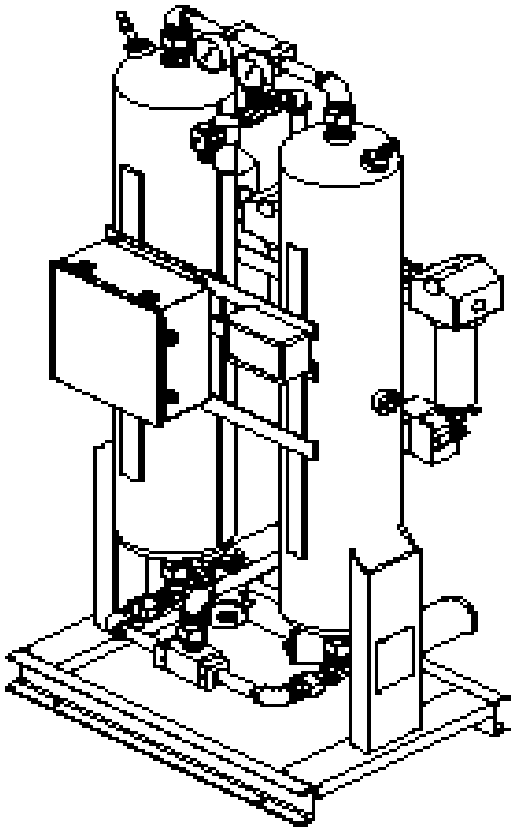
Aircel

OPERATION MANUAL

AirceL BHD series
Breathing Air Purifier System



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Aircel

ADDENDUM

1. This is a Breathing Air System and has been designed to meet or exceed grade D Breathing Air specifications.

2. This System contains a Catalyst media which converts carbon monoxide to carbon dioxide.

3. A Carbon Monoxide Analyzer must is included to indicate the level of Carbon Monoxide in the outlet air stream to indicate safe Breathing Air. (This system has a carbon monoxide monitor as standard)

4. Do not use this System without the Carbon Monoxide Analyzer.

5. A High Carbon Monoxide alarm System has been installed along with local alarm strobe light and remote alarm indication. The Alarm is normally Factory set for 10 PPM.

6. Supply air to the Carbon Monoxide Analyzer must be regulated to 55 psi max. and supplied from the Air Outlet of the Breathing Air System.

7. Do not use this system without the specified Desiccant and Catalyst Media and arrangement .

8. Do not use this Breathing Air System if Carbon Monoxide level is above 10 PPM. The System Catalyst media and Dryer Media must be changed.

9. Refer to the Electrical Schematic and Flow Diagram separate from this manual for additional information.

10. The Outlet Air from the Breathing Air System is very Dry typically in the minus 40 deg. F. dew point range. An Air Humidifier System can be installed downstream of the Breathing Air System to provide moisture for comfortable breathing, longer work time and reduce the drying out of the user's mouth, throat and lungs.

11. For number of people the breathing air system can accommodate, refer to the respirator manufacture's recommended air flow rate per person. Then take the average outlet flow rate of the BHD model size (outlet flow rate average is typically 20% less than BHD model size) and divide by the (respirator air flow rate per person) to get the maximum people per BHD model size.

Introduction

Thank you for purchasing AirCel's Breathing Air Purification System. AirCel Systems are engineered and manufactured to provide you with many years of trouble free service. To ensure that you get the get first class service from this equipment, we recommend you take some time and read the contents of this manual.

This manual contains the information required for installing and maintaining your new equipment. It also includes the safety procedures and corresponding drawings. We strongly suggest that all personnel involved with the machine, read the entire contents of the manual before proceeding with the installation or maintenance activities.

System Type	
System Model Number	
System Serial Number	
System Year of manufacture	

The manufacturer reserves the right to make changes without any prior notification and is not obligated in any manner. Information in this manual is deemed current at the time of publication and AirCel disclaims all liability for any errors resulting in any loss or damage.

If you have questions or need additional copies or would like to schedule a AirCel's serviceman visit. Contact your distributor.

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Safety Instructions

Safety symbols used in the manual

 This represents Important Information. Readers of the manual must pay extra attention to instructions and information succeeding this symbol.

 This is a Warning symbol. It indicates that it is dangerous and could result in physical injury and death if the instructions are not followed correctly.

 Electrical Danger High Voltage symbol. This means that there is a risk of electric shock and only authorized personnel with proper gear must approach it

 High Noise Area - All personnel are required to wear ear protectors before approaching the vicinity of the equipment

 Hazardous Fumes and gases – Personnel must wear protective gear to prevent inhaling of the gases and fumes

 Suspension points – look for these symbols before making any attempt to move or relocate your equipment

 This represents valuable tips and suggestions. Following these tips can make your work easier

 This indicates that there might be possible risk of material damage and personnel are advised to exercise extra caution

Unpacking and Inspection:

All AirCel Systems are tested and operated before shipment. However, during shipment it can get damaged or certain parts might come loose. To ensure you have a smooth installation we recommend –
Immediately upon receipt of the unit, check carefully for external damage that may have occurred in shipping. In the event of any damage, immediately file a claim with the carrier and notify your AirCel Distributor or the factory (865-681-7066) of the nature of the damage. The carrier is legally responsible for all damages.
After you are assured that the unit has not sustained any external shipping damage –

1. Make sure you have received all the crates/packages that are indicated in the packing slip.
2. Remove the crate and packaging.
3. Inspect the unit for any internal damages. If you notice anything, follow the same procedure as above and notify the shipping agency and factory.
4. Check the AirCel nameplate and make sure that it is the correct Model that you had ordered.
5. Note the equipment Capacity and Power Supply requirements and ensure that they are in accordance with your specifications. The rated conditions of the System are indicated on the data plate. If you notice any discrepancy, contact the AirCel representative or the factory at (865) 681-7066.

