

# Service Manual

**No. 175 C**  
**ECO #11181**  
**(ENG. DWG. 412531)**

## **AUTOMATIC PRESSURIZATION DEHYDRATORS**

**Series APD-20, 22, 70, 72, 73**

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**RADIO FREQUENCY SYSTEMS**



## SECTION 1. DESCRIPTION

The APD-20 and APD-70 Series Automatic Pressurization Dehydrators are designed for reliable pressurization of elliptical waveguide, coaxial cable and rigid line systems. The dehydrators utilize a dual canister, self-reactivating, heatless fractionator process, using high efficiency aluminum-silicate molecular sieve absorbent. The drying system is completely automatic, with no need for replacement or manual reactivation of any absorption material.

The APD-20 60 Hz model is rated at 0.2 SCFM (.09 liter/sec) and  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) dry air dew point output at  $95^{\circ}\text{F}$  ( $35^{\circ}\text{C}$ ) 95% relative humidity input. The APD-20 dehydrator will maintain up to 2000 feet of  $3\frac{1}{2}$  inch diameter transmission line.

The APD-22 50 Hz model is rated at 0.14 SCFM (.08 liter/sec) and  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) dry air dew point output at  $95^{\circ}\text{F}$  ( $35^{\circ}\text{C}$ ) 95% relative humidity input. The APD-22 has a capacity reduction of 17 percent relative to the 60 Hz APD-20 model.

The APD-70 and APD-73 60 Hz models are designed for operation in larger systems with up to 1,700 feet of 6 $\frac{1}{2}$  inch diameter transmission line. The dehydrator is rated at 0.7 SCFM (.32 liter/sec) and  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) dry air dew point output at  $95^{\circ}\text{F}$  ( $35^{\circ}\text{C}$ ) 95% relative humidity input.

The APD-72 50 Hz model is rated at 0.58 SCFM (0.27 liter/sec) and  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) dry air dew point output at  $95^{\circ}\text{F}$  ( $35^{\circ}\text{C}$ ) 95% relative humidity input. The APD-72 has a capacity reduction of 17 percent relative to the 60 Hz APD-70 model.

Output pressure is factory set to 3 psig (20.7 kPa) "on" and 5 psig (34.5 kPa) "off". Dehydrator output may be readjusted in the field to operate anywhere between 1 and 15 psig (6.9 -103.4 kPa). A check valve prevents loss of pressure back through the dehydrator. A standard low pressure alarm switch, factory set for 1 psig (6.9 kPa) is included for remote monitoring.

Standard features include a circuit breaker switch, 0-15 psig pressure gauge, and a visual moisture alarm which turns dark blue when dry and pink when wet. The dehydrators may be shelf mounted or flush mounted in a standard EIA 19" relay rack, (use rack mount kit P/N 913907). The APD-70 Series includes a vented rear cover as standard equipment. An optional vented rear cover, P/N 933639, may be ordered as an accessory for the APD-20 Series.

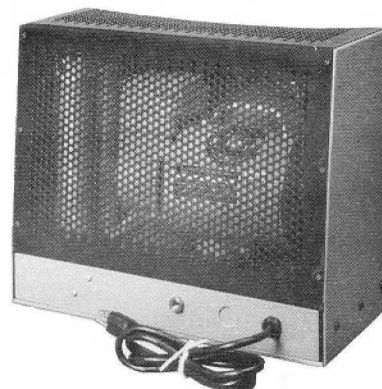
### NOTE:

The pipe fittings referred to in this section are to U.S. National Pipe Thread standards and are abbreviated as  $\frac{1}{8}$ " MPT for  $\frac{1}{8}$ " NPT male and  $\frac{1}{8}$ " FPT for  $\frac{1}{8}$ " NPT female. These fittings may be mated with the International  $\frac{1}{8}$ " pipe thread fittings although the U.S. standards include 27 threads per inch, while the European International Standards Organization fittings have 28 threads per inch.

\*1.0 to 2.0 PSIG on APD-20L.



