

# POWEREX<sup>®</sup>

PURE AIR TECHNOLOGY

## Regenerative Heatless Desiccant Dryer System

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

### DESCRIPTION

The desiccant dryer system utilizes the process of adsorption in which molecules accumulate on the surface of an adsorbent, isolating the molecules from its compound. In the case of the dryer, water molecules accumulate on desiccant bead adsorbent, removing them and other harmful contaminants from the airstream. It utilizes a twin-tower design to dry the air coming from the compressor in one tower while the other tower is being regenerated for future use.

Regeneration is achieved by a process known as purging in which a portion of the dried air from the pressurized tower is directed back over the desiccant beads in the depressurized tower. A heatless desiccant dryer uses no heating elements to regenerate the adsorbent. The dry air used to purge the desiccant beads of moisture is considered “wasted” air since it isn’t recoverable for application use and is for that reason engineered to a minimum.

An additional purge saving mode of operation ensures that the dryer is operating most efficiently yet providing a dependable dew point even under continuous load. Dryers capable of achieving pressure dew points as low as -100°F are available.

### SAFETY GUIDELINES

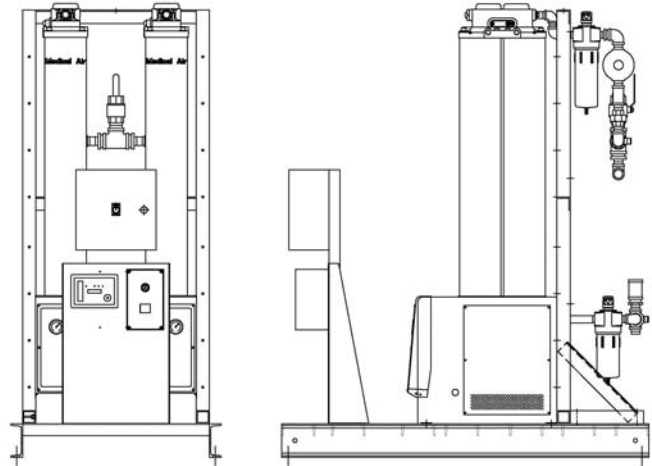
**A SEPARATE SAFETY BOOKLET IS PROVIDED ALONG WITH THIS MANUAL. READ AND UNDERSTAND THE SAFETY BOOKLET.** This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols.

**⚠ DANGER** *Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or injury.*

**⚠ WARNING** *Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.*

**⚠ CAUTION** *Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or*

**NOTICE** *Notice indicates important information, that if not followed, may cause damage to equipment.*



### SPECIFICATIONS

Product	Regenerative Heatless Desiccant Dryer, MDD Series
Dew Point Capacity	<b>Zander KMT-RX-2:</b> +20°F Dew Point at 100 PSI <b>DH DME-RX-2:</b> 0°F Dew Point at 100 PSI <b>KMT &amp; DME Reds:</b> -40°F Dew Point at 100 PSI
Operating Pressure	60 psig—125 psig (4,14 bar—8,62 g) at inlet
Operating Temperature	35°F—122°F (2°C—50°C) at inlet
Overpressure Protection	ASME Safety Valve Factory Set and Sealed
Outlet Air Connections	MDD1008, 1358: 1 1/2" FNPT MDD1658: 2" FNPT
Flow Capability @ 100 PSI	MDD1008: 135 CFM, MDD1358: 156 CFM, MDD1658: 211 CFM
California Ordinance 462 (L) (2)	Meets Requirements of this Ordinance
Control Enclosure	NEMA 1 50/60 Hz
Power Requirements	110 V -120 V AC ± 10%, Alternate 230V 50/60 Hz
Fuse	Type FNM 7 amp
Est Weight	MDD1008: 1196 lbs, MDD1358: 1250 lbs., MDD1658: 1750 lbs

# Regenerative Heatless Desiccant Dryer System

## SAFETY INFORMATION

### CALIFORNIA PROPOSITION 65

#### **⚠WARNING**

*This product contains chemicals, including lead, known to the State of California to cause birth defects and other reproductive harm. Wash hands after handling.*

### GENERAL

#### **⚠WARNING**

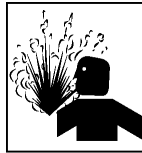
*Failure to comply with these instructions can lead to personal injury and/or property damage.*

