Petrol (Gasoline) Watermaker Operations Manual

Contents

1 **Introduction**

2 **Understanding Your System**

- 2.1 Rainman Concept
- 2.2 Getting To Know Your Rainman

3 **Preparing System For First Use**

- 3.1 Engine Oil
- 3.2 High Pressure Pump Travel Plug
- 3.3 Fill Fuel Tank

4 **Operating The Watermaker**

- 4.1 Setting Up For Use
- 4.2 Running The System
- 4.3 Shutting Down
- 4.4 Desalinating While Under Way
- 4.5 Desalinating Brackish Water

5 **Care and Maintenance**

- 5.1 Storage
- 5.2 Reverse Osmosis Membrane Care
- 5.3 Fresh Water Flushing
- 5.4 Pickling Your Watermaker
- 5.5 Changing The Prefilter
- 5.6 High Pressure Pump Maintenance
- 5.7 Changing Engine Oil
- 5.8 Lift Pump Service
- 5.9 Push-Fit Instructions
- 5.10 Shipping
- 5.11 Service

6 **Warranty**

7 **Troubleshooting**

rainman watermakers

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Introduction

This instruction manual is for our petrol (gasoline) powered watermakers. It covers basic operations and maintenance of your system.

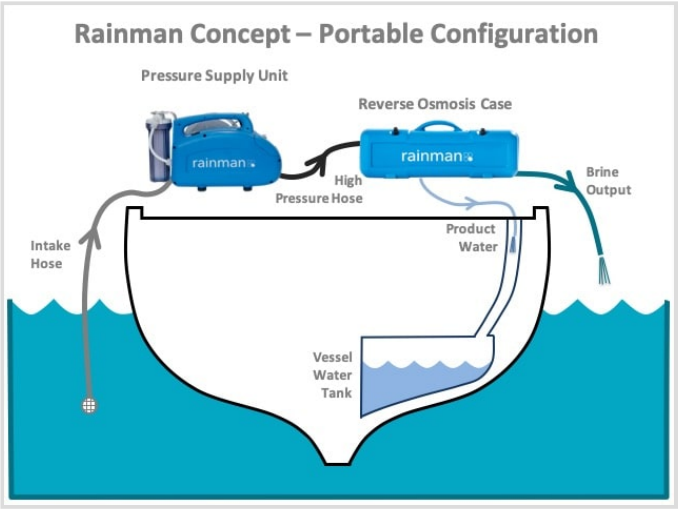
More technical information can always be found on the **support section of our website**.

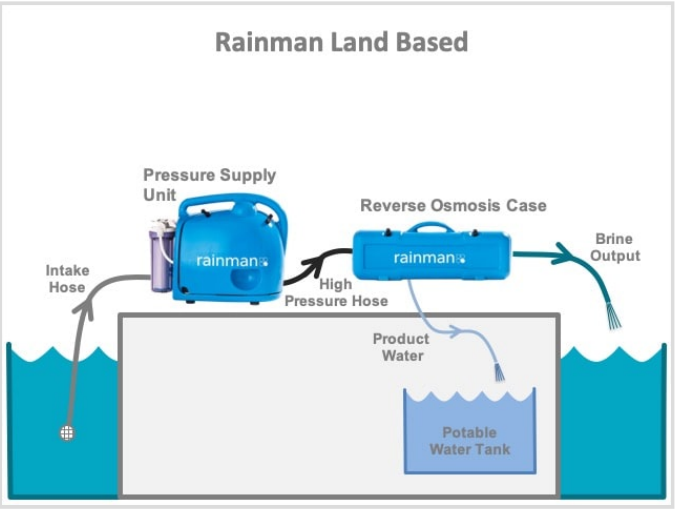
Understanding Your System

Rainman Concept

Rainman systems consist of two main components – a pressure supply unit (PSU) and a reverse osmosis unit (RO). The PSU will lift water to the system, pre-filter it down to five microns and feed it into a high pressure pump. The RO unit is attached to the PSU via a high pressure hose. The membrane(s) extract a small amount of fresh water from the pressurised seawater stream and diverts it into your tank. The bulk of the seawater goes to waste as a supersaline brine output.

Six common configurations for Rainman Watermakers



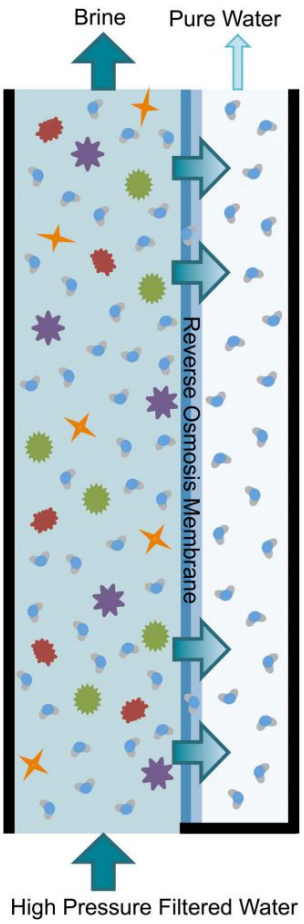


Desalination sounds complex, but it's quite simple in principle.

