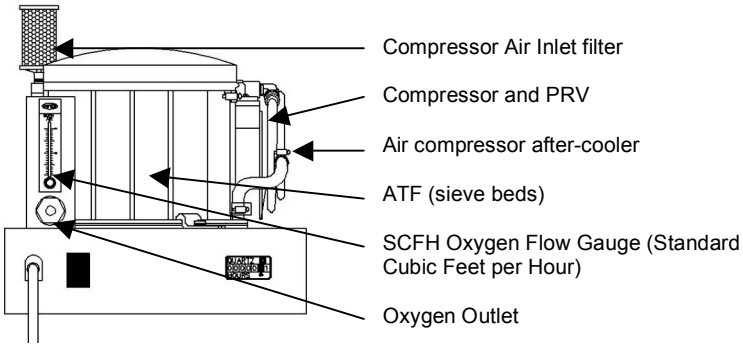
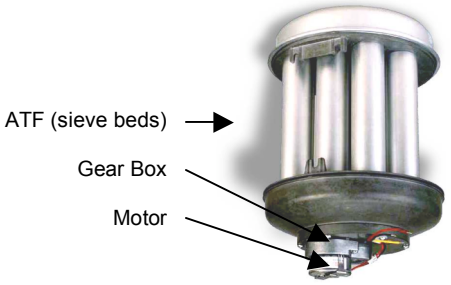
SeQual Oxygen Concentrator Troubleshooting Guide

Oxygen Concentrator Components and Normal Operating Parameters

Oxygen Concentrator – Shown: Workhorse 8C



ATF – Advanced Technologies Factionator



Normal Operating Parameters						
Product	**PRV Set Point (PRE 010106)**	**PRV Set Point (POST 010106)**	**Pre ATF PSI Swing**	**Post ATF PSI**	**Oxygen Output SCFH Flow Rate**	**Oxygen Output Percentage**
Workhorse 8c	35 PSI	45 PSI	17 to 19	5 to 7 PSI	8 SCFH	90% +3/-5%
Workhorse 12c	40 PSI	45 PSI	24 to 28	9 to 12 PSI	12 SCFH	90% +3/-5%
Workhorse 15c	35 PSI	45 PSI	17 to 19	5 to 7 PSI	15 SCFH	90% +3/-5%
Ambient Conditions: Temperature 40˚ to 95˚F, Humidity 0 to 95% RH non-condensing, Ambient Oxygen Level 20.0% minimum.						

System Operation

The SeQual Oxygen Concentrator is a PSA (pressure swing adsorption) system. The system operation begins with ambient air being drawn in through the compressor air inlet filter. The air is then compressed and pressurized through an after-cooler before being delivered to the ATF or sieve beds. Within the ATF, each of the 12 sieve beds trap most of the moisture and nitrogen allowing the oxygen to pass through. This oxygen is concentrated in the ATF where some of the pressure created by the compressor delivers oxygen out of the system at 90-93%. The remaining pressure is used in the ATF recovery cycle. In the recovery cycle the residual pressure continually purges the ATF of the moisture and nitrogen. The motor at the bottom of the ATF turns the gears in the gear box, which turns a disc within the ATF. This disc rotates allowing one third of the sieve beds to dispense oxygen to use, while the one third of the remaining sieve beds are depressurized in the recovery cycle expelling moisture and nitrogen in a vapor form to waste, and another third of the beds are equalizing. If the recovery cycle fails the sieve beds can become saturated. This will cause back pressure to the compressor, which will cause the compressor pressure relief valve (PRV) to relieve air. The PRV relieving air is typically an audible noise, anytime the PRV is relieving air the oxygen concentrator should be shut down and troubleshooting steps should be taken.