#### **⚠WARNING**

*Always notify the appropriate medical facility staff before commencing any work on the **compressed air system**; air level and quality may be affected during maintenance.*

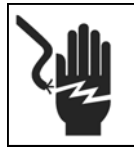
#### **⚠WARNING**

*Dryer under pressure. Isolate and depressurize the dryer and its components before commencing any electrical maintenance.*



#### **⚠WARNING**

*Electrical shock hazard exists. Different parts of the dryer carry electrical current. Any potential must be properly de-energized before commencing any electrical maintenance.*



#### **⚠WARNING**

*The dryer's desiccant towers are spring loaded. Extreme caution should be taken if/when disassembling. Please contact the manufacturer for assistance.*

#### **⚠WARNING**

*Hazard from sudden air ejection. Normal operation of the dryer consists of sudden vessel depressurization. Ear and eye risks are present. Always wear proper protection equipment when around the dryer.*



1. Read all manuals included with this product carefully. Be thoroughly familiar with the controls and the proper use of the equipment.
2. Follow all local electrical and safety codes as well as in the United States, the National Electrical Codes (NEC) and Occupational Safety and Health Act (OSHA).
3. Only persons well acquainted with these rules of safe operation should be allowed to use the unit.



## **⚠DANGER**

### Breathable Air Warning

This unit is not equipped and should not be used "as is" to supply breathing quality air. For any application of air for human consumption, you must fit the compressed air source with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in Compressed Gas Association Commodity Specification G 7.1-1966, OSHA 29 CFR 1910.134, and/or Canadian Standards Associations (CSA).

### DISCLAIMER OF WARRANTIES

**IN THE EVENT THE UNIT IS USED FOR THE PURPOSE OF BREATHING AIR APPLICATION AND PROPER IN-LINE SAFETY AND ALARM EQUIPMENT IS NOT SIMULTANEOUSLY USED, EXISTING WARRANTIES ARE VOIDED, AND POWEREX DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY LOSS, PERSONAL INJURY OR DAMAGE.**

4. Before each use, inspect **compressed air system** and electrical components for signs of damage, deterioration, weakness or leakage. Repair or replace defective items before using.
5. Check all fasteners at frequent intervals for proper tightness.
6. Only persons experienced and properly trained in **compressed air systems** or licensed electricians should service or repair this dryer.
7. The dryer is intended for drying compressed air. **Under no circumstances should it be used to dry any other gases.**
8. Do not operate the dryer if a leak is detected.
9. Do not operate the dryer at pressures and/or temperatures above the marked maximum allowable.
10. Do not operate the dryer if any signs of damage are detected or if the dryer isn't operating as described in this manual.
11. No conversions or modifications should be made to the dryer without prior approval by the manufacturer.

## TERMS AND DEFINITIONS

### DUPLEX DRYER SYSTEM

Per the NFPA 99 Standard for Healthcare Facilities, the dryer system is completely redundant, having one dryer capable of peak demand and with one dryer in reserve at all times. Each dryer consists of two desiccant towers, one pre-filter, one after-filter, regulator, safety relief valve, a dew point dependent control system and bypass plumbing. The system includes a pre-piped and pre-wired dew point monitor, carbon monoxide monitor, and certifier's test port.

#### NOTICE

*Only one dryer should be in service at any given time, unless a dryer switchover procedure is being performed. CLOSE THE ISOLATION VALVES FOR THE DRYER NOT IN SERVICE.*

### DRYER 1 & 2

Each dryer is a regenerative heatless desiccant dryer. It employs a pressure swing adsorption cycle and purge saving control system. Refer to page 6 for dryer flow schematic.

The pre-filter equipped with a separator element prevents any liquids and particulates from entering the dryer. It comes with an automatic condensate drain valve and filter element change indicator. The after-filter stops any desiccant dust from leaving the dryer. It comes with an indicator as to when the element needs to be replaced. Each regulator is factory set at 55 PSIG and protected with a safety relief valve rated for 75 PSIG.

### PRESSURE SWING ADSORPTION CYCLE

The dryer uses a fully automatic pressure swing adsorption cycle in which one tower is online in a drying phase while the other is offline either preparing or waiting for the next drying phase. The towers rotate between phases based on either time or dew point status, depending on the mode of operation.