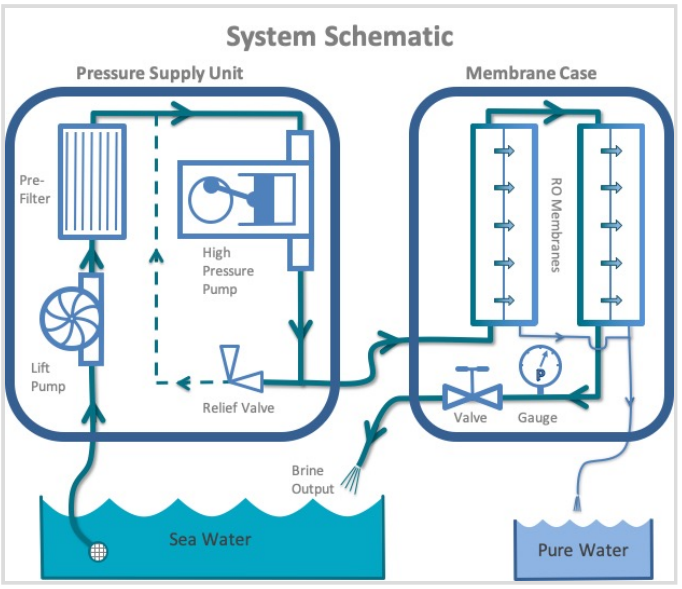
The Rainman watermaker operates through a process called reverse osmosis (RO). In its most simple terms, the system draws seawater up, filters out sediment and particulates, then puts the clean seawater under high pressure to pass through an RO membrane. The RO membrane is a semi-permeable polyamide thin-film composite.

A traditional filter, like our prefilter, works by passing all the water through it. The fine construct prevents larger particles from getting through and they are captured on the filter material. When a lot of particles have been captured on the filter and it's dirty, you change it.

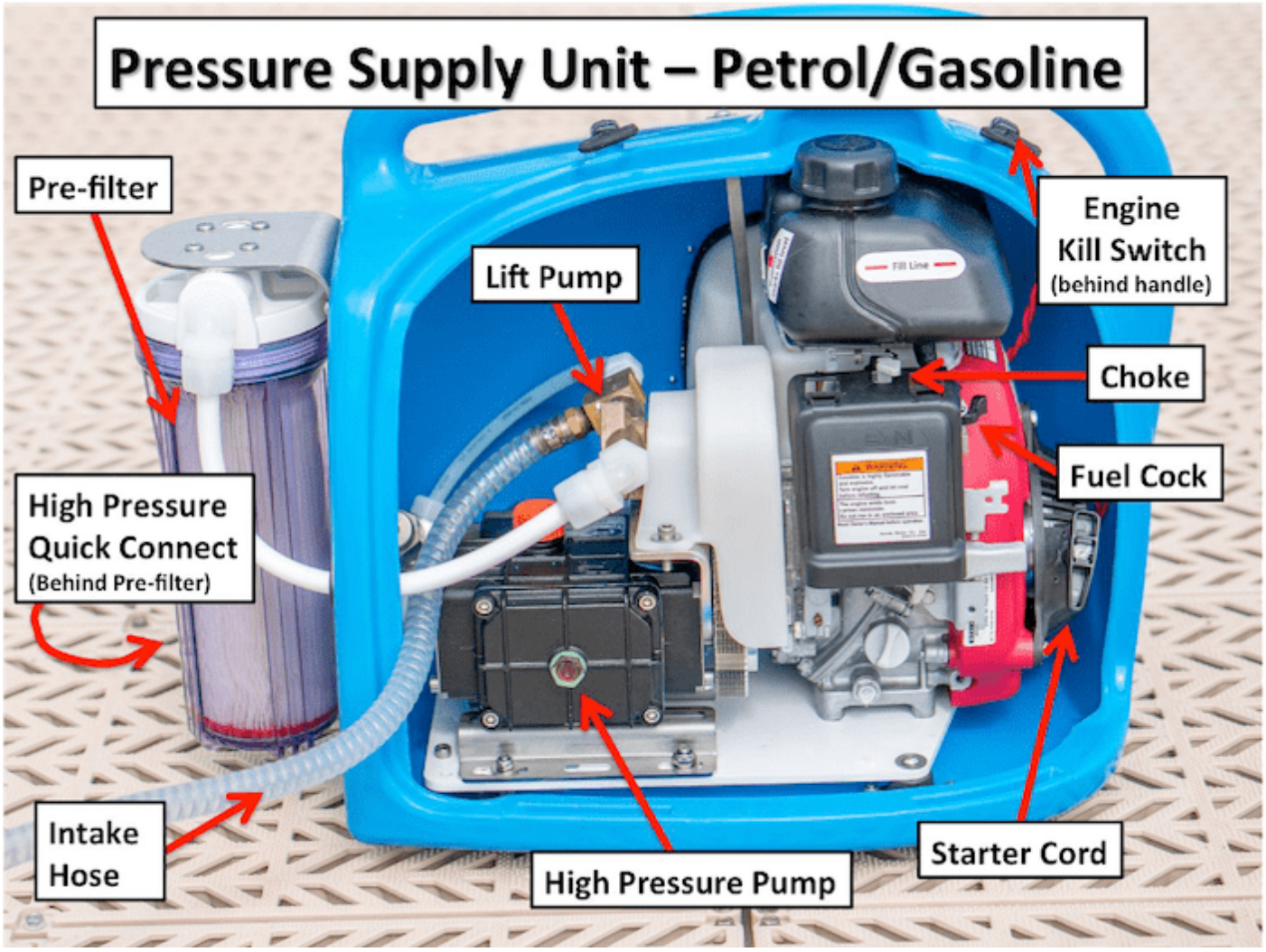
In contrast to a traditional filter, the RO process has filtered seawater passed across the membrane surface at high pressure. Keeping the description simple, the system is essentially extracting a small percentage of the freshwater from the seawater stream. The majority of the water and all of the salt continues in the flow and out the brine waste water hose. The salt does not accumulate on the membrane, which is why RO membranes do not need to be cleaned or replaced regularly.

