

Oxygen Concentrator

Installation and Operation Manual 8C, 12C, 15C Series



ClearWater Tech, LLC.
Integrated Ozone Systems

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Cautions, Warnings, and Hazards

Oxygen is a powerful oxidizing agent. It can cause fires or explosions. Observe strict cleanliness procedures when fabricating and connecting the oxygen piping. ***It is imperative that oxygen systems be properly cleaned and inspected to insure that no combustible materials remain in the connecting piping and fittings.*** Do not allow the free flow of oxygen from the Oxygen Concentrator or from any point on the oxygen manifolding.

Ensure that the Oxygen Concentrator is in a well-ventilated area. If the space is occupied, sufficient ventilation must be provided to prevent the accumulation of low oxygen concentration waste gas in the space. Approximately 6 air changes per hour are necessary.

Do not allow rain or condensation to contact the Oxygen Concentrator. The Oxygen Concentrator is not weatherproof. It must be operated indoors or in an enclosure in a non-condensing environment.

The Oxygen Concentrator should be installed and operated per the Compressed Gas Association Guide P-8.1, "Safe Installation and Operation of PSA and Membrane Oxygen and Nitrogen Generators."

Patents, Trademarks, and Copyright

The 15C Series Oxygen Concentrator is protected by the following US Patents:

4,925,464 5,112,367 5,114,441 5,268,021 5,366,541 5,593,478
5,370,778 Re. 35,099 Other patents pending.

ATF® is a registered trademark of SeQual Technologies, Inc.

Introduction

The operation of the Oxygen Concentrator is based on the pressure swing adsorption (PSA) cycle using a synthetic zeolite molecular sieve. The Oxygen Concentrator is capable of delivering oxygen flows up to 8 standard cubic feet per hour (SCFH) for 8C, 12 SCFH for 12C, and 15 SCFH for 15C at over 90% by volume oxygen concentration at rated conditions. The main components of the Oxygen Concentrator are a SeQual ATF Oxygen Concentrator Module and an oil-less air compressor.

Installation

IMPORTANT: There are packaging materials that must be removed from under and around the compressor. Do not attempt to operate the Oxygen Concentrator without removing these packaging materials as damage may result.

Ensure that there is sufficient access space around the Oxygen Concentrator so that normal maintenance and service can be performed. Also ensure that there will be a free flow of cooling air around the compressor. Connect the unit to a grounded power source rated for the voltage and current requirements stated on the label on the unit.

IMPORTANT: The location of the Oxygen Concentrator must be well ventilated. Refer to the recommendations in the Compressed Gas Association Guide P-8.1, "Safe Installation and Operation of PSA and Membrane Oxygen and Nitrogen Generators." Contact ClearWater Tech if further assistance is needed.

IMPORTANT: Choose a location for the Oxygen Concentrator that does not allow rain or condensation to contact the unit.

Oxygen Hook-up

The oxygen connection is 1/8 inch female National Standard Pipe Thread (NPT) and is located on the front of the Oxygen Concentrator. The hex nut bulkhead fitting should be stabilized with a 7/8 inch wrench to prevent rotation when making your connection to the unit.

IMPORTANT: Oxygen is a powerful oxidizing agent. It can cause fires or explosions. Observe strict cleanliness procedures when fabricating and connecting the oxygen piping. ***It is imperative that oxygen systems be properly cleaned and inspected to insure that no combustible materials remain in the connecting pipe and fittings.*** If you are not familiar with oxygen cleaning procedures, refer to the Compressed Gas Association documents G-4.1, "Cleaning Equipment for Oxygen Service" and G-4.4, "Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems."

Cover Removal and Replacement

If the Oxygen Concentrator is supplied with a cover, remove the screws fastening the cover to the base. Lift the cover straight up off the base until sufficient space is available to reach under and unplug the fan cord from the cooling fan. There is 24 inches of cord length available to lay the cover down without disconnecting the cord, if desired.

When reinstalling the cover, reconnect the fan cord, if required, and set the cover back on the base. Ensure the fan cord does not come in contact with the compressor's aluminum air after-cooling coil. Replace the screws.