The two phases are described below:

- A. **Drying Phase:** A tower in a drying phase receives humid air through the pre-filter and then flows upward through the desiccant bed. At full system pressure the desiccant dehumidifies the air by means of adsorption. The dry air is then distributed out the top of the tower for different uses:
- B. **Regeneration Phase:** Parallel to the tower in a drying phase the opposing tower is in one of four stages of the regeneration phase.

**1. Expansion:** The expansion stage takes place immediately after a tower switches from the drying phase to the regeneration phase. During this stage the tower pressure is expanded to ambient through the purge muffler over the course of a couple seconds, accompanied by a sudden blast.

**2. Purge:** A portion of the dry air from the opposing tower in the drying phase is bled through an orifice and directed through the top of the regenerating tower now at ambient pressure. The moisture stored in the desiccant bed is picked up by this dry air and expelled out the purge muffler.

**3. Pressurize:** After the tower is purged, the orifice continues to bleed dry air into the regenerated tower, building it up to system pressure. This prevents the dryer's pre-filter and desiccant bed from being shocked with a blast of air upon tower switchover. Shocking a desiccant bed not only puts a strain on the effectiveness of the filtration and drying systems but can cause the desiccant material to dust. That dust will clog the after-filter and decreases the dryer's capacity to dry the air passing through it.

**4. Standby: (KMT's only)** When the dryer is switched into the variable mode of operation, the regenerating phase is capable of a fourth stage in which the regenerated tower is standing by, fully pressurized, ready for the next drying phase. The control system will switch to this tower as soon as the measured dew point has reached the set point for the switchover.

### TOWER SWITCHOVER

When the dryer control system calls for a tower switchover, either by reaching a certain time or dew point, the towers switch the function each is performing and the process starts over again.

# ***Regenerative Heatless Desiccant Dryer System***

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## **INSTALLATION**

### **INSTALLATION SITE**

1. The dryer must be located in a clean, well lit and well ventilated area.
2. The installation site must be protected against the weather. The area should be free of excessive dust, toxic or flammable gases, moisture, water and direct sunlight.
3. Never install the dryer system where the ambient temperature will drop below +34°F or rise above +104°F or where humidity is high.
4. The installation area must be level, firm, and capable of holding the weight of the dryer system.
5. The site should provide sufficient spacing around the system in order to be able to carry out routine maintenance on each dryer. At least three feet is recommended from the front and sides of the dryer system.
6. Never install the dryer system outside.

### **MOVING AND SECURING**

If it is necessary to move a freestanding dryer, proper technique is extremely important. The dryer should only be lifted from its structural points such as the frame or tank brackets, never from its piping. Caution should be taken when lifting a dryer due to its high center of gravity. Once the dryer is in position, use suitable anchoring fasteners in all four holes provided to secure the dryer frame to the mounting location. Suitable vibration dampening devices should be used if that is a potential condition at the installation site.

### **POWER CONNECTION**

The main dryer control box requires a stable 120VAC  $\pm$  10%. The individual dryer control boxes are pre-wired to that main panel. No other installation procedures to power the dryer are necessary.

### **WIRING**

All electrical connections to the main system control panel must be performed by a qualified electrician. Installations must be in accordance with local and national electrical codes.

### **DEW POINT MONITOR CONNECTION**

The dew point monitor's relay output contacts are wired to a relay in the main system control panel. The individual dryer control boxes are pre-wired to that main panel. No other installation procedures to run the dryer in a dew point dependant mode are necessary.

## **CONNECTIONS**

The dryer system inlet and outlet are equipped with female NPT ports which differ in size depending on the dryer model. Ensure before plumbing in and out of the dryer that all compressed air lines are clean, undamaged, and won't subject any stress to the dryer's piping.

1. Make sure the piping is lined up without being strained or twisted when assembling the piping for the dryer.
2. Appropriate expansion loops or bends should be installed at the dryer to avoid stresses caused by changes in hot and cold conditions.
3. Piping supports should be anchored separately from the dryer to reduce noise and vibration.
4. Never use any piping smaller than the dryer connection.
5. Use flexible hose to connect the outlet of the dryer system to the customer piping so that the vibration of the dryer does not transfer to the piping.

