

**Crawley Branch
of
The British Sub-Aqua Club.**

Compressor Operation Guidelines

Version 1.1 – 12 September 2011

For safety reasons:

- a) Only authorised Compressor Operators should use the Compressor Equipment.
- b) Operators should wear ear defenders.
- c) There should ideally be two people present in the hut when the machinery is in operation.
- d) The operators should ideally be the only people in the room when the machinery is in operation.
- e) Operators should not leave the equipment running unattended.
- f) The operators should only fill cylinders marked with a valid test stamp. If you are doubtful about the test status of any cylinder, refuse to fill it.
- g) Do not over-tighten valves and knobs – just finger tight is sufficient

Pre-Operational

Fill in Compressor Log

1. Complete a new log entry in the Compressor Log. Enter your name and today's date.

Consumables Checks

If you only intend to fill cylinder from banks, and not run the compressor, then you may skip the steps below.

1. Check the thermometer on the wall. If the ambient temperature is below 5°C then do not run the compressor.
2. Check the “Number of hours run” on the compressor, and enter this into the Compressor Log, under “Start Hours”.
3. Compare this to the figure written on the board as “Next filter change due at”.

If the filter is due within the next three hours, then notify the Equipment Officer

If the filter change is overdue, then contact the Equipment Officer before using the compressor.

4. Check the water/oil emulsion container level [*This is a container on the floor, next to the wall, to the right of the two banks*], and empty it if necessary into the large orange oil recycling container..
5. Check the oil level in the compressor by unscrewing the red plug that lies underneath the intake air filter on the compressor. The oil level should be at least level with the stick on the underside of the plug. If necessary, top up the oil carefully from the small container of fresh compressor oil, and wipe up any oil spills that you might cause.

The red plug may be hard to unscrew by hand – if so, then apply gentle force using a pair of pliers. Ensure that the red plug is replaced correctly and securely, (it is made of plastic, and it is possible to cross-thread it) as a major loss of oil can result if not.

Start and Fill

Start Prime Mover

1. Check that all filter and separator tower valves are closed. There are three of these mounted on the compressor base on the left hand side.
2. Check that all charging valves and bank control taps are closed.
3. Ensure that the Electrical Isolator Switch box, on the wall to the right of, and behind, the compressor, is in the “On” position.
4. Ensure that the Emergency Stop button on the top of the compressor, on the far left hand side, is in the “run” position – i.e. fully out.
5. Ensure that the Emergency Stop button, marked “Stop/Lock” on the Control Panel, is in the “run” position – i.e. fully out.
6. Press the “Start/Reset” button on the Control Panel to start the compressor.

Check Cylinder

1. Check that each cylinder meets the requirement for filling:
 - within test date
 - correctly labelled
 - manufactured to a valid standard.
2. Note the working pressure – not all cylinders are rated to 232bar.
3. Enter the details of the cylinder into the Compressor Log.
4. Check the current pressure in the cylinder. Using a separate pressure guage is a recommended way of doing this.
5. Check whether the cylinder is labeled as being in “Oxygen Service”. If it is, then only fill it from the Clean Air Filling Station.

Providing all of the requirements of a cylinder are met, it should be safe to fill it. If there are any doubts as to the markings or labelling, or if the cylinder looks to be in a poor physical condition, then as a compressor operator you have the right not to fill it.

Connect Cylinder & Start Filling

1. Connect the cylinder to the flexible hose of the outlet connector (whip) from the charging panel.

If you are presented with a DIN valve for filling, then check for a second time that the cylinder is not in oxygen service. Use a DIN insert if necessary to adapt the cylinder to the outlets from the charging panel. Do not forget to remove and return the DIN insert once the cylinder is charged.

Our compressor is currently unable to charge cylinders with 300bar DIN valves directly from the whips. At time of writing a 232/300 bar DIN adapter is present in the Club Hut, usually located on top of the compressor control panel.

Outlet safety valves are currently set to 250 bar –it should not possible to charge a diving cylinder higher than this. This does not mean that is is safe to charge a 232 bar, or a 208 bar cylinder to this pressure. Do not rely on this safety valve to prevent overcharging of a cylinder.

On our multi-outlet system, several cylinders can be filled at the same time. Try to fill cylinders of the same working pressure together. If this is not possible fill the lower WP cylinders first. When they are filled, close the cylinder shut-off valve and let the higher WP cylinders fill.