Operation

To start the Oxygen Concentrator, connect the unit to a grounded power source rated for the voltage and current requirements stated on the label of the unit. **Note:** 220VAC and 240VAC units may be provided with a standard NEMA rated cord. The plug on this cord must be cut off and the unit hard-wired to main power. Color codes: Black=Line or L1, White=Neutral or L2, Green=Ground or Earth.

IMPORTANT: Ensure that the Oxygen Concentrator is in a well-ventilated area. If the space is occupied, sufficient ventilation must be provided to prevent the accumulation of low oxygen concentration waste gas in the space. Approximately 6 air changes per hour are necessary. Do not allow the oxygen product to vent freely. Do not exceed rated capacity.

Set the outlet oxygen flow to 8 SCFH or less for 8C, 12 SCFH or less for 12C, and 15 SCFH or less for 15C.

IMPORTANT: The flow meter installed on the Oxygen Concentrator is set to read accurately when the discharge is set to atmospheric pressure. If the actual discharge pressure is substantially above atmospheric pressure, the reading can be adjusted to determine the precise flow rate according to the following formula:

$$(adjusted\ flow) = (measured\ flow) \times \frac{\sqrt{oxygen\ pressure + 14.7}}{14.7}$$

IMPORTANT: Ensure that vacuum is not applied to the oxygen concentrator if power is off. If vacuum is being created by the venturi injector, the oxygen concentrator must be powered or damage will occur to the ATF.

WINTERIZING: Disconnect O3 delivery line from venturi injector.

Maintenance

The Compressor Inlet Filter is recommended to be changed every 4,000 hours. Filter change frequency is dependent on environmental conditions and may vary.

Compressors are recommended to be rebuilt after 5,000 to 12,000 hours of operation depending on environmental conditions.

See the Service Parts section for information on replacement air inlet filters and compressor rebuild kits.

Specifications

Compressed Air

Pressure Relief Valve setting: 45 psig \pm 10%

Oxygen Output

(8C) 8 SCFH at 90% +3%/-5% oxygen by volume at 5 psig

(12C) 12 SCFH at 90% +3%/-5% oxygen by volume at 12 psig

(15C) 15 SCFH at 90% +3%/-5% oxygen by volume at 5 psig

Electrical Input

	120 VAC, 60 Hz	220 VAC, 50 Hz	240 VAC, 60 Hz	PHASE
8C	4.1 AMPS	2.3 AMPS	2.0 AMPS	Single
12C	5.4 AMPS	2.9 AMPS	2.7 AMPS	Single
15C	5.4 AMPS	2.3 AMPS	2.7 AMPS	Single

Environment

The Oxygen Concentrator is not weatherproof. It must be installed where rain and condensation are not allowed to contact the unit. If the space is occupied, sufficient ventilation must be provided to prevent the accumulation of low oxygen concentration waste gas in the space.

