Arrow Pneumatics, Inc.

BLOWER PURGE DESICCANT AIR DRYER
INSTRUCTION & MAINTENANCE MANUAL

MODEL BP-123 THROUGH BP-725

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BLOWER PURGE DRYER

INSTRUCTION AND MAINTENANCE MANUAL

IMPORTANT

BEFORE INSTALLING OR OPERATING THE DRYER IT IS RECOMMENDED THAT THIS MANUAL BE STUDIED AND CLEARLY UNDERSTOOD.

1. SAFETY PRECAUTIONS

Warnings, Cautions, and Notes used in this manual have the following significance:

WARNING

MAINTENANCE OR OPERATING PROCEDURES AND TECHNIQUES THAT WILL RESULT IN PERSONAL INJURY OR LOSS OF LIFE IF NOT CAREFULLY FOLLOWED.

CAUTION

MAINTENANCE OR OPERATING PROCEDURES AND TECHNIQUES THAT WILL RESULT IN DAMAGE TO EQUIPMENT IF NOT CAREFULLY FOLLOWED.

NOTE

MAINTENANCE OR OPERATING PROCEDURES AND TECHNIQUES THAT ARE CONSIDERED IMPORTANT ENOUGH TO EMPHASIZE.

2. INTRODUCTION

HOW DOES A BLOWER PURGE DRYER WORK?

The Blower Purge Dryer is a twin tower drying system. It is also called an “absorbent” or “desiccant” type dryer. In operation, a regenerative dryer has one tower on-line drying the compressed air stream while the off-line tower is regenerating itself. This process alternates automatically and consciously on 4 hour intervals. We call on complete cycle an 8 hour NEMA cycle.

A. Dryer Air Flow Path— Drying/Regenerating

Wet saturated air enters the inlet of the dryer (top) and is routed down through the desiccant in the on-line tower (left tower is our example). Like a sponge, the desiccants in this tower soak up the water and dry the air to –40°F pressure dew point (0.0521 gr/cf). At this dew point, the air is very dry and is sent downstream to your process.

To regenerate the off-line tower (right tower), this type of dryer is supplied with an integrally mounted centrifugal-type blower. Air (purge air flow) from the blower is delivered to an external heater, to increase its moisture holding capacity, and then routed through the off-line tower (right tower). The heater raises the temperature of the blower-supplied purge air to 350°F to 425°F.

This heated purge air stream has low vapor pressure which allows it to efficiently dry out (regenerate) the wet desiccant in the off-line tower.

As the purge air passes through the desiccant bed of the off-line tower, the hot purge air picks up moisture, drying out the desiccant. The hot purge air gradually “soaks” up all the water found in the off-line tower’s desiccant bed. Now “wet”, the purge air is discharged from the drying system through the purge muffler.

3. INSTALLATION

Arrow Regenerative Air Dryers are shipped as completely assembly packages, filled with desiccant ready to install.

Visually check the dryer to make certain that all air lines and electrical connections are securely fastened and were not damaged in transit. If there is evidence of damage, immediately enter a claim with the carrier, and notify your Arrow representative.

A. APPLICATION CHECK AND ANALYSIS

To achieve the best dryer performance, you should carefully check that the design and installation requirements outlined below are satisfied.

1. Operating pressure of your Arrow Dryer can range from 60 min to 150 max PSIG. Check dryer label and ASME nameplate to verify maximum service pressure. Air available for your air usage will vary with operating pressure.
2. The dryer should not be installed where compressed air and/or ambient temperature exceeds 100°F or drops below +50°F. Locate dryer to avoid extremes of heat and cold from other conditions. Best results occur when dryer is located as close to point of use as practical. Where applicable, dryer towers should be insulated to reduce heat loss. Avoid locating dryer outside or where it is exposed to the elements.

B. MOUNTING SPECIFICATIONS AND DRYER LOCATION

1. Refer to Electrical Schematic. Electrical connection must be hard piped with an external fused disconnect switch with proper overload protection.
2. Frame must be suitably ground.