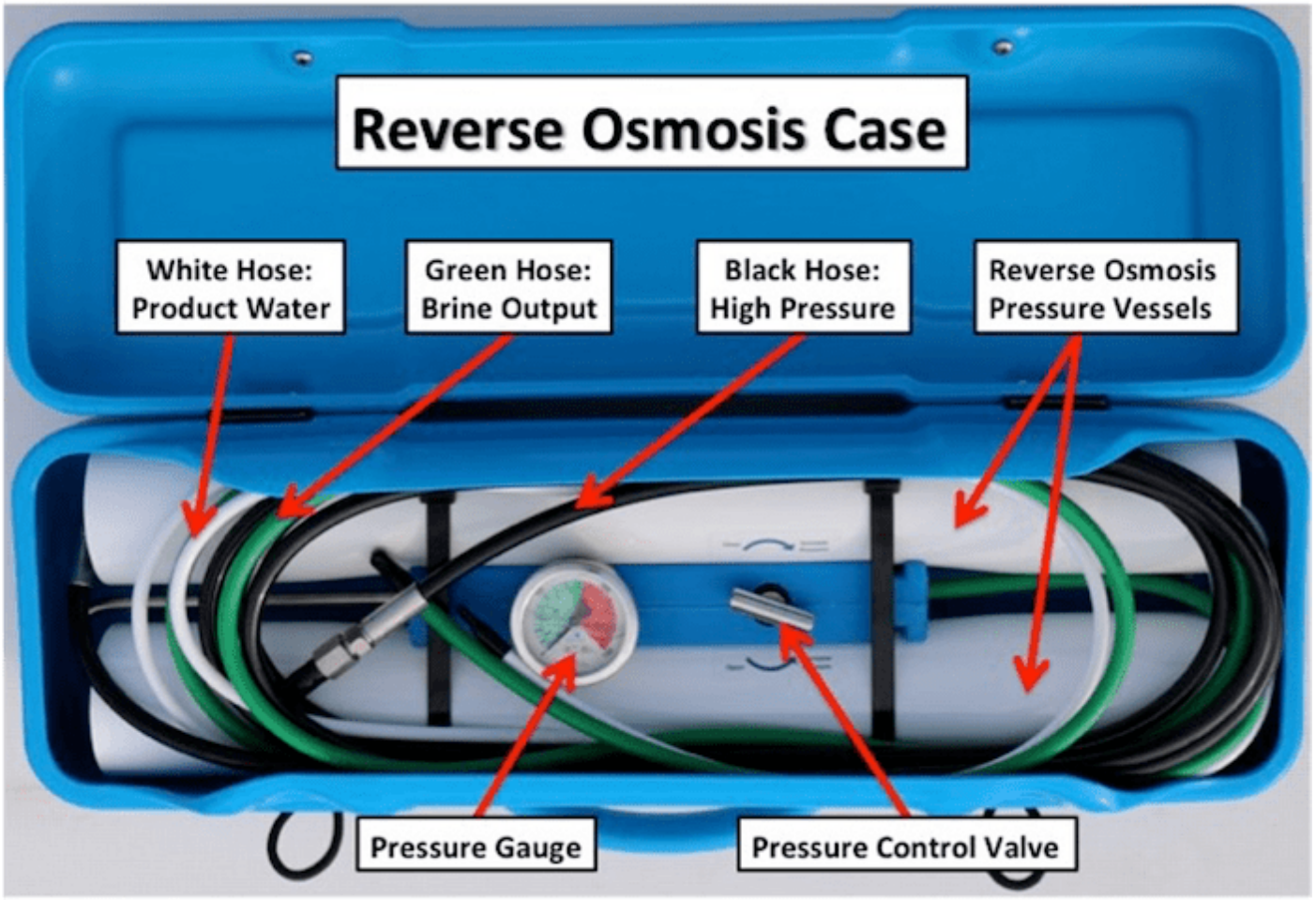


1. An impeller lift pump draws seawater up to the pressure supply unit (PSU) and creates positive pressure for the high pressure pump.
2. The pre-filter removes particulates larger than 5 microns from the seawater.
3. A plunger pump pressurises the system for the reverse osmosis membranes to operate.
4. The relief valve only opens if the control valve is closed excessively.
5. A high pressure hose carries filtered seawater to the reverse osmosis membranes.
6. Multiple membranes are connected in series (double RO membrane configuration).
7. The pressure control valve at the end of the system is used to set system pressure to approximately 55 bar (800 psi).
8. Brine water is released to the sea while fresh water is routed to your drinking water tank.



