






HANKISON®

PRESSURE-SWING DESICCANT TYPE COMPRESSED AIR DRYERS

Instruction Manual

DH Series

GENERAL SAFETY INFORMATION

1. **Pressurized devices:** This equipment is a pressure containing device. Do not exceed maximum operating pressure as shown on equipment serial number tag. Make sure equipment is depressurized before working on or disassembling it for service. 
2. **Electrical:** This equipment requires electricity to operate. Install equipment in compliance with national and local electrical codes. Standard equipment is supplied with NEMA 4, 4x electrical enclosures and is not intended for installation in hazardous environments. Disconnect power supply to equipment when performing any electrical service work. 
3. **Breathing Air:** Air treated by this equipment may not be suitable for breathing without further purification. Refer to OSHA standard 1910.134 for the requirements for breathing quality air. 
4. **Noise:** Do not operate dryer without mufflers installed. 
5. **High Velocity Air:** Do not stand near mufflers during tower depressurization. 

IMPORTANT: READ PRIOR TO STARTING THIS EQUIPMENT

A. UNPACKING

This shipment has been thoroughly checked, packed and inspected before leaving our plant. It was received in good condition by the carrier and was so acknowledged.

1. Check for Visible Loss or Damage. If this shipment shows evidence of loss or damage at time of delivery to you, insist that a notation of this loss or damage be made on the delivery receipt by the carrier's agent.
2. Check for Concealed Loss or Damage. When a shipment has been delivered to you in apparent good order, but concealed damage is found upon unpacking, notify the carrier immediately and insist on his agent inspecting the shipment. Fifteen days from receipt of shipment is the maximum time limit for requesting such inspection. Concealed damage claims are not our responsibility as our terms are F.O.B. point of shipment.

B. MOVING CAUTION:

Do not lift by piping. Use lifting lugs or fork lift.

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| MODEL | RATED FLOW | DESIGNATED AS MODELS |
|---------|------------|----------------------|
| DH-25 | 25 SCFM | 25 |
| DH-45 | 45 SCFM | 45 |
| DH-60 | 60 SCFM | 60 |
| DH-80 | 80 SCFM | 80 |
| DH-115 | 115 SCFM | 115 |
| DH-165 | 165 SCFM | 165 |
| DH-260 | 260 SCFM | 260 |
| DH-370 | 370 SCFM | 370 |
| DH-450 | 450 SCFM | 450 |
| DH-590 | 590 SCFM | 590 |
| DH-750 | 750 SCFM | 750 |
| DH-930 | 930 SCFM | 930 |
| DH-1130 | 1130 SCFM | 1130 |
| DH-1350 | 1350 SCFM | 1350 |
| DH-1550 | 1550 SCFM | 1550 |
| DH-2100 | 2100 SCFM | 2100 |
| DH-3000 | 3000 SCFM | 3000 |
| DH-4100 | 4100 SCFM | 4100 |
| DH-5400 | 5400 SCFM | 5400 |

CONTENTS

1.0 DESCRIPTION 4

1.1 Function 4

1.2 Description of Operation 5

2.0 INSTALLATION 6

2.1 Location in a compressed air system 6

2.2 Physical Location 6

2.3 Minimum & Maximum Operating Conditions 6

2.4 Mounting 6

2.5 Piping 6

2.6 Electrical connections 9

2.7 Provisions for purge exhaust 9

2.8 Initial Desiccant Charge 9

3.0 OPERATION 11

3.1 Start-up 11

3.2 Operational check points 14

3.3 Shut-down 15

3.4 Loss of power 15

3.5 Design parameters 16

3.6 Determining purge and outlet flows 16

3.7 Outlet dew points vs. inlet temperatures 16

4.0 MAINTENANCE 18

4.1 Desiccant replacement 18

4.2 Pilot air filter cartridge replacement (models 370 & larger only) 18

4.3 Fuse Replacement 18

4.4 Test Mode 19

5.0 TROUBLESHOOTING 21

NOTE

Supplemental instructions for units supplied with the optional Automatic Purge Saving System are shown in italics.

MINI INSTRUCTIONS

For complete instructions on installation, operation and maintenance, consult manual.

I. INSTALLATION

1. Install on level surface.
2. Ambient temperature range: 35 to 120°F (1.7 to 49°C)
[if low ambient package supplied: -10 to 120°F (-23 to 49°C)]
3. Install purge mufflers if shipped separately.
4. Connect air from compressor to inlet.
 - Maximum compressed air temperature: 120°F (49°C)
 - Maximum compressed air pressure: Refer to serial number tag.
 - Minimum compressed air pressure:
 - 150 psig (10.5 kgf/cm²) MWP models -**
 - 60 psig (4.2 kgf/cm²) for dryers operated on a 10 minute cycle
 - 80 psig (5.6 kgf/cm²) for dryers operated on a 4 minute cycle
 - 250 psig (17.6 kgf/cm²) MWP models -**
 - 125 psig (8.8 kgf/cm²) for dryers operated on a 10 minute cycle
 - 150 psig (10.5 kgf/cm²) for dryers operated on a 4 minute cycle.
5. Connect outlet to air system.
6. Refer to serial number tag for correct voltage. Make electrical connection to terminal strip in control panel. Connect line to position 5, neutral to position 6 and ground to position 7.
7. Verify voltage selector switch (115V or 230V). Position should match voltage on Serial Number Tag.

II. START UP

1. Set or verify controller settings. See section 3.1.1.
2. SLOWLY pressurize unit.
3. Energize dryer by turning on/off switch on. ("I" is on; "O" is off)
4. Adjust purge air flow rate. Turn purge rate valve until Purge Pressure Gauge reads as shown in the following table.
NOTE: One tower must be purging when setting purge pressure.

III. OPERATIONAL CHECKPOINTS

1. **Check that dryer is energized (indicating lights are illuminated)**
2. **MOISTURE INDICATOR - Indicator should be green** (Allow 4 hours after start up for indicator to turn green).
3. **TOWER PRESSURE GAUGES -**
 - Tower on line should read line pressure
 - Tower off line should read 2 psig (0.14 kgf/cm²) or less while purging. If pressure exceeds 2 psig (0.14 kgf/cm²) replace purge muffler elements.
NOTE: An extra set of elements is shipped with dryer.
4. **PURGE PRESSURE GAUGE - Verify proper setting.**
5. **CHECK FOR ALARM CONDITION.**

IV. DEPRESSURIZATION

Isolate dryer. Run timer until both tower pressure gauges read 0 psig (0 kgf/cm²)(test mode may be used to speed up cycle).

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Purge Pressure Settings

| DRYER MWP | | 150 psig (10.5 kgf/cm ²) | | | | | | 250 psig (17.6 kgf/cm ²) | | | | | | | | | |
|----------------|-----------------------------|--------------------------------------|------------|------------|------------|------------|-------------|--------------------------------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| INLET PRESSURE | psig kgf/cm ² | 60-100 4.2-7 | 110 7.7 | 120 8.4 | 130 9.1 | 140 9.8 | 150 10.6 | 125 8.8 | 130 9.1 | 135 9.5 | 140 9.8 | 145 10.2 | 150 10.6 | 175 12.3 | 200 14.0 | 225 15.8 | 250 17.6 |
| CYCLE TIME | 10 MIN. | 45 | 43 | 41 | 39 | 37 | 36 | 80 | 79 | 78 | 77 | 76 | 75 | 70 | 64 | 60 | 57 |
| | 4 MIN. | 70 | 66 | 63 | 60 | 58 | 56 | - | - | - | - | - | 132 | 123 | 115 | 108 | 102 |

1.0 DESCRIPTION

1.1 Function

1.1.1 Dryer Dual tower regenerative desiccant dryers are an economical and reliable way to dry compressed air to dew points below the freezing point of water (dew points as low as -150°F (101°C) [1 ppb @ 100 psig, 7.0 kgf/cm²] are possible) or reduce the moisture content of compressed air when used in critical process applications.

These dryers continuously dry compressed air by using two identical towers, each containing a desiccant bed. While one tower is on-stream drying the compressed air, the other tower is off-stream being regenerated (reactivated, i.e., dried out). The towers are alternated on- and off-stream so that dry desiccant is always in contact with the wet compressed air. In this way a continuous supply of dry air down-stream is possible.

Desiccant dryers lower the dew point of compressed air by adsorbing the water vapor present in the compressed air onto the surface of the desiccant. Desiccant is a highly porous solid containing extensive surface area.

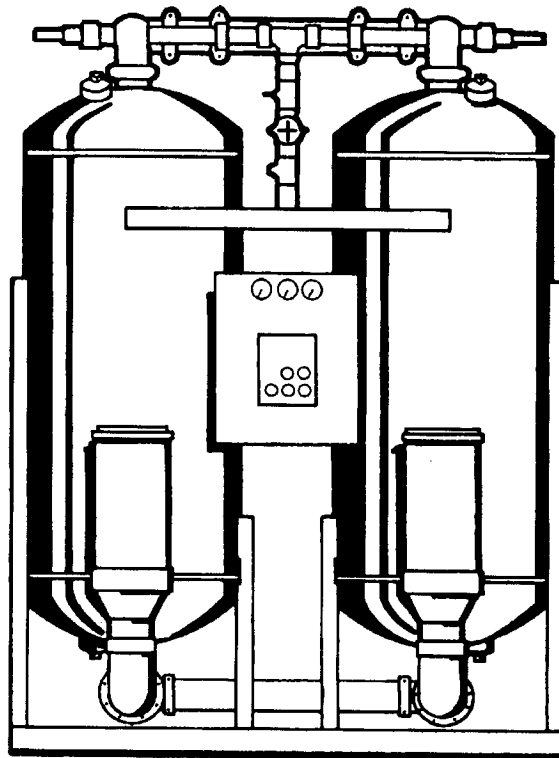
Adsorption occurs until the partial pressure of the water vapor in the air and that on the surface of the desiccant come into equilibrium. As adsorption occurs, heat is released (referred to as the heat of adsorption) and is stored in the bed for use during regeneration.

Desiccant is regenerated by driving off (desorbing) the water collected on its surface. Pressure-swing (also called heatless or heaterless because no outside heat is added) dryers regenerate by expanding a portion (approximately 14 - 15% at 100 psig, 7 kgf/cm²) of the dried air to atmospheric pressure. This "swing in pressure" causes the expanded air to become very dry (have a very low vapor pressure). This very dry air (called purge air) plus the stored heat of adsorption allows the moisture to desorb from the desiccant. The purge air then carries the desorbed water out of the dryer.

1.1.2 Optional Automatic Purge Saving System

The Automatic Purge Saving System is designed to save energy (purge air) when pressure-swing dryers are operated at reduced loads.

The patented Purge Saving System operates by monitoring the changes in temperature within the desiccant beds. These changes in temperature are the result of heat (thermal energy) that is released when a bed is on-line drying (heat of adsorption), and the heat that is used when a bed is off-line being regenerated (heat of desorption). The magnitude of these changes in temperature is an indirect measure of the water vapor content in the air being dried. This information is used to determine the time a tower stays on line during the drying cycle.



1.2 Description of Operation

1.2.1 Dryer (Refer to Figure 1A.)

Compressed air flows through inlet switching valve (3A) (normally open) to tower (4A) where the air is dried. After the air is dried it flows through check valve (5A) and then to the dryer outlet.

A portion of the dry air, the purge stream, branches off from the main air stream prior to the outlet. The purge stream flow rate is controlled by the adjustable purge rate valve (6) and the purge orifice (7).

The purge flow, which has been throttled to near atmospheric pressure, is directed through check valve (5D) to tower (4B). As the purge flow passes over the desiccant in tower (4B), it removes the water vapor which was deposited there while the tower was on-line drying. The purge air then passes through purge and repressurization valve (9B) (normally closed) and purge muffler (10B) to the atmosphere.