### OPERATION

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#### BEFORE START UP

1. Make sure all safety warnings, labels and instructions have been read and understood before continuing.
2. Remove any shipping materials.
3. Confirm that the electric power source and ground have been firmly connected.
4. Be sure all pressure connections are tight.
5. Check to be certain all safety valves, etc., are correctly installed.
6. Securely mount all panels and guards.
7. Check that all fuses, circuit breakers, etc., are the proper size.
8. Make sure the inlet and after filters are properly installed.

#### TURNING THE DRYER SYSTEM ON

The dryer system is supplied power through a three position switch on the main system control panel labeled **Dryer 1—BOTH—Dryer 2**. After the appropriate dryer is selected, that dryer's control box has electric potential.

#### START UP

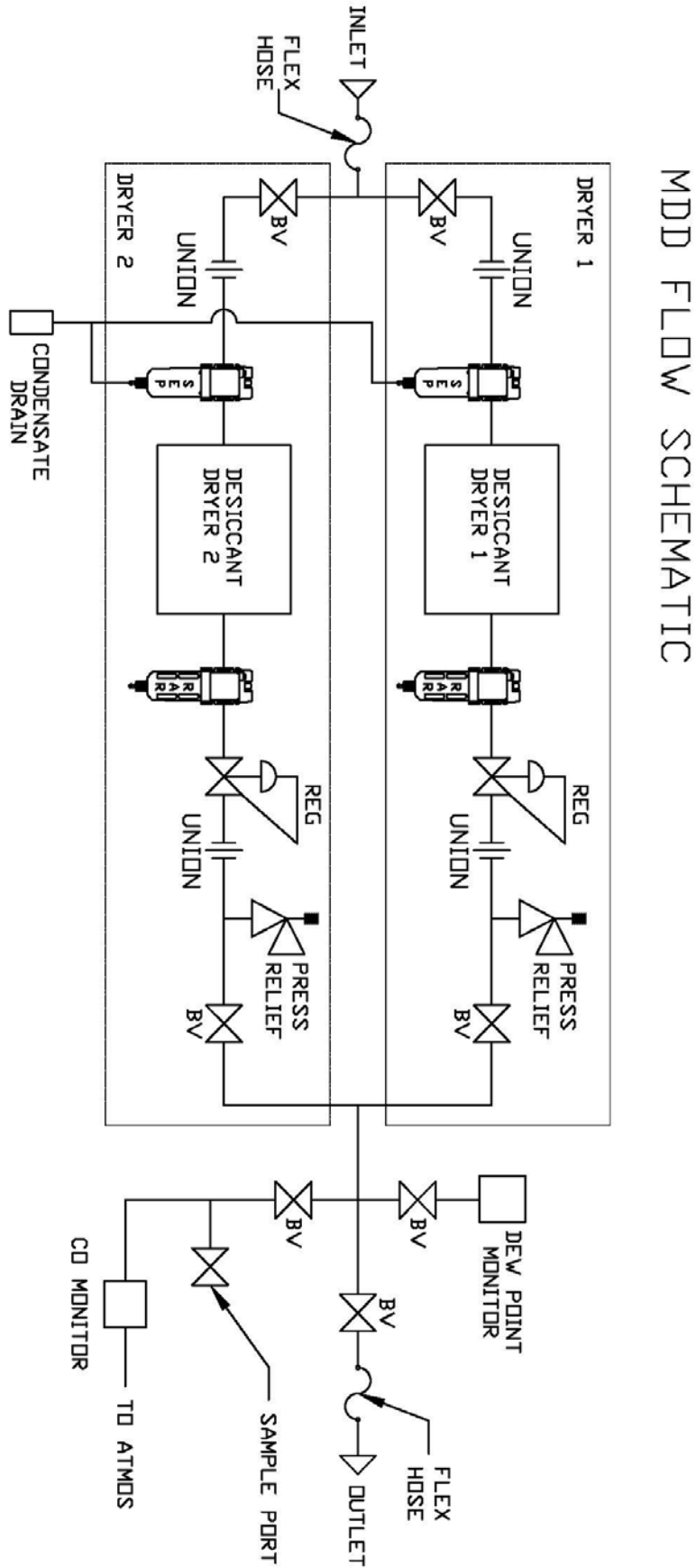
- Ensure that all isolation valves (dryer, monitor, and source) are closed.
  - Ensure the electrical connections are in safe contact and in good condition.
  - Ensure the compressed air system upstream of the dryer is pressurized.
1. At the main system control panel there will be a switch labeled **Dryer 1—BOTH—Dryer 2**. Place this switch to the **Dryer 1** position. This will apply power to the dryer control box for **Dryer 1**.
  2. SLOWLY open the inlet isolation valve to **Dryer 1**. Avoid sudden pressure build-up in every circumstance as it can cause damage to the dryer.
  3. **Dryer 1** will now begin cycling between its two desiccant towers.
  4. Check for airflow from **Dryer 1**'s purge mufflers.
  5. SLOWLY open **Dryer 1**'s outlet isolation valve, making sure the source valve is still closed.
  6. SLOWLY open the monitor isolation valve(s) allowing air to flow to the CO and dew point monitor's sensors.
  7. Check for airflow from the dew point sensor's orifice tube.
  8. Allow the dryer to cycle in this state for at least 15 minutes. During this time, test all joints for any leaks using a leak detector spray or suitable alternative. Repair any detected leaks as they will cause degraded performance of the dryer.