WARNING

ARROW DRYERS ARE WIRED FOR HIGH VOLTAGE. ONLY QUALIFIED ELECTRICIANS ARE AUTHORIZED TO SERVICE THIS ELECTRICAL EQUIPMENT.

3. Generally, locate your dryer downstream from the air receiver. The only exception would be on applications with a fluctuating demand. Then the dryer should be located upstream of the receiver to avoid air surges through the dryer's desiccant beds.
4. Provide adequate space around the dryer for servicing. Bolt dryer skid to foundation, where possible.

CAUTION

EXHAST PURGE AIR FROM PURGE VALVE MUST BE PIPED OUT-SIDE OF BUILDING TO OUTSIDE ATMOSPHERIC AIR.

4. To reduce backpressure in your dryer, exhaust purge air from the purge MUST BE piped outside to atmospheric air.
5. Disconnect and discard the shipping strap securing the centrifugal blower in place.

C. SUGGESTED PIPING ARRANGEMENT

Wet air inlet is at the dryer's top 4-way plug valve. Dry outlet air is from the dryer's bottom 4-way plug valve. See attached flow diagram.

In situations where air supply is required 24 hours a day (it is undesirable to interrupt the airflow), a three valve bypass system is recommended to bypass the dryer. Use the fewest elbows and taper connections necessary to keep pressure drop at a minimum.

D. PREFILTERS / AFTERFILTERS

It is important that a prefilter and an afterfilter be provided in your dryer installation.

Prefilters, located before dryer, protect desiccant beds from contamination by oil, entrained water, pipe scale, etc., thereby extending dryer desiccant life. Locate prefilters as close to dryer as possible.

It is recommended that a mechanical separator be installed immediately preceding the prefilter to remove the bulk liquid oil and entrained water.

CAUTION

LIQUID WATER SHOULD BE REMOVED BEFORE THE AIR ENTERS THE DRYER. BE SURE SEPARATORS, PREFILTERS AND DRAINS ARE IN GOOD WORKING ORDER.

After filters, located after the dryer, help eliminate the possibility of desiccant dusting and carryover into the air system.

Install afterfilters as far downstream as practical to minimize exposure to elevated compressed air temperatures (160°F to 180°F normally) common at dryer tower switch over. High temperature filters are recommended to prevent rupture possibility in the event dryer failure should occur. Consult your Arrow representative for appropriate filter selection and sizing. Plastic bowl type filters are not recommended.

4. OPERATION

A. START-UP

After all piping and electrical connections are made, proceed as follows:

1. **SLOWLY** pressurize the dryer. When the dryer reaches full operating pressure, check the system for air leaks. Soap test all joints and fittings. To maintain desired dewpoint, any leaks detected must be fixed, especially those on the outlet side of the dryer.
2. After complete pressurization of system has occurred, fully close throttling valve located at discharge of blower.
3. Energize electrical circuit by pressing the Power On/Off button located on the front panel. Check motor rotation.
4. If motor rotation is incorrect, de energize circuit and reverse motor leads. Go back to Step 3. If correct go on to step 5.
5. Attach high accuracy amp probe or ammeter to single leg of supply power to blower.
6. Open throttle valve until amp draw reads the same as the full load amp as shown on the motor nameplate. Lock throttling valve into position.
7. The Power On LED will be illuminated when the dryer is in operation. When the electrical circuit has been energized, the control circuit board will start to operate and automatically initiate dryer operation. The timer is factory set, so that no field adjustment is necessary.

NOTE

AT INITIAL START-UP, CHECK THE DRYER OPERATION FOR ONE OR TWO CYCLES, ESPECIALLY AT THE TIME OF THE TOWER SHIFT. VERIFY THAT ALL SYSTEMS ARE OPERATING IN THEIR PROPER ORDER AND SEQUENCE. IF THE DRYER IS NOT FUNCTIONING PROPERLY, CONTACT YOU ARROW REPRESENTATIVE.