Vibration during shipping can loosen the connections. So inspect all pipe and tubing and make sure they are all tightened and secured.

General Safety Instructions

What you must do: 

1. Certified/authorized electricians must perform electrical work
2. Electrical work must conform to the specifications indicated by AirCel and the local state laws and Power Company.
3. Personnel must wear appropriate safety gear before working on any electrical or mechanical aspects of the machine.
4. Appropriate tools have to be used for all installation and maintenance work. If special tools are required and are not available to the installation crew, contact the factory or your AirCel representative.
5. A copy of the Operation Manual must be made available to all personnel involved with the installation, operation and maintenance of the equipment.
6. Before performing any maintenance operations on the equipment, the unit must be halted, completely depressurized, and electrical power removed.
7. To ensure compatibility and continued trouble free operation, only genuine AirCel parts must be used.
8. This system contains a catalyst to remove carbon monoxide. Also included is a carbon monoxide monitor to indicate the level of carbon monoxide in the outlet air stream
9. An air **humidifier** must be installed downstream of the breathing air purifier by the customer to prevent excessive throat dryness and discomfort in breathing. Breathing air humidifiers can be furnished by the provider of the breathing apparatus (not included in system).
10. The system outlet Pressure must be reduced to atmospheric pressure before delivering to personnel breathing the purified air.

What you must not do: 

1. Do not make constructional changes to the unit. Only AirCel or its authorized representatives with the prior approval can perform any constructional work on the machine.
2. Do not use foreign parts. For any reason if you wish to use non-original parts, you are required to contact the factory for approval.
3. Do not disable or disengage any protective equipment used on the machine.
4. Do not use this system without the carbon monoxide monitor.
5. Do not use the System without the proper Desiccants and Catalyst Media in the vessels, also media must be loaded in a certain order and a certain weight.

Safe operating procedures:

1. Pressurize and depressurize compressed air SLOWLY! Always open air valves slowly when pressurizing the air line system or equipment. Replace air slowly when depressurizing your air system or equipment.
2. Circuit breakers, fusible disconnects, and wiring should conform to national and/or local electrical codes. Make certain that the electrical installation for this unit is performed by qualified electrical personnel.
3. Only use original fuses for the rated voltage and current.
4. Shut down the unit in the correct recommended procedure. Depressurize the unit and remove all electrical connections.
5. After shut down, put up warning notice to prevent the unit from being switched "ON" accidentally.
6. Inspect all piping, hoses and connections. Make sure that all hoses are in good condition and are rated for the correct working pressure. Do not allow hoses to come into contact with oil, chemicals, or sharp objects.
7. Secure condensate drain lines. Unsecured flexible drain lines may whip violently under pressure and may cause bodily harm.
8. Make certain carbon monoxide monitor is functioning.
9. Make certain system is on when and outlet purity is within spec before placing online for use.

This unit is designed to produce grade 'D' breathing air per OSHA Regulations (Standard – 29 CFR), 1910.134 – Respiratory Protection, from a compressed air system that is either oil lubricated or oil-free.... based on normal inlet atmospheric air as described in the ASHRAE Brochure on Psychrometry. The compressed air quality provided by the system meets the air requirements of ISO 8573.1 for Class 1.2.1 purity.

An air **humidifier** must be installed downstream of the breathing air purifier by the customer to prevent excessive throat dryness and discomfort in breathing. Breathing air humidifiers can be furnished by the provider of the breathing apparatus (not included in system).

The system outlet Pressure must be reduced to atmospheric pressure before delivering to personnel breathing the purified air.

AirCel disclaims any liability what so ever for loss, injury or damage.

Product Description

Why we need breathing air purification systems:

Untreated compressed air contains many contaminants such as water, compressor oil, possible carbon monoxide, pipe scale and contamination from ambient air. These contaminants could cause unhealthy air for breathing and contamination to components that come in contact with the untreated compressed air. A breathing air purification system with filtration will remove many contaminants to harmless levels. The end result is purified air for breathing, also any instruments that come in contact with the purified compressed air stay clean and do not corrode, therefore lasting much longer. Products that may come in contact with the purified compressed air are virtually unaffected, hence rejection rates are reduced.

Standard Features:

- Compact digital Carbon Monoxide (CO) monitor/alarm.
- System controlled via a PLC (Aircel Programmable Controller (APC))
- Sequence of operation displayed on Aircel Programmable Controller (APC).
- Optimal vessel size for low velocities reducing desiccant fluidization, and high contact time for efficient low dewpoint performance
- Adjustable (5 min., 10 min.) timing.
- Unique vessel media bed arrangement for effective purification and long Life.
- Mounted filtration: pre-filter, activated carbon after-filter and final-filter.
- Electronic drain timer.
- APC protected with a NEMA 4 electrical steel enclosure
- LED tower operation indicating lights display sequence of operation. (Left Tower Drying… Right Tower Drying… Left Tower Regenerating … Right Tower Regenerating)
- Automatic piston valve (inlet/outlet) with 10 year longevity.
- Control pilot air filter… provides clean air to air control system for long trouble-free reliable operation.
- Media vessels are designed and fabricated and stamped according to ASME code. (6” vessels and larger).
- Tower ASME UV stamped pressure relief valves.
- Purge exhaust mufflers for quiet operation.
- Angle-body purge exhaust valve with 10 year longevity.
- Tower pressure gauges with large easy-to-read 3.5” dial for additional visual operation of system operation.
- Stainless steel desiccant supports and air diffusers to prevent channeling.
- Counter-current regeneration for efficient desiccant regeneration, upflow drying, downflow depressurization and repressurization.
- Fail-safe design: failure of power and/or pilot air causes the purge exhaust valves to close. The System also provides uninterrupted drying air flow preventing a deadheading affect.
- Controlled repressurization to slowly repressurize the regenerated vessel to line pressure prior to switchover preventing desiccant bed movement and attrition.
- Desiccant fill and drain ports for easy desiccant replacement.
- ON/OFF switch and power ON light.
- Red alarm strobe light for quick view indication of system malfunction.
- Alarm dry contact for remote indication of system malfunction.
- Failure-to-shift alarm (system pressure monitoring) to indicate a system problem if a valve malfunctions.