Getting To Know Your Rainman


Pressure Supply Unit – Petrol/Gasoline
Pre-filter
Lift Pump
Engine
Kill Switch
(behind handle)
Choke
Fuel Cock
High Pressure
Quick Connect
(Behind Pre-filter)
Intake
Hose
High Pressure Pump
Starter Cord


Reverse Osmosis Case
White Hose: Product Water
Green Hose: Brine Output
Black Hose: High Pressure
Reverse Osmosis Pressure Vessels
Pressure Gauge
Pressure Control Valve

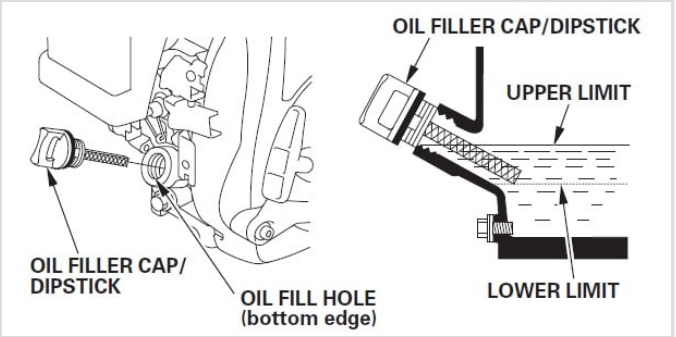
Preparing System For First Use

Your Rainman system can't travel with oil or fuel in the motor. The high pressure pump has oil in it, but it has a travel plug to prevent oil spilling out through a breather plug. A few minutes of preparation is required before first use.

Note that the system was fully tested and operated at the Rainman factory when it was built. As such, there may be some residual water in the plumbing. This is normal. Do not mistake this for looking like a used system.

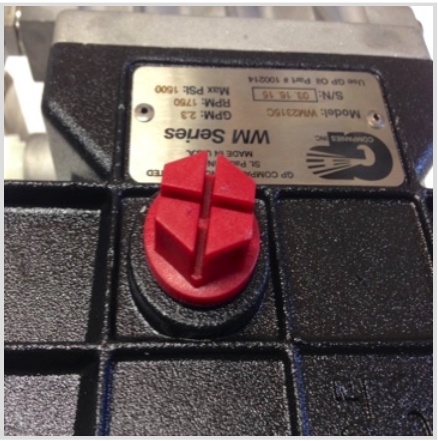
Engine Oil

Fill the engine with 200 ml (0.21 US Qt) of grade 10W-30 or SAE30 motor oil.



High Pressure Pump Travel Plug

Remove the hex oil plug from the black high pressure pump and replace the supplied breather plug. The breather plug has the word "OIL" on it. Save the travel plug in case the unit needs to be shipped in the future.

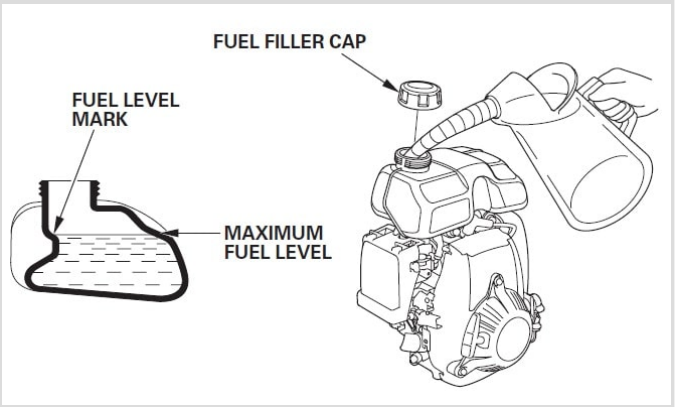


Failure to use the breather plug will eventually lead to oil and or water leaks in the high pressure pump as it heats up during use.

Fill Fuel Tank

The 0.7 litre (0.2 gallon) tank should allow the unit to run for approximately 70 minutes.

1. With engine stopped and unit on a level surface, remove the fuel cap.
2. Check the fuel level. If the level is low, fill the tank to the bottom of the fuel level mark. Do not overfill beyond the maximum fuel level shown. Refill carefully to avoid spilling fuel. Use premium fuel that does not contain ethanol.



Wipe up any spilled fuel before starting engine.

For more information on the Honda motor, consult the provided Honda owner's manual.

Operating The Watermaker

This section explains how to operate the system on a regular basis, including set up, starting, stopping, flushing, and pickling the system.

Setting Up For Use

1. Place the Rainman Pressure Supply Unit (PSU) and Reverse Osmosis Unit (RO) in a stable location. A swim platform is an ideal location.

Make sure the PSU is no more than 2 metres (6 feet) above water level. The unit will work best operating as close to water level as possible.

2. Open the cover of the RO unit. Remove and uncoil the three hoses. Connect the black high pressure hose to the PSU.

3. Open the PSU by removing the front cover.

4. Remove the clear plastic spiral intake hose from inside the PSU. Remove the cap.

⚠ Starting the unit with the cap in place will damage the pumps.

5. Place the intake hose into the source water.

⚠ Ensure the intake hose is submerged and is not on the sea floor or among seaweed, which can cause blockage.

6. Place the green brine output water hose into the source water.

7. Place the white product water hose on the deck of your vessel.

⚠ Make sure the product water hose is NOT initially in your fresh water tank.

8. Ensure the pressure valve on the RO unit is in an open position (fully anti-clockwise).

⚠ Never allow water containing chlorine to enter your watermaker. That includes town or tap water, which contains chlorine, or water from a vessel's tanks, which also may contain chlorine. Chlorine damages RO membranes.

⚠ Never run the unit dry. It will damage the pumps.

⚠ Never start the motor in an enclosed space.

