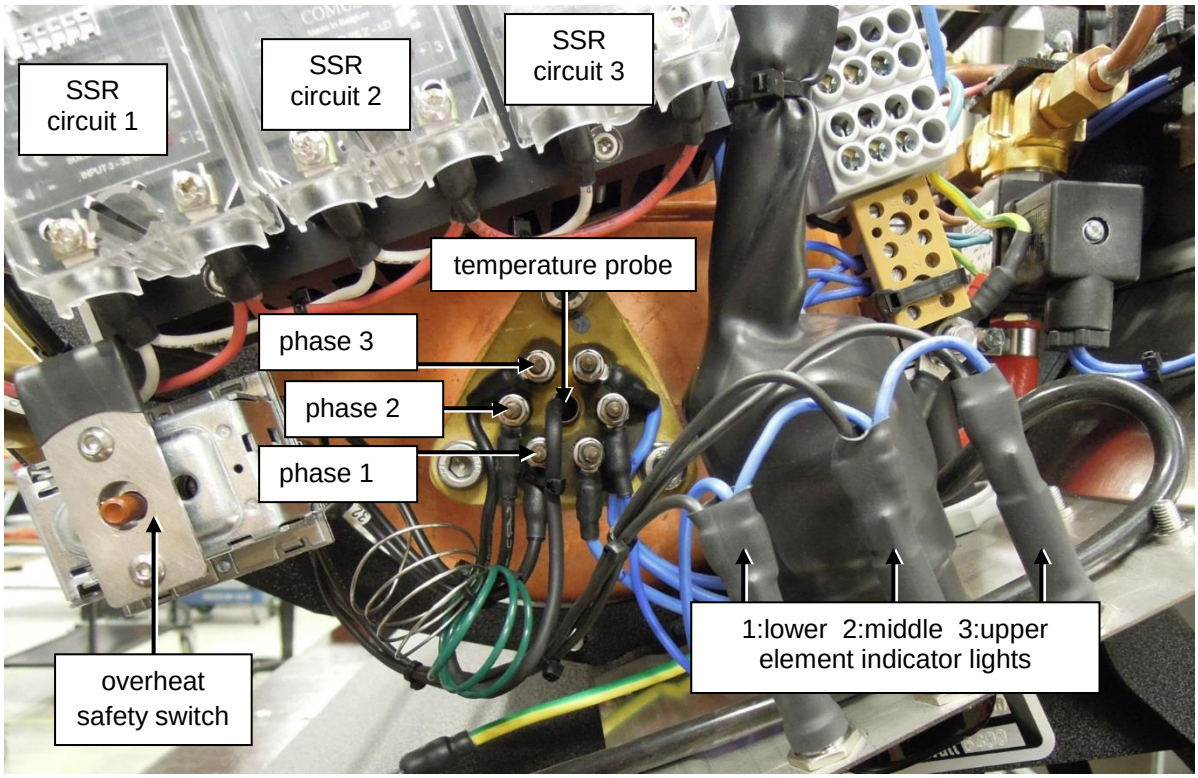


Figure P 8. Showing the heating element of a 3-phase (or single-phase high power) machine with the element cover removed. Each heating spiral is connected to an individual circuit or phase (left connectors), the neutral connectors (right) are bridged on the large grey connector block. The temperature sensor of the overheat safety switch is inserted in a tube in the centre of the heating element flange.

Heating element seal



Figure P 9. Standard element flanges by Iberital and Backer can be sealed with either a Teflon ring only (see Figure P 7) or with the shown EPDM O-ring (42x4.5mm) with complementary 2mm thick spacer.

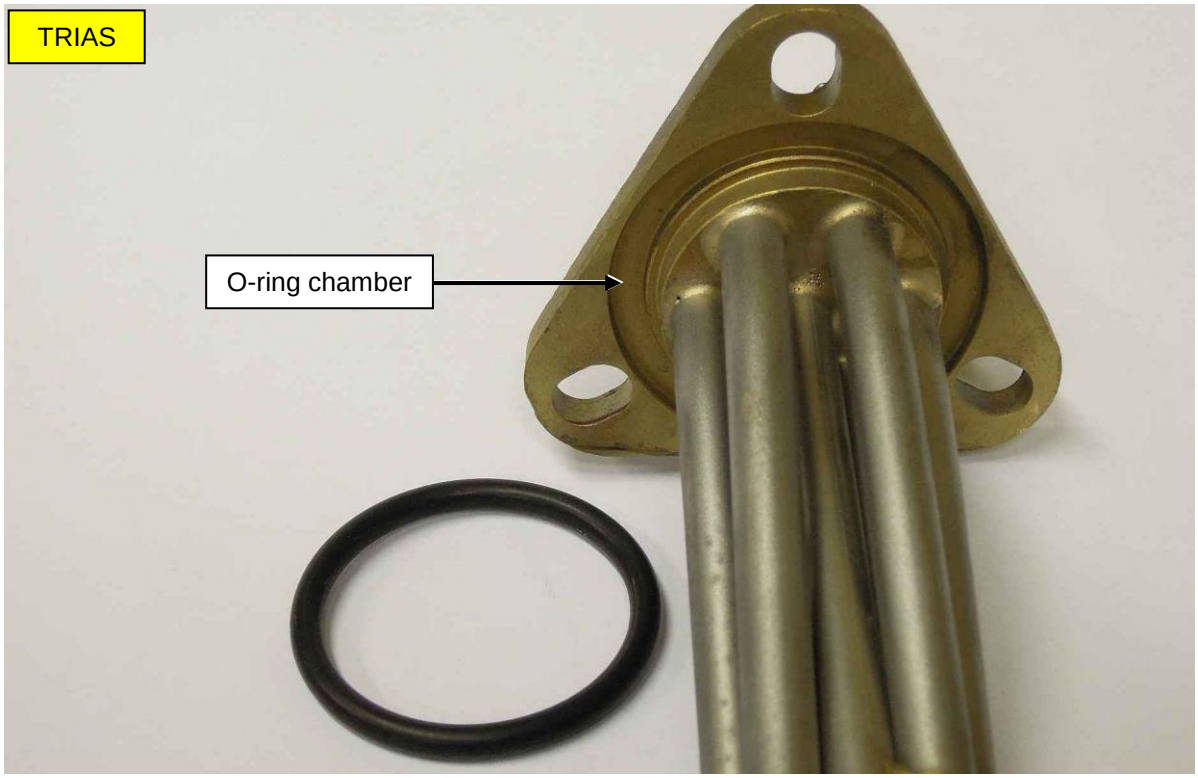


Figure P 10. Custom element flange by TRIAS must be sealed with EPDM O-ring (42x4.5mm) only as the flange has an integrated O-ring chamber. The TRIAS flange will NOT properly seal with a Teflon ring.

More information on our website

Visit our website for latest versions of spare parts lists, (pre-) installation and user manuals, etc:

http://www.keesvanderwesten.com/mirage-support.html

Contact information

Please supply machine details (model and number) and full contact information when seeking support or ordering parts.

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