After regeneration, purge and repressurization valve (9B) (normally open) closes allowing tower (4B) to repressurize slowly. Adequate repressurization time is allowed so that tower 4B is fully repressurized before switchover. After a controlled time period, air inlet switching valve (3B) (normally open) opens and inlet switching valve (3A) (normally open) closes, purge and repressurization valve (9A) (normally closed) then opens.

(Refer to Figure 1B.) Tower (4B) is now drying the main air stream while tower (4A) is being regenerated by the purge air stream. The operation of the inlet switching (normally open) and purge and repressurization valves (normally closed) is sequenced by the control system located in the electrical box.

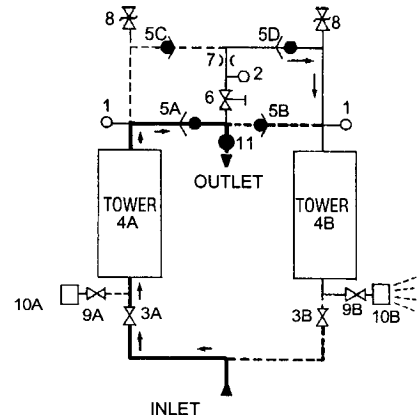


FIGURE 1A
TOWER 4A DRYING: TOWER 4B REGENERATING

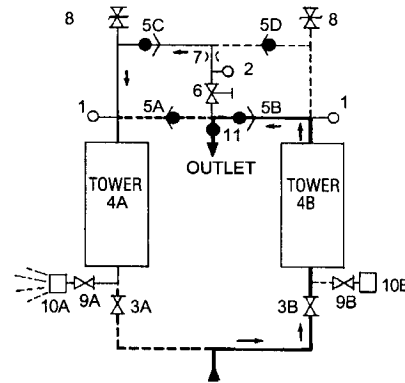


FIGURE 1B
TOWER 4B DRYING: TOWER 4A REGENERATING

- | | |
|--------------------------------|------------------------------------|
| 1. Pressure Gauges | 7. Purge Orifice |
| 2. Purge Pressure Gauge | 8. Pressure Relief Valves |
| 3. Inlet Switching Valves | 9. Purge / Repressurization Valves |
| 4. Desiccant Drying Towers | 10. Purge Mufflers |
| 5. Check Valves | 11. Moisture Indicator |
| 6. Adjustable Purge Rate Valve | |

Purge Stream - - - - -

Process Stream —————

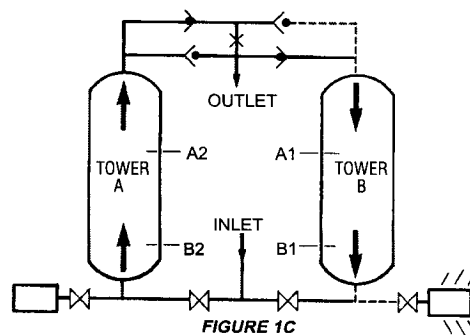


FIGURE 1C

1.2.2 Optional Automatic Purge Saving System

(Refer to Figure 1C)

Assume Tower A is on-line drying the air while tower B has just gone off-line to be regenerated. At the beginning of tower B's regeneration cycle a temperature measurement is made at position B1. After the tower has been regenerated, another measurement is made at B1. The drop in temperature sensed during regeneration is an indirect measure of the water vapor content of the inlet air. The Purge Saving System's microprocessor then uses this information to calculate an allowable temperature rise in the bed during the drying cycle.

When tower B goes back on-line, a temperature probe at position B2 measures the initial bed temperature at this point and then monitors the bed until the calculated temperature rise occurs. The temperature rise occurs as heat of adsorption is released during the drying process. The time for the temperature rise to occur depends on flow rate. At 100% flow the temperature rise takes five minutes, at 50% flow it takes 10 minutes.

When the calculated temperature rise is reached, the towers switch with tower A now drying and tower B being regenerated. Tower B regenerates for 3.9 minutes, repressurizes, and remains idle until it is called upon for the next drying cycle.

2.0 INSTALLATION

2.1 Location in the compressed air system.

NOTE: Air Compressor should be adequately sized to handle air system demands as well as purge loss. Failure to take this into account could result in overloading air compressors and/or insufficient air supply downstream.

NOTE: It is desirable to install dryer where compressed air is at the lowest possible temperature (downstream of aftercoolers) and the highest possible pressure (upstream of pressure reducing valves) without exceeding the maximum working pressure. (Refer to Figure 2A)

(A) AFTERCOOLER/SEPARATOR - Compressed air entering dryer must be cooled to at least 120°F (49°C). Use aftercooler and separator if higher temperatures are present.

NOTE: Installation of a refrigerated dryer ahead of a pressure-swing desiccant dryer does not increase desiccant dryer capacity or reduce purge flow requirements. However a cooling unit installed ahead of the desiccant dryer reduces the inlet air temperature and outlet air dew point.

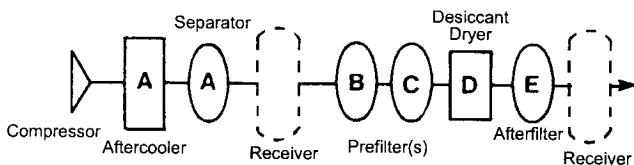


FIGURE 2A

(B & C) PREFILTERS - Adequate filtration is required upstream of the dryer in order to protect the desiccant bed from contamination. The following filtration is recommended:

B - Particulate/Gross Liquid Removal - On heavily contaminated systems use a gross contaminant filter to remove solids and high inlet liquid concentrations.

C - Oil Aerosol Removal - On systems with lubricated compressors, use an oil removal filter to remove oil aerosols and protect desiccant bed from oil contamination.

(D) DESICCANT DRYER

(E) AFTERFILTER - To ensure downstream air purity (prevent desiccant dust from traveling downstream) adequate filtration downstream of the dryer is required. Typically 1 micron filtration is specified although finer filtration is available.

OR

Oil Vapor Adsorber - Use as an afterfilter to remove oil vapor and its subsequent taste and odor and to protect down-stream components from solid particles 0.01 micron and larger.

NOTE: By-pass lines and isolation valves are recommended so that maintenance work can be performed without shutting off the air supply.

2.2 Physical Location

Dryer must be installed with suitable overhead protection.

2.3 Minimum & Maximum Operating Conditions

The compressed air supply inlet should be checked periodically to ensure that equipment design specifications are not exceeded. Normally the compressor installation includes intercoolers, aftercoolers, separators, receivers, or similar equipment which adequately pretreat the compressed air supply in order to avoid excessively high air temperatures and liquid slugging of downstream equipment.

2.3.1 Compressed air conditions

2.3.1.1 Maximum working pressure: Refer to Serial Number Tag.

WARNING

Do not operate the dryer at pressures above the maximum pressure shown on the tag.

2.3.1.2 Minimum working pressures:

150 psig (10.5 kgf/cm²) MWP models -

60 psig (4.2 kgf/cm²) for dryers operated on a 10 minute cycle

80 psig (5.6 kgf/cm²) for dryers operated on a 4 minute cycle

250 psig (17.6 kgf/cm²) MWP models -

125 psig (8.8 kgf/cm²) for dryers operated on a 10 minute cycle

150 psig (10.5 kgf/cm²) for dryers operated on a 4 minute cycle.

If lower inlet pressures are encountered, consult factory.

2.3.1.3 Maximum inlet compressed air temperature:

120°F (49°C)

NOTE: If inlet air is higher than 120°F (49°C) the air must be pre-cooled with an aftercooler.

2.3.2 Ambient temperatures:

Minimum:

Standard units: 35°F (1.7°C)

Units with optional low ambient package: - 10°F (-23°C)

Maximum: 120°F (49°C)

NOTE: If dryer is installed in ambients below 35°F (1.7°C) heat tracing of the prefilters and inlet piping and valves is necessary to prevent condensate from freezing. If installing heat tracing, observe electrical class code requirements for type of duty specified.

2.4 Mounting

Install dryer on a level pad on floor. Holes are provided in the floor stand base angles for floor anchors if desired.

NOTE: Floor anchors must be used if area is subject to vibrations.

2.5 Piping

2.5.1 Inlet and Outlet connections

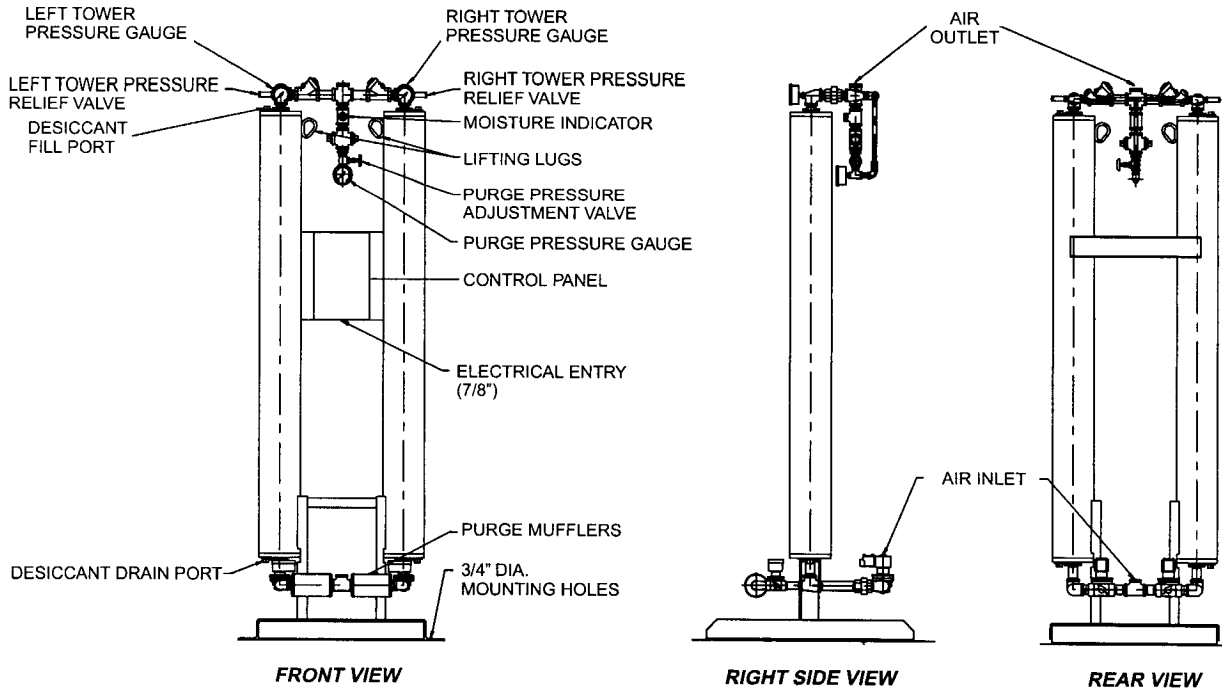
Observe location of inlet and outlet connections as indicated in Figure 2B, 2C, or 2D and connect inlet and outlet piping.

NOTE: All piping must be supported so as not to bear on the dryers or filters.

2.5.2 Isolation valves

If isolation valves are installed, it is recommended that gate valves be used to ensure that dryer is pressurized slowly. This is particularly true if isolation valves are placed before and after pre- and afterfilters where rapid pressurization could cause excessive pressure drop across filter elements.