Running The System

1. On the engine, switch the fuel valve lever to teh open position (away from you) and close the choke (all the way to the right).

ainman watermaker fuel lever

ainman watermaker choke lever

2. Pull the cord to start the engine. As the engine warms, gradually adjust the choke until the engine runs smoothly.
3. Water will start flowing out of the green brine output hose.

4. Gradually close the pressure control valve on the reverse osmosis unit by turning clockwise until the pressure gauge reads 55 bar (800 psi). The correct pressure is indicated by the dark green area on the pressure dial. For maximum membrane life, raise the pressure no more than 20 bar (300psi) a minute. Within 15 seconds water will start flowing out the white product hose.

⚠ Never exceed 58 Bar (850 psi). If you over-tighten the pressure control valve, the relief valve in the PSU will release and water will recirculate within the high pressure pump. This prevents damage to the RO membranes from excess pressure. However, prolonged operation of the relief valve can damage the unit.

⚠ If you are using your desalinator for the first time, run for at least half an hour to flush all preservatives from the system.

5. Every time you use the unit, let fresh water flow out the white product hose for approximately 60 seconds to clear water or pickle solution that may be in the system. You should test the product water at this point by taste or with a TDS hydrotester.

6. When the product water is pure, direct the product water hose into a fresh water tank and allow the system to run uninterrupted until full. Check the pressure gauge approximately every ten minutes. Although the ideal pressure is 55 Bar (800 psi), the acceptable range is between 51-58 Bar (750-850 psi). A small amount of pressure drift is normal. Adjust if necessary.

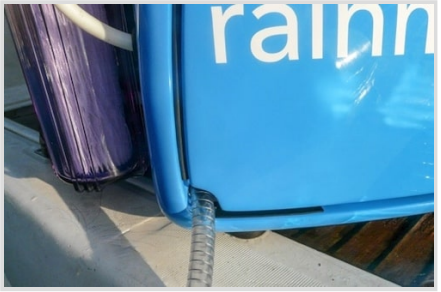
7. Use the white 10 metre (30 foot) product water extension hose to fill multiple tanks without the need to move the desalination system. Use the push-fit joiner provided.

   Product water flow will vary depending on several factors, including temperature and salinity. Warmer or lower salinity water will lead to higher levels of product water output. Natural membrane variability and other factors will play a role in product water output.

   As a guideline every degree Celsius increase in water temperature, product water flow increases approximately 3%.

Unless the weather is hot, we recommend you replace the cover on the PSU during operation. When replacing the cover, take care to ensure the intake hose is placed in the indentation on the bottom left hand corner of the cover. If the ambient temperature is over 35°C (95°F) then leave the cover off to help cool the engine.

If you stop the machine, or it stops due to low fuel, and you intend to start it again within the next 30 minutes it is advisable to remove the lid to prevent excess heat buildup inside. Excess heat buildup inside can cause fuel in the carburetor to vaporise, meaning that the machine will be hard to start again until it has cooled down.



Shutting Down

1. Remove the product water hose from the tank.
2. Slowly turn the pressure control valve in an anti-clockwise direction until the pressure reads less than 20 bar (300 psi).
3. Turn off the fuel valve lever by pulling it towards you.
4. Press and hold the engine kill switch until the engine stops. If you plan to pickle your system for longer term storage, let the carburettor run dry of fuel instead of using the kill switch. This will take approximately 40 seconds.
5. Wait 60 seconds for internal pressure to dissipate before disconnecting the black high- pressure hose from the PSU.
6. Replace the cap on the intake hose to keep the unit primed during storage.
7. Replace the rubber boots on each of the other hoses to keep the system clean and prevent water dripping while stowed.
8. Rinse the strainer in fresh water before storage.

⚠ Switching off the watermaker while system is under pressure will cause pressure shock to the membranes and may damage them.

⚠ Ensure the exhaust has cooled before moving the PSU.

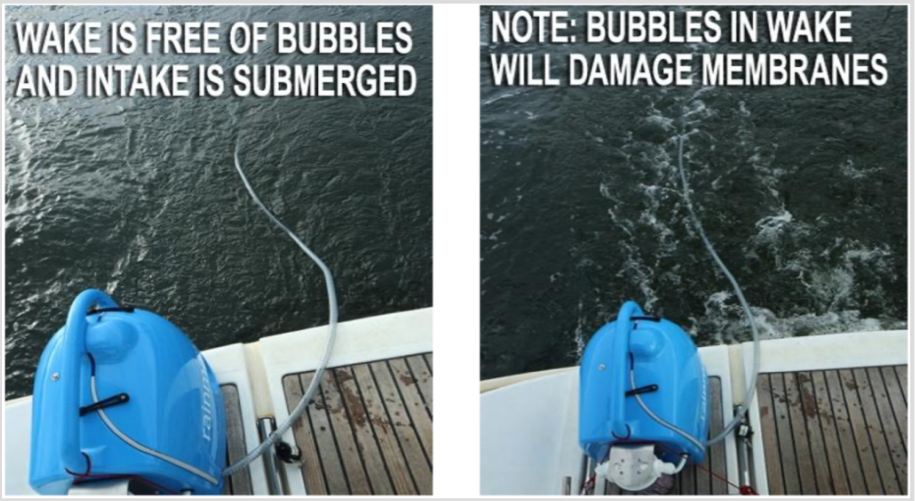
Desalinating While Under Way

Your Rainman watermaker can be operated while under way. Ideally, your unit should be installed and connected to a through hull that is always underwater at all angles of heel and roll. In this case you can operate your system as per the normal procedure outlined above.

