

ANU SCUBA CLUB

Compressor guide



Version control	Name
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ANU scuba club compressor use guidelines:

The ANU scuba club has two compressors, a 2011 Bauer Mariner 250, referred to as “Mariner” in this document, and a 1972 Bauer Utilis referred to as “Utilis”. The purpose of this document is to provide guidance on when the compressors can be used, how to operate them and how to maintain them. If you are undertaking in-depth work on the compressors, hopefully the contents of this guide is not new to you. For more technical detail refer to the documents referenced at the end of the guide.

Mariner:

The mariner, also known as “the big compressor” or “the new compressor” was acquired by the club in 2011. The compressor was purchased through a competitive tender process with three suppliers, and at a cost of approximately \$20,000. Much debate was had over several years about the relative merits and economics of buying a new compressor. In the end, the primary driver was the reliability of the compressors we took on our Lady Musgrave trip – the compressor we had been hiring up to that point was becoming increasingly temperamental on the island, with resulting lost diving in a remote environment. The intent is for this compressor to be the clubs primary compressor over the decades to come.

Fill rate	250L/min (about 8 minutes per tank)
Weight	140kg (minimum 3 person lift)
Year	2011
Role	Primary compressor

The mariner has wheels with a locking mechanism attached to the frame. These wheels can be removed for transport if required.

Utilis:

Purchased in 1972, the utilis has been with the club longer than many of our members have been alive. As such, it’s showing its age a little! The utilis was originally acquired by the club to allow more remote trips – to areas like Green Cape, and other areas where tank fills were not commercially available. 2012 saw a new engine, and an overhaul of the final stage of this compressor, with the hope of extending its life by 5-10 years.

Fill rate	90L/min (about 25 minutes per tank)
Weight	70kg (minimum 2 person lift)
Year	2011
Role	Backup compressor

When can we use the compressors?

The compressors are for the benefit of the club and its members. The club encourages members to make use of the compressors, when appropriate. For example:

- Use the compressors on trips where tank fills are a long way away. Good examples are Lady Musgrave Island, Seal Rocks, Port Hacking, Honeymoon Bay and Green Cape. As a general rule, if there is a dive shop close by, we tend to make use of the dive shop for tank fills.
- The compressor should be used for convenience, as opposed for financial gain. As a general rule, fills should be no cheaper than that available at dive shops.
- Generally, it makes sense to only take the mariner. If an extended duration trip necessitates redundancy (such as Lady Musgrave Island), consider taking the utilis as backup.
- Due to the costs of transportation, and the set-up/pack up overheads, it typically does not make sense to take the compressor on two day weekend trips.

Compressor dollars

- Tank fills should be priced by the trip organiser at a reasonable par to commercial rates. As a guide, tank fills have been charged at \$8/fill for all 2012 trips.
- Lady Musgrave Island is an exception, where a flat return for the trip is expected within the LMI budget. In 2012, the committee has priced this at \$1500 for the trip.
- The compressors are expensive equipment – please treat them with respect and keep them secure.
- The club needs to raise sufficient revenue from the compressors to fund consumables (fuel, filters, parts), and to amortize future replacement of the compressors.
- A towing subsidy of 5L/100km is provided to whoever transports the compressor, be it in a trailer or in their vehicle.
- Compressor fuel can be treated with boat fuel in trip accounting.

Who can operate the compressor?

- Any club member on a trip can operate the compressor to fill their own tank. The labour of filling the tank should be provided by the person who emptied the tank.
- At least one club member familiar with the setup of the compressors must be present at the set-up/pack-up of the compressor.

Compressor setup

1. Determine where you want to run the compressor. Considerations include:
 - a. Flat, easily accessed land
 - b. Compressors are noisy, so away from people
 - c. You will need to locate the snorkel near the compressor, upwind, and preferably higher up. Ideally, you would have a tree with a fork a few metres above the ground upwind from the compressor.
2. Unload the compressor, the compressor box, snorkel and a jerry can of fuel (regular unleaded)
3. Put the compressor in its location, aiming the exhaust away from the snorkel. Ensure that the compressor is level. Lock the wheels on the mariner.
4. Throw the snorkel rope through the fork in the tree (or improvise). One end of the snorkel needs to be attached here. For the utilis, face the hose down, to stop it filling up with bird poo!
5. Attach the snorkel (black for the mariner, white for the utilis) at the compressor end. Secure with hose clamp and/or wrap with duct tape. This is important, as bad seal = poisoned air.