Operating temperature: 40°F to 95°F

Storage temperature: 0°F to 140°F

Humidity: 0 to 95% RH

Barometric Pressure Range: 28 to 31 inches of Hg

Ambient Oxygen Concentration: 20% minimum

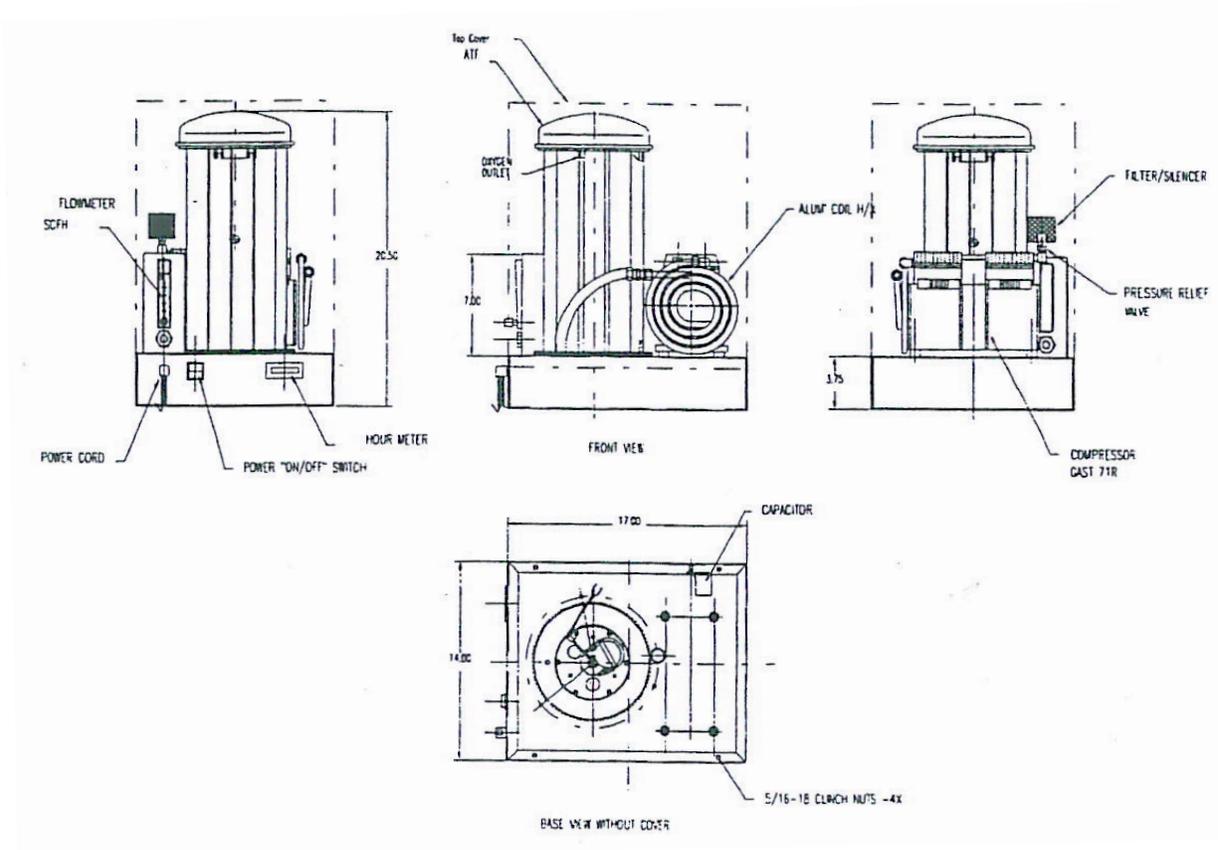
Operation

Unit should be installed and operated per the Compressed Gas Association Guide P-8.1, "Safe Installation and Operation of PSA and Membrane Oxygen and Nitrogen Generators."

Mechanical

Maximum Dimensions: (15C) 22.25"H (8C & 12C) 18.0"H x 14"W x 17"D

Maximum Weight: 53.5 lb



15C Shown

Service Parts

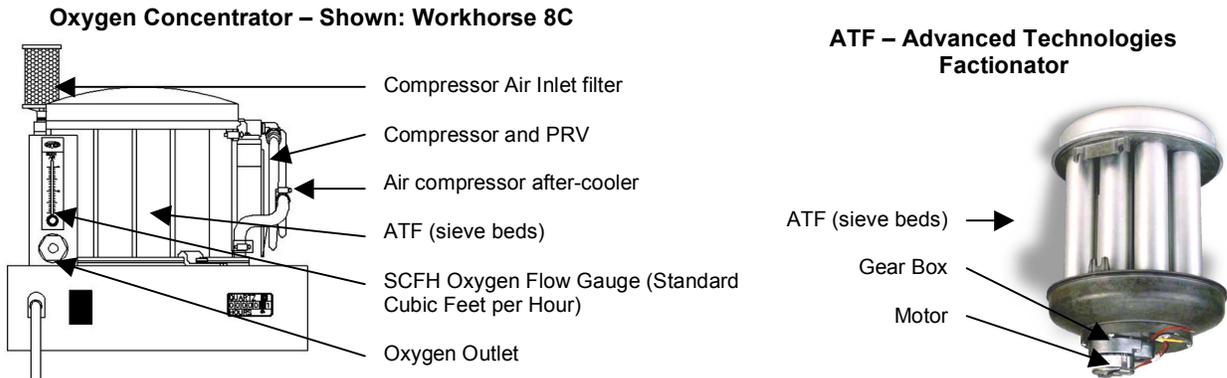
Service parts listed below can be obtained directly from ClearWater. Hose can generally be obtained locally' specifications are listed below. Always replace hoses with equal or better specifications. Other parts are not considered regular service items. Please contact ClearWater directly for further information on other parts.