Do not attach cylinders that are not in oxygen service to the Clean Air Filling Station. While the non-return valves help avoid any contamination, they do not prevent it, but more importantly, the filter tower on the Clean Air Filling Station has a limited life, and is expensive to replace, and we would like to reserve its use for cylinders that require it.

Diving cylinders heat up when being filled. If action to reduce the effect of heating is not taken, when the cylinder cools down the pressure will be considerably less. While filling from a high output machine, it is a good idea to submerge cylinders in a cold water tank. Immerse each cylinder up to its shoulder in water, or if there are multi-outlets, fill more than one cylinder at a time. If cylinders get noticeably warm while filling, do not compensate by overfilling. You may however choose to 'top them up' later after they have cooled.

Should anything out of the ordinary occur during filling operations, stop the compressor immediately and investigate.

Remove Cylinder

1. Allow the cylinder pressure to build up to its working pressure as indicated on the outlet pressure gauge and then close the cylinder valve.
2. Close the charging valve and vent the pressure from the interstitial space or the hose, and disconnect the cylinder from the charging hose.

At the point where the cylinder pillar valve is closed the compressor outlet pressure will begin to increase rapidly and the compressor relief valve will lift and vent the excess gas. The compressor, when at maximum pressure, will run for a short time, then automatically shut off. It is recommended that between filling individual cylinders, the compressor is used to charge the banks.

Keep filled cylinders separate from empty ones. Putting masking tape around the valves of full cylinders also helps to keep dirt out of the air way.

Drain Condensate

The compressor has automatic drains which will open periodically. There will be a hiss and a mixture of air, water and emulsified oil, usually white, will be expelled and captured in the dedicated container.

Shutdown and Log

Stop Compressor

To stop the compressor in an emergency use either of the STOP buttons.

Before stopping the compressor normally, ensure that the storage banks are charged to their full capacity, time permitting.

1. Close all charging valves and bank taps.
2. Let the compressor run up to full pressure (c 275bar). The compressor will go into a unload condition and carry on running for about 3 minutes. then it will automatically stop.

Should you subsequently wish to restart the compressor, then relieve some of the pressure from any charging valve, and the compressor will start up again automatically.

3. Press one or both of the Emergency Stop buttons mentioned earlier to prevent a further automatic restart..
4. Close the Air Control Valve at the Clean Air Filling Station. Open the valve on the end of the charging whip at the Clean Air Filling Station to release any pressure. Close the valve again.

(If you don't do this, then you will leave the whip pressurised, which uses up the battery in the digital pressure gauge.)

5. Open the valve on the end of one or both charging whips on the Charging Panel and allow the pressure to reduce to around 10 bar. Close the valves again. Re-check that all valves are closed
6. Close all panel taps.
7. Open the drain tap on the second (centre) compressor filter slightly [2 seconds] to blow out any water/oil that been carried over, then close tap.

Do not operate the taps on either of the outside filter towers.

Filter drain taps must not be left open. To help ensure that very low levels of carbon dioxide are reached, it is important that the filters are held under pressure when the compressor is not running.

Fill in Compressor Log

1. Check the "Number of hours run" on the compressor, and enter this into the Compressor Log, under "Start Hours". If the filter is due within the next three hours, then notify the Equipment Officer

Additional Notes

Filling Cylinders from a Bank

Decanting, or charging from a gas storage bank, is a quick and easy way to fill cylinders if the bank is full (bank pressure could be as high as c 275 bar).

The method used to get the most from a gas storage bank is to fill cylinders with the highest pressure first from the gas storage bank cylinder that has the lowest pressure. In this way it will be capable of filling more cylinders. Highest cylinder to lowest bank.

Sort diving cylinders into descending order of working pressures with the one with the highest pressure of gas remaining in it as the first in line to be filled.

Starting with the first (lowest pressure) storage cylinder in the bank, first fill the diving cylinder containing the highest pressure (obviously, the pressure in the bank must be greater than that in the cylinder to be filled).

Fill the remaining diving cylinders in descending order of contents and working pressure.

When there is not enough pressure in the first bank cylinder to fill a diving cylinder, top it up with gas from the second bank cylinder.

Follow this procedure through until all diving cylinders are filled or there is no usable gas left in the bank. Top up any remaining diving cylinders directly off the compressor, and then run the compressor to refill the storage bank.

Some Hints and Advice

Always know the pressure of every cylinder attached to the system. This includes both banks, and any diving cylinders attached to the system.