Optional Features:

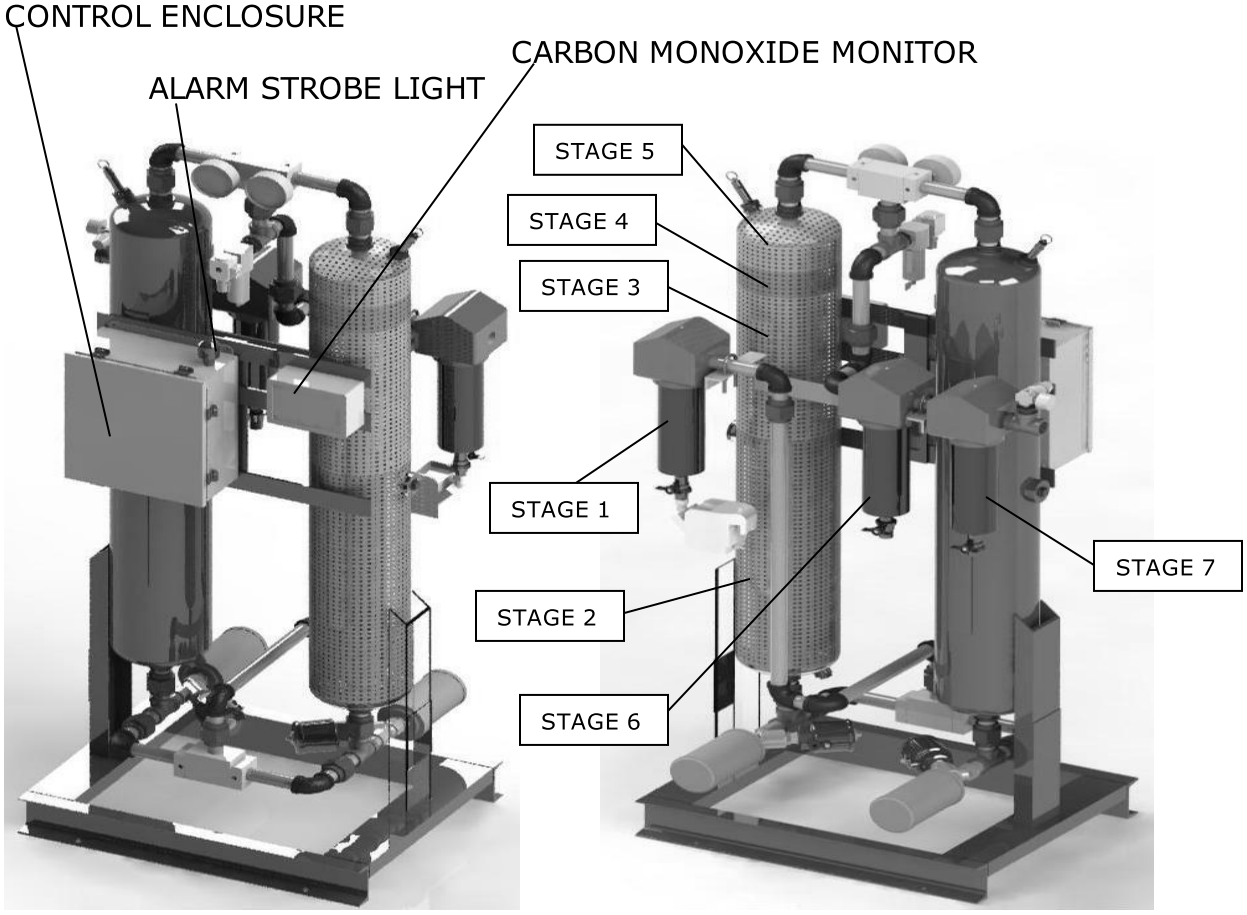
- High inlet temperature alarm.
- Outlet dew point displayed on system screen, includes high humidity alarm.
- Visual moisture indicator.

Technical Specifications

How does it work?

The breathing air purifier is fully automatic and continuously purifies the inlet compressed air. The air is purified as it passes through the media bed of one tower while the bed in a second tower is being reactivated. Reactivation of the media is accomplished without the use of heat. A small portion of the outlet purified air (purge air) from the purifying or on-line vessel is passed through an orifice to the other media bed at near atmospheric pressure, which removes moisture vapor and impurities from the media surface. Purifier operation is performed automatically via a PLC control system. Standard purifyers operate on a 10-minute timing cycle. For dew points lower than -40°F (-4°C), different time cycles (5 min.) may be used.

In order to prevent line surge and to minimize media attrition when switching from one vessel to the other is carried out only when both desiccant chambers are at equal pressure. The vessel being reactivated will be re-pressurized at the end of its reactivation/regeneration cycle before switch-over takes place. Purge flow and depressurization are in a downward direction, counter to the purifying flow.