**APD-20 SERIES**



**APD-70 SERIES**

## .2 SCFM Automatic Dehydrators Series APD-20, APD-20L

### CHARACTERISTICS

<b>Power Source</b>	
APD-20 P/N 920635	115 Volt 50/60 Hz
APD-22 P/N 920637	230 Volt 50/60 Hz
<b>Output Ratings</b>	
60 Hz	0.2 SCFM (0.09 liters/sec)
50 Hz	0.14 SCFM (0.08 liters/sec)
<b>Output Dew Point</b>	
-40°F (-40°C)	
<b>Ambient Inlet Temp.</b>	
33°F - 120°F (1°C - 49°C)	
<b>Ambient Humidity</b>	
95% maximum	
<b>Output Pressure (on/off) : APD-20</b>	
Factory set	3 - 5 psig (20.7 - 34.5 kPa)
Field adjustable	1 - 15 psig (6.9 - 103.4 kPa)
Output Differential	2 psig (13.8 kPa) minimum
<b>Output Pressure (on/off) : APD-20L</b>	
Factory set	1 - 2 psig (6.9 - 13.8 kPa)
Field adjustable	1 - 5 psig (6.9 - 34.5 kPa)
Output Differential	1 psig (6.9 kPa) minimum
<b>Compressor Rating</b>	
1/12 hp	
<b>Power Consumption</b>	
pumping	350 watts
idle	10 watts
<b>Low Pressure Alarm**</b>	
P/N 920467	Factory set for 1 psig 0.5 psig differential.
<b>Output Fitting</b>	
1/8" FPT to 3/8" plastic tube fitting.	
<b>Dimensions</b>	<b>inches</b>
H x W x D	(mm)
	14 x 17-11/16 x 8 (355 x 450 x 203)
<b>Net Weight</b>	
36 lbs. (16 kg)	
<b>Shipping Weight</b>	
44 lbs. (20 kg)	
<b>Standard Items Supplied</b>	
P/N 913348-240	20 ft. of 3/8" plastic tubing
P/N 913344	Connector, 3/8" tubing to 1/8" MPT
<b>Optional Accessories</b>	
P/N 920641	Maintenance Parts Kit for APD-20 or APD-22
P/N 920184	High Pressure Alarm
P/N 914710	Floor Stand
P/N 913907	Dehydrator Rack Mount
P/N 940008	Wall Shelf
P/N 920717-001	Pressure and Humidity Monitor for APD-20
P/N 920717-003	Pressure and Humidity Monitor for APD-22
P/N 933639	Back Cover Kit

#### APD-20

### MAXIMUM DEHYDRATOR CAPACITY RATINGS Based on 2 psi leakage in 24 hours and 5% running time.

Transmission Line	Approximate Length	
	feet	(meters)
7/8"	21,000	6,400
1 1/8"	7,000	2,100
3 1/8"	2,100	600
6 1/8"	500	150
6 to 12 GHz waveguide	8,000	2,400
4 to 5 GHz waveguide	4,000	1,200

\* For 50 Hz operation, multiply capacity ratings by 5/6 (a reduction of 17%).

## .7 SCFM Automatic Dehydrators Series APD-70

### CHARACTERISTICS

<b>Power Source</b>	
APD-70 P/N 940019	115 Volt 60 Hz
APD-72 P/N 940020	230 Volt 50 Hz
APD-73 P/N 940022	230 Volt 60 Hz
<b>Output Ratings</b>	
60 Hz	0.7 SCFM (0.32 liters/sec)
50 Hz	0.58 SCFM (0.27 liters/sec)
<b>Output Dew Point</b>	
-40°F (-40°C)	
<b>Ambient Inlet Temp.</b>	
33°F - 120°F (1°C - 49°C)	
<b>Ambient Humidity</b>	
95% maximum	
<b>Output Pressure (on/off)</b>	
Factory set	3 - 5 psig (20.7 - 34.5 kPa)
Field adjustable	1 - 15 psig (6.9 - 103.4 kPa)
Output Differential	2 psig (13.8 kPa) minimum
<b>Compressor Rating</b>	
1/4 hp	
<b>Power Consumption</b>	
pumping	600 watts
idle	10 watts
<b>Low Pressure Alarm</b>	
P/N 920467	Factory set for 1 psig 0.5 psig differential.
<b>Output Fitting</b>	
1/8" FPT to 3/8" plastic tube fitting.	
<b>Dimensions</b>	<b>inches</b>
H x W x D	(mm)
	14 x 17-11/16 x 8 (355 x 450 x 203)
<b>Net Weight</b>	
62 lbs. (28 kg)	
<b>Shipping Weight</b>	
72 lbs. (33 kg)	
<b>Standard Items Supplied</b>	
P/N 913348-240	20 ft. of 3/8" plastic tubing
P/N 913344	Connector, 3/8" tubing to 1/8" MPT
<b>Optional Accessories</b>	
P/N 920641	Maintenance Parts Kit for APD-70, APD-72, or APD-73
P/N 920184	High Pressure Alarm
P/N 914710	Floor Stand
P/N 913907	Dehydrator Rack Mount
P/N 940008	Wall Shelf
P/N 920717-001	Pressure and Humidity Monitor for APD-70
P/N 920717-003	Pressure and Humidity Monitor for APD-72 or APD-73