Depending on hull shape, speed, and the sea state, air bubbles can find their way to a through hull fitting even if it is well below the water. Some boats, speeds and sea states are not suitable for making water underway.

Several Rainman owners have been successful in using their portable watermaker while under way without a dedicated through hull by trailing the intake hose in the wash at the stern of their vessel. To prevent air working into the system, customers have used either weights or a down pole to hold the intake below the surface.

Slide the intake cap up the intake hose and securing it on board the vessel so that the end of the intake hose can sink sufficiently below the surface.



Do not use the detachable suction strainer when towing the intake hose.

If the intake hose is sucking air, the membranes may be damaged.

Another method of using a portable system whilst underway is by supplying it via a deckwash pump, providing that it is fed from an intake that is below the waterline at all angles of heal and has a minimum flow rate of 10 litres/min, and a maximum output pressure of 3 bar (45 psi).

If using a portable Rainman whilst underway, make sure the system is placed securely and protected from getting wet.

Desalinating Brackish Water

Brackish water contains some level of salt but is less salty than seawater. Examples include estuaries, harbours and saline aquifers (bore water). After heavy rain, some sources of seawater can become less saline.

The product water output levels increase when operating in this decreased salinity source water. If the product water output level goes above the maximum rated output, it may damage the membrane. When desalinating brackish water, use the product water flow meter.

To desalinate brackish water, follow the setup and run instructions as described above, however, whilst increasing the pressure, observe the flow meter. If it reaches the rated maximum product water flow for your system, stop increasing the pressure at this point. Note that in instances of very low salinity water, this pressure can be as low as 13 bar (200 psi).

When desalinating brackish water, it is important to monitor the fresh water production rate using the flow meter, so as not to exceed the maximum flow rate for the membranes.

RATED MAXIMUM OUTPUTS

PSU / RO Type	High Output (2 x 40")	Compact (2 x 21")	Economy (1 x 40")
AC Electric	140lph (37gph)	70lph (18gph)	70lph (18gph)
Petrol / Gasoline	140lph (37gph)	70lph (18gph)	70lph (18gph)
12VDC	Not Compatible	Not Compatible	34lph (9gph)
AC Torrent		230lph (60gph)	

Exceeding the maximum fresh water production rate may damage the membranes.

Care and Maintenance

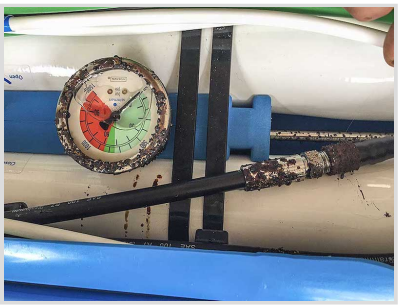
Storage

Always store your Rainman watermaker upright in a dry and ventilated area. Dry any obvious moisture off the unit before putting it away. Water can drip from the unit during storage, particularly in hot weather, and it is very important that there is sufficient ventilation to avoid creating an overly humid environment.

Always store the pickle solution mix away from the watermaker.

⚠ Seawater and/or pickle solution in an unventilated sealed enclosure in the presence of metals can quickly become a highly corrosive environment, causing anaerobic corrosion to any metal, including marine grade 316 stainless steel.

These photos show severe anaerobic corrosion to a system that was stored in an unventilated locker with pickle solution for just 1 month.



Reverse Osmosis Membrane Care

The Dupont Filmtec membrane or membranes in your Rainman watermaker should last between five and ten years if well cared for. The primary way RO membranes are damaged is through biological growth or 'fouling' on the surface of the membranes. This occurs if seawater is left sitting inside the RO pressure vessels for extended periods of time.

In temperate climates, growth can occur in less than two weeks, in tropical climates, growth can occur in as little as a few days. There are no precise times in which fouling can occur, only general guidelines. A conservative approach to membrane care will maximise membrane life.

Regular use of your watermaker is the most effective prevention against fouling. That means using your system at least weekly in temperate climates and every few days in the tropics.

If you are not using your watermaker frequently enough to prevent fouling, then it should be flushed with fresh water or a 'pickle' solution.

The following table is a guide to when you might need to flush or pickle:

RAINMAN FLUSHING AND PICKLING GUIDE	
Unused for 2 days or less	No treatment necessary.
Unusued between 2 and 7 days	Fresh water flush.
Unused between 7 and 30 days	Pickle the system.
Unused for 30 days +	Pickle the system, discard the pre-filter and drain the pre-filter housing. Some pre-filters can turn black if stored too long in pickling solution.

When storing the unit for more than a month, discard the pre-filter and drain the pre-filter housing. Some marine deposits can continue to decompose even when immersed in a pickling solution.

Fresh Water Flushing

The Rainman automatic fresh water flush system is an optional unit that automatically flushes your system with fresh water from your boats water tanks every 7 days. Instructions for the Rainman automatic fresh water flush system are in Appendix 3.

To flush your system manually:

1. After the fresh water tank is full, use the product water direct from the watermaker to fill an open container of water with approximately 10 litres (2.5 gallons) of fresh water.
2. Open the pressure control valve completely and switch off the unit. Remove the intake hose from the source water and place it in the open container of fresh water. Ensuring the pressure control valve remains open, start the unit and run the entire contents through the system. If the watermaker is installed, use the 3 way valve on the intake to draw water from the bucket.
3. When the bucket is almost empty, switch off your watermaker, leaving the fresh water in the system.