6. Check the engine oil (dipstick on engine). Top up if necessary.
7. Check the compressor oil (sight glasses on Mariner on both sides of block, dipstick on utilis). Top up as necessary. **WARNING – THE COMPRESSORS USE DIFFERENT OIL. DO NOT MIX THEM**
8. Check the fuel level. Fill the tank (regular unleaded). If you spill fuel, don't start the compressor until it has all evaporated and the vapour dispersed.
9. Check the filter status. This can be done on the B-timer on the mariner. Push the enter button, and scroll with the up arrow until the filter % is shown. If this is below 10%, change the filter (see that section). The filter on the utilis should be repacked prior to being set up each trip.
10. Remove any transportation tape from the fill whip
11. Secure the bleed lines so they won't whip around when bled.
12. Visually check the compressor for obstruction. With the motor switch set to off, gently pull the starter cord to check for obstruction.
13. Congratulations, you are set up!

Compressor packup

1. With the compressor running, set the throttle to mid-point. Turn the fuel switch to off. Wait for the compressor to run out of fuel. Failure to do this will result in glazing of the carburettor, and make the compressor unstart-able next year.
2. Let the compressor cool.
3. Disconnect and pack the snorkel into the bag.
4. Bleed any residual moisture out of the drains.
5. Secure the fill whip(s). The glass of the gauges is fragile – if rough handling is likely (LMI) the gauges should be covered with old rag, secured with tape. The fill whip should be securely taped to the compressor frame.
6. The compressor is now ready for transportation. Once loaded, or stored, please ensure the cover is securely fitted to the compressor.

Compressor startup (compressor has already been setup)

1. Remove the cover, and place where it won't blow away.
2. Check the engine oil (dipstick on engine). Top up if necessary.
3. Check the compressor oil (sight glasses on Mariner on both sides of block, dipstick on Utilis). Top up as necessary. **WARNING – THE COMPRESSORS USE DIFFERENT OIL. DO NOT MIX THEM**
4. Check the fuel level. Fill the tank. If you spill fuel, don't start the compressor until it has all evaporated and the vapour dispersed.
5. Check the filter status. This can be done on the B-timer on the mariner. Push the enter button, and scroll with the up arrow until the filter % is shown. If this is below 10%, change the filter (see that section). The filter on the utilis should be repacked prior to being set up each trip.
6. Check the snorkel is securely attached and still upwind.
7. Check that the knob on the top of the filter is set to "operate" (Mariner only)
8. Check the compressor for obstruction.
9. Switch the fuel lever to ON (bottom lever)
10. Switch the ignition switch to ON (switch on side of motor)
11. Set the throttle (top lever) in the middle
12. Switch the choke (middle lever) to off (the same direction as the fuel lever).
13. Pull the starter. The compressor should start. Once started, set to full throttle. Didn't start?
 - a. Too hard to pull? Open the separator (bleed closer to motor). Should now be easier to pull.
 - b. Pulls but does not start? Try some choke (middle lever). Try mid-way, or full choke. Once started, remove choke as soon as the motor runs smoothly without it.
 - c. No good? Double check the fuel.
 - d. Still won't start? Find someone who is good with motors!
14. Once running, bleed filters and fill whip.
15. Compressor is ready to fill tanks.

Compressor shutdown

1. If the compressor is going to be started again soon:
 - a. switch the ignition to Off.
2. If the compressor is going to be used again this trip (e.g end of day)
 - a. switch ignition to Off.
 - b. Bleed filters
 - c. Allow to cool and cover compressor. If leaving the compressor, or going to bed, check that the compressor is in a secure area.
3. If the compressor is not going to be used again this trip, follow directors for compressor pack-up

Filling a tank

1. Label your tank with the duct tape and permanent marker in the compressor box. No name → no fill
2. Put your empty tank at the back of the empty tank line. Jumping the queue may result in your tank being hidden in the bush.
3. At the front of the queue and ready to fill? Earmuffs first. If the compressor isn't already on, see the section on starting the compressor.
4. Bleed any water from your tank. This means opening your tank for a few seconds.