9. **Dryer 1** is now capable of drying air and switching into the economy mode.
10. SLIGHTLY open the outlet source valve and allow the compressed air system downstream of the dryer to pressurize. This will prevent the dryer from being overloaded.
11. SLOWLY open the source valve to its fully open position. **Dryer 1** is now in service and fully operational.

#### OPERATION

##### *Variable Cycle*

The drying and regenerating phases are based on an elapse of time as well as dew point. If the dew point is  $-10^{\circ}\text{F}$  or above, the control system operates the dryer in the fixed cycle mode. In the case that the demand on the dryer is low and the dew point is below  $-15^{\circ}\text{F}$ , the dryer will switch into an economy mode in which the purge flow is eliminated and the drying phase time is increased.



### **MAINTENANCE**

#### **PREVENTATIVE MAINTENANCE SCHEDULE**

To ensure reliable, uninterrupted dryer operation, follow the recommended preventative maintenance schedule provided in the dryer manual. If done so, the dryer system should provide years of dependable service.

#### **MONTHLY SWITCHOVER PROCEDURE**

In order to maintain proper and unified performance from the desiccant air dryer system, it is recommended that the dryers be alternated on a regular schedule (once every month). The following procedure explains alternating two systems, where

**Dryer 1** is the online dryer and **Dryer 2** is the offline dryer.

1. At the main system control panel there will be a switch labeled **Dryer 1—BOTH—Dryer 2**. Place this switch to the **BOTH** position. This will apply power to both dryers' control boxes.
2. SLOWLY open the inlet isolation valve to **Dryer 2**. Avoid sudden pressure build-up in every circumstance as it can cause damage to the dryer.
3. **Dryer 2** will now begin cycling between its two towers.
4. Check for airflow from **Dryer 2**'s purge mufflers.
5. Allow both dryers to run for a period of 15 minutes to ready **Dryer 2**. At this point **Dryer 2**'s outlet isolation valve is still closed, and **Dryer 1** remains the online dryer. During this time, test all plumbing joints on **Dryer 2** for leaks with a leak detector spray or suitable alternative. Repair any detected leaks as they will cause degraded performance of the dryer.
6. SLOWLY open **Dryer 2**'s outlet isolation valve.
7. Close **Dryer 1**'s outlet isolation valve.
8. Wait 15 seconds for **Dryer 1** to fully pressurize and close **Dryer 1**'s inlet isolation valve.
9. At the main system control panel, rotate the dryer selector switch labeled **Dryer 1—BOTH—Dryer 2** to the **Dryer 2** position. **Dryer 1** is now dormant. **Dryer 2** is in service and fully operational.

#### **MAINTENANCE SHUT DOWN**

All of the maintenance items that take place at 6 month intervals or more require that the dryer be shut down in order for them to take place. The following procedure explains how to shut down a dryer that needs maintenance labor.

1. Bring the reserve dryer online by following steps 1 through 7 of the Monthly Switchover Procedure.
2. Close the outlet isolation valve of the dryer that needs maintenance.
3. Close the inlet isolation valve of the same dryer.
4. Rotate the dryer cycle switch on the main control box to the **BOTH** position and allow the dryer to continue cycling until the purge exhaust has fully depressurized all towers. Check all towers' pressure gauge to confirm

that the system is depressurized.