Never allow the bucket to run dry while the pump is running or the system may be damaged.

Never allow water containing chlorine to enter your watermaker. That includes town or tap water, which contains chlorine, or water from a vessel's tanks, which also may contain chlorine. Chlorine damages RO membranes.

Pickling Your Watermaker

Pickling fills the membrane housings with a preservative that prevents fouling for up to twelve months.

The best preservative is propylene glycol. Since propylene glycol is a liquid, it is impractical and expensive to ship and store useful amounts. The most commonly used preservative is food grade Sodium Meta-Bisulphate (SMBS) mixed from powder. 1 kg of SMBS powder is supplied with your system. This section describes pickling your system. If you wish to use propylene glycol, instructions are included under the next heading, *Pickling in cold climes.*

1. To pickle your watermaker, add 3 X 29ml scoops (approx. 3 heaped tablespoons) of SMBS powder to a 10 litre (2.5 gallon) bucket of fresh water, making a 1% solution of SMBS. After opening the pressure control valve completely, switch off the unit, remove the intake hose from the source water and place it in the open container of fresh water. Start the system again, keeping the pressure control valve open and run the entire contents through the system.
2. When the bucket is almost empty, switch off your watermaker, leaving the pickling fluid in the system. Do not allow the pickling solution bucket to run completely dry while the PSU is running.

When storing the unit for more than a month, discard the pre-filter and drain the pre-filter housing.

Your watermaker is now pickled and can be stored for up to twelve months.

Do not use SMBS solution at greater concentrations than specified above. High concentrations of SMBS can be corrosive and damage your system.

Avoid inhaling SMBS dust or fumes from SMBS solution. Inhalation of SMBS dust or fumes can cause respiratory problems.

Always store SMBS in a sealed container, in a dry, ventilated place. Even small amounts of air-borne moisture in an enclosed space can react with the SMBS and create a corrosive environment.

Pickling In Cold Climes

If there is a chance that your watermaker will be exposed to freezing temperatures, you'll need to pickle the unit with Propylene Glycol (PG), otherwise known as potable antifreeze. This will prevent damage to the unit through freezing, as well as preventing biological growth.

There are various brands of potable antifreeze available. It is important to note the percentage of PG in the product. Potable antifreeze labelled 'concentrate' is usually near to 100% PG, however, some brands are pre- diluted.

For freeze protection to -15°C (+5°F), use a solution of 30% PG / 70% fresh water.

For freeze protection to -40°C (-40°F), use a solution of 50% PG / 50% fresh water.

Note: if your system has already been pickled with SMBS, flush this out with 10 litres (2.5 gallons) of fresh water before pickling with PG. Mixing SMBS and PG can damage your system.

1. To pickle your watermaker with potable antifreeze, fill a bucket with 10 litres (2.5 gallons) of PG/fresh water solution. With the unit switched off, place the intake hose in the open container of potable antifreeze solution.
2. Start the unit with the pressure control valve wide open. When the bucket is almost empty, switch off your watermaker, leaving the pickling fluid in the system. Do not allow the pickling solution bucket to run completely dry while the PSU is running.

Your unit is now protected from freezing and from biological growth for up to twelve months.

Recommissioning After Being Pickled

After the system has been pickled, it is important to clear it of the preservative before making water. The following procedure should be executed:

1. If the system has been pickled for more than one month, install new prefilter.
2. If the system has been pickled for more than six months, install new impeller.
3. Set up the system as per normal operation.
4. Run the system unpressurised for five minutes. All water going out to brine waste.
5. Pressurise the system as per normal operation, with product water diverted to waste.
6. Make water for at least five minutes with product water diverted to waste. Even if you use the optional control panel and the product water quality LED shows green, you should still run for five minutes before sending the product water to your tank.
7. Test / taste water quality. Pickle solution is distasteful, but not harmful when simply tasted on the tongue.
8. When water quality is good, send product water into the tank for use.

Changing The Prefilter

Pre-filters should be changed when they become visibly fouled.

1. To change the pre-filter, place the Pressure Supply Unit (PSU) on the deck of your vessel. Use the supplied filter wrench to remove the clear filter housing.
2. Replace the cartridge.
3. Fill the housing with water before screwing it back on. This will aid the priming of the pump.

The correct type of cartridge is a ‘sediment’ or ‘particle’ type cartridge with a 5 micron rating. Do not use a carbon cartridge. Some carbon cartridges also function as sediment filters, and therefore may be labelled as ‘sediment’ cartridges and have a 5 micron rating. These are NOT suitable for use with your Rainman watermaker as they will restrict flow rates and cause problems with your high pressure pump.

High Pressure Pump Maintenance

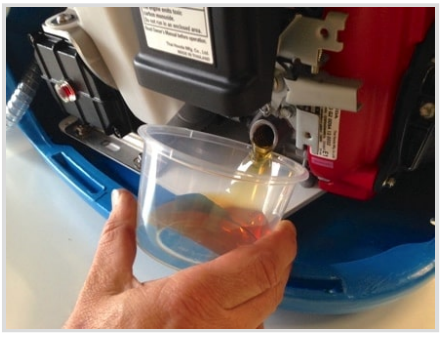
We recommend you change the pump's crankcase oil annually. It is important to check the oil level from time to time, particularly if you have had oil leak or spill from the pump at any time.