5. If the fill whip isn't attached to a tank already, attach the fill whip. This is like attaching a regulator – a Yoke tank has been shown. The whips on the mariner can also screw into DIN fittings. If it is attached, wait for the first tank to be filled.



6. Close the bleed screw



7. Open your tank



8. Bleed the filters (2 on each compressor). A few seconds - just until liquid stops coming out. Be gentle in opening and closing them. When opening them, they may cause dirt to spray, or the bleed line to whip around. Excessive force closing them damaged the valve seats. You need to tighten them just enough to stop the air flow.





9. **IF THE COMPRESSOR DOES ANYTHING STRANGE, TURN IT OFF.** If the compressor runs out of fuel, let it cool down, refill (regular unleaded), and follow the startup procedure.
10. Wait till your tank is full (225 bar, check the gauge). Once at this pressure, the compressor will start to bleed air.
11. Once the tank is full, close the valve on your tank.
12. Close the fill valve (Utilis only).
13. Bleed the fill whip (both Utilis and Mariner).
14. Disconnect your tank. Put it in a separate place from the empty tanks.
15. Take the next empty tank in line
16. Follow steps 5-8.
17. Find the person who's tank has just been connected. They need to go to the compressor to complete their fill. At that time, not after their lunch, not after their chat. The compressor should not be left unattended.

Changing a filter (Mariner)

1. The mariner has a timer to estimate remaining filter life. If the remaining life is less than 10%, change the filter.
2. Stop the compressor.
3. Bleed both drains until empty.
4. Take the metal bar from the compressor box. Use this in the filter housing to unscrew the cap. Be careful that you just turn the cap, not the whole filter barrel. You might need to have someone hold the filter barrel still.



5. Remove the cap. Place somewhere clean, where grit will not get on the o-rings.



6. Remove the used cartridge using the metal handle. Using a permanent marker, write USED on the cartridge 3-4 times. This can now be disposed of. **DO NOT PUT IT BACK IN THE COMPRESSOR BOX**



7. Open a new filter cartridge from the compressor box. Remove from the sealed bag. Remove both end caps. **NOTE – IF YOU DON'T REMOVE BOTH, THE FILTER IS VERY DIFFICULT TO REMOVE NEXT CHANGE**
8. Place the new filter into the chamber. Press down firmly – you should feel and hear it pop into place



9. Check the o-rings on the filter cap for grit and debris. Clean if necessary. Screw the cap into the top of the filter. Tighten gently – only two fingers tight on the bar.
10. Reset the B-Timer by holding down the enter button for ~5 seconds. The % counter should reset to 100%.
11. Follow the procedure to start up the compressor.

Changing a filter (Utilis)

1. The utilis has a hand packed filter cartridge. This needs regular changing – in practice at least every 30 fills, or ~3-4 days on LMI, depending on usage.
2. Turn off the compressor.
3. Open both bleeds and allow all air to drain.
4. Disconnect the swaged inlet pipe with a spanner. Sometimes the taper can get a bit stuck – try not to bend the pipe too much when freeing this.



5. Unscrew the filter housing. This can be quite stiff. Note that it might seem to stop turning, until you apply some upwards pressure to the cap (use the gold coloured over pressure relief valve).



6. Unscrew the filter cartridge from the filter cap



7. Take the filter cartridge to a clean place where you can work on it.
8. Remove the spring clip. Make sure you keep the spring – it can go flying at this point!



9. Empty the cartridge into a container. Keep the two perforated metal discs.



10. Make sure the cartridge is empty – you should see light through the hole. Place the disc in the cartridge, followed by two cotton balls.



11. Tamp down with a blunt instrument. A permanent marker works well. Fill 40% full with activated carbon.



12. Tap the side gently for 10 seconds to get the carbon to settle. Place one cotton ball in the filter. Tamp down with the blunt instrument.



13. Fill to just below the spring line with 13x molecular sieve. Tap, cover with two cotton balls and tamp down.
14. Place the second metal disc on top of the cotton balls.
15. Secure with the spring clip. The spring clip should be very firm – i.e. the filter material under some compression when finished.