5. At the main system control panel, rotate the dryer selector switch labeled **Dryer 1—BOTH—Dryer 2** from the **BOTH** to whichever is now online.
6. Isolate and disconnect the electrical power to the dryer. Follow all Lock out/Tag out procedures while maintenance is being carried out.

#### **CLEANING OR REPLACING THE PRE-FILTER'S AUTO DRAIN VALVE**

The auto drain valve is a float mechanism condensate trap. It automatically opens and drains the collected condensate as soon as the level of fluid rises to lift the float. If the valve is suspected to be malfunctioning it should be cleaned or replaced. A typical characteristic of valve malfunction is a permanent flow noise from the drain outlet signifying the float mechanism is stuck open or the float mechanism is stuck closed indicated by water buildup in the bowl. In either case, the valve needs to be removed for cleaning or replacement.

To do this:

1. First perform a maintenance shut down, making sure the dryer needing maintenance is fully depressurized and isolated from all electrical potential.
2. Remove the drain hose from the auto drain outlet.
3. Remove the filter bowl by twisting counter-clockwise.
4. Loosen and remove the retaining nut at the bottom of the filter bowl.
5. The auto drain valve can now be pushed out the top of the bowl to be cleaned or replaced.
6. Place the clean or new auto drain valve in the bowl and tighten the retaining nut.
7. Return the filter bowl securely to the body and the drain hose to the auto drain outlet.

#### **REPLACING THE FILTER ELEMENTS**

The filter elements will eventually become clogged with particulates and contaminants and should be replaced at regular intervals. A clogged filter element creates too large of a pressure drop across the filter and can hurt the dryer's performance. The differential pressure indicators on top of the filters will change from green to red when the pressure drop across the filter is too high, usually signaling an element that needs to be replaced.

1. First perform a maintenance shut down, making sure the dryer needing maintenance is fully depressurized and isolated from all electric potential.
2. Remove the filter bowl by twisting counter-clockwise.
3. Unscrew the filter element from the body and properly discard it.
4. Screw in the new element and replace the filter bowl securely.

## ***Regenerative Heatless Desiccant Dryer System***

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### **MAINTENANCE CONT.**

5. Disposed of the old filter element in an environmentally safe way, in accordance with all current statutory regulations.

### **REPLACING THE PURGE MUFFLER**

The purge muffler is a critical component of the dryer. If it becomes clogged, dryer performance will degrade quickly due to the restraints on the purge stage of the regeneration phase. A characteristic of a clogged muffler is a tower pressure gauge reading anything but zero while that tower is purging.

1. First perform a maintenance shut down, making sure the dryer needing maintenance is fully depressurized and isolated from all electric potential.
2. Remove the purge muffler by unscrewing it from the purge solenoid valve.
3. Screw the new muffler into place.

### **REPLACING THE DESICCANT AND CHECK VALVES**

Refer to the dryer manual for maintenance.