FIGURE 2B Models 25 through 80



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Icon identification

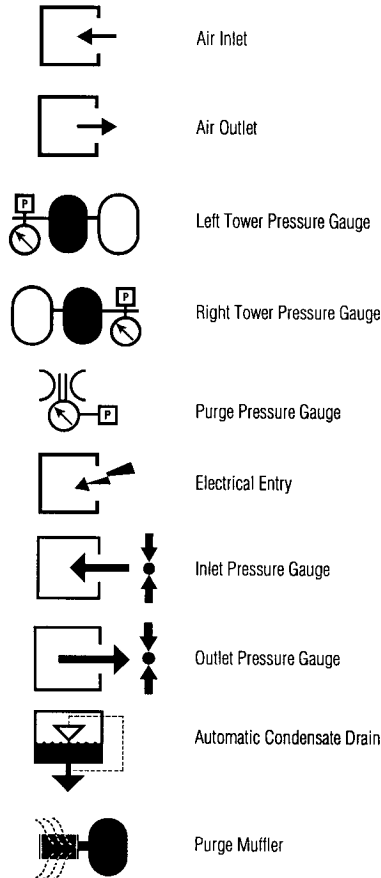
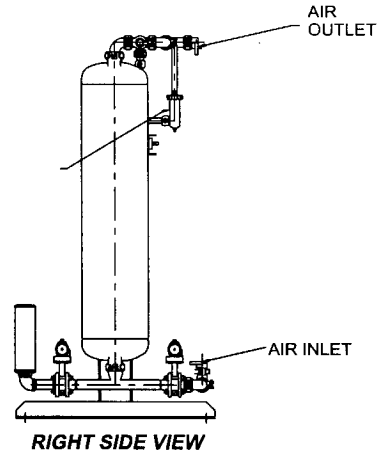
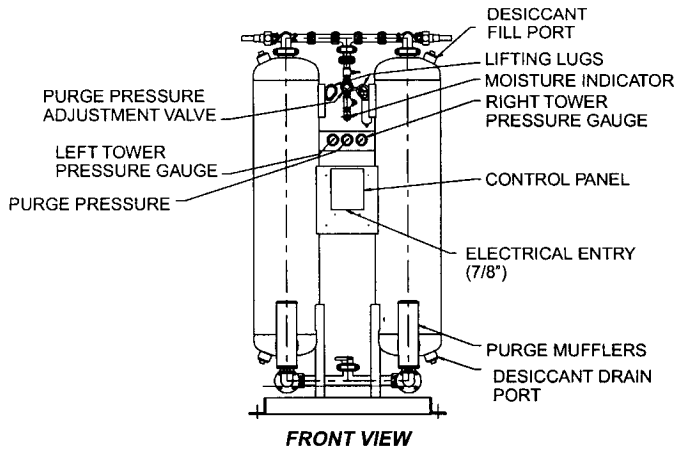
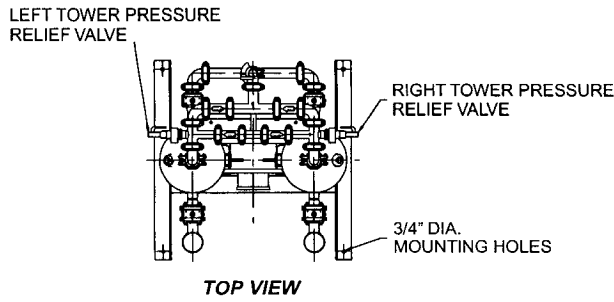


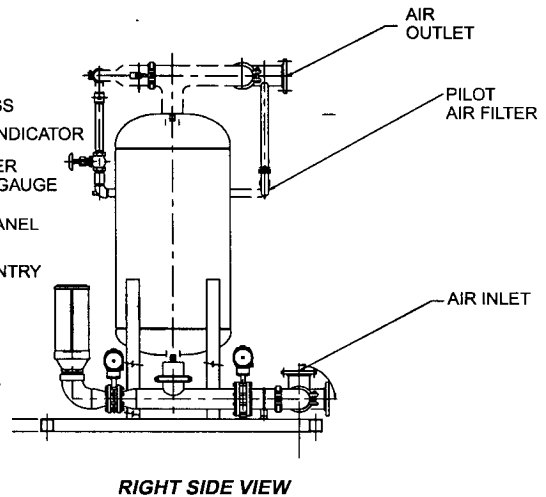
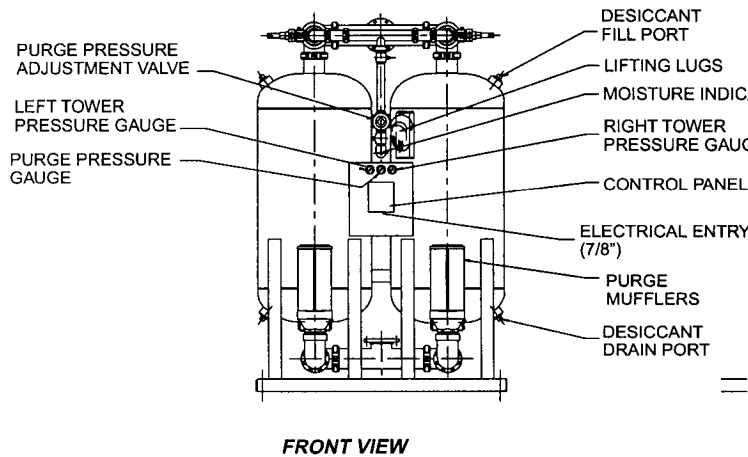
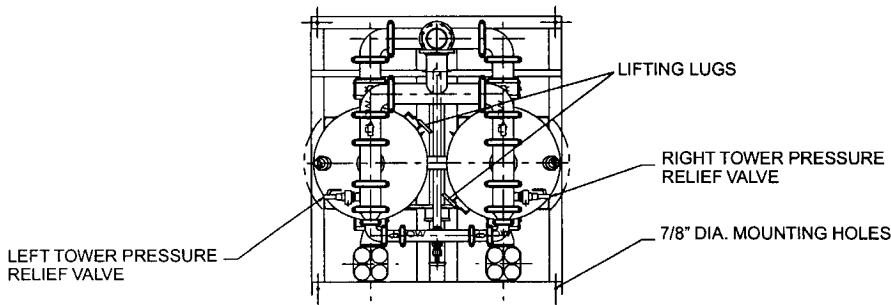
FIGURE 2C Models 115 through 2100



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* Models 115 through 260 use solenoid valves. Models 370 and larger use air operated butterfly valves.

FIGURE 2D Models 3000 thru 5400



2.6 Electrical Connections

Standard and Automatic Purge Saving

2.6.1 Power Connections

NOTE: Check Serial Number Tag for correct voltage.

Connect wires to terminal strip. Connect L1 (line) to position 5, L2 (neutral) to position 6, and ground to position 7. Do not make connections to terminals labeled with grounding symbol or labeled with RS.

Set the voltage selection switch located at the lower edge of the control board for the proper supply voltage.

Electrical entry is 7/8" dia. hole for 1/2" nominal conduit entry.

2.6.2 Alarm Connections - Dry contacts for a remote alarm are supplied at terminals 20, 21, 22. When the unit is energized and no alarms are in effect, continuity should exist between terminals 20 and 21, with no continuity between terminals 21 and 22. Alarm contact is common for switching failure alarm and optional high humidity alarm.

Maximum contact rating is:

240 VAC - 5.0 amps

50 VDC - 1.0 amps

NOTE: Check Serial Number Tag for electrical values.

2.7 Provisions for Purge Exhaust -Purge exhaust must be routed through the factory supplied mufflers or piped to a remote location.

2.7.1 Purge mufflers - If shipped separately, install purge exhaust mufflers in the locations shown in Figure 2B, 2C or 2D.

2.7.2 If purge exhaust is piped to a remote location, choose a pipe size large enough so that back pressure through the piping is not created.

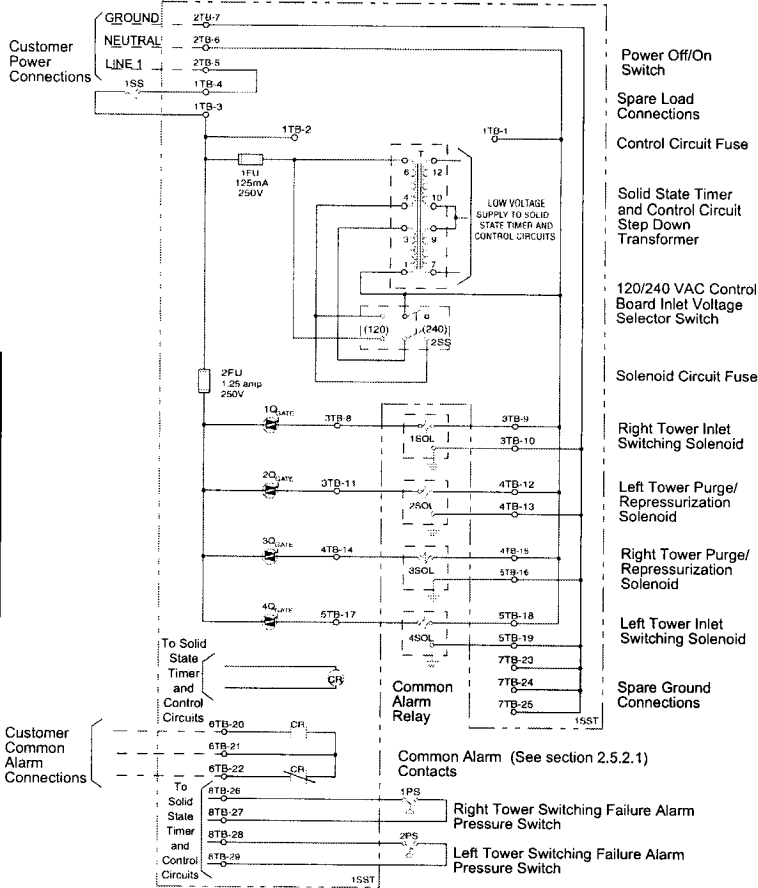
WARNING

Do not operate dryer without one of the above measures. Exhausting air will result in noise levels above OSHA permissible levels and exhausting gas could potentially cause harm to persons or property.



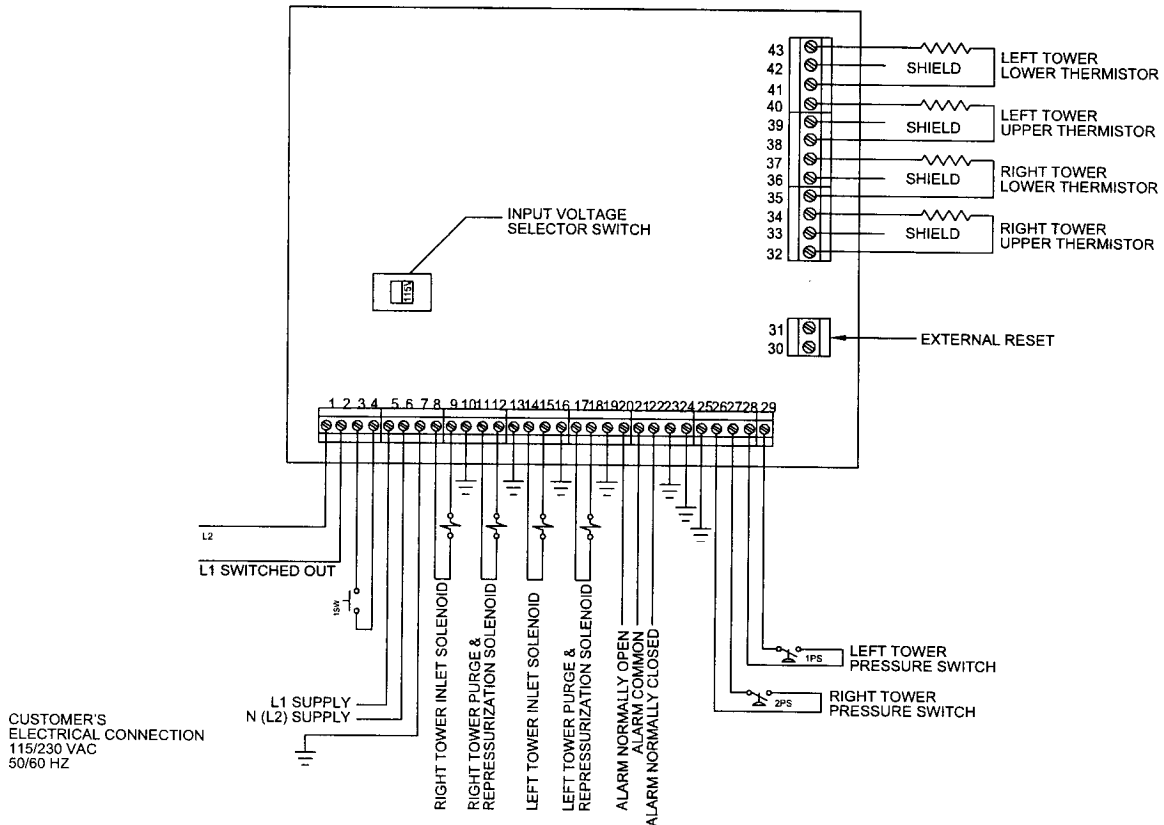
2.8 Initial Desiccant Charge -The dryer is shipped complete with desiccant and ready to operate after piping and electrical connections are made.