Front of purifier Back of purifier

(see next page for an explanation of each stage)

Stage 1: Inlet Particulate and Coalescing Pre-Filter
The pre-filter removes particulates, water aerosols, and oil mist content efficiently. The pre-filter is equipped with a differential pressure indicator and a Zero-loss automatic condensate drain valve.

Stage 2: 13X Molecular Sieve
The inlet portion first layer of the adsorbent media filled in the towers is 13X molecular sieve to remove contaminants such as volatile organic compounds, acid forming gases, base gases and moisture.

Stage 3: Activated Alumina
This layer of activated alumina removes moisture to a dewpoint of -40° F and below at line pressure.

Stage 4: Carulite Catalyst
The catalyst layer is used to convert carbon monoxide to carbon dioxide.

Stage 5: Activated Alumina
This final layer of activated alumina is installed at the top of the towers to remove residual contaminants.

Steps 2-5: The towers adsorb and regenerate alternately. The regeneration of this unique multi-layer adsorbent media and catalyst arrangement typically extends its life under normal conditions to three to five years.
The control system sequence is monitored by a standard fail to switch system using pressure transducers and alarms when the system does not function properly.

Stage 6: Activated Carbon After-Filter
The activated carbon contained in the filter element assures a residual oil vapor content below 0.003 ppm. The filter is equipped with a manual ball valve.

Stage 7: Sub-Micron Final-Filter
The final-filter efficiently removes fine aerosols and particulates generated in the system. The filter is equipped with a differential pressure indicator and manual ball valve.
The outlet air is monitored by a standard carbon monoxide analyzer and triggers an alarm when a preset level is reached.

Design parameters of the System:

Type of System: BREATHING AIR PURIFICATION SYSTEM
Model Number: BHD- (MODEL SIZE)
Power Supply: 115VAC/1PH/60HZ
Pressure vessel:
Design Pressure in PSIG: 200 PSIG (150 psig on models BHD-750 and larger)
Design Temperature in Deg. F: -20°F-450°F
System cycle times:
Adsorption Time in minutes: 5 MINUTES
Regeneration Time in minutes: 4 MINUTES
Repressurization Time in minutes: 1 MINUTE

OPERATING CONDITIONS

Inlet Compressed Air Design Flow Rate: (MODEL SIZE) scfm
Inlet operating Pressure: 100 psig
Inlet Design Temperature: 100°F
System max. operating Design Pressure : 175 psig
(model sizes 50 - 600)
Relief valve pressure setting: 200 psig
(model sizes 50 - 600)
System max. operating Design Pressure : 135 psig
(model sizes 750 and higher)
Relief valve pressure setting: 150 psig
(model sizes 750 and higher)
Outlet Air Flow Rate: (20% less than Model number scfm) avg.
Outlet Dewpoint at Design Conditions: -40°F (at line pressure)
Ambient Air Temperature: 35°F (Min.); 120°F (Max.)
System Press Loss with Clean, Dry Filter Elements: 6 - 10 psid

Media bed loading:

1. **LOADED FIRST AT BOTTOM OF BED**:
   MOLECULAR SIEVE DESICCANT TYPE 13X, 4X8 MESH
2. **LOADED SECOND:**
   ACTIVATED ALUMINA DESICCANT TYPE F200
3. **LOADED THIRD:**
   CARULITE 300 CATALYST, 4X8 MESH GRANULAR
4. **LOADED LAST AT TOP OF BED:**
   ACTIVATED ALUMINA DESICCANT TYPE F200

SYSTEM CONTROL SETTINGS:

Note: these settings are accessed in the system panel display (also see the **screen shots and descriptions** section for additional information)

TIME CYCLE CNTL setting, minutes: **10** (do not adjust)

****ENTER PRESSURE FOR FTS ALARM**** setting, psig: **60** (can be adjusted if needed, typically 20 psig below working pressure to avoid nuisance alarm trips since the alarm must be manually reset)
note: the failure to switch alarm will activate strobe light on main system enclosure, will activate light on main system display and deactivates common alarm relay to transfer relay contacts. The failure to switch alarm needs to be manually reset.

HI-DEW ALM setting (Air Outlet high humidity alarm setting, degF) : **N/A**
(note: only used if outlet dewpoint sensor with displayed outlet dewpoint option is purchased)

Carbon Monoxide Monitor alarm setting:

Note: this setting is located at the carbon monoxide monitor (refer to the carbon monoxide monitor instruction manual for additional information)

High Carbon Monoxide setting, ppm: **10** (can be adjusted if necessary to satisfy various customer, national, state, or local safety codes and regulations)
note: the High Carbon Monoxide alarm will activate strobe light on main system enclosure, will activate light on main system display, activates light on carbon monoxide monitor, activates audible alarm on carbon monoxide monitor, and deactivates common alarm relay to transfer relay contacts. This alarm will automatically reset if carbon monoxide level is lower than set point.

continued next page:

Outlet Air Quality based on standard inlet conditions (100 degF inlet temp., 100 psi inlet pressure and 100 degF ambient) and normal inlet atmospheric air to compressor as described in the ASHRAE Brochure on Psychrometry:

Particles:	< 0.01 ppm
Residual oil content:	< 0.003 ppm (based on inlet concentration of 2.5 ppm)
Oil Vapor and hydrocarbons:	< 0.003 ppm
Carbon Dioxide:	< 300 ppm
Carbon monoxide:	< 1 ppm
Oxygen content:	19.5 to 23.5% (20.95% inlet)
Outlet dew point:	-40 PDP or lower

The dryer capacity is reduced when the water loading rate is greater than designed as when the inlet air temperature is higher or when the inlet pressure is lower than specified above.

