NQUEC COMPRESSOR OPERATING PROCEDURES

Introduction

Page 24 of the *Bauer Compressor Operating Manual* states that the owner of the compressor should develop their own operating procedures which incorporate owner-specific requirements and local regulations. Therefore, this set of operating procedures is provided to NQUEC compressor users as an additional reference source, complementary to the instructions contained within the *Bauer Compressor Operating Manual.*

Scope

The following procedures were derived from the equipment manufacturer's instructions, and then supplemented with Club-specific requirements. If compressor users find a discrepancy between these procedures and the manufacturer's instructions, then users should follow the manufacturer's instructions and advise the NQUEC Equipment Officer of the problem.

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PRE-START UP CHECKS

1. Ensure each empty cylinder has a current hydrostatic test stamp. Out of test cylinders, or cylinders with illegible test stamps must not to be filled.

2. Inspect each cylinder valve o-ring for damage such as cuts or splits. Replace damaged o-rings with new o-rings, held in the NQUEC Save-a-Dive-Kit. Also ensure o-rings are properly seated within the o-ring groove of the valve.

3. Ensure cylinder valves are clean, dry, and easy to access (i.e. BCDs left fitted may need to be re-positioned if they interfere with the connection of the filling yoke). Contaminants such as saltwater and sand can be blown free from the center of the valve by momentarily 'cracking' the valve open and then closed.

Correct positioning of the compressor is fundamental to preventing Carbon Monoxide contamination of the compressed breathing air.

4. Position the compressor on a stable and level surface, away from other engines or possible contamination sources, and with the compressor air intake directed up-wind and the motor exhaust directed down-wind.

5. Check the compressor has the correct oil level as per *Bauer Compressor Operating Manual – Page 84.*

6. Check the motor has the correct oil level as per *Subaru Engine Operating Manual – Page 5.*

7. Ensure the motor fuel tank is full. Note that a full fuel tank fills no more than 8 cylinders.

8. Assemble each section of compressor air intake tubing and fit to the compressor suction filter. Make sure the base of the intake tubing is fully seated inside the suction filter housing.

9. Drape the filling yokes over the compressor frame. Ensure the filling hoses do not contact the motor exhaust, and the yokes and gauges do not contact the ground.

10. Fully release system pressure by opening all three condensate drain cocks and both filling valves, (to ensure the compressor starts without load).

11. Close all drain cocks and one filling valve, but leave the other filling valve open.

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COMPRESSOR START UP

1. Move the red motor stop switch to the <ON> position.

2. Open the motor fuel cock by moving the black fuel cock lever in the direction of the arrow.

3. If the motor is cold, close the choke by moving the grey choke lever to the <START> position, (all the way to the left).

4. Set the motor start speed by moving the yellow throttle lever to about ⅓ of the distance between the idle speed stop (tortoise symbol) and full speed stop (hare symbol).

Hearing protection is held in the compressor kit.

5. Grasp the starter grip; take up the slack in the cord until slight resistance is felt, and then pull the grip to fully withdraw the starter cord in one smooth movement. Gently return the starter grip to the motor.

6. Gradually open the choke as the motor begins to run by moving the choke lever back to the <RUN> position, (all the way to the right).

7. Close the filling valve and gradually increase motor speed by moving the throttle lever towards the full speed stop.

Don't apply force to the throttle lever once the full speed stop is reached.

8. Run the compressor to 'final pressure' to confirm correct functioning of the final pressure safety valve by gradually moving the motor throttle lever to the left until it touches the full speed stop. Final pressure is reached once pressure vents from the final pressure safety valve (mounted on top of the P21 filter assembly) and the pressure gauge needles remain stationary at 225 Bar.

9. Drain condensate by opening each drain cock (one after the other) for at-least 5 seconds.

10. Carefully open both filling valves (in a safe direction) to purge the compressor for 2 minutes, then close the filling valves.

CYLINDER FILLING

1. Confirm the filling yokes are clean (free of surface contaminants) and connect the yokes to the first two cylinders to be filled. Note that o-rings provide the seal for the delivery of compressed air, so avoid overtightening the yokes.

All valves (including drain cocks) should be opened and closed <u>slowly</u> to avoid sudden pressure changes. For example, aim to operate the filling valves and cylinder valves so that the gauge needles don't 'jump' to the new reading.

2. Open one filling valve counter-clockwise (CCW), then open its corresponding cylinder valve CCW.

3. Now open the other filling valve, and then open its corresponding cylinder valve. Note that the two cylinder pressures will equalize, and the gauge needles will move to the new combined cylinder pressure.

The compressor filtration system has been designed to operate most effectively when condensate is drained every 15 minutes. Opening the drain cocks more frequently than this during filling shortens filter life, and places unnecessary differential pressure loads on the filter housing.