**TROUBLESHOOTING GUIDE**

Problem	Cause	Corrective Action
Control valve not cycling	Conductor Connection	Check and verify conductor connection; see wiring schematic
Dew point degradation	<ol style="list-style-type: none"> <li>1. Control valve failure</li> <li>2. Pre-filter auto drain clogged</li> <li>3. Air receiver auto drain malfunctioning</li> <li>4. Leakage</li> <li>5. Too much back pressure during regeneration phase</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace control valve.</li> <li>2. A clogged pre-filter auto drain will allow liquid condensate to enter the desiccant tower. Check the auto drain to confirm that it is operating correctly.</li> <li>3. An air receiver with a malfunctioning auto drain will send more than intended amounts of moisture towards the dryer, possibly resulting in a degradation of dew point. Confirm the auto drain is working properly in regular intervals.</li> <li>4. All plumbing joints and filter valves should be checked for leaks. Any small leak can degrade the dew point and result in a shortened life span.</li> <li>5. Too much back pressure on a regenerating tower hinders its ability to purge itself of moisture in preparation for the next drying phase. The causes listed below should be investigated.</li> </ol>
Back pressure on a desiccant tower during the regeneration phase	<ol style="list-style-type: none"> <li>1. Clogged purge muffler</li> <li>2. Purge solenoid valve is malfunctioning</li> <li>3. Check valve leaking</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact an authorized distributor for a replacement purge muffler.</li> <li>2. The purge solenoid valve should be removed and inspected for repair or replacement. See dryer manual.</li> <li>3. Remove, inspect, and clean the check valve; replace if necessary. See dryer manual.</li> </ol>
Dryer not switching out of economy cycle when dew point is above -10°F	Wrong connection with dew point monitor	Check the dew point monitor wiring diagram and confirm that the proper controller outputs are relaying to the dryer.
Dryer is not switching into the economy cycle	<ol style="list-style-type: none"> <li>1. Wrong connection with dew point monitor</li> <li>2. Dew point degradation</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the dew point monitor wiring diagram and confirm that the proper controller outputs are relaying to the dryer.</li> <li>2. Check the possible causes from the list above.</li> </ol>
No pressure build up before tower switch-over; Dryer is continuously purging	Purge solenoid valve is not closing	The purge solenoid valve should be removed and inspected for repair or replacement. See dryer manual.
No expansion in tower during regeneration phase	Purge solenoid valve is not opening	The purge solenoid valve should be removed and inspected for repair or replacement. See dryer manual.

## *Regenerative Heatless Desiccant Dryer System*

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### **TROUBLESHOOTING GUIDE CONT.**

<b>Problem</b>	<b>Cause</b>	<b>Corrective Action</b>
Excessive compressed air consumption	<ol style="list-style-type: none"><li>1. Dew point monitor not receiving power</li><li>2. Leakage</li></ol>	<ol style="list-style-type: none"><li>1. Check that the dew point monitor is powered and in normal operation. It sends the signal to the dryer controller to switch in and out of the economy cycle.</li><li>2. Check the auto drain valve of the dryer pre-filter to confirm that it's not stuck open. Clean or replace if necessary.</li></ol>
No dryer light	<ol style="list-style-type: none"><li>1. Power supply interrupted</li><li>2. Blown fuse in control box</li></ol>	<ol style="list-style-type: none"><li>1. Check and verify that the correct dryer is receiving power from the main panel dryer selector switch.</li><li>2. Replace fuse.</li></ol>



## Powerex Limited Warranty

**Warranty and Remedies. (a) General.** Powerex warrants each Compressor System, Vacuum System, Vacuum Pump, Compressor Air-End, or Powerex branded Accessory (collectively "Products", individually each a "Product") to be free from defects in material and workmanship ("Defects") at the date of shipment. EXCEPT AS SET FORTH BELOW, NO OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL EXIST IN CONNECTION WITH THE SALE OR USE OF SUCH PRODUCTS. TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. All claims under this warranty must be made in writing and delivered to Powerex, or such claim shall be barred. Upon timely receipt of a claim, Powerex shall inspect the Product claimed to have a Defect, and Powerex shall repair, or, at its option, replace, free of charge, any Product which it determines to have had a Defect at the time of shipment from Powerex; provided, however, that if circumstances are such as to preclude the remedying of Defect by repair or replacement, Powerex shall, upon return of the Product, refund to buyer any part of the purchase price of such Products paid to Powerex. Freight for returning Products to Powerex for inspection shall be paid by buyer. The warranties and remedies herein are the sole and exclusive remedy for any breach of warranty or for any other claim based on any Defect, or non-performance of the Products, whether based upon contract, warranty or negligence.

(b) (i) **Standard Period of Warranty – Parts and Labor** - The purchase of any system includes our standard warranty. Powerex warrants and represents all Products shall be free from Defects for the first eighteen (18) months from the date of shipment by Powerex, or twelve (12) months from the documented date of startup, or five thousand (5,000) hours of use, whichever occurs first. During such warranty period, Powerex shall be fully liable for all Defects in the Products (the "Product Defects"), i.e., all costs of repair or replacement, which may include "in and out" charges, so long as the Products are located in the continental United States, and the Products are reasonably located and accessible by service personnel for removal. "In and out" charges include the costs of removing a Product from buyer's equipment for repair or replacement.