Service Parts

Service Part	Quantity	8C Part No.	12C Part No.	15C Part No.
ATF Module 120/240VAC 60Hz	1	OXS320	OXS320	OXS300
ATF Module 220VAC 50Hz	1	OXS320	OXS320	OXS305
Compressor 120VAC 60Hz	1	OXS373	OXS340	OXS340
Compressor 220VAC 50Hz	1	OXS374	OXS346	OXS345
Compressor 240VAC 60Hz	1	OXS374	OXS347	OXS346
Compressor Inlet Filter	1	OXS350	OXS350	OXS350
Compressor Rebuild Kit	1	OXS356	OXS356	OXS356
Pressure Relief Valve	1	OXS362	OXS362	OXS362

Troubleshooting Guide

Oxygen Concentrator Components and Normal Operating Parameters



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.

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.

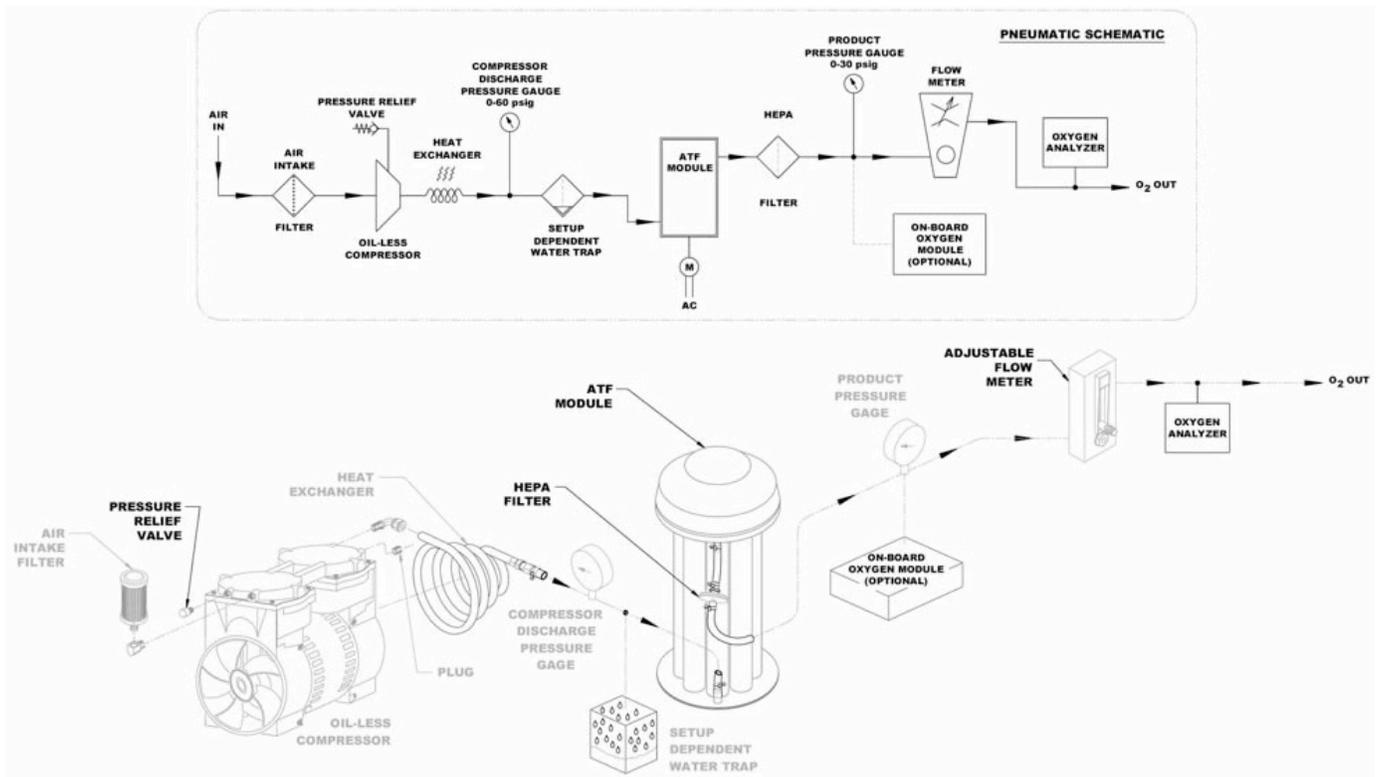
- Tee a liquid PSI gauge between the compressor and PRV or between the after-cooler and the ATF
- Apply power to oxygen concentrator
- Observe swing, see the Normal Operating Parameters Chart above.