FIGURE 2E Electrical Schematic (Standard Dryers)



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FIGURE 2F ELECTRICAL SCHEMATIC (AUTOMATIC PURGE SAVING SYSTEM)



3.0 OPERATION

3.1 Start-up

3.1.1 Controller Settings- Set or verify settings on controller

3.1.1.1 Standard Control Board

WARNING

Enclosure may have live electric parts.

De-energize dryer before opening enclosure.



3.1.1.1.1 Voltage Selection - Set the voltage selection switch located at the lower edge of the power board for the proper voltage.

3.1.1.1.2 Dip Switch Settings - (Refer to Table 3A)

NOTE: For ON DIP switch is up; OFF DIP switch is down

- Select setting for Standard (150 psig, 10.5 kgf/cm² MWP) or High Pressure (250 psig, 17.6 kgf/cm² MWP) unit (See Serial Number Tag)
 - Standard - place switch 4 in OFF position
 - High Pressure - place switch 4 in ON position
- Select Operating Cycle (4 or 10 minute)
 - 10 minute cycle - place switch 5 in OFF position, switch 6 in ON position
 - 4 minute cycle - place switch 5 in ON position, switch 6 in OFF position
- To select Test Mode - place switch 5 and 6 in ON position
- Purge Economizer Switch Setting - If dryer is operated at less than maximum flow capacity a reduction in purge air usage may be possible. Refer to Section 3.5.4 to determine maximum inlet flow capacity at operating pressure. Divide your actual flow by Maximum Flow to get % of Maximum Flow. Set switches 1 through 3 as shown. Selection will be indicated under Economizer Setting on front of Control Panel.

TABLE 3A

| Max. Flow Caudal Max. Debit Max. | Switch No. / Nro. de interruptor / Comm. DIP no | | | | | |
|--|--|-------------------------------------|-------------------------------------|-------------------------------------|--|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | <input type="checkbox"/> OFF / APAGADO / ARRET <input checked="" type="checkbox"/> ON / ENCENDIDO / MARCHE | | | | | |
| 100% | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 90% | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 80% | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 70% | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 60% | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 50% | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 40% | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 30% | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| | 150 psig, (10.5 kgf/cm ²) Standard Estandar Standard | | | <input type="checkbox"/> | 10 minute cycle Ciclo de 10 minutos Cycle de 10 min. | |
| | 250 psig, (17.6 kgf/cm ²) High pressure De Alta Presion Haute pression | | | <input checked="" type="checkbox"/> | 4 minute cycle Ciclo de 4 minutos Cycle de 4 min. | |
| | | | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Test mode Modo de prueba Mode d'essai |

EXAMPLE: A 60 scfm unit has a Maximum Rated Inlet Flow of 60 scfm @ 100 psig. Currently only 30 scfm is used. 30/60 = .50 = 50%. To save purge air, set Purge Economizer Switch for 50%: switches 1 and 3 are ON, switch 2 is OFF.

NOTE: If full flow is restored, Purge Economizer Switch must be reset for 100%.

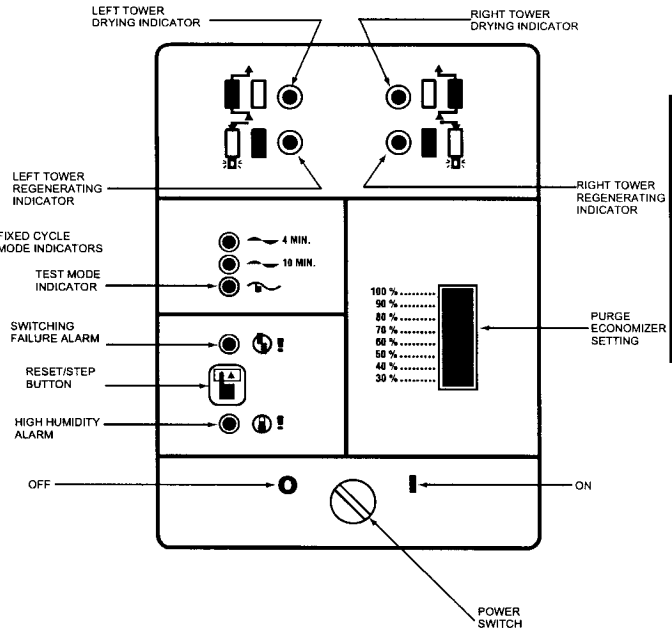


FIGURE 3A
Standard Control Panel

ENGLISH

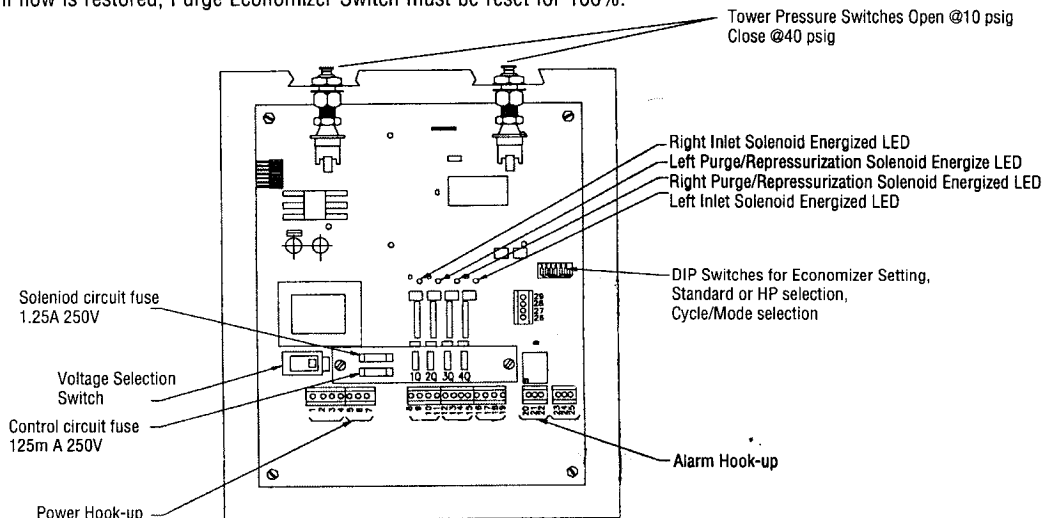


FIGURE 3B
Standard Control Board

3.1.1.2 Automatic Purge Saving System Control Board

WARNING

Enclosure may have live electric parts.

De-energize dryer before opening enclosure.



3.1.1.2.1 Voltage selection - Set the voltage selection switch located at the lower edge of the main circuit board for the proper voltage.

3.1.1.2.2 Dip Switch Settings - (Refer to Table 3B)

NOTE: For ON DIP switch is up; OFF DIP switch is down

1. Select setting for Standard (150 psig, 10.5 kgf/cm² MWP) or High Pressure (250 psig, 17.6 kgf/cm² MWP) unit (See Serial Number Tag)

- A. Standard - place switch 4 in OFF position
- B. High Pressure - place switch 4 in ON position

2. Mode/cycle selection

- A. Fixed mode - in this mode dryer operates the same as a standard controller
 - 10 minute cycle- Switch 1 ON; Switch 2 OFF; Switch 3 OFF
 - 4 minute cycle - Switch 1 OFF; Switch 2 OFF; Switch 3 OFF
- B. Demand mode - in this mode dryer switches automatically when the controller determines that the on-line tower is loaded. In this mode controller can be set to produce three outlet dew points:
 - +40°F, -4.4°C - Switch 1 OFF; Switch 2 ON; Switch 3 OFF
 - 0°F, -17.7°C - Switch 1 ON; Switch 2 ON; Switch 3 OFF
 - 40°F, -40°C - Switch 1 OFF; Switch 2 OFF; Switch 3 ON
- C. Test mode - in this mode dryer can be stepped through the operating sequence to verify performance or for troubleshooting
 - Switch 1 ON; Switch 2 ON; Switch 3 ON; Switch 4 ON

NOTE: Automatic control will begin 1/2 cycle after start-up.

NOTE: If a cycle change is made while dryer is operating, dryer will finish previous cycle (right tower drying terminates) before changing. If it is necessary to begin a new selection immediately, shut unit off and back on. (This is not recommended if either tower is in the regeneration mode since rapid repressurization could result.)

NOTE: If switching to a cycle mode producing a lower dew point (e.g. 0°F to -40°F [-17.8 to -40°C]) while dryer is operating, one or two days of operation may be needed before the new dew point is achieved.

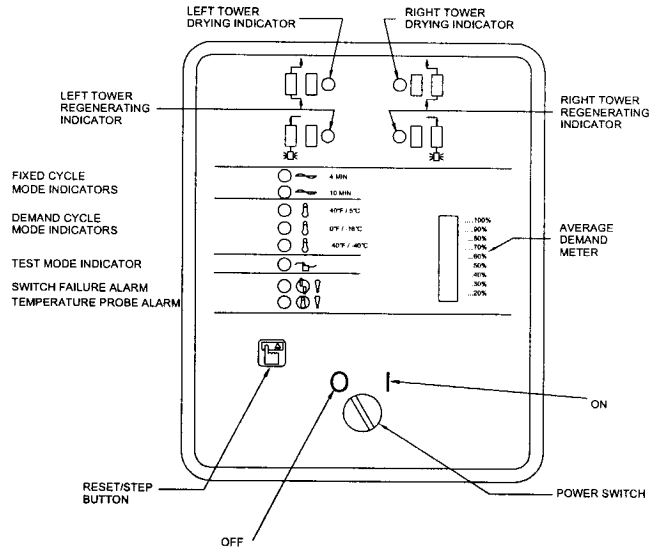


FIGURE 3C
Automatic Purge Saving Control Panel

TABLE 3B

| Switch No. / Nro. de interruptor / Comm. DIP n° | | | | |
|---|---|---|---|---|
| ☐ OFF / APAGADO / ARRÊT | | | | |
| ▣ ON / ENCENDIDO / MARCHÉ | | | | |
| | 1 | 2 | 3 | 4 |
| Fixed cycle / Ciclo fijo / Cycle fixe | | | | |
| 4 minute / minutos / min. | ☐ | ☐ | ☐ | |
| 10 minute / minutos / min. | ▣ | ☐ | ☐ | |
| Demand cycle | | | | |
| Ciclo de demande | | | | |
| Cycle à la demande | | | | |
| +40°F, 44°C P.D.P. | ☐ | ▣ | ☐ | |
| 0°F, -17.7°C P.D.P. | ▣ | ▣ | ☐ | |
| 40°F, -40°C P.D.P. | ☐ | ☐ | ▣ | |
| Test Mode | | | | |
| Modo de Prueba | | | | |
| Mode d'essai | | | | |

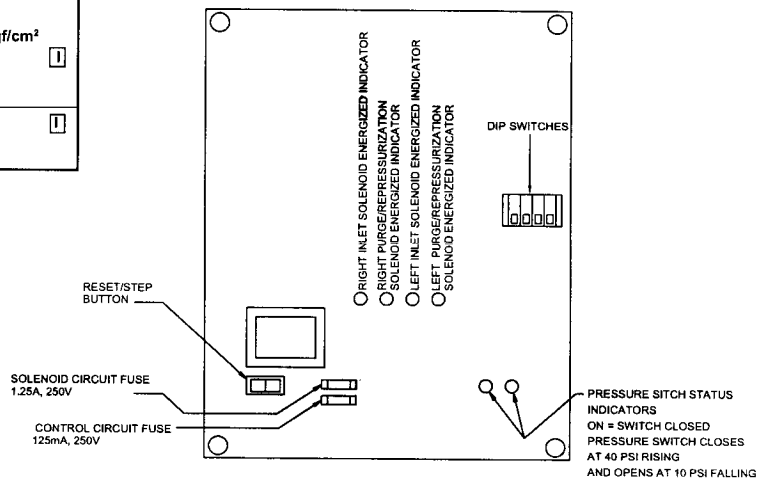


FIGURE 3D
Automatic Purge Saving Control Board

3.1.2 SLOWLY pressurize dryer to full line pressure (open inlet isolation valve, outlet isolation valve remains closed).

NOTE: During initial start-up check entire system for leaks. If necessary, depressurize and correct any leaks.