#### APD-70

### MAXIMUM DEHYDRATOR CAPACITY RATINGS Based on 2 psi leakage in 24 hours and 5% running time.

Transmission Line	Approximate Length	
	feet	(meters)
7/8"	73,000	22,200
1 1/8"	24,000	7,300
3 1/8"	7,300	2,200
6 1/8"	1,700	500
6 to 12 GHz waveguide	28,000	8,500
4 to 5 GHz waveguide	14,000	4,300

\*\*APD-20L also supplied with 5 psi high pressure alarm, p/n 921287.



## SECTION 2. INSTALLATION

**WARNING:** Disconnect the unit from the power source before opening the base for service!

### 2.1 Incoming Inspection

This instrument was inspected mechanically and electrically prior to shipment. Inspect for possible mechanical damage received in transit. If there is damage or deficiency, notify the carrier and Radio Frequency Systems immediately.

### 2.2 Mounting

The dehydrators may be installed free-standing on the rubber feet provided. Where the installation requires it, the rubber feet may be replaced with shock- and/or vibration-isolating mounts. Wall shelves and relay rack mounting bracket kits are available, see page 3 for part numbers.

### 2.3 Electrical

Connect equipment to appropriate power source. If it is desired to use the low pressure alarm feature, leads must be taken from Terminals 6 and 7. The alarm contacts are passive and power must be supplied externally to the alarm device. High pressure alarm are at Terminals 7 & 8. See page 7.

### 2.4 Operation

#### 2.4.1 Purging

The transmission line system should be purged of moisture with dry nitrogen before the dehydrator is placed into service. This will save excessive dehydrator running time during start-up.

### 2.4.2 Capacity Ratings

The dehydrator should be of sufficient output capacity to accommodate the calculated line volume and anticipated leak rate. A duty cycle between 1 and 5 percent per day should be maintained for lowest possible line humidity. A unit too large for the line volume may not operate long enough to purge the system of moisture. A dehydrator should run for a minimum of 2½ minutes to recover from a line drop of 2 psig. See Table 2.2 for recommended dehydrator capacity ratings, and Figure 2.3 for dehydrator run time.

### 2.4.3 Start-Up

Turn the circuit breaker switch ON. Allow the unit to initially operate, exhausting to the atmosphere, until the visual humidity indicator turns a dark blue color. This insures the proper dry air delivery. After this break-in period, turn the circuit breaker switch OFF.

Connect the unit's outlet fitting to the line to be pressurized with the polyethylene tubing provided (See Fig. 2.1). After making connection, turn the switch ON. Operation is completely automatic, and no further attention should be required.

### 2.4.4 Shut-Down

Turn the circuit breaker switch OFF.

### 2.4.5 Humidity Indicator

The humidity indicator provides a visual means to determine whether the dehydrator is furnishing dry air to the system. The indicator contains a substance which changes color from dark blue when dry to pink when wet.

## PRESSURE CONNECTOR ASSEMBLY

1. CUT PLASTIC TUBE TO DESIRED LENGTH.
2. SCREW CONNECTOR FITTING INTO MATING COMPONENT (USE A THREAD SEALANT).
3. SLIDE NUT AND SLEEVE OVER PLASTIC TUBE, AND INSERT TUBE INTO REAR OF CONNECTOR FITTING.
4. ENGAGE AND TIGHTEN NUT AND SLEEVE.