Pre-requisites for Installation:

To ensure a safe and smooth installation, we recommend you go through the steps indicated below:

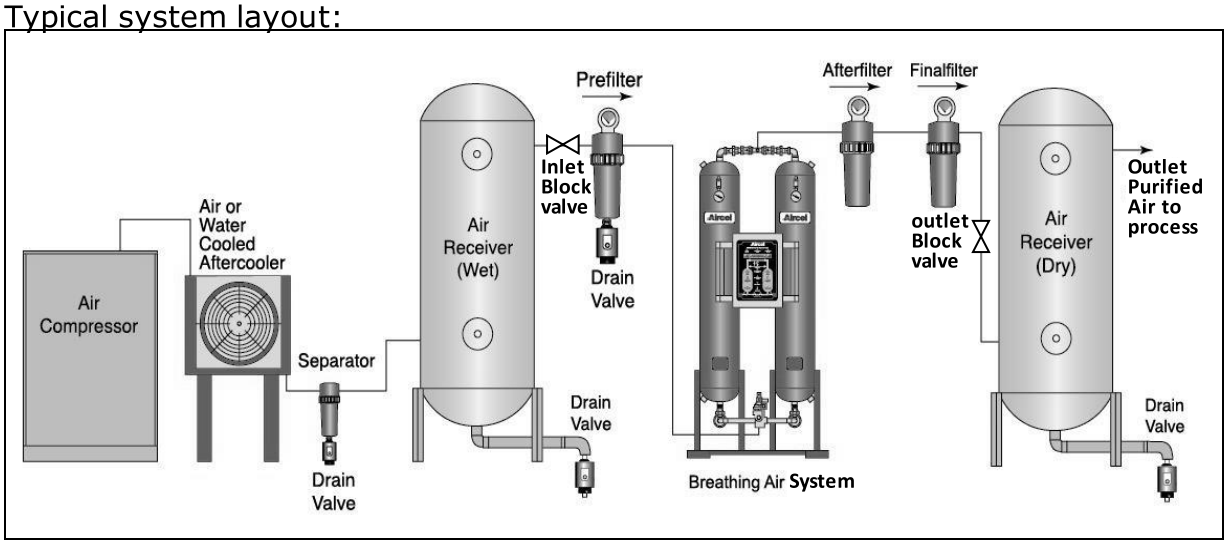
- Make sure that all personnel involved have read this Operation Manual thoroughly. If you have any questions, feel free to contact your AirCel representative or the factory and we will be glad to assist you. If you need help with the installation and commissioning, we will be glad to schedule a factory serviceman to visit your site and perform the entire process of installation for a nominal fee.
- Have extra copies of the Operation Manuals.
- Special care must be taken while transporting the unit to the installation site.
- System must not be moved or lifted by the attached piping

Location:

- Careful consideration should be given to the location of the System in order to assure optimum results. Ensure that the load bearing weight of the floor is adequate for the weight of the System.
- The System should be located in an open area and a level ground. System can be bolted to the floor to eliminate vibrations.
- The ambient temperature should be between 40 Deg.F and 100 Deg.F. Low temperature could affect the System process and result in high outlet dew point.
- In conditions where the ambient drops below freezing, AirCel recommends the use of heat trace for the equipment. For a nominal price, this feature will ensure that you have trouble free operation during the winter months (the dewpoint of the outlet air will be consistent)
- System and accompanying filters should be installed with at least 2~5 feet clearance from the adjoining walls to provide easy access for routine maintenance.

Installation:

Typical system layout:



Note: Only Qualified personnel should make electrical and mechanical connections.

WARNING: **On the Outlet Purified Air to customer process it is recommended to have a an Oxygen Monitoring Device and Alarm, VOC Monitoring Device and Alarm , a Dew Point Monitoring Device and Alarm, and any additional Monitoring devices deemed necessary to ensure the outlet air purity is within customers specifications .**

WARNING: **Do Not use the Purified Air from the system until the air meets the customer requirements.**

WARNING: **This system must be operated or serviced by qualified persons familiar with pressurized systems and electrical controls.**

WARNING: **An air humidifier must be installed downstream of the breathing air purifier by the customer to prevent excessive throat dryness and discomfort in breathing. Breathing air humidifiers can be furnished by the provider of the breathing apparatus (not included in system).**

WARNING: **The system outlet Pressure must be reduced to atmospheric pressure before delivering to personnel breathing the purified air.**

Note: **It is recommended to supply power to the purifier through a customer supplied disconnect switch to remove all power to the purifier.**

Foundation:
System should be mounted on a suitably structured flat and level floor or base that is free from vibration. Special care must be used when lifting the System to prevent tip-over

Mounting:
Bolt System to the foundation using the boltholes provided in the frame.

Piping:
Connect the inlet of the System to the moist air from the compressor/separator/receiver/inlet filter. Install the Inlet piping and the inlet shutoff valve, Install the Outlet piping and the outlet shutoff valve. Compressed air piping has to be at least the same size as that of the inlet and outlet connections of the System. Larger pipe sizes can be used with reducers.
Make certain piping is rated for the pressure of the system.

Back Pressure regulators:
Install backpressure regulator to prevent the possibility of fluidizing the media bed. When there is a sudden increase in the demand for compressed air downstream of the System, a huge pressure drop develops which can affect the performance and the life of the System and the system media. The backpressure regulator helps maintain a constant pressure on the purifier system.