3.1.3 Energize dryer using the power switch located on the control panel.

NOTE: Switching failure alarm: alarm (light) may be activated if unit is energized before it is pressurized. To deactivate alarm, allow dryer to cycle to next step and press the reset button.

3.1.4 Adjust the purge rate valve.

3.1.4.1 Determine:

- 1) Maximum working pressure (MWP) of dryer from the dryer serial number tag
- 2) Air pressure at inlet to dryer
- 3) Cycle time setting (4 or 10 minutes)

NOTE: For units with optional Automatic Purge Saving System in the demand cycle mode use the 10 minute purge pressure setting.

3.1.4.2 Refer to Table 3C below for proper purge rate pressure setting at the conditions found in 3.1.4.1

3.1.4.3 Adjust purge rate valve until purge flow indicator reads required pressure setting.

NOTE: Adjustment must be made while a tower is purging (air exhausting from muffler).

IMPORTANT

INSUFFICIENT PURGE AIR WILL EVENTUALLY RESULT IN SATURATION OF DESICCANT BED AND WET AIR DOWNSTREAM. MAKE CERTAIN THAT CYCLE TIME, PURGE ECONOMIZER SWITCH, AND PURGE PRESSURE ARE CORRECTLY SET.

3.1.5 Establish normal flow through dryer (open outlet isolation valve). Close air by-pass valve if present.

NOTE: When dew points below -40°F (-40°C) are required, the dryer must be run with an inlet flow rate of less than 50% of maximum until the desired dew point is attained. Depending on the initial dryness of the desiccant, this can take as long as 2 to 3 days. This stabilization period is required on initial startup, after dryer has been shutdown for extended periods of time, or after dryer maintenance (desiccant change, etc.).

3.1.6 With the inlet pressure to the dryer at its minimum level, readjust the purge pressure as determined in 3.1.4.

NOTE: Adjustment must be made while a tower is purging (air exhausting from muffler).

TABLE 3C Purge Pressure Settings (psig)

| DRYER MWP | | 150 psig (10.5 kgf/cm ²) | | | | | | | 250 psig (17.6 kgf/cm ²) | | | | | | | | |
|----------------|---------------------|--------------------------------------|-----|-----|-----|-----|------|-----|--------------------------------------|-----|-----|------|------|------|------|------|------|
| INLET PRESSURE | psig | 60-100 | 110 | 120 | 130 | 140 | 150 | 125 | 130 | 135 | 140 | 145 | 150 | 175 | 200 | 225 | 250 |
| | kgf/cm ² | 4.2-7 | 7.7 | 8.4 | 9.1 | 9.8 | 10.6 | 8.8 | 9.1 | 9.5 | 9.8 | 10.2 | 10.6 | 12.3 | 14.0 | 15.8 | 17.6 |
| CYCLE TIME | 10 MIN. | 45 | 43 | 41 | 39 | 37 | 36 | 80 | 79 | 78 | 77 | 76 | 75 | 70 | 64 | 60 | 57 |
| | 4 MIN. | 70 | 66 | 63 | 60 | 58 | 56 | - | - | - | - | - | 132 | 123 | 115 | 108 | 102 |

3.2 Operational Check Points

3.2.1 Standard Unit

3.2.1.1 Power to unit - Check periodically that there is power to the unit (indicating lights illuminated).

3.2.1.2 Moisture Indicator - Every four hours check moisture indicator. Indicator should be green. Outlet relative humidity of the desiccant dryer is indicated by the color change humidity indicator. Green indicates a R.H. below 3% and yellow indicates a R.H. above 3%. Table 3L (page 17) indicates outlet dew point when moisture indicator changes from green to yellow at various inlet temperatures.

NOTE: During start-up the indicator may be yellow, however, it should begin to change to green within four hours.

3.2.1.3 Purge Flow Indicator - Every four hours check the purge pressure and adjust as required. Adjustment should be made when the inlet pressure to the dryer is at its minimum level.

NOTE: Adjustment must be made while a tower is purging (air exhausting from muffler).

Units with Standard Board Operation

3.2.1.4 Alarms

Periodically check for flashing red alarm light. Alarm light will flash if either tower fails to pressurize or depressurize to the required levels at the proper time or if optional high humidity alarm indicates high exiting dewpoint.

NOTE: Alarm will activate if dryer is energized without being pressurized. If this occurs allow dryer to cycle to next step and press reset button.

NOTE: Alarm light will continue to flash even if fault clears. To clear alarm, press reset button.

NOTE: If the tower being regenerated fails to repressurize, the dryer will not switch towers. The switching failure alarm will be activated and the dryer will remain in this mode until the tower repressurizes.

Switching Failure

The switching failure alarm operates by sensing tower pressures after tower changeover. If towers have failed to pressurize or depressurize to the required levels, an alarm condition exists. The alarm light blinks while the alarm condition exists. Depressing the reset switch will extinguish the light, but will not interrupt the drying cycle.

If the tower being regenerated fails to repressurize, the dryer will not switch towers. The switching failure alarm will be activated and the dryer will remain in this mode until the tower repressurizes.

3.2.1.5 Tower Status Lights - illuminated light indicates which tower is on-line drying or off-line regenerating.

3.2.1.6 Tower pressure gauges

3.2.1.6.1 Periodically check tower pressure gauges to verify that tower pressure gauge of tower on-line reads line pressure and tower pressure gauge of tower off-line reads below 2 psig.

NOTE: Read off-line tower gauge when tower is purging (air exhausting from muffler)

3.2.1.6.2 Check mufflers for back pressure

Excessive back pressure may result due to the accumulation of dust in the muffler. This sometimes occurs after start-up because of dusting of the desiccant during tower filling and dryer transport.

If the tower pressure gauge of the off-stream tower rises out of the black area on the gauge dial, muffler elements should be replaced. A set of purge exhaust muffler replacement elements is supplied with the dryer.

3.2.2. Units with Automatic Purge Saving System

3.2.2.1 Power to unit - Check periodically that there is power to the unit (indicating lights illuminated).

3.2.2.2 Moisture Indicator - Every four hours check moisture indicator. Indicator should be green. Outlet relative humidity of the desiccant dryer is indicated by the color change humidity indicator. Green indicates a R.H. below 3% and yellow indicates a R.H. above 3%. Table 3L (page 17) indicates outlet dew point when moisture indicator changes from green to yellow at various inlet temperatures.

NOTE: During start-up the indicator may be yellow, however, it should begin to change to green within four hours.

3.2.2.3 Purge Flow Indicator - Every four hours check the purge pressure and adjust as required. Adjustment should be made when the inlet pressure to the dryer is at its minimum level.

NOTE: Adjustment must be made while a tower is purging (air exhausting from muffler).

3.2.2.4 Alarms

3.2.2.4.1 Switching Failure Alarm - The switching failure alarm operates by sensing tower pressures after tower changeover. If towers have failed to pressurize or depressurize to the required levels, an alarm condition exists. The alarm light blinks while the alarm condition exists. If the alarm condition clears for two complete cycles, the light will switch to a steady glow. Depressing the reset switch will extinguish the light, but will not interrupt the drying cycle.

If the tower being regenerated fails to repressurize, the dryer will not switch towers. The switching failure alarm will be activated and the dryer will remain in this mode until the tower repressurizes.

3.2.2.4.2 Temperature Probe Alarm - (operates in a demand cycle mode only) This alarm is actuated by a short circuit, an open circuit, or temperatures below 40°F (4.4°C) or above 150°F (65.5°C). The alarm light blinks while the alarm condition exists. After the alarm condition clears for one complete cycle, the light will switch to a steady glow. Depressing the reset switch will extinguish the light, but will not interrupt the drying cycle.

3.2.2.4.3 Dryer Cycle (operates in demand cycle mode only) Either alarm will cause the controller to automatically switch to a fixed 10 minute cycle (cycle mode light will not indicate this).

After the alarm condition clears and the light stops blinking, the controller will clear the internal information and switch back to a demand mode. It is not necessary to push the alarm reset for the dryer to return to the selected demand cycle mode. However, to extinguish the alarm light, press the alarm reset button.

NOTE: After an alarm condition clears, the dryer will not return to a demand cycle mode until the dryer completes two cycles if a switching failure alarm is experienced or one cycle if a temperature probe alarm is experienced. This occurs even if the alarm reset is depressed and the alarm light is extinguished.

3.2.2.4.4 Relay for Remote Alarm

The remote alarm relay will close when an alarm occurs and remain closed until the alarm clears and is reset. The relay does not cycle as the lights blink.

3.2.2.5 Tower status lights - indicate when left and right towers are drying and regenerating.

3.2.2.6 Average Demand Meter

The demand meter displays the average demand on the dryer for the last 4 cycles. It is determined by dividing 40 (time to complete 4 cycles at full flow) by the actual time to complete the last 4 cycles.

3.2.2.7 Tower pressure gauges

3.2.2.7.1 Periodically check tower pressure gauges to verify that tower pressure gauge of tower on-line reads line pressure and tower pressure gauge of tower off-line reads below 2 psig.

NOTE: Read off-line tower gauge when tower is purging (air exhausting from muffler)

3.2.2.7.2 Check mufflers for back pressure

Excessive back pressure may result due to the accumulation of dust in the muffler. This sometimes occurs after start-up because of dusting of the desiccant during tower filling and dryer transport.

If the tower pressure gauge of the off-stream tower rises out of the black area on the gauge dial, muffler elements should be replaced. A set of purge exhaust muffler replacement elements is supplied with the dryer.

3.2.3 All MODELS - Determine if air control valves are operating and sequencing correctly.

Refer to Section 1.2 and Figure 1A and 1B for a general description of operating sequence.

3.2.3.1 Inlet switching and purge/repressurization valves.

1) Tower pressure gauge of tower on-line should read line pressure. No air should be leaking from purge/repressurization valve of the on-line tower.

2) Tower pressure gauge of tower off-line should read below 2 psig while tower is purging. If excessive purge air is exhausting during purge cycle, inlet valve may have failed to close or a check valve may be sticking.

3.2.3.2 Check valves

Check valve sticking will result in excessive air discharge through a muffler. If excessive air is discharged through the muffler on the left, check if valve 5a or 5d is sticking. If excessive air is discharged through the muffler on the right, check if valve 5b or 5c is sticking.

3.2.3.3 Operating Sequence

For dryers with standard controller and dryers with automatic purge saving system operating on a fixed time cycle - Figure 3E and Table 3D show valve sequence times when dryer is operating on a 10 minute cycle. Figure 3F and Table 3E show sequence times when dryer is operating on a four minute cycle.

3.3 Shut Down

3.3.1 Depressurize dryer

3.3.1.1 Open by-pass valve (if one is installed) and close inlet and outlet isolation valves.

3.3.1.2 Run timer through a tower change cycle until pressure gauges on both towers read 0 (test mode may be used to speed this up).