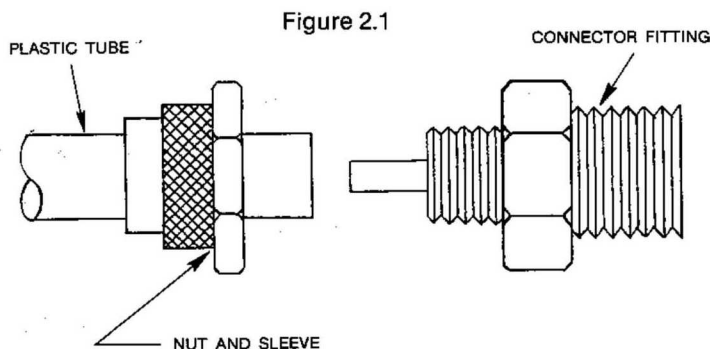


FIGURE 2.3

Dehydrator Running Time:

$$\text{Running Time (min/day)} = \left[ \frac{\text{Volume of Air Lost (ft}^3\text{/day)}}{\text{Dehydrator Output (ft}^3\text{/min)}} \right]$$

Table 2.2

APD-20 & APD-70 Maximum Dehydrator Capacity Ratings\*

Transmission Line	APD-20		APD-70	
	Approx. feet	Length (meters)	Approx. feet	Length (meters)
¾" cable	21,000	(6,400)	73,000	(22,200)
1" cable	7,000	(2,100)	24,000	(7,300)
3" cable	2,100	(600)	7,300	(2,200)
6" cable	500	(150)	1,700	(500)
Waveguide				
6 to 12 GHz	8,000	(2,400)	28,000	(8,500)
4 to 5 GHz	4,000	(1,200)	14,000	(4,300)

\* Based on 2 psi leakage in 24 hours and 5% running time to 60 Hz operation. For 50 Hz operation, multiply capacity ratings by 5/6 (reduction of 17%).

## SECTION 3. PRINCIPLES OF OPERATION

The Automatic Pressurization Dehydrators consist of the following major components:

- 3.1 Dry-lubricated compressor
- 3.2 Dehydrator time delay relay and solenoid valve
- 3.3 Check valve and flow control device
- 3.4 Pressure switch
- 3.5 Humidity indicator
- 3.6 Low-pressure alarm contacts
- 3.7 Outlet pressure gauge
- 3.8 Circuit breaker switch
- 3.9 Power indicator light

### 3.1 Compressor

The compressor's main and throw bearings are pre-lubricated ball bearings. No additional lubrication is necessary. The compressor has an integral safety relief valve to prevent over-pressurization.

The compressor is adjusted to run at about half its rated output to increase its life.

### 3.2 Dehydrator

The dehydrator consists of two cylindrical desiccant chambers, a one four-way solenoid valve, and a time delay relay.

One solenoid valve admits compressed air to one of the chambers where moisture is absorbed by the desiccant material dehydrating the air. During this time, the other chamber is venting to atmosphere. A small portion of the dry air leaving the active drying chamber is directed downward through the idle chamber, purging it of the moisture it had absorbed during its last drying cycle and preparing it for its next.

The drying and purging functions are switched automatically from one chamber to the other and vice versa, by the time delay relay every 45 seconds. The shift from drying to purging is evidenced by a rush of air from the chamber that is being vented. At no time should this vent be restricted.

### 3.3 Check valve and flow control device

The check valve isolates low pressure from high pressure within the dehydrator, and also prevents loss of system pressure when the dehydrator is at idle.

### 3.4 Pressure switch

The pressure switch monitors the pressure in the external system. When the unit has pumped the system up to a preset pressure the switch automatically shuts off the compressor and the dehydrator. When pressure drops to a lower preset figure, the switch automatically restarts the compressor and dehydrator.

## SECTION 4. MAINTENANCE AND ADJUSTMENTS

### 4.1 Compressor

The compressor inlet filter must be kept clean and should be inspected on a regular basis. A monthly schedule is recommended.

The compressor has one filter located on top of cylinder head. Unscrew the plastic body and remove the felt pad. Wash the pad thoroughly in solvent; dry completely; replace in the body and reinstall. Replace the pad when it becomes worn.

Never operate the unit without an inlet filter, as this will allow dust and foreign particles to enter the compressor and reduce its operating life. We recommend the replacement of inlet filter every two years. Filter p/n listed on page 8.

### 4.2 Lubrication

No parts of the unit require lubrication.

### 4.3 Changing ON/OFF Pressure (Ref. Fig. 4.1)

The unit is delivered pre-set at the factory (see table page 3). The output pressure may be field adjusted to settings between 1 and 10 psig (6.4 & 68.9 kPa). Note: The maximum output pressure is limited to the pre-set safety relief valve pressure limit of 10 psig (68.9 kPa).