Setting System Air flow

All SeQual oxygen concentrators must be set to standard atmospheric pressure. This means, the oxygen SCFH flowmeter must be set ***without*** the oxygen delivery line connected, see the Normal Operating Parameters Chart for correct SCFH setting. **Note: Once the oxygen delivery line is connected the oxygen flow will drop from this set point due to back pressure through the system, this is normal, DO *NOT* READJUST THE SCFH FLOW METER. Warning: Failure to set the oxygen concentrator correctly will cause premature failure. Warranty will be VOID if this step is not completed correctly upon start-up.**

Testing Oxygen Purity

Using an oxygen meter, test the oxygen purity level. If the purity is found to be low further troubleshooting must be completed. If immediate troubleshooting cannot be done the system should be shut down until it is possible. Degradation level of the ATF can be found based on the level of oxygen purity, see chart below.

Oxygen Purity	88% +	40% - 87%	Below 40%
Action	ATF is in good condition, no action required	If no further issues are found, perform a recovery purge cycle	If no further issues are found, the ATF module may need to be replaced

Troubleshooting

Signs of Failure:

- Low oxygen output percentage
- Pressure relief valve relieving air or "Popping Off"
- If an Indicating cartridge color turns from blue and white to pink or all white, if so equipped

Note: These signs of failure can be directly related to the failure of the ATF module.

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Possible Reasons for ATF Failures:

- Insufficient Power
- Compressor inlet filter is dirty
- Pressure relief valve has failed
- Compressor requires rebuild
- ATF Motor/Gear box not operating
- Ambient humidity above 95% RH or condensing
- SCFH oxygen flow not set properly
- Vacuum drawn through system with main power off
- Air leak in fittings or hose clamp not tight

Insufficient Power – SeQual Oxygen concentrators require correct input power, +/- 10% rated input voltage and correct cycle. If a low or high voltage or incorrect cycle is used this will cause the motors to turn slower or faster, which will cause insufficient air flows and pressure to be delivered to the ATF. Voltage outside specification can also cause the compressor to heat up, decreasing compressor life and decreasing oxygen concentration.

Compressor Inlet Filter is Dirty – The compressor inlet filter's suggested replacement period is every 4000 hours of operation. If the filter becomes dirty to the point at which insufficient air is drawn through, this will starve the compressor of air resulting in insufficient air flow and pressure to be delivered to the ATF. Because of insufficient air flow and pressure, the ATF will be unable to purge moisture and nitrogen sufficiently and become saturated.

Pressure Relief Valve has Failed – The PRV's suggested replacement period is every 8,500 to 12,000 hours of operation. Over time the PRV can wear causing it to leak. The PRV is an adjustable valve made up of a set-nut and a jam-nut. If the jam-nut is not tightened against the set-nut the vibration of the compressor can cause the set-nut to loosen, causing an air leak.

Setting the PRV:

- Tee a liquid PSI gauge between the compressor and PRV
- Loosen the jam-nut
- Apply power to oxygen concentrator
- Slowly apply back pressure on the compressor by kinking the air compressor delivery tubing to the ATF.
- As back pressure builds on the PSI gauge, listen for the air relief break point of the PRV
- Adjust the set-nut of the PRV until the correct air relief PSI break point is observed. See Normal Operating Parameters Chart above for the correct set point for the system.
- While holding the set-nut stationary tighten the jam-nut against the set-nut

Compressor Requires Rebuild - The compressor's suggested rebuild period is every 8,500 to 12,000 hours of operation. If the compressor requires rebuild or is rebuilt improperly, this may cause insufficient air flow and pressure to the ATF. Which will cause the ATF to insufficiently purge moisture and nitrogen and become saturated.

Air Leak in Fittings or Hose Clamp not Tight – If there is an air leak due to a loose fitting or hose clamp, this will cause insufficient air flow and pressure to the ATF. Which will cause the ATF to insufficiently purge moisture and nitrogen and become saturated. Tighten all fittings and hose clamps.