System Vessel Media:
Make sure that the System towers are filled with the various desiccants and Catalyst (the System is loaded initially with the various media prior to shipment). Larger Systems may have Media shipped separately – in which case, the media has to be filled into the pressure vessels from the desiccant fill ports. Care must be taken when filling the media and it must be done gradually to prevent powdering.
The flow diagram and/or Vessel Loading Diagram will give the placement, type and amounts of Media required.

Muffler:
If the event that mufflers have been shipped loose, they must be installed and secured

By-pass:
A bypass valve may or may not be needed, it is depends on the end user requirements. A bypass valve will ensure air downstream ... but the air will not be purified if not flowing through the purifier.

Electrical:

Make all electrical connection to the System as shown on the wiring diagram. Special care must be taken in connecting the proper voltage as indicated on the specification sheet and wiring schematic. It is recommended to supply power to the purifier through a customer supplied disconnect switch to remove all power to the purifier.

Note:

It is mandatory that System be grounded. Use of your plants frame as a ground may cause problems with the control.

A fused disconnect is not supplied with this equipment therefore one must be supplied by customer. All electrical fuses, breakers, etc. should be properly sized.

AirCel Corporation is not liable for any code violations, component damage, downtime or consequential damage related to customer supplied electrical components and connections.

Exhaust:

If you intend to vent your exhaust with additional piping, the discharge piping from the exhaust should not be piped upward without an arrangement for removing trapped condensate. Make sure that you do not apply a backpressure on this exhaust system, additional piping length generally should be of a larger diameter than the purifier system exhaust piping.

Outlet purification monitoring:

The purification system has a standard outlet carbon monoxide monitor and alarm for personnel protection.

It is recommended to have a an Oxygen Monitoring Device and Alarm, VOC Monitoring Device and Alarm , a Dewpoint Monitoring Device and Alarm, and any additional Monitoring devices deemed necessary to ensure the outlet air purity is within customers specifications and for added safety.

Outlet air humidifier:

An air humidifier must be installed downstream of the breathing air purifier by the customer to prevent excessive throat dryness and discomfort in breathing. Breathing air humidifiers can be furnished by the provider of the breathing apparatus (not included in system).

Outlet air pressure regulation:

The system outlet Pressure must be reduced to atmospheric pressure before delivering to personnel breathing the purified air.

Equipment for Installation:

This System does not need special tools for installation

Start-up procedure

Notes, Cautions and Warnings:

Note: Refer to the Mechanical, Electrical and Flow Diagram for the System

Note: It is recommended to have isolation valves before and after the Purifier to maintain High Purity levels when not in use

Note: It may take days to a few weeks of operation to stabilize the system and produce the specified Purification.

CAUTION: Do Not turn Purifier power on until instructed.

CAUTION: Make certain air inlet and air outlet are connected correctly the air inlet is at the end with filter and automatic drain. The air outlet is at the end with the filters and manual drain/vent valves .

CAUTION: Make certain the power supply is connected to the system correctly, a supply voltage of 120VAC-1PH-60HZ is required.

WARNING: Do Not adjust tower/vessel relief valves they are preset by the Valve Manufacturer.

WARNING: Always pressurize and depressurize the system slowly.

WARNING: This system must be operated or serviced by qualified persons familiar with pressurized systems and electrical controls

WARNING: Before servicing any component make certain the system is depressurized and de-energized.

WARNING: Hearing protection is recommended for personnel protection when the system is in operation and or pressurized to protect from any load burst of pressurized air to atmosphere… such as through the depressurization and purge exhaust mufflers, through any vent ports, filter drain ports, etc.

WARNING: Eye protection safety glasses are recommended for personnel protection when the system is in operation and/or pressurized to protect from possible flying debris expelled from the purge exhaust mufflers during tower depressurization or during any depressurization through any vents, drains etc. and any other possible flying debris.

WARNING: Do Not use the Purified Air from the system until the air meets the customer requirements.

WARNING: The dryer must not be subjected for an extended period of time to low operating pressures. Extremely high velocities in the desiccant bed would cause serious attrition of the desiccant and possibly rupture the filter elements. Some control over the flow through the desiccant dryer on start-up must be exercised.

WARNING: Do Not use the purifier without the inlet filter element or outlet afterfilter elements.

WARNING: Do Not use the purifier without the tower media in place.

WARNING: **On the Outlet Purified Air to customer process it is recommended to have an Oxygen Monitoring Device and Alarm, VOC Monitoring Device and Alarm , a Dew Point Monitoring Device and Alarm, and any additional Monitoring devices deemed necessary to ensure the outlet air purity is within customers specifications . (the system has an outlet carbon monoxide monitor and alarm provided as standard equipment for added safety)**

WARNING: **An air humidifier must be installed downstream of the breathing air purifier by the customer to prevent excessive throat dryness and discomfort in breathing. Breathing air humidifiers can be furnished by the provider of the breathing apparatus (not included in system).**

WARNING: **The system outlet Pressure must be reduced to atmospheric pressure before delivering to personnel breathing the purified air.**

Note: **It is recommended to supply power to the purifier through a customer supplied disconnect switch to remove all power to the purifier.**

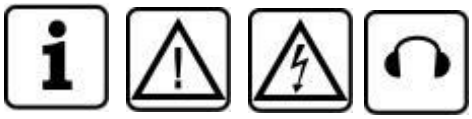
At any point during the process of startup or shutdown, you notice anything unusual; we recommend you refer to the operation manual immediately. If you cannot find the answer in the troubleshooting section, contact your AirCel representative or the factory at once.