3.3.2 De-energize dryer

Turn dryer off using on-off switch (indicating lights extinguished).

3.4 Loss of Power

Control valves are designed so that upon loss of power the air dryer is capable of drying air until the desiccant exposed to the air flow is saturated.

FIGURE 3E For dryers operating on a 10 minute cycle

| VALVE | TIME (Min.) | | | | | | | | | | |
|-------|-------------|----------|---|---|----|--------|----------|---|--------|---|----|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3A | OPEN | | | | | CLOSED | | | | | |
| 3B | CLOSED | | | | | OPEN | | | | | |
| 9B | CI 6" | OPEN (1) | | | CI | CLOSED | | | | | |
| 9A | CLOSED | | | | | CI 6" | OPEN (1) | | CLOSED | | |

(1) See table 3D for open times.

TABLE 3D Purge valve open times for dryers operating on a 10 minute cycle.

| PRESSURE | ECONOMIZER SWITCH SETTING | PURGE TIME |
|---|---------------------------|------------|
| 150 psig MWP (10.5 kgf/cm ²) | 100% | 234 sec. |
| | 90% | 211 sec. |
| | 80% | 187 sec. |
| | 70% | 164 sec. |
| | 60% | 140 sec. |
| | 50% | 117 sec. |
| | 40% | 94 sec. |
| 250 psig MWP (17.6 kgf/cm ²) | 100% | 174 sec. |
| | 90% | 157 sec. |
| | 80% | 139 sec. |
| | 70% | 122 sec. |
| | 60% | 104 sec. |
| | 50% | 87 sec. |
| | 40% | 70 sec. |
| | 30% | 52 sec. |

ENGLISH

FIGURE 3F For dryers operating on a 4 minute cycle

| VALVE | TIME (MIN) | | | | | |
|-------|------------|----------|--------|--------|----------|--------|
| | 0 | 1 | 2 | 3 | 4 | |
| 3A | OPEN | | | CLOSED | | |
| 3B | CLOSED | | | OPEN | | |
| 9B | CI 6" | OPEN (2) | CLOSED | CLOSED | | |
| 9A | CLOSED | | | CI 6" | OPEN (2) | CLOSED |

(2) See table 3E for open times.

TABLE 3E Purge valve open times for dryers operating on a 4 minute cycle.

| PRESSURE | ECONOMIZER SWITCH SETTING | PURGE TIME |
|---|---------------------------|------------|
| 150 psig MWP (10.5 kgf/cm ²) | 100% | 66 sec. |
| | 90% | 59 sec. |
| | 80% | 53 sec. |
| | 70% | 46 sec. |
| | 60% | 40 sec. |
| | 50% | 33 sec. |
| | 40% | 26 sec. |
| 250 psig MWP (17.6 kgf/cm ²) | 100% | 42 sec. |
| | 90% | 38 sec. |
| | 80% | 34 sec. |
| | 70% | 29 sec. |
| | 60% | 25 sec. |
| | 50% | 21 sec. |
| | 40% | 17 sec. |
| | 30% | 13 sec. |

3.5 Verify that dryer is operating within design parameters

3.5.1 Maximum working pressure:

Refer to Serial Number Tag to determine maximum working pressure of dryer.

WARNING

Do not operate dryer at pressures above the maximum pressure shown on the tag.

3.5.2 Minimum working pressures:

150 psig, (10.5 kgf/cm²) MWP models -

60 psig (4.2 kgf/cm²) for dryers operated on a 10 minute cycle

80 psig (5.6 kgf/cm²) for dryers operated on a 4 minute cycle

250 psig, (17.6 kgf/cm²) MWP models

125 psig (8.8 kgf/cm²) for dryers operated on a 10 minute cycle

150 psig (10.5 kgf/cm²) for dryers operated on a 4 minute cycle.

If lower inlet pressures are encountered, consult factory.

3.5.3 Maximum operating temperature: 120°F (49°C).

3.5.4 Maximum Inlet Flow Capacity

3.5.4.1 For maximum inlet flow at 100 psig

(7.0 kgf/cm²) and 100°F (38°C) refer to *Table 3F*.

3.5.4.2 At other conditions, multiply inlet flow from *Table 3F* by multipliers from *Tables 3G and 3H* that correspond to the pressure and temperature at inlet to dryer.

3.6 Determining Purge and Outlet Flows:

3.6.1 Purge Flows

3.6.1.1 Maximum Purge Flow.- Maximum Purge Flow is the amount of purge air flowing through the off-stream tower when the purge/repressurization valve is open. After the purge/repressurization valve closes, the purge flow will gradually decrease as the off-stream tower repressurizes to line pressure.

For maximum purge flow multiply inlet flow at rated conditions from *Table 3F* by Maximum Purge Flow Factor from *Table 3I* that corresponds to the dryer MWP, Cycle Time Setting, and air pressure at inlet to dryer. For dryers supplied with the optional Automatic Purge Saving System operating in the Demand Cycle Mode, use 10 minutes as the cycle time.

3.6.1.2 Average Purge Flow - For dryers with the Standard Control Board and dryers with the Automatic Purge Saving System operating in the fixed cycle mode:

The Average Purge Flow is the actual amount of flow used during the entire purge/repressurization cycle. It includes the maximum purge flow for a portion of the purge/repressurization time and the volume of air used for repressurization, averaged over the cycle time.

To determine average purge flow, multiply maximum inlet flow at rated conditions from *Table 3F* by Average Purge/Repressurization Flow Factor from *Table 3J* that corresponds to the dryer Maximum Working Pressure, Inlet Pressure, Cycle Time Setting, and on Standard Control Boards, Economizer Switch Setting.

3.6.2 Outlet Air Flow

3.6.2.1 Minimum Outlet Flow

Determine minimum outlet flow available from dryer by subtracting Maximum Purge Flow found in 3.6.1.1 from inlet flow to the dryer.

3.6.2.2 Average Outlet Flow - For dryers with the Standard Control Board and dryers with the Automatic Purge Saving System operating in the fixed cycle mode:

Determine average outlet flow available by subtracting Average Purge Flow found in 3.6.1.2 from the inlet flow to the dryer.

NOTE: Average outlet flow may be used to determine available downstream air supply if a storage vessel (e.g. receiver tank) of sufficient volume is available between dryer and point of air usage. Otherwise use minimum outlet flow to determine downstream air available.

EXAMPLE

Find maximum inlet flow, maximum and average purge flows, and minimum and average outlet flows for a 60 scfm unit with a MWP of 150 psig operated with 120 psig and 100°F inlet conditions on a 10 minute cycle. Dryer will operate with an inlet air flow of 46 scfm.

Step 1: Find Maximum Inlet Flow @120 psig by multiplying Maximum Inlet Flow at Rated Conditions from *Table 3F* by Inlet Pressure Correction Factor for 120 psig from *Table 3G* and Inlet Temperature from *3H*: $60 \times 1.08 \times 1.00 = 64.8$ scfm.

Step 2: Find Maximum Purge Flow by multiplying Maximum Inlet Flow at Rated Conditions from *Table 3F* by Maximum Purge Flow Factor from *Table 3I*: $60 \times 0.162 = 9.7$ scfm.

Step 3: Find Average Purge Flow by multiplying Maximum Inlet Flow at rated conditions from *Table 3F* by Average Purge/Repressurization Flow Factor from *Table 3J*: $60 \times 0.097 = 5.8$ scfm.

NOTE: At 46 scfm inlet flow, dryer is operating at 70% of maximum flow found in Step 1: $(46/64.8 = 70\%)$. Average purge flow is based on Economizer Switch setting of 70%.

Step 4: Find Minimum Outlet Flow available by subtracting Maximum Purge Flow (Step 2) from inlet flow: $46 - 9.7 = 36.3$ scfm.

Step 5: Find Average Outlet Flow available by subtracting Average Purge Flow (Step 3) from inlet flow: $46 - 5.8 = 40.2$ scfm.

3.7 Determining outlet pressure dew point at various inlet compressed air temperatures:

The outlet pressure dew point is determined by the compressed air temperature at the inlet to the dryer and cycle time selected (4 or 10 minutes). Use *Table 3K* to determine outlet dew points at various inlet compressed air temperatures and cycle times.

NOTE: For temperatures above 100°F (38°C), the chart does not apply if inlet flow was reduced by the factors from *Table 3H*.

TABLE 3F Maximum Inlet Flow at Rated Conditions

| MODEL | 25 | 45 | 60 | 80 | 115 | 165 | 260 | 370 | 450 | 590 | 750 | 930 | 1130 | 1350 | 1550 | 2100 | 3000 | 4100 | 5400 |
|--|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
| Inlet @ 100 psig (7.0 kgf/cm ²) (scfm) (1) (2) | 25 | 45 | 60 | 80 | 115 | 165 | 260 | 370 | 450 | 590 | 750 | 930 | 1130 | 1350 | 1550 | 2100 | 3000 | 4100 | 5400 |

(1) Convert scfm to metric units as follows: 1 scfm = 0.028 m³/min.

(2) *Performance data obtained and presented in accordance with CAGI standard ADF200 - Methods for rating and testing.*

Conditions for rating air dryers are: 100 psig (7.0 kgf/cm²) and 100°F (37.8°C) saturated inlet air, and a maximum 5 psi (.4 kgf/cm²) pressure drop. Actual pressure drop for all units is less than 3 psi at rated conditions.

TABLE 3G Inlet Pressure Correction Factor

| INLET PRESSURE | psig kgf/cm ² | 60 4.2 | 70 4.9 | 80 5.6 | 90 6.3 | 100 7.0 | 110 7.7 | 120 8.4 | 125 8.8 | 130 9.1 | 140 9.8 | 150 10.5 | 175 12.3 | 200 14.1 | 225 15.8 | 250 17.6 |
|----------------|-----------------------------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| MULTIPLIER | | 0.65 | 0.74 | 0.83 | 0.91 | 1.00 | 1.04 | 1.08 | 1.10 | 1.12 | 1.16 | 1.20 | 1.29 | 1.37 | 1.45 | 1.52 |

TABLE 3H Inlet Temperature Correction Factor

| INLET TEMPERATURE | °F | 100 and below | 105 | 110 | 115 | 120 |
|-------------------|----|---------------|------|------|------|------|
| | °C | 38 and below | 41 | 43 | 46 | 49 |
| MULTIPLIER | | 1.0 | 0.98 | 0.96 | 0.93 | 0.91 |

TABLE 3I Maximum Purge Flow Factor

| DRYER MWP | 150 psig (10.5 kgf/cm ²) | | | | | | | 250 psig (17.6 kgf/cm ²) | | | | | |
|------------|--------------------------------------|--------|-------|-------|-------|-------|-------|--------------------------------------|-------|-------|-------|-------|-------|
| | INLET PRESSURE (psig) | 60-100 | 110 | 120 | 130 | 140 | 150 | 125 | 150 | 175 | 200 | 225 | 250 |
| CYCLE TIME | 10 minute | 0.175 | 0.168 | 0.162 | 0.156 | 0.151 | 0.146 | 0.214 | 0.196 | 0.184 | 0.172 | 0.163 | 0.155 |
| | 4 minute | 0.249 | 0.239 | 0.230 | 0.221 | 0.215 | 0.207 | - | 0.326 | 0.304 | 0.286 | 0.270 | 0.257 |