Always know the state (open or closed) of all of the valves in the system, including bank control valves, whip end valves, and diving cylinder pillar valves.

Be warned that there are no automatic flow control valves in the system to prevent you from doing things that you shouldn't. If you connect a diving cylinder with 50 bar to the system, and then open the bank control valve of a bank containing 275 bar, the diving cylinder is going to fill very very quickly and get extremely hot.

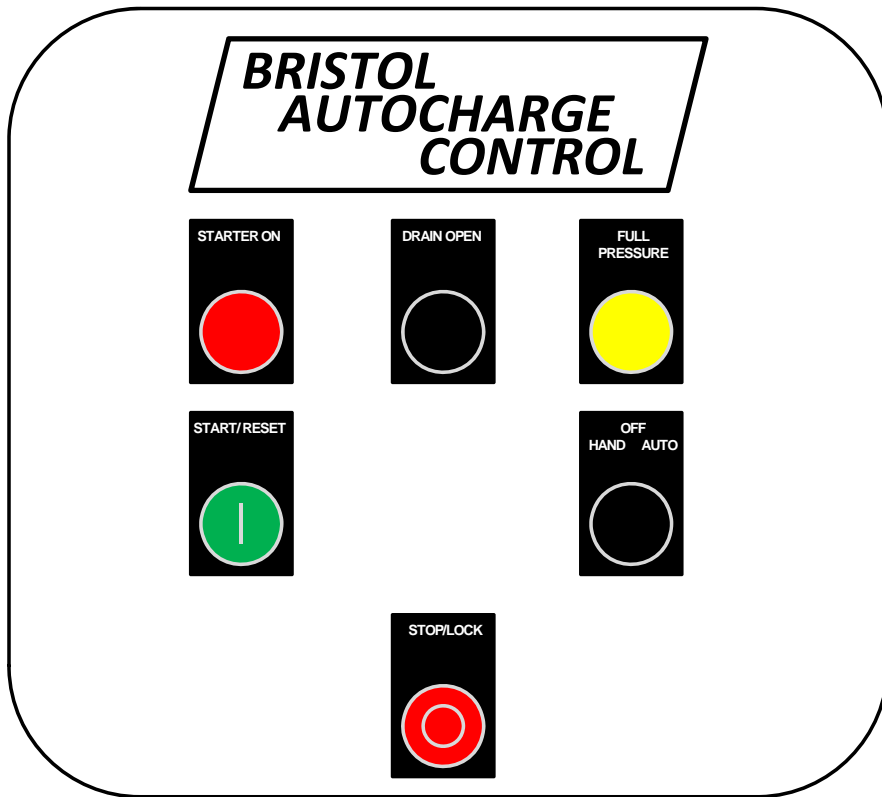
If you are charging two diving cylinders, and they are at different pressures, then charge the diving cylinder with the lesser pressure first until they are the same. Opening both cylinder/whip valves at once will equalise the pressure between the diving cylinders – and do it very quickly (see above).

Do not allow the compressor to keep stopping and starting when you are changing diving cylinders. If the compressor is not charging any diving cylinders, then let it charge the banks.

If the banks are at different pressures, then charge the bank with the lesser pressure first until they are the same. Opening both bank control valves at once will equalise the pressure between the banks – and do it very quickly (see above). When you are ready to charge another diving cylinder, then close the banks first (see above).