1. Ensure that the System is connected to a suitable compressed air supply. Make sure the pressure of the supply is equal to the normal operating pressure of the System.
2. Check to make sure the inlet "shut-off' valve is closed and the outlet "shut-off' valve is closed.
3. Close all manual drain valves/vent valves.
4. Make certain the inlet prefilter drain isolation valve is open.
5. Slowly pressurize the inlet receiver tank prior to the purifier.
6. Slowly pressurize the purifier system by gradually opening the inlet shut-off valve to the full OPEN position.
7. Make certain the Carbon Monoxide Analyzer supply sample air pressure regulator is set for 55 psi maximum. (also refer to carbon monoxide monitor manual)
8. When the purifier system is completely pressurized, check the complete system for air leaks. Use soap and water to test all joints and fittings. If any leaks are detected, immediately depressurize the unit and correct the leaks.

(continued next page)

9. When normal operating pressure is reached, switch on electrical power (Turn switch to ON position)
10. Open the outlet valve slowly to allow air downstream. (caution: typically the system outlet purification quality should be verified ok before allowing the air downstream)
11. When energized one of the towers should depressurize.
12. Check the operation of one cycle completely by following the control panel lights on the electrical box.
13. Check the parameter settings in the display menu. (refer to the BHD display screen shots with descriptions section and the SYSTEM CONTROL SETTINGS section... for more information and typical settings)
14. Check the drain valve for proper operation and discharge of liquid (filters and separators).
15. Make certain Carbon Monoxide Analyzer power is on and functioning. (refer to the carbon monoxide manual if needed) note: Make certain the Carbon Monoxide Analyzer supply sample air pressure regulator is set for 55 psi maximum, this regulator will be attached to the air outlet sampling line that is routed to the carbon monoxide monitor.
16. If the system has an outlet dew point sensor with the outlet dew point displayed on the system display, the needle valves before and after the dew point sensor may need to be adjusted. The needle valve before the dew point sensor sample cell should be full open... the needle valve after the dew point sensor sample cell should be slightly open until a slight amount of air is felt on the end of coiled tube to ambient.
17. The purifier system should now be operating properly... observe operation for several cycles... to verify operation.

Shut-down procedure for long term or short term non-usage period.



1. The system can be shutdown at any time.
2. For best purity the system is best left isolated and pressurized.
3. Slowly CLOSE the outlet "shut-off" valve (customer supplied).
4. Slowly CLOSE the inlet "shut-off" valve (customer supplied).
5. Next, turn power off/on switch off at the purifier system.
6. If an optional outlet dewpoint sensor is included in the system make certain the outlet needle valve attached to the sample cell is closed (the needle valve closest to the exhaust coil to ambient no airflow should be felt at end of coiled tube)
7. The system should now be isolated and pressurized.

Shut-down procedure for maintenance

1. Slowly CLOSE the outlet "shut-off" valve (customer supplied).
2. Slowly CLOSE the inlet "shut-off" valve (customer supplied).
3. The system can be left to run for a cycle to depressurize the vessels.
4. Next, turn power off/on switch off at the purifier system.
5. Disconnect main electrical power to purifier system.
6. Next... open the vent valve on the bottom of the outlet afterfilter, this will complete the depressurization of the system.
7. The system can now be serviced (caution: always remove fittings slowly in case some residual pressure is remaining in system, and double check to make certain electrical power is not present.

Maintenance 

Prior to performing any maintenance on the System, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual. AirCel strongly recommends the strict adherence of all the safety procedures prior to any performing any maintenance activity on the System.
(note: refer to the shutdown procedure section for shutting the system down and the startup section for startup operation, use electrical, mechanical and flow diagrams as reference)

A. The pressure differential indicator referred to as the "Delta-P" is a very good indicator of the state of the filter elements. Maintenance personnel must pay attention to these to keep the System running with full efficiency.
B. The useful life of a filter element depends on the quality of air.
C. Powdered desiccant can accumulate in the muffler and increase the backpressure in the regenerating tower. (note: mufflers should be changed after the first 2-weeks of operation and typically every 2 to 3-months thereafter.)
D. Excessive Oil and oil vapor can reduce the life of the Vessel Media. Take precautions to eliminate oil from the airflow
E. Fluctuating dewpoint indicates uneven Purification and regeneration between the towers.

Weekly checklist:

1. Check all drains, valves , prefilter, afterfilter and separators
2. Check the pressure differential indicators (Delta-P) on the pre-filter and afterfilter.
3. Check mufflers ... clean, or replace as needed. (note: mufflers should be changed after the first 2-weeks of operation and typically every 2 to 3-months thereafter.)
4. Verify system is operating properly and all control panel lights and display operation agree with the system operation.
5. Verify Carbon Monoxide monitor is on and functioning and within safe margin.
6. Check the outlet Dewpoint to ensure the dewpoint is being achieved.
7. Verify the outlet air purity is within specifications.

Semi-annual checklist:

1. Remove and inspect all filters for excessive particulate loading and physical damage – if needed replace prefilter element, afterfilter element, pilot air filter element and mufflers.
2. Check filter pressure differential indicators ,if red, replace the element. (note: pressure differential indicators can fail, a typical rule of thumb... replace elements after each 3000 hours of operation)
3. Change the exhaust mufflers. (note: mufflers should be changed after the first 2-weeks of operation and typically every 2 to 3-months thereafter.)
4. Check all solenoid valves – check valve seating, coil condition and control circuit.
5. Carbon Monoxide Analyzer sensor calibration (refer to Carbon Monoxide Analyzer manual for calibration procedure)
6. Verify system is operating properly and all control panel lights and display operation agree with the system operation.
7. Verify Carbon Monoxide monitor is on and functioning and within safe margin.
8. Check the outlet Dewpoint to ensure the dewpoint is being achieved.
9. Verify the outlet air purity is within specifications.