WARNING

IF THE DRYER IS DE-ENERGED WHILE DRYING SERVICE AIR THROUGH THE RIGHT TOWER, IT MUST BE DEPRESSURIZED BEFORE RE-ENERGIZING THE CIRCUIT BOARD. FAILURE TO DO SO COULD CAUSE PERSONAL INJURY AND DAMAGE TO DRYER

B. DRYER OPERATION

The dryer is fully automatic in operation and will now operate with a minimum of maintenance and care. Each sequence of operations is programmed by an automatic timer. Dryer programs may differ slightly, but all perform similar functions.

Standard dryers operate on an 8 hour NEMA cycle with 4 hours drying and 4 hours regenerating (3 hours heating and 1 hour cooldown).

Prior to tower switch over, a 10 minute time interval is allowed to bring both towers to full line pressure before switch over (right and left tower switch drying/regenerating functions). This is accomplished by closing both purge valves, and allowing the purge air flow to bring the off-line tower up to full line pressure. After the pressure in the regenerated tower reaches line pressure, the 4-way valves shift. This shift should always occur at full line pressure to prevent rapid pressurization which would agitate, and cause attrition of the desiccant bed.

The purge valve will now open, depressurizing the tower that had been in drying service for the previous 4 hours. At this point the heater is energized for the three hour heating period. The purge air flow begins to carry heat into and through the wet desiccant bed. During the 4th hour of the regeneration cycle, the heater is turned off and the purge air is allowed to continued flowing through the bed.

The now cool purge air cools the desiccant, carrying the heat out of the regenerating tower. This cool down period is important in reducing both desiccant thermal shock (pulverization of desiccant caused by excessive temperature differentials) and the exposure of downstream equipment and processes to excessive temperatures at dryer tower switch over.

C. TIMER OPERATION

The circuit board timer supplied will provide complete and reliable control for all dryer functions. The timer is completely factory tested and calibrated. No field adjustments of settings should be necessary. Refer to voltage sequence page for timer operation.

Upon startup the timer will initiate regeneration of the right tower. At the same time the left tower will begin drying the process gas stream.

Regeneration begins with blower startup. The blower and heater will now remain in operation for approximately 3 hours.

After approximately 2 hours, the heater will de energize, allowing the regenerating bed to cool down. The cool down period will last 50 minutes.

At this point the blower will shutoff and a 10 minute stabilization period will be initiated. After the 10 minute stabilization period, tower shift will occur and regeneration will be initiated as described above.

D. HEATER OPERATION

For long and efficient heater element life, Arrow externally mounted heaters are operated at a low watt density. When supplied with proper purge flow, heaters are rated and sized not to overheat.

CAUTION

HEAT REACTIVATED DRYERS MUST ALWAYS BE PRESSURIZED WHEN ENERGIZED. HEATERS CAN OVERHEAT AND PREMATURELY AGE IF PURGE AIRFLOW IS INTERRUPTED OR DISCONTINUED DURING HEATER OPERATION.

During dryer operation, you will note that the heater will cycle on and off during the 3 hour heating period. The heater supplies enough heat that when combined with purge airflow, it will fully regenerate (dry out) the wet desiccant bed in the off-line tower. The temperature setting is factory set at 425 deg F and should be maintained at that position

WARNING

DURING THE REGENERATION CYCLE THE OFF-LINE REGENERATION TOWER GETS HOT. CARE SHOULD BE TAKEN WHENEVER YOU ARE WORKING ON OR NEAR THE DRYER.

You will note that the tower temperature gauges (located on the panel) will indicate when desiccant regeneration is nearing completion.

Near the end of the 4 hour regeneration period, a temperature reading of 250°F to 275°F normally indicates the desiccant bed has been regenerated.

NOTE

AT THE END OF 3 HOUR HEATING PERIOD OBSERVE TEMPERATURE GAUGE FOR 30 MINUTES. TEMPERATURE GAUGE READINGS WILL VARY WITH MOISTURE LOADING OF DESICCANT.

SHOULD MOISTURE CONTENT OF INLET COMPRESSED AIR BE LOW (I.E. DURING DRY WINTER MONTHS) REGENERATION TEMPERATURES MAY REACH AS HIGH AS 325ºF.