4. Monitor the gauges throughout the fill, and drain condensate by opening each drain cock for at-least 5 seconds every 15 minutes. Note that moisture is expelled under pressure, so be mindful of where the drain cock outlets are pointing. A rag can be used to 'muffle' expelled moisture.

5. Fill cylinders until the gauge needles reach the black pen marks on the face of each gauge. At this point, close one cylinder valve clockwise (CW), then close its corresponding filling valve CW, and continue turning the filling valve handle CW until line pressure is vented (indicated by a high-pitched momentary 'hiss').

6. Close the other cylinder valve, then close its corresponding filling valve, again until line pressure vents.

7. Disconnect filling yokes from the cylinders.

8. Repeat these steps until all cylinders are full.

COMPRESSOR SHUT DOWN

1. Reduce motor speed by slowly moving the throttle lever to the right, gradually returning the motor to about ⅓ speed, and open one filling valve (in a safe direction) to reduce system pressure.

2. Run the compressor at this reduced speed for a further 1 to 2 minutes.

3. Close the filling valve and move the motor stop switch to the <OFF> position.

4. Drain condensate and close the motor fuel cock by moving the fuel cock lever in the opposite direction to the arrow.

5. Open and close one filling valve as necessary to depressurize the system to around 80 Bar. Retaining this system pressure prevents ambient air and moisture from entering the compressor.

6. Perform a final check of the drain cocks and filling valves to ensure they are fully closed.

7. Drape the filling yokes over the compressor frame. Ensure the filling hoses do not contact the motor exhaust, and the yokes and gauges do not contact the ground.

8. Once the compressor is cool to touch, refuel the compressor motor. The 4-stroke motor uses 91 octane ULP. A fuel funnel and rags for cleaning the funnel (plus any fuel spills) are held in the NQUEC compressor kit.

9. Protect the compressor from the elements by disassembling the compressor air intake tubing, and covering the machine with a suitable tarpaulin. Confirm the suction filter housing is fully covered to prevent entry of water and other contaminants.

USER NOTES

a) The prime objective of a compressor filtration system is to produce breathing air to a purity which is safe for consumption at depth. *Australian Standard 3848.2 - 1999* defines this safe purity as air containing not more than 5 ppm CO, 600 ppm CO_2, and 0.5 mg/m^3 of oil. To achieve this, the compressor must first be supplied with clean air, and this is done by correctly positioning the unit. The compressor air intake must be positioned up-wind, and the motor exhaust must be directed down-wind. The unit must never be operated in an enclosed space, and it must be sufficiently remote from other engines and potential contamination sources.

b) The B-timer (hour meter) will count compressor operating hours and calculate filter saturation. Therefore, manually recording operating time is only necessary if the B-timer fails during a dive trip.

c) Users must be aware that the B-timer displays filter saturation with an image of a filter containing 4 segments. These segments appear progressively from the bottom of the image to the top as the service life of the filter is consumed. Four segments indicate total filter saturation.

d) Where possible, fill in the shade and during the cooler parts of the day. This is because filter life is reduced as ambient temperature increases.

e) Temperature and pressure are proportional, so users should expect a slight drop in final cylinder pressure as the cylinder cools to ambient temperature after filling. This is completely normal, and users may elect to 'top up' an already filled cylinder, after a period of cooling. Filling cylinders immersed in a large container of water can reduce this pressure drop, but will not eliminate it.

f) When filling cylinders in pairs; fully disconnect both full cylinders before connecting the next empty cylinders, to prevent a freshly filled cylinder from equalizing into an empty cylinder.

g) Most cylinders filled with the Club compressor use a yoke valve, rather than a DIN valve. Users may set up the compressor to enable filling cylinders with DIN valves, however, they must plan their filling sessions so that conversions to accommodate both yoke and DIN valves are not performed during a filling session with a running compressor. Fill cylinders with DIN valves in a separate filling session.

h) Spring tension helps keep the condensate drain cocks closed; therefore, avoid over-tightening them, (use light finger pressure only).

i) When moving the compressor for transport, try and keep the unit as level as possible, and delay starting the compressor after moving it for at-least 10 minutes to allow oil levels to stabilize before they are checked.

j) If operating the compressor on a vessel, carefully consider where the unit is positioned to prevent air supply contamination as well as exposure to salt spray and deck wash, and never fill during rough conditions.

k) Divers should also avoid standing or leaning over the compressor immediately after a dive, to prevent saltwater from dripping onto the unit.

l) If users have any questions or concerns, they should refer to the *Bauer Compressor Operating Manual* and seek assistance from the NQUEC Equipment Officer.