TABLE 3J Average Purge/Repressurization Flow Factor

| DRYER MWP | | 150 psig (10.5 kgf/cm ²) | | | | | | | | | | 250 psig (17.6 kgf/cm ²) | | | | | | |
|-----------------------|---------------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------------|-------|-------|-------|-------|-------|-------|
| INLET PRESSURE (psig) | | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 125 | 150 | 175 | 200 | 225 | 250 | |
| 10 MINUTE CYCLE | ECONOMIZER SWITCH SETTING | 100% | 0.141 | 0.142 | 0.143 | 0.143 | 0.144 | 0.139 | 0.135 | 0.131 | 0.128 | 0.125 | 0.133 | 0.125 | 0.119 | 0.114 | 0.111 | 0.108 |
| | | 90% | 0.127 | 0.128 | 0.129 | 0.130 | 0.130 | 0.126 | 0.122 | 0.119 | 0.116 | 0.113 | 0.120 | 0.113 | 0.108 | 0.104 | 0.101 | 0.099 |
| | | 80% | 0.114 | 0.114 | 0.115 | 0.116 | 0.117 | 0.113 | 0.110 | 0.107 | 0.104 | 0.102 | 0.108 | 0.102 | 0.098 | 0.094 | 0.092 | 0.090 |
| | | 70% | 0.100 | 0.101 | 0.101 | 0.102 | 0.103 | 0.100 | 0.097 | 0.095 | 0.092 | 0.091 | 0.096 | 0.091 | 0.087 | 0.084 | 0.082 | 0.081 |
| | | 60% | 0.086 | 0.087 | 0.088 | 0.088 | 0.089 | 0.087 | 0.084 | 0.082 | 0.081 | 0.079 | 0.083 | 0.079 | 0.076 | 0.074 | 0.073 | 0.072 |
| | | 50% | 0.073 | 0.073 | 0.074 | 0.075 | 0.076 | 0.073 | 0.072 | 0.070 | 0.069 | 0.068 | 0.071 | 0.068 | 0.066 | 0.064 | 0.063 | 0.063 |
| | | 30% | 0.052 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 |
| 4 MINUTE CYCLE | ECONOMIZER SWITCH SETTING | 100% | 0.147 | 0.149 | 0.151 | 0.153 | 0.155 | 0.151 | 0.148 | 0.145 | 0.143 | 0.141 | - | 0.141 | 0.137 | 0.135 | 0.134 | 0.134 |
| | | 90% | 0.134 | 0.136 | 0.137 | 0.139 | 0.141 | 0.138 | 0.135 | 0.133 | 0.131 | 0.129 | - | 0.129 | 0.127 | 0.125 | 0.125 | 0.125 |
| | | 80% | 0.120 | 0.122 | 0.124 | 0.125 | 0.127 | 0.124 | 0.122 | 0.120 | 0.119 | 0.118 | - | 0.118 | 0.116 | 0.115 | 0.116 | 0.116 |
| | | 70% | 0.106 | 0.108 | 0.110 | 0.112 | 0.114 | 0.111 | 0.110 | 0.108 | 0.107 | 0.106 | - | 0.106 | 0.105 | 0.105 | 0.106 | 0.107 |
| | | 60% | 0.093 | 0.095 | 0.096 | 0.098 | 0.100 | 0.098 | 0.097 | 0.096 | 0.095 | 0.095 | - | 0.095 | 0.095 | 0.095 | 0.097 | 0.098 |
| | | 50% | 0.079 | 0.081 | 0.083 | 0.084 | 0.086 | 0.085 | 0.084 | 0.084 | 0.084 | 0.084 | - | 0.084 | 0.084 | 0.085 | 0.087 | 0.089 |
| | | 30% | 0.052 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | - | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 |

TABLE 3K Outlet pressure dew points at various inlet temperatures

| INLET TEMPERATURE | °F | 35 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|-----------------------------|----|--------|-------|-------|-------|-------|-------|-------|-------|---------|---------|
| | °C | 1.7 | 4.4 | 10.1 | 15.6 | 21.1 | 26.7 | 32.2 | 37.8 | 43.3 | 48.9 |
| OUTLET P.D.P. 10 MIN. CYCLE | °F | -75 | -70 | -65 | -60 | -55 | -50 | -45 | -40 | -35 (1) | -30 (1) |
| | °C | -59.4 | -56.7 | -53.9 | -51.1 | -48.3 | -45.6 | -42.8 | -40.0 | -37.2 | -34.4 |
| OUTLET P.D.P. 4 MIN. CYCLE | °F | -149 | -145 | -138 | -130 | -122 | -115 | -108 | -100 | -92 | -85 (2) |
| | °C | -100.6 | -98.3 | -94.4 | -90.0 | -85.6 | -81.7 | -77.8 | -73.3 | -68.9 | -65.0 |

(1) If flow rate is downrated by a factor from Table 3H, outlet dew point is -40°F/C, 40°F/C

(2) If flow rate is downrated by a factor from Table 3H, outlet dew point is -100°F, 73°C.

TABLE 3L Outlet pressure dew points at moisture indicator color change

| INLET TEMPERATURE | °F | 35 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|-------------------|----|-------|-------|-------|-------|-------|-------|-------|-------|------|------|
| | °C | 1.7 | 4.4 | 10.1 | 15.6 | 21.1 | 26.7 | 32.2 | 37.8 | 43.3 | 48.9 |
| OUTLET P.D.P. | °F | -34 | -28 | -22 | -16 | -10 | -4 | 3 | 9 | 15 | 21 |
| | °C | -36.7 | -33.4 | -30.0 | -26.7 | -23.4 | -20.0 | -16.1 | -12.8 | -9.5 | -6.1 |

E N G L I S H

4.0 MAINTENANCE

WARNING

The heatless desiccant dryer is a pressure containing device. Depressurize before servicing. (See Section 3.3)

4.1 Desiccant Replacement

NOTE: The use of the correct replacement desiccant is necessary for proper dryer operation. Never use hygroscopic salts of the type commonly used in "deliquescent" type dryers.

4.1.1 Frequency of desiccant replacement

Desiccant should be replaced whenever the required dew point cannot be maintained while the dryer is being operated within its design conditions and there are no mechanical malfunctions. Refer to section 5.0 for troubleshooting hints.

NOTE: Desiccant life is determined by the quality of the inlet air. Proper filtering of the inlet air will extend the life of the desiccant. Typically desiccant life is 3 to 5 years.

4.1.2 Procedure for Desiccant Charge Replacement

4.1.2.1 Depressurize and de-energize the dryer. (See section 3.3)

4.1.2.2 Remove the fill and drain plugs from desiccant tower and drain the spent desiccant. Place a container at the base of the vessel to collect the desiccant. If necessary tap the sides of the vessels with a rubber mallet to loosen desiccant.

4.1.2.3 Replace the drain plug using teflon tape sealant or equivalent.

4.1.2.4 Fill the desiccant drying tower as full as possible with dry desiccant. Do not tamp desiccant.

4.1.2.5 Replace the fill plug using teflon tape sealant or equivalent.

4.1.2.6 Repeat this procedure for the other tower.

4.1.3 Insuring desiccant dryness

4.1.3.1 Replacement desiccant is shipped in air tight containers. Keep the covers on these containers tightly closed until use to avoid moisture contamination. If desiccant is exposed to air it can be heated in an oven at 400°F (204°C) for four hours before use, or the procedure in 4.1.3.2 can be used.

4.1.3.2 If the dryer is not refilled with dry desiccant, it will be necessary to operate the dryer with an inlet flow rate of less than 50% of maximum to dry the desiccant. To do this, set the Economizer Switch for 100%, and the purge pressure for 45 psig. (3.2 kgf/cm²)

4.1.3.3 Purge mufflers should be changed annually.

4.1.3.4 Valve(s) should be checked annually.

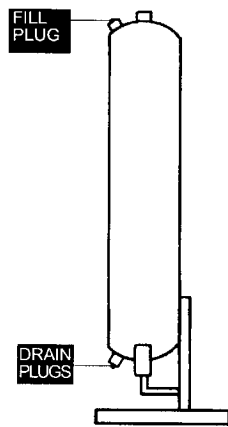


FIGURE 4A

4.2 Pilot Air Filter - Element Replacement - Models 370 scfm and larger

4.2.1 Frequency of replacement - Pilot air filter contains a filter element which should be changed yearly or sooner if pressure drop across cartridge prevents valves from actuating. Pilot air pressure must not drop below 60 psig (4.2 kgf/cm²).

4.2.2 Procedure for element replacement.

Follow instructions supplied with replacement element.

WARNING THIS SEPARATOR IS A PRESSURE CONTAINING DEVICE. DEPRESSURIZE BEFORE SERVICING.

IF SEPARATOR HAS NOT BEEN DEPRESSURIZED BEFORE DISASSEMBLY, AN AUDIBLE ALARM WILL SOUND WHEN THE BOWL BEGINS TO BE REMOVED FROM THE HEAD. IF THIS OCCURS, STOP DISASSEMBLY, ISOLATE AND COMPLETELY DEPRESSURIZE SEPARATOR BEFORE PROCEEDING.

1. Shut off air supply.
2. Depressurize Dryer.
3. Remove bowl.
 - a. Push bowl up, turn bowl 1/8th turn to your left, and pull bowl straight down
4. Clean filter bowl
5. Replace element

- a. Pull off old element and discard
- b. Make certain o-ring inside top of replacement element is in place and push element onto filter head.

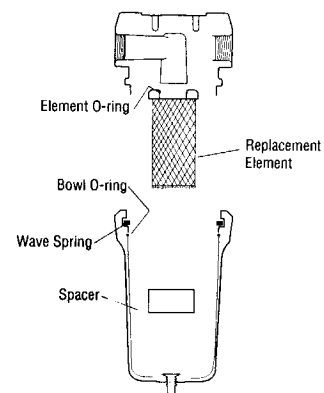


FIGURE 4B

NOTE: Make certain o-ring is generously lubricated.

6. After making certain that bowl o-ring is in place, reassemble bowl to head.

NOTE: Wave spring ends should be pointed down to prevent the wave spring from interfering with reassembly.

4.3 Fuse Replacement

4.3.1 Fuses are located on board in electrical enclosure. See figure 3B for Standard Control Board and 3C for Automatic Purge Saving System.

TABLE 4A Amount of desiccant required for complete change lb (kg)

| MODEL | 25 | 45 | 60 | 80 | 115 | 165 | 260 | 370 | 450 | 590 |
|-------------------|---------|---------|---------|----------|----------|----------|-----------|-----------|-----------|-----------|
| ACTIVATED ALUMINA | 48 (22) | 48 (22) | 72 (33) | 106 (48) | 182 (83) | 182 (83) | 316 (143) | 452 (205) | 528 (240) | 710 (322) |

| MODEL | 750 | 930 | 1130 | 1350 | 1550 | 2100 | 3000 | 4100 | 5400 |
|-------------------|-----------|------------|------------|------------|------------|-------------|-------------|------------|-------------|
| ACTIVATED ALUMINA | 926 (420) | 1172 (532) | 1468 (666) | 1766 (801) | 2064 (936) | 2592 (1176) | 3930 (1783) | 4920(2232) | 7750 (3515) |

4.4 Test Mode

WARNING

Enclosure contains electricity.
Use caution when working inside box.



4.5.1 Test Mode - Standard Control Panel

4.5.1.1 Wait until point in cycle when right tower is drying and left tower has completed regeneration and repressurization (both towers at full line pressure).

4.5.1.2 De-energize dryer (on/off switch off, "O"); Select Test Mode by placing DIP switches 5 and 6 (found inside enclosure) in the ON (up) position; Re-energize dryer (1) (2).

4.5.1.3 Use Reset/step button to step through the operating cycle in the order shown in Table 4B.

4.5.1.4 Complete all 9 steps, allow the left tower to fully repressurize and de-energize dryer. (1) (3).

4.5.1.5 Reset DIP switches 5 and 6 to operating mode desired (10 min. cycle - 5 is OFF, 6 is ON or 4 min. cycle - 5 is ON, 6 is OFF); Re-energize dryer.

- (1) Do not de-energize dryer unless both towers are at line pressure.
- (2) If Test Mode is selected without de-energizing dryer, Test Mode light will blink until tower on line has completed drying. Dryer will then enter Test Mode and light will glow steadily.
- (3) If another operating mode is selected without de-energizing dryer and before all 9 steps are completed, selected mode light will blink and dryer will automatically complete a cycle. Dryer will then operate in selected mode and light will glow steadily. You may also use the Reset/step button to manually step through the cycle until the left tower drying light illuminates and pressing the Reset/step button will not advance through further steps.