SHOULD MOISTURE CONTENT OF THE COMPRESSED AIR EXCEED DRYER'S DESIGN CAPACITY, (OVERLOADING, TOO MUCH SCFM, ELEVATED INLET TEMPERATURE, LOW PRESSURE) TEMPERATURE READINGS WILL RANGE BELOW 220ºF. SEE TROUBLESHOOTING GUIDE SHOULD THESE TEMPERATURES BE OBSERVED.

E. MOISTURE INDICATOR OPERATION

Moisture Indicator is provided to warn operating personnel of dryer malfunction. If dryer is functioning properly, desiccant in Moisture Indicator will be blue. Should blue color fade or turn pink, consult Troubleshooting Guide.

F. OPTIONAL EQUIPMENT (IF APPLICABLE)

1. Dewpoint Demand System (DDS)

A. The function of DDS is to conserve energy by eliminating unnecessary dryer cycling and heater power consumption.
B. The DDS works by utilizing a moisture sensitive probe to measure the water vapor content of the outlet air from the drying instantaneously to a change in the moisture content of air stream. The moisture content of the sample air stream indicates the wetness of the drying tower's desiccant bed.

The purpose of the probe and its associated electronics is to first measure the "wetness" of the air within the desiccant beds and then regenerate the desiccant beds only when the moisture loading reaches a pre-set maximum dewpoint.

C. Dewpoint Demand System Startup and Operation

1. Put dryer's auto/manual selector switch in "manual" position.
2. Close DDS sample valve
3. Pressurize the dryer
4. Energize the dryer. Allow dryer cycle for 8 to 16 hours. Observe that both towers have completed a full regeneration cycle.
5. Allowing the dryer to operate for two complete cycles ensures that the probe will not be exposed to high humidity and damaging liquid water. This is especially important when dryer has been stored or sitting idle for several months.
6. After this period, slowly open the DDS sample valve so that a small flow of air passes across the probe (approximately 2 to 3 SCFH). This valve should be open at all times when dryer is in operation.
7. Now turn the auto/manual selector switch to the "auto" position. The DDS operational light will come on to provide indication that the Dewpoint Demand System has been activated.

NOTE

IT IS RECOMMENDED THAT THE DRYER BE OPERATED IN THE MANUAL MODE FOR A PERIOD OF 4 TO 6 MONTHS WHILE DESICCANT AGING OCCURS.

2. Failure to Shift Alarm (FTSA)

A. The Failure to Shift Alarm monitors tower shifting and energize an alarm light on the front panel of the control box should the regenerative dryer fail to cycle.
B. Should dryer fail to cycle because of malfunction of a system component (i.e. cylinder, 4-way valve, and solenoid valve) the FTSA light will be energized for 4 hours of each 8 hour cycle. Should FTSA alarm light be observed, refer to "Troubleshooting Guide".

NOTE

FAILURE TO SHIFT ALARM LIGHT WILL BE DE-ENERGIZED EACH TIME DRYER TIMER CYCLES TO POSITION WHERE CYLINDER IS STUCK (EITHER EXTENDED OR RETRACTED). OBSERVE DRYER OPERATION TO DETERMINE WHICH SIDE OF CONTROL CIRCUIT IS MALFUNCTIONING.

3. High Humidity Alarm (HHA)

A. The High Humidity Alarm monitors the outlet moisture condition and energizes an alarm light on the front panel of the control box should the regenerative dryer fail to provide proper dewpoint performance.
B. Should dryer dewpoint elevate because of malfunction of a system component, overflow condition, oil contamination, or desiccant attrition, the HHA light will be energized. Should alarm light be observed, refer to “Troubleshooting Guide”.

5. MAINTENANCE AND SYSTEM CHECK

WARNING

TO AVOID INJURY, DEPRESSURIZE DRYER BEFORE PERFORMING ANY SERVICE.

WARNING

IF THE DRYER IS DE-ENERGED WHILE DRYING SERVICE AIR THROUGH THE RIGHT TOWER, IT MUST BE DEPRESSURIZED BEFORE RE-ENERGIZING THE CIRCUIT BOARD. FAILURE TO DO SO COULD CAUSE PERSONAL INJURY AND DAMAGE TO DRYER

A. 4-WAY VALVES

All 4-way valve are shipped from stock assembled and filled with proper valve sealant. The valves are designed with double O-ring seals creating a self lubricating valve. The valve must be lubricated every 3 months to keep all seals pliable.