ATF Motor/Gear Box not Operating – The ATF motor/gear box assembly is a critical component to the oxygen concentrator. If this assembly is not operating it will cause the ATF to insufficiently purge moisture and nitrogen and saturate the ATF. To check the motor/gear box assembly operation, locate the spindle on the gear box. When the system is in normal operation this spindle will turn slowly. Make a mark on the spindle with a felt tipped ink pen to observe it turning. If the spindle is not turning replace the ATF motor/gear box assembly. Be sure to check oxygen purity as the sieve beds may already be saturated if the motor/gear box assembly is faulty.

Ambient Humidity Above 95%RH Condensing – All ambient air parameters must be met when using this equipment. Using the equipment outside the manufactures specifications may result in premature failure. In a condensing environment a coalescing filter with auto-drain must be used.

SCFH Oxygen Flow not Set Properly – As stated above, setting the oxygen concentrator to its specified SCFH at atmospheric pressure is a critical step in the set up of the system. If the oxygen flow rate is set above the rated specification for the system there will be insufficient back pressure to the ATF, which will cause the ATF to insufficiently purge moisture and nitrogen and become saturated. **Note: The oxygen flow rate may be set lower than the specified amount.**

Vacuum Draw through System with Main Power 'OFF' – At no time should a vacuum be drawn through the oxygen concentrator. In a standard ozone system installation a vacuum created by a venturi is used to draw ozone gas into the water line. If this vacuum is drawn while the oxygen concentrator is 'OFF' the sieve will trap the moisture and nitrogen in the same fashion. However, because the compressor and ATF motor/gear box assembly is not 'ON' the ATF cannot be purged of the adsorbed moisture and nitrogen, which will saturate the ATF causing it to fail.

Testing Pre ATF Pressure Swing:

If a visible failure cannot be found the Pre ATF pressure swing should be tested. Because the oxygen concentrator relies on this pressure swing any deviation of the normal operating swing parameters will help aide the trouble shooting process.

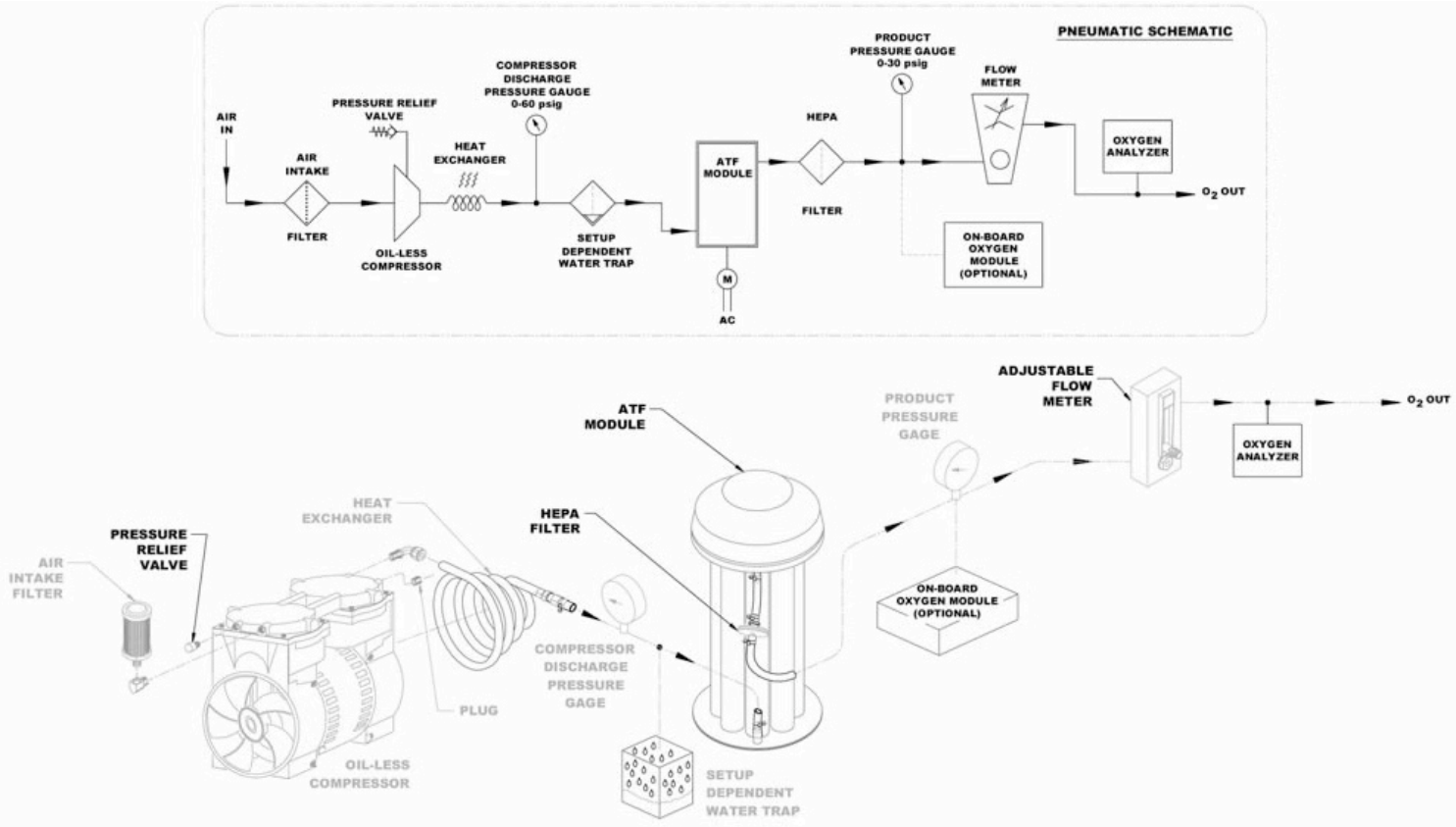
- Tee a liquid PSI gauge between the compressor and PRV or between the after-cooler and the ATF
- Apply power to oxygen concentrator
- Observe swing, see the Normal Operating Parameters Chart above.