4.4.2 Test Mode - Automatic Purge Saving System

4.4.2.1 If possible wait until point in cycle when right tower is drying and left tower has completed regeneration and repressurization (both towers at full line pressure).

4.4.2.2 De-energize dryer (on/off switch off "O"); Select Test Mode by placing 4 DIP switches (found inside enclosure) in the ON (up) position; Re-energize dryer (1) (2).

4.4.2.3 Use Reset/step button to step through the operating cycle in the order shown in Table 4B.

NOTE: In the Test Mode, the average demand meter reflects voltage across the thermistors. Table 4B indicates which thermistor is being checked. 0% indicates a short; 100% indicates an open; Figure 4C relates meter reading to thermistor temperature.

4.4.2.4 Complete all 9 steps, allow the left tower to fully repressurize and de-energize dryer. (1) (3).

4.4.2.5 Reset DIP switches to operating mode (switches 1,2 and 3) and maximum operating pressure (150 psig, switch 4 is OFF; 250 psig, switch 4 is ON) desired; Re-energize dryer.

- (1) Do not de-energize dryer unless both towers are at line pressure.
- (2) If Test Mode is selected without de-energizing dryer, Test Mode light will blink until right tower drying terminates. Dryer will then enter Test Mode and light will glow steadily.
- (3) If another operating mode is selected without de-energizing dryer and before all 9 steps are completed, selected mode light will blink and the controller will automatically step through the remaining steps. Dryer will then operate in selected mode and light will glow steadily. You may also use the Reset/step button to manually step through the cycle until the left tower drying light illuminates and pressing the Reset/step button will not advance through further steps.

**Test Mode
TABLE 4B**

| STEP NUMBER | WHAT OCCURS | TOWER STATUS | | | | VALVE POSITION | | | | SOLENOID/TERMINALS ENERGIZED (light illuminated) | | | | THERMISTOR BEING CHECKED (automatic purge saving system) | | | |
|-------------|--------------|--------------|----|----------|-----|----------------|------|-------|------|--|------|-------|------|--|-----|-----|-----|
| | | MODE | | PRESSURE | | L P/R | L IN | R P/R | R IN | L P/R | L IN | R P/R | R IN | T L | T R | B L | B R |
| | | LT | RT | LT | RT | | | | | | | | | | | | |
| Start | | D | D | LP | LP | C | O | C | O | | | | | | | | |
| 1 | R IN closes | D | - | LP | LP | C | O | C | C | | | | E | X | | | |
| 2 (1) | R P/R opens | D | R | LP | <2 | C | O | O | C | | | | E | E | | | X |
| 3 | No change | D | R | LP | <2 | C | O | O | C | | | | E | E | | | X |
| 4 (2) (3) | R P/R closes | D | - | LP | REP | C | O | C | C | | | | E | X | | | |
| 5 | R IN opens | D | D | LP | LP | C | O | C | O | | | | | | | | |
| 6 | L IN closes | - | D | LP | LP | C | C | C | O | | E | | | | | X | |
| 7 (1) | L P/R opens | R | D | <2 | LP | O | C | C | O | E | E | | | X | | | |
| 8 | No change | R | D | <2 | LP | O | C | C | O | E | E | | | X | | | |
| 9 (2) (3) | L P/R closes | - | D | REP | LP | C | C | C | O | | E | | | | | X | |

NOTES:

- (1) Close purge rate valve during this step to check for any valve leaks. No air should exhaust through the muffler. If air is exhausting through the muffler, check all valves for leaks. After testing for leaks or fixing any leaks, be sure to open the purge pressure valve and reset the purge pressure.
- (2) Do not go to the next step until the tower is repressurized.
- (3) Switching failure alarm circuit is energized during this step (alarm light should flash until pressure exceeds 40 psig).

CODES:

R IN - Right inlet valve
R P/R - Right purge/repressurization valve
L IN - Left inlet valve
L P/R - Left purge/repressurization valve
LT - Left tower
RT - Right tower

D - Drying
R - Regenerating
LP - Line Pressure
<2 - Less than 2 psig
REP - Repressurizing
C - Closed
O - Open

E - Energized
TL - Top left
TR - Top right
BL - Bottom left
BR - Bottom right

TEMPERATURE RANGE VERSUS AVERAGE DEMAND

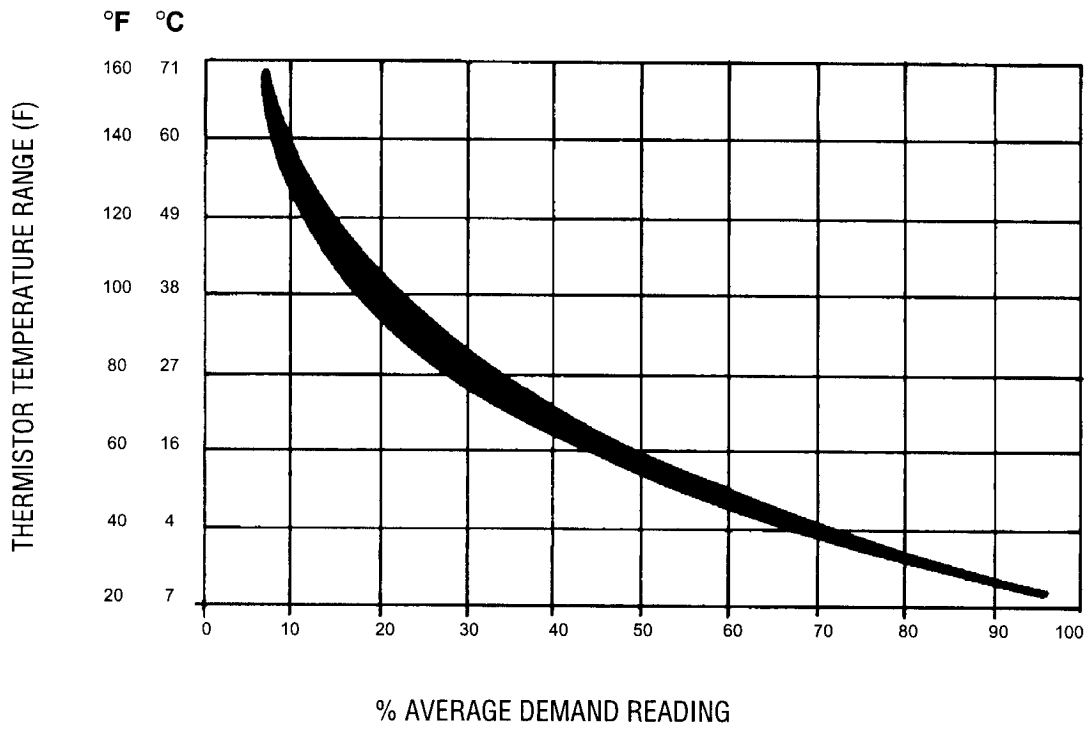


FIGURE 4C

ENGINEERING

5.0 TROUBLESHOOTING

| SYMPTOM | POSSIBLE CAUSE(S) | CORRECTIVE ACTION |
|---|--|---|
| 5.1 Indicator lights not illuminated | No power to unit On/Off Switch off Switch malfunctioning | Check voltage at terminal board. Turn on. Replace switch. |
| 5.2 Moisture Indicator turns yellow (elevated outlet dew points) | Maximum flow being exceeded Design conditions being exceeded Desiccant not adsorbing a. Useful service life has ended b. Desiccant is contaminated (e.g. with oil) c. Premature exhaustion (saturated with water) | Refer to Section 3.5.4 to determine maximum flow. Refer to Section 3.5 to determine if dryer is being operated within its design limitations. Change desiccant. Take corrective action. Refer to Section 2.1 to determine proper prefiltration then change desiccant. Refer to 5.3 for corrective action. Desiccant beds may be reactivated by running at reduced flow until desired outlet dewpoint is achieved. |
| 5.3 Desiccant being exhausted prematurely | Insufficient purge rate a. Improper purge rate b. Tower not completely depressurized during purge cycle (Tower pressure gauge should read lower than 2 psig) 1. Clogged exhaust muffler 2. Purge valve won't open 3. Check valve stuck open Insufficient purge time a. Improper set points b. Faulty Timer | Refer to Section 3.1.4 to determine correct Purge Pressure Indicator Setting. Replace muffler inserts. Check power to valve to determine if valve or timer at fault. On Models 370 and larger, check pilot air line for obstruction. Repair valve. Refer to Section 3.1.1 to determine correct Economizer Switch and Cycle Settings. Refer to Section 3.2.3 to verify proper time sequence. |
| 5.4 Tower fails to pressurize to line pressure | Purge repressurization valve won't close Excessive downstream air demand | Check valve for obstruction. This valve is normally closed. On Models 370 and larger, check pilot solenoid valve and pilot air line for obstruction. |
| 5.5 Tower fails to depressurize to less than 2 psig | Purge rate valve open too far Clogged muffler Check valve stuck open Purge repressurization valve won't open | Check Section 3.1.4 for purge rate indicator setting. Replace muffler. Repair valve. Check power to valve (pilot valve on Models 370 and larger) to determine if valve or timer is at fault. Models 370 and larger: Check pilot valve, pilot air line, and purge repressurization valve for obstruction. |
| 5.6 Excessive purge air is discharged during purge cycle | Inlet valve won't close Check valve sticking | Check power to valve (pilot valve on Models 370 and larger) to determine if valve or timer is at fault. Check valve for obstruction. Models 370 and larger: Check pilot valve and pilot air line for obstruction. Repair Valve |
| 5.7 Excessive desiccant dust downstream | Faulty timer Purge rate valve closed | Refer to Section 3.2.3 to verify proper time sequence. Refer to Section 3.1.4 to determine Correct Purge Pressure setting. |
| 5.8 Switching Failure Unit did not depressurize in time (24 sec) or below 10# Unit did not repressurize in time (24 sec) or not above 40# | Clogged mufflers, faulty check valve, faulty inlet valve or purge valve, or faulty pressure switch. Make sure dryer has air pressure, check purge pressure setting, faulty purge valve, or faulty pressure switch. | Replace mufflers or defective parts. Provide proper air pressure. Replace defective parts. Set purge pressure per section 3.1.4. |

NOTES

NOTES

WARRANTY

The manufacturer warrants the product manufactured by it, when properly installed, operated, applied, and maintained in accordance with procedures and recommendations outlined in manufacturer's instruction manuals, to be free from defects in material or workmanship for a period of one (1) year from the date of shipment to the buyer by the manufacturer or manufacturer's authorized distributor, or eighteen months from the date of shipment from the factory, whichever occurs first, provided such defect is discovered and brought to the manufacturer's attention within the aforesaid warranty period. The manufacturer will repair or replace any product or part determined to be defective by the manufacturer within the warranty period, provided such defect occurred in normal service and not as a result of misuse, abuse, neglect or accident.

The warranty covers parts and labor for the warranty period. Repair or replacement shall be made at the factory or the installation site, at the sole option of the manufacturer. Any service performed on the product by anyone other than the manufacturer must first be authorized by the manufacturer. Normal maintenance items requiring routine replacement are not warranted. Unauthorized service voids the warranty and any resulting charge or subsequent claim will not be paid. Products repaired or replaced under warranty shall be warranted for the unexpired portion of the warranty applying to the original product. The foregoing is the exclusive remedy of any buyer of the manufacturer's product. The maximum damages liability of the manufacturer is the original purchase price of the product or part.

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**AUTHORIZATION FROM THE SERVICE DEPARTMENT IS NECESSARY
BEFORE MATERIAL IS RETURNED TO THE FACTORY OR IN-WARRANTY REPAIRS ARE MADE.**

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