CAUTION

A COMBINATION LUBRICANT/SEALANT WITH A SUITABLE TEMPERATURE RANG MUST BE USED. REFER TO PARTS LIST FOR RECOMMENDED TYPE. DO NOT USE GREASE!

To lubricate the 4-way valve, give the lubricant screw (located ontop of the 4-way valve) one complete clockwise turn once a week. Re-lubricate valve when lubricant screw threads are no longer visible.

Use steps provided to lubricate the 4-way plug valve:

1. Remove lubricant screw from plug valve. For larger valves, a lubricant gun is recommended.
2. Insert sealant and add as much as necessary to fill the port completely.
3. Insert lubricant screw back into plug valve. Turn down lubricant screw until increased resistance is evident. Sealant will ooze out around the valve stem.

NOTE

IF INCREASED RESISTANCE IS NOT FELT AND THE LUBRICANT SCREW IS 50% OR MORE THREADED INTO VALVE BODY, REPEAT STEPS 1 -3.

NOTE

VALVES SHOULD BE DISASSEMBLED, CLEANED AND RE-LUBRICATED ONCE EVERY YEAR AS PART OF A REGULAR MAINTENANCE SCHEDULE.

NOTE

THE EXHAUST PURGE DRYER HAS TWO 4-WAY PLUG VALVES. CHECK AND LUBRICATE EACH VALVE ON A REGULAR SCHEDULE.

B. PREFILTERS AND AFTERFILTERS

1. Prefilters - The cartridges of the prefilters must be changed as often as required to prevent contamination of the regenerative dryer's desiccant bed.

The prefilter MUST BE DRAINED DAILY. To prolong filter cartridge life, it is recom mended that a mechanical air/moisture separator be placed immediately before the prefiter. If an automatic drain trap is used, check its operation every 48 hours.

2. Afterfilters - The purpose of the afterfilter is to remove residual desiccant dust.

NOTE

SHOULD THE DRYING SYSTEM BE OVERLOADED AND/OR MALFUNCTIONING, CAUSING HIGH PRESSURE DROP, AFTERFILTERS WILL PREMATURELY PLUG. THIS PROBLEM CAN BE AVOIDED BY FREQUENT INSPECTION AND CLEANING OF CARTRIDGES.

WARNING

TO AVOID INJURY, DEPRESSURIZE DRYER BEFORE PERFORMING ANY SERVICE.

C. SOLENOID VALVES

Periodically clean all solenoid valves. If the solenoid valves fails to operate, check the following:

1. Control Circuit - Check the timer micro-switch to verify that the solenoid is receiving electric current.
2. Burned out solenoid cell.
3. High/low voltage - Voltage should be plus or minus 10% of nameplate readings.
4. Solenoid valve leaking - Disassemble, clean and repack or replace.

D. TIMER

The control circuit board has no maintenance features. Should the sequencing of towers fail, check voltage sequence to the appropriate solenoid. See attached voltage sequence schematic.

E. PILOT OPERATED CYLINDER

Should the air cylinder fail to extend or retract, disconnect the pilot line to check if the cylinder is receiving pilot pressure.

1. If the cylinder is receiving pressure, disassemble, clean and replace cylinder seals as required.
2. If the cylinder is not receiving pressure, clean or replace solenoid valve or as required.

F. PILOT OPERATED VALVES

Should the pilot operated valves fail to operate, disconnect the pilot line to check if the valve is receiving pilot pressure.

1. If the pilot operated valve is receiving pressure, disassemble, clean and replace seals and diaphragm as required.
2. If the pilot operated valve is not receiving pilot pressure, clean or replace solenoid valve or as required.