16. Re-install into the housing cap
17. Check the o-ring in the housing cap for debris.
18. Screw down the housing cap. Be careful to align the inlet connector with the steel tube.
19. Reconnect the inlet tube.
20. Follow the procedure for starting the compressor.

Working bee compressor tasks

1. Inspect the compressors for damage / corrosion / exterior wear
2. Check the feel (“sloppiness”) of the bearings, belt, bushings.
3. Audit the compressor box against the inventory. Replace any missing parts.
4. Change the engine oil on the motor every year.
5. Change the compressor oil every second year (odd numbered years).
6. Re-pack the utilis filter
7. Start the compressor and fill a tank.
8. Shut down the compressor, leaving the filters full. Listen carefully for any air leaks. Leave connected to tank and pressurised for ~30 minutes. Check for any drop in pressure. If any leaks / drops in pressure detected, use soapy water to identify the location of the leak and rectify.
9. Re-start, and follow procedure for pickup.

Compressor spares (compressor box) inventory

A plastic tub contains a variety of compressor parts and consumables that should cover likely situations arising from the compressor. Check these contents each working bee! For specialised parts, see the attached suppliers list:

Part	Number	Supplier
Filter cartridge for Mariner (unused), BAUER 80114	2	August Industries (cheaper), Pro Diving Services (faster)
Activated carbon	1*1 litre bottle	Pro diving services
13x Molecular sieve	1*1 litre bottle	Pro diving services
Cotton balls	One bag (~100)	Supermarket
Air filter, Mariner (Honda AFZE28)	1	ACT small engines
Air filter, Utilis (Honda AFZE18)	1	ACT small engines
Compressor oil, Mariner (Mobil Rarus 829)	1*2.5 litre bottle	Pro Diving Services
Compressor oil, Utilis (Shell Corena P150)	1*1.25 litre bottle	Pro Diving Services
Engine oil, 10W40 (both Hondas)	2*1 litre bottle	Car shops / garage
Spark plugs (both), NGK BPR6ES	2	Car shops / garage
Ear muffs	2	
Fire extinguisher (dry chemical type)	1	
Funnel + thin adaptors (for both fuel and oil changes)	1	
Spare belt, Mariner, SPA(TBC)	1	M&G Industrial
Spare belt, Utilis, SPZ1470	1	M&G Industrial
Duct tape (for labelling tanks)	1 roll	
Permanent marker	2	
Honda spark plug wrench extension	1	
BAUER valve removal tool (new type)	1	
Bar for filter removal	1	
Spare O-rings for P31 filter	4	

Bauer filter drain taps & seats	2 taps, 4 seats	Pro Diving Services
Allen keys	1*5mm, 1*6mm, 1*8mm	
Thin rope for snorkels	2*15m+	
Compressor snorkels (external to box, each in fertilizer bag)	1*black, for Mariner] 1*white, for Utilis	

Parts Suppliers:

ACT small engine specialists

Unit 1, 30 Raws Crs, Hume, ACT 2620
02 6260 1828

August Industries:

<http://www.augustindustries.com/>

Note – August Industries are a cheaper supplier of filter cartridges, ~\$100 unit, as opposed to \$200+/unit locally. Allow several weeks lead time on ordering, order in batches to save on freight

M&G industrial

<http://www.mgis.com.au>

3/5 Wiluna St Fyshwick, ACT
02 6280 7517

Pro Diving Services

<http://www.prodivingservices.com.au>

Unit 5/12 Anderson St, Banksmeadow, NSW 2019
02 9316 4013

Technical references:

Background reading on compressors and filtration theory

<http://www.neptunoworld.com/articles/Understanding%20Compressors%20Article.pdf>

A good background paper on compressor basics, and why filtration is important

Workshop manual for Mariner

http://www.scubaengineer.com/pictures/compressors/bauer/utilus_capitano_mariner_manual.pdf

A workshop manual for the Mariner. Provides more technical detail than the owners brochure provided at purchase.

Honda engine manuals

<http://engines.honda.com/parts-and-support/owners-manuals/GX270> for Mariner

<http://engines.honda.com/parts-and-support/owners-manuals/GX160> for Utilis