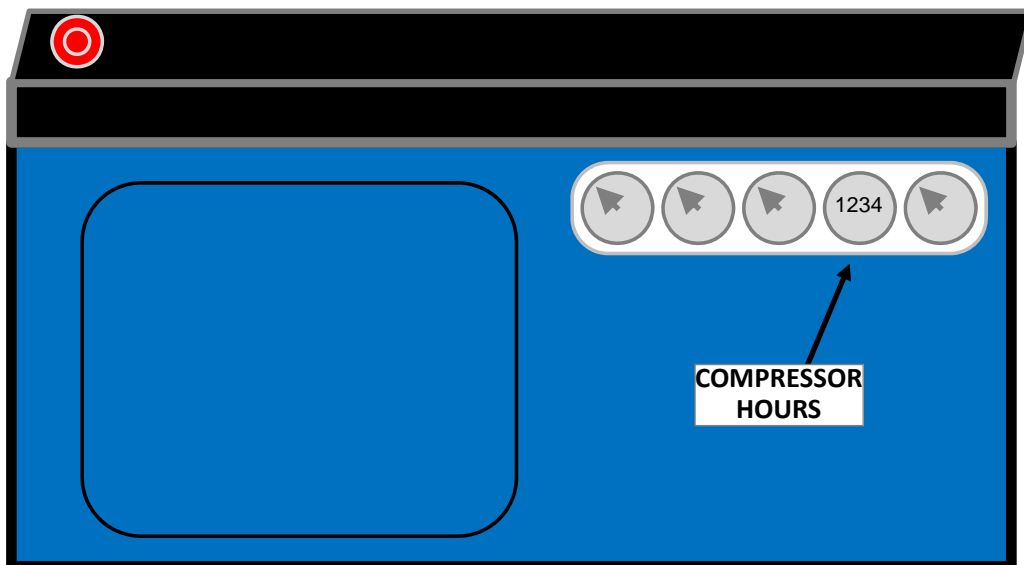
Diagrams

Control Panel

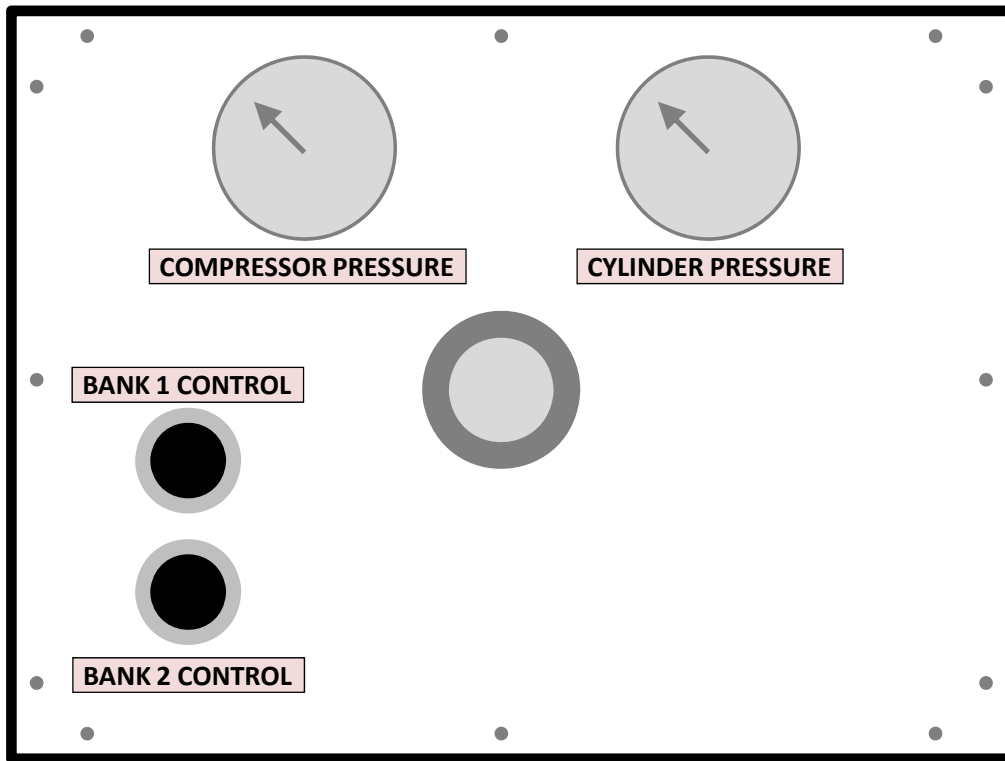


Compressor

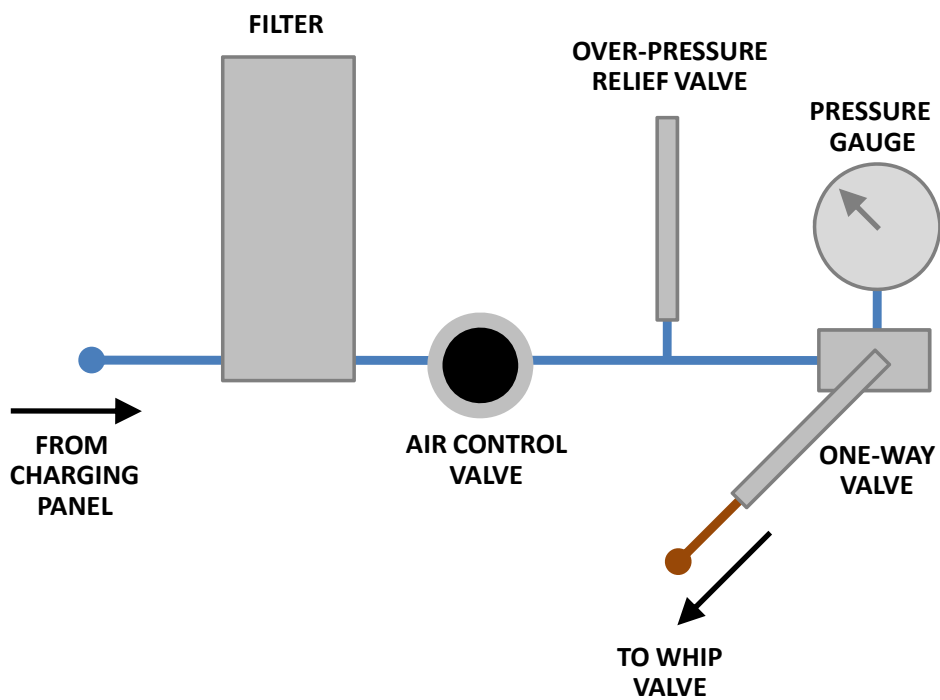
EMERGENCY
STOP



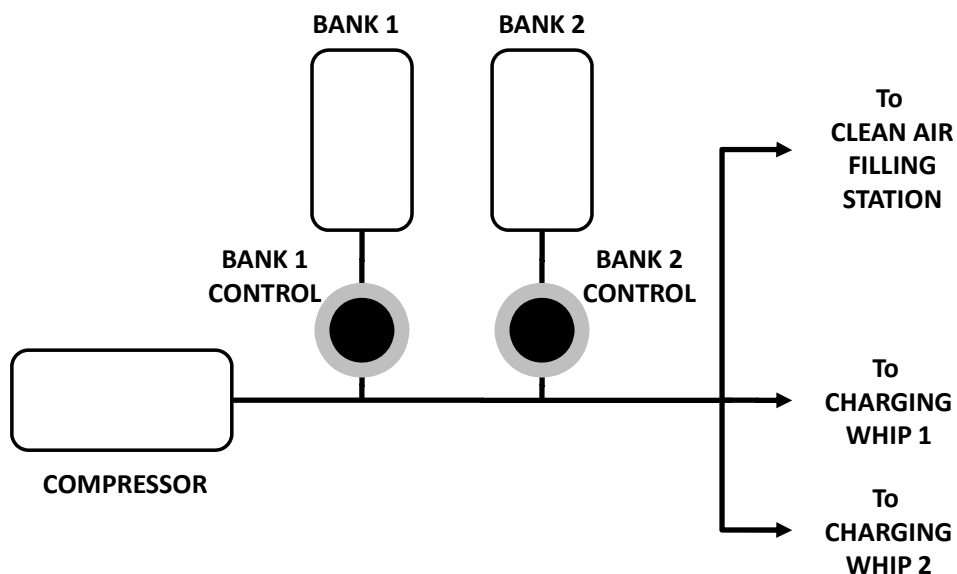
Charging Panel



Clean Air Filling Station



Schematic



Applicable Club Rules

- 5.6 The Equipment Officer shall be responsible for ensuring the upkeep and maintenance of all diving equipment, boats, engines, compressors and properties owned or hired by the Branch. He shall additionally keep and publish a register of authorised (i.e. properly trained and competent) operators of the Club compressor equipment.
- 7.1 Vehicles shall not be parked outside the double doors of the Club House (for safety reasons) when the compressor is in use; compressor operators are responsible for ensuring that the area in which vehicles are not to be parked is clearly marked by means of traffic cones.
- 7.2 The Club compressor equipment may only be operated by persons whose names appear on the register kept, and published, by the Equipment Officer. Said persons shall be responsible for maintaining records of use of the Club compressor equipment, and for collection of moneys associated with their use.
- 7.3 Operators of the Club compressor equipment will ensure that it is never left running unattended for any reason, and will ensure that only cylinders marked with a valid test stamp are filled.



Crawley Divers BSAC 0148 Compressor Record Sheet



Operator's details	
Operator's name	Date

Start Hours		Start Pressures	
Start Hours	Oil Check	Bank 1	Bank 2

Fill details					
Diver's Name	Cylinder Size	Fill Pressure	In Test ?	Cost	Paid

Please use a new sheet for each session

End Hours

End Pressures	
Bank 1	Bank 2