6. PREVENTATIVE MAINTENANCE

A. DAILY

1. Check and record inlet pressure, temperature and flow. Verify that it is within specifications.
2. Check tower pressure gauge readings within operating tolerance.
3. Check tower pressure gauges for proper dryer cycling
4. Check that there is no condense discharged from prefilters.
5. Verify that pressure in purging tower is 5 PSIG or less.
6. Verify that prefilters and afterfilters differential pressure is within operating limits.

B. MONTHLY

1. Check your operating conditions: inlet flow, inlet pressure, and inlet temperature.
2. Check prefilters and afterfilters.
3. Check dryer cycle and sequence of operations. (i.e. drying, depressurizing, regenerating, heating, and cooling)
4. Check tower temperature gauges during third and fourth hour of regeneration cycle.

C. EVERY 3 MONTHS

1. Replace prefilter and afterfilter elements.
2. Check pilot air filter element and clean.
3. Lubricated both top and bottom 4-way plug valves.

CAUTION

DO NOT USE CONVENTIONAL GREASE. THE SPECIAL LUBRICANT/ SEALANT REQUIRED FOR THESE VALVES IS RATED FOR BOTH HIGH TEMPERATURE AND HIGH PRESSURE SERVICES. THE PROPER LUBRICANT/SEALANT IS REQUIRED TO AVOID LEAKS AND/OR DESICCANT FOULING CAUSED BY “GREASE” BREAKDOWN AT ELEVATED TEMPERATURE.

D. SEMI-ANNUALLY

1. Check outlet dewpoint.
2. Blow down relief valves.

E. ANNUALLY

1. Check desiccant and replace if necessary.
2. Inspect and clean pilot operated valves and replace packings as required.
3. Inspect and clean pilot operated valves and replace packings as required.
4. Inspect and clean solenoid valves, check valves, purge lines and lubricated plug valves.
5. Test lights and switches, replace as necessary.
6. Test electrical components, replace as necessary.

F. EVERY 3 YEARS

1. Replace desiccant if necessary.

6. TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Elevated Dewpoint	Insufficient purge rate	1. Check blower operation. 2. Check purge piping for obstruction. 3. Clean purge piping and muffler.
	Inlet air/gas pressure below design condition	1. Check pressure source.
	Flow rate higher than design condition	1. Check flow rate and caused for increased Demand.
	Inlet temperature above design condition.	1. Check aftercooler, clean and service as necessary
	Entrained water entering desiccant bed.	1. Check air/moisture separator and prefilter. 2. Replace dryer desiccant if necessary.
	Desiccant contaminated by oil	1. Install suitable prefilter 2. Replace dryer desiccant.
Excessive pressure drop in dryer.	Excessive flow rate.	1. Check flow rate. 2. Locate cause for increased air demand.
	Inlet pressure below design condition.	1. Check pressure source.
Failure to shift towers from drying to regenerating service.	Not input power.	1. Check timer micro switch.
	Defective solenoid valve.	1. Check solenoid valve.
	Defective timer motor	1. Replace motor
	No pilot air	1. Check pilot air-line for blockage 2. Check pilot air-line valve and see if it is open 3. Check to see if pilot air-line filter is clean. Replace element if needed
	No lubricant/sealant in 4-way plug valves.	1. Clean and repack both valves with lubricant/sealant.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Dryer fails to pressurize	Faulty purge valve	1. Check purge valve and its solenoid valve. 2. Check timer micro-switch. 3. Check that Repressurization circuit is sending a control signal.
Dryer depressurizes too rapidly	Purge valve does not close; dryer depressurizing through purge valve.	1. Check purge valve and its solenoid valve. 2. Check depressurization timer circuit. 3. Check that depressurization circuit is sending control signal.
Dryer fails to purge	Purge valve does not open; Purge valve stuck in closed position.	1. Check timer micro-switch. 2. Check solenoid valve. Repair and replace if necessary. 3. Check that repressurization circuit is sending control signal.
Excessive back pressure in regenerating tower (above 5PSIG)	Purge muffler does not pass air.	1. Purge muffler is dirty; replace
	Purge muffler passes to much air. Are is leaking across valve	1. Check top 4-way plug valve. Check lubricant/sealant in both 4-way plug valves. Relubricate with approved lubricant/sealant.