Annual checklist:

1. Replace prefilter elements, afterfilter elements, pilot air filter elements and mufflers. (note: mufflers should be changed after the first 2-weeks of operation and typically every 2 to 3-months thereafter.)
2. If included in system... Recalibrate dew point sensor probe ,send back to factory for recalibration.
3. Carbon Monoxide Analyzer sensor calibration (refer to Carbon Monoxide Analyzer manual for calibration procedure)
4. Verify system is operating properly and all control panel lights and display operation agree with the system operation.
5. Verify Carbon Monoxide monitor is on and functioning and within safe margin.
6. Check drains for proper operation.
7. Check all valves for proper operation... this is a good time to clean and/or replace valve components.
8. Check the outlet Dewpoint to ensure the dewpoint is being achieved.
8. Verify the outlet air purity is within specifications.

Troubleshooting

The following section briefly discusses the various faults that can occur in the System, the reason of the fault and how it can be rectified. If you do not find the solution to your problem, contact your AirCel representative or the factory. All necessary safety and precautionary steps must be followed before attempting to perform any of the recommended measures to resolve any faults in the Air System.
Before any attempt is made to undertake any action, the machine must be shut down. Follow the shutdown procedure section.
(note: refer to the shutdown procedure section for shutting the system down and the startup section for startup operation, use electrical, mechanical and flow diagrams as reference)

1. Check to make sure if the unit has been damaged externally or if any part is missing.
2. Check if there is proper power supply and if it corresponds to that mentioned on the data plate.
3. Check to see if there is power at all the electrical connections in the machine and if it's the required amount
4. Check if control air is available in the right quantity at all pneumatically operated components
5. Make sure all shut-off valves are in the correct position
6. Check the Airflow, inlet temperature and pressure and make sure it falls within the operating range

(continued next page)

Problem/Reaction of the Unit	Possible Cause	Measure to be taken
High dew point	High inlet air flow.	Reduce inlet air flow.
	Inlet air temperature above design spec.	Reduce inlet air temperature to design spec.
	Poor pre-filtration.	Check pre-filter element.
	Inlet air pressure below design spec.	Increase pressure to the System.
	Media contaminated.	Replace media.
	Plugged purge orifice	Remove outlet valve shuttle and clean orifice and valve
	Back pressure in regenerating chambers.	Mufflers are clogged, install new mufflers.
	Exhaust valve(s) not fully opening or closing.	Clean and re-pack exhaust valve(s).
High-pressure drop.	High inlet flow rate.	Reduce inlet flow rate to meet System spec.
	Inlet prefilter dirty.	Inspect and replace as needed.
	Low inlet pressure.	Increase inlet pressure to design pressure.
	media dusting.	High inlet flow velocities due to high flow.
Dryer fails to switch towers.	Inlet valve not operating.	Check for pilot air signal.
	No input power.	Check to assure that System is being on with correct voltage.
	Exhaust valves(s) not functioning.	Check exhaust solenoid valve.
	Pilot air supply restricted.	Check pilot filter, and pilot tubing restriction.

Purge Failure	Plugged purge orifice	Remove outlet valve shuttle and clean orifice and valve
	Purge exhaust valve fails to close	Check solenoid actuator, purge exhaust vale and control module
	Purge muffler clogged	Remove and clean, replace if necessary
Pressurization Failure	Repressurization failure	Check purge orifice
High back pressure	Purge muffler clogged	Clean and replace if required
	Restrictive purge exhaust piping Check valve leakage	Clean and replace with larger pipe if required Clean, repair or replace
High Carbon Monoxide	Vessel Media bad Carbon Monoxide Analyzer not functioning properly	Replace Media Refer to Carbon Monoxide Manual for information

AirCel Compressed Air & Gas Warranty

The Manufacturer warrants it standard Refrigerated Dryers are free from defects in materials and workmanship for two years (1st year parts and labor, 2nd year parts only) from the date of invoice. Custom engineered products, desiccant air dryers, and nitrogen generators are warranted to be free from defects in materials and workmanship for one year (parts and labor coverage) from date of invoice. The Manufacturer Warranty excludes damages due to: corrosion, lack of Proper maintenance, incorrect installation, modification, or misapplication of equipment. Routing maintenance or adjustments required under normal operation as outlined in the Manufacturer's operation and maintenance manuals are not covered under warranty. After the Manufacturer has been given adequate opportunity to remedy any defects in material or workmanship in accordance with Manufacturer's Warranty Policy and Procedures, the Manufacturer retains the sole option to accept the return of the goods, with freight paid by the purchaser, and to refund the purchase price for the goods after confirming the goods are returned undamaged and in usable condition. Such a refund will be the full extent of the Manufacturer's liability. The Manufacturer shall not be liable for any other costs, expenses or damages whether direct, indirect, special, incidental, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by the Director, General Manager or Vice President of the Manufacturer. THERE EXIST NO OTHER REPRESENTATIONS, WARRANTIES OR GUARNATEES EXCEPT AS STATED IN THIS PARAGRAPH AND ALL OTHER WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESS OR IMPLIED ARE HEREBY EXPRESSLY EXCLUDED AND DISCLAIMED.

Refer to Aircel's website **airceldryers.com** for a complete copy of the Warranty or contact Aircel Customer Service Dept. for a copy.

Customer Hotline: (800) 767-4599