(ii) **Premium Period of Warranty – Parts and Labor** - In order to be eligible for premium warranty coverage, a premium warranty for each system must be purchased when order is placed. Powerex warrants and represents all Products shall be free from Defects for the first thirty (30) months from the date of shipment by Powerex, or twenty-four (24) months from the documented date of startup, or seventy-five thousand (7,500) hours of use, whichever occurs first. During such warranty period, Powerex shall be fully liable for all Defects in the Products (the "Product Defects"), i.e., all costs of repair or replacement, which may include "in and out" charges, so long as the Products are located in the continental United States, and the Products are reasonably located and accessible by service personnel for removal. "In and out" charges include the costs of removing a Product from buyer's equipment for repair or replacement.

(c) **Additional Period of Warranty – Parts Only (No Labor)**. In addition to the above, Powerex warrants each Powerex branded Compressor Air-End, and Vacuum Pump shall be free of Defects for a period of forty-two (42) months from the date of shipment by Powerex, or thirty-six (36) months from the documented date of startup, or ten thousand (10,000) hours of use, whichever occurs first. Supplier's repair or replacement of any Product shall not extend the period of any warranty of any Product. This warranty applies to the exchange of part(s) found to be defective by an Authorized Powerex Service Center only.

(d) **Coverage** The above mentioned warranty applies to Powerex manufactured units or systems only.

(e) **Exceptions**. Notwithstanding anything to the contrary herein, Powerex shall have no warranty obligations with respect to Products:

- (i) that have not been installed in accordance with Powerex's written specifications and instructions;
- (ii) that have not been maintained in accordance with Powerex's written instructions;
- (iii) that have been materially modified without the prior written approval of Powerex; or
- (iv) that experience failures resulting from operation, either intentional or otherwise, in excess of rated capacities or in an otherwise improper manner.

(f) The warranty provided herein shall not apply to: (i) any defects arising from corrosion, abrasion, use of insoluble lubricants, or negligent attendance to or faulty operation of the Products; (ii) ordinary wear and tear of the Products; or (iii) defects arising from abnormal conditions of temperature, dirt or corrosive matter; (iv) any OEM component which is shipped by Powerex with the original manufacturer's warranty, which shall be the sole applicable warranty for such component.

**Limitation of Liability**. TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, NOTWITHSTANDING ANYTHING TO THE CONTRARY HEREIN, UNDER NO CIRCUMSTANCES SHALL POWEREX BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, PUNITIVE, SPECULATIVE OR INDIRECT LOSSES OR DAMAGES WHATSOEVER ARISING OUT OF OR IN ANY WAY RELATED TO ANY OF THE PRODUCTS OR GOODS SOLD OR AGREED TO BE SOLD BY POWEREX TO BUYER. TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, POWEREX'S LIABILITY IN ALL EVENTS IS LIMITED TO, AND SHALL NOT EXCEED, THE PURCHASE PRICE PAID.

**Warranty Disclaimer**. Powerex has made a diligent effort to illustrate and describe the Products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the Products are merchantable, or fit for a particular purpose, or that the Products will necessarily conform to the illustrations or descriptions.

**Product Suitability**. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of Products for certain purposes, which may vary from those in neighboring areas. While Powerex attempts to assure that its Products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a Product, please review the Product applications, and national and local codes and regulations, and be sure that the Product, installation, and use will comply with them.

**Claims**. Claims pertaining to the Products, with the exception of warranty claims, must be filed with Powerex within 6 months of the invoice date, or they will not be honored. Prices, discounts, and terms are subject to change without notice or as stipulated in specific Product quotations. All agreements are contingent upon strikes, accidents, or other causes beyond our control. All shipments are carefully inspected and counted before leaving the factory. Please inspect carefully any receipt of Products noting any discrepancy or damage on the carrier's freight bill at the time of delivery. Discrepancies or damage which obviously occurred in transit are the carrier's responsibility and related claims should be made promptly directly to the carrier. Returned Products will not be accepted without prior written authorization by Powerex and deductions from invoices for shortage or damage claims will not be allowed. **UNLESS OTHERWISE AGREED TO IN WRITING, THESE TERMS AND CONDITIONS WILL CONTROL IN ANY TRANSACTION WITH POWEREX** any different or conflicting terms as may appear on any order form now or later submitted by the buyer. All orders are subject to acceptance by Powerex.