Result	Possible Cause	Solution
Low Pre ATF Pressure Swing	<ul style="list-style-type: none"> - Compressor inlet filter is dirty - Compressor not operating properly - Leak in fitting or hose clamp not tight - PRV is relieving air 	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> - 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.



ClearWater Tech, LLC. Limited One-Year Warranty

Summary of the Warranty

ClearWater Tech, LLC ("CWT") makes every effort to assure that its products meet high quality and durability standards and warrants the products it manufactures against defects in materials and workmanship for a period of one (1) year, commencing on the date of original shipment from CWT, with the following exceptions: 1) The warranty period shall begin on the installation date if the installation is performed within 90 days of the original shipment from CWT; 2) The warranty period shall begin on the date of the bill of sale to the end user if the installation date is more 90 days after the original shipment date. To validate the warranty, a warranty card, accompanied by a copy of the bill of sale, must be returned to CWT and must include the following information:

- End user name
- Complete address, including telephone number
- Date installed
- Complete model and serial number information
- Name of company from which the unit was purchased

Repairs and replacement parts provided under this warranty shall carry only the unexpired portion of this warranty or 90 days, whichever is longer.

Items Excluded from the Warranty

This warranty does not extend to any product and/or part from which the factory assigned serial number has been removed or which has been damaged or rendered defective as a result of:

- An accident, misuse, alteration or abuse
- An act of God such as flood, earthquake, hurricane, lightning or other disaster resulting only from the forces of nature
- Normal wear and tear
- Operation outside the usage parameters stated in the product user's manual
- Use of parts not sold by CWT
- Service or unit modification not authorized by CWT
- Check valve/solenoid valve failure
- Damage which may occur during shipping
- Failure to meet service requirements as outlined in the I & O manual

Obtaining Service Under the Warranty

Any product and/or part not performing satisfactorily may be returned to CWT for evaluation. A Return Goods Authorization (RGA) number must first be obtained by either calling or writing your local authorized dealer, distributor or CWT direct, prior to shipping the product. The problem experienced with the product and/or part must be clearly described. The RGA number must appear prominently on the exterior of the shipped box(es). The product and/or part must be packaged either in its original packing material or in comparable and suitable packing material, if the original is not available. You are responsible for paying shipping charges to CWT and for any damages to the product and/or part that may occur during shipment. It is recommended that you insure the shipment for the amount you originally paid for the product and/or part.

If, after the product and/or part is returned prepaid and evaluated by CWT, it proves to be defective while under warranty, CWT will, at its election, either repair or replace the defective product and/or part and will return ship at lowest cost transportation prepaid to you **except for shipments going outside the 50 states of the United States of America**. If upon inspection, it is determined that there is no defect or that the damage to the product and/or part resulted from causes not within the scope of this limited warranty, then you must bear the cost of repair or replacement of damaged product and/or part and all return freight charges. Any unauthorized attempt by the end user to repair CWT manufactured products without prior permission shall void any and all warranties. For service, contact your authorized dealer or distributor or CWT direct at (805) 549-9724.

Exclusive Warranty

There is no other expressed warranty on CWT products and/or parts. Neither this warranty, nor any other warranty, expressed or implied, including any implied warranties or merchantability of fitness, shall extend beyond the warranty period. Some states do not allow limitation on how long an implied warranty lasts, so that the above limitation or exclusion may not apply to you.

Disclaimer of Incidental and Consequential Damages

No responsibility is assumed for any incidental or consequential damages; this includes any damage to another product or products resulting from such a defect. Some states do not allow the exclusion or limitation of incidental or consequential damages, so that above limitation or exclusion may not apply to you.

Legal Remedies of Purchaser

This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

THIS STATEMENT OF WARRANTY SUPERSEDES ALL OTHERS PROVIDED TO YOU AT ANY PRIOR TIME.