Result	Possible Cause	Solution
Low Pre ATF Pressure Swing	- Compressor inlet filter is dirty - Compressor not operating properly - Leak in fitting or hose clamp not tight - PRV is relieving air	- Replace compressor inlet filter - Rebuild compressor heads - Tighten all fittings and hose clamps - Check PRV set point, replace as required
High Pre ATF Pressure Swing	- ATF motor/gear box is not operating properly - ATF is saturated with moisture and/or nitrogen. To be certain of saturation take a weight of the ATF module by itself. This weight can be checked against the original weight at the date of manufacturing.	- Replace ATF motor/gear box assembly if it is not operating. - Complete the steps below for the ATF Recovery Purge Cycle or replace the ATF as required.

ATF Recovery Purge Cycle:

If after all troubleshooting and testing has been completed and the ATF is found to be saturated, a recovery purge cycle of the ATF may return the ATF to normal operating status. However, the success of this recovery purge is dependent upon the saturation level of the ATF, see the "Oxygen Purity Chart" to decide if a recovery purge is relevant. The basis of this recovery purge is to allow 'all' of the pressure and air flow created by the compressor to purge the sieve beds to waste. Over time this recovery purge can clean the ATF sieve beds to the point of normal operational status.

To run the ATF recovery purge cycle, first test the oxygen purity level to create an oxygen purity starting point. Provide main power to the oxygen concentrator and close the oxygen output SCFH needle valve completely. The oxygen concentrator should be run for a minimum of 24 hours, and then oxygen purity should be tested again. If the oxygen purity level has increased to 88% or greater then the ATF has been recovered, if the oxygen purity level has increased though not up to 88%, run the recovery cycle for another 24 hours. As long as an increase in purity is observed after each 24 hour period the recovery cycle may be continued. If the oxygen purity level is not increasing after one or two attempts, then the ATF must be replaced.



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