The correct oil to use is SAE 30 oil. Any grade that ends in 30 is suitable i.e. 5W-30, 10W-30 and 15W-30 are all suitable. These are the most common grades of automotive engine oil. The equivalent ISO oil grade is ISO100.

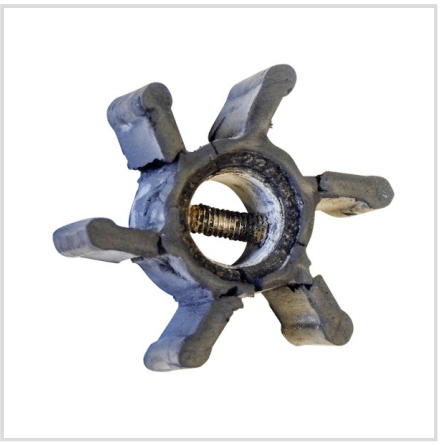
1. Crankcase oil can be drained by using an oil extractor to suck the oil from the crankcase breather hole.
2. To refill the crankcase oil, insert a long stemmed funnel through the breather hold and add 350ml (12 ounces) of oil. Oil levels can be checked via the clear inspection window on the front of the high pressure pump.

Changing Engine Oil

Engine oil can be drained either by tipping the unit forward or using an oil extractor. Only tip the unit forward when the fuel tank is empty.



Lift Pump Service

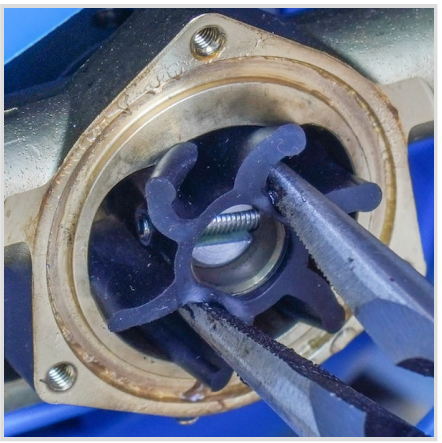


The impeller in the brass lift pump is a consumable item. We recommend inspecting the impeller for signs of wear or cracking every 12 months or 500 hours and replacing if appropriate. The photo on the right shows a heavily worn impeller.

As a matter of preventative maintenance, replace the impeller every year or 500 hours.

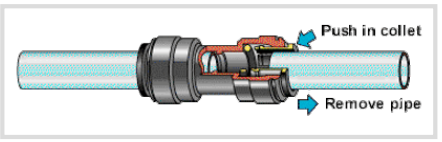
The lift pump impeller can be accessed by inside the PSU, just above the black high pressure pump.

1. Using a 7mm socket, remove the 3 bolts and the triangular plate.



2. The impeller can then be removed with needle-nose pliers.
3. Replace impeller with needle-nose pliers using a rotating motion to bend the fins and align the cross-screw with the slot in the shaft.

Push-Fit Instructions



Rainman watermakers use push-fit connectors for brine waste and product water.

To connect, simply press the hose firmly into the connector. To remove a hose from the Push-fit, press in the collet as shown in the diagram.

Shipping

To prepare the unit for shipping:

1. Pickle your reverse osmosis membranes if possible.
2. Empty the pressure supply unit of fuel and ensure the tank has run completely dry.

3. Leave the fuel cap off of the system for 24 hours to ensure any residual fuel is fully evaporated away.
4. Drain the oil from the Honda motor by tipping the system forward and emptying into an appropriate waste container.
5. With a dry rag, clean the internals and externals of the system to remove any fuel, oil or dirt residue.
6. Replace the breather plug in the high pressure pump with the travel plug that the system was originally shipped with. If you have misplaced your original travel plug, then ensure the pump is drained of oil.
7. Pack into a sturdy cardboard box, using foam, cloth or paper to pad the system sufficiently. Place the system inside a large plastic bag within the box. Tape the box securely.

Service

If your watermaker exhibits any of the following problems, stop the unit immediately and consult your Rainman dealer:

- Unusual noises or vibration.
- The system pressure will not reach 55 bar (800 psi).
- With the unit running, there is no water flow through the green brine output water hose.
- The white product hose continues to make salty tasting water after several minutes at 55 bar (800 psi).
- Major leaks of water in the PSU or the RO unit.

Alternatively, you can contact Rainman directly for support at **www.rainmandesal.com/support-request**

Warranty

Rainman desalinator pressure supply unit and RO membrane units are guaranteed to be free of manufacturer defects and to perform within the published specifications for a period of two years from the date of shipment to the original purchaser.

In the event of a warranty claim, Rainman Technology will inspect the defective component and repair or replace at our discretion. All shipping charges are the responsibility of the purchaser to and from our office in Sydney, Australia.

The warranty is void if the system was mishandled, abused, or not operated / maintained as directed by the user manual. Consumable items, such as the pre-filter cartridges, lift pump impeller, high-pressure pump oil, high-pressure pump packings, high pressure hose, engine lubricant, or RO membranes are not covered under the terms of this warranty.

Rainman Technology's liability under this warranty is limited to repair or replacement of our systems to the original purchaser. Under no circumstances is Rainman Technology liable for consequential damages related to the failure of the system to perform.

The engine holds a three year Honda warranty. The system can be brought to your local Honda dealer for engine warranty issues.

Troubleshooting

For troubleshooting the operation of your Rainman, we have a dedicated page in the support section of our website.

Rainman Troubleshooting Guide