To change the output pressure setting, turn setting screw using a small flat screwdriver clockwise to decrease output pressure setting, and counterclockwise to increase output pressure setting. See Figure 4.1.

### 5.0 Spare Parts

The spare parts list shown on page 8 is typically available for maintenance. Contact the factory for specific cost and delivery of parts.

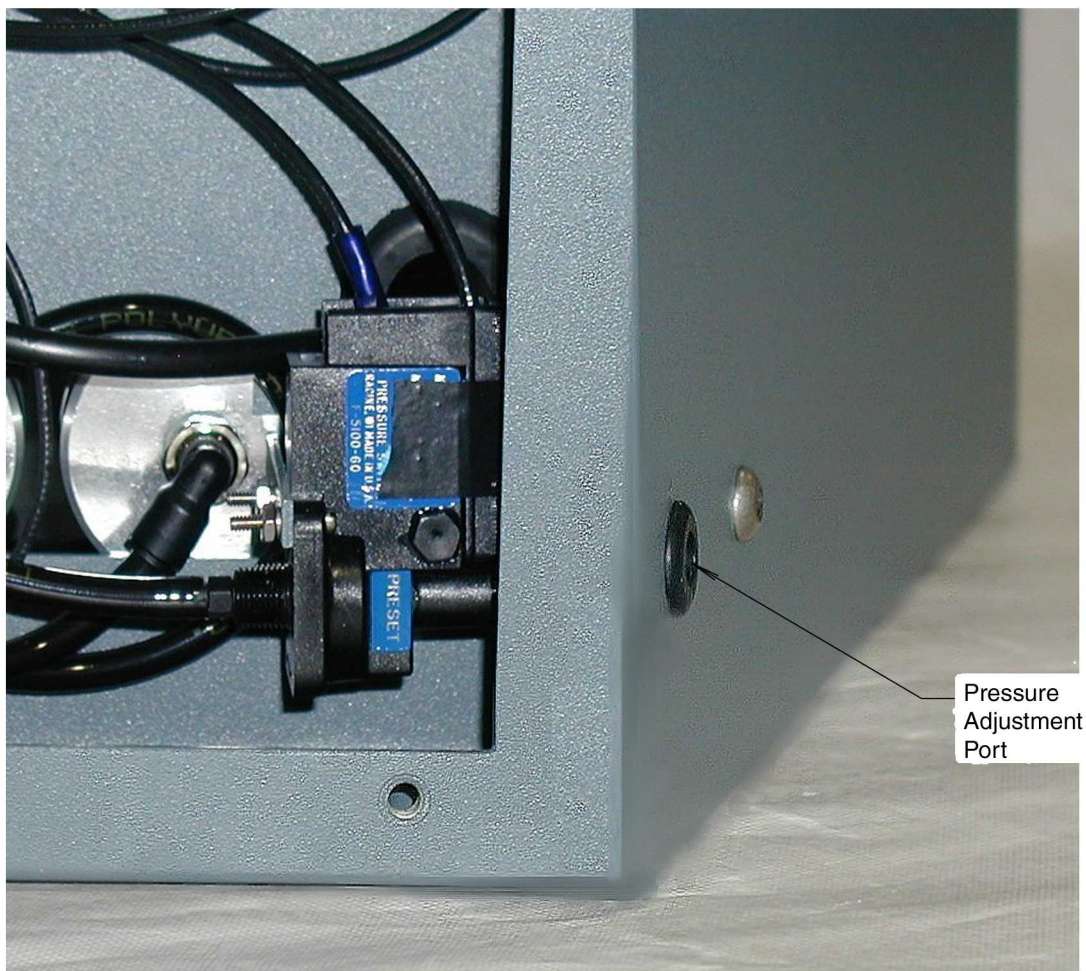


Figure 4.1 Pressure Switch

## SECTION 6. TROUBLESHOOTING

### 6.1 Failure to Start

- 6.1.1 If the breaker indicator light is off when the circuit breaker switch is in the ON position, the circuit breaker has tripped and must be reset.
- 6.1.2 Check the power source.
- 6.1.3 Check internal wiring.
- 6.1.4 *Disconnect the power from the unit* and check to see that the compressor will turn over by rotating the compressor fan by hand. If not, the compressor is damaged and must be replaced. The motor has thermal overload protection which is self resetting. If the motor overheats, the overload will open the circuit. Allow the motor to cool before attempting to restart.

### 6.2 Humidity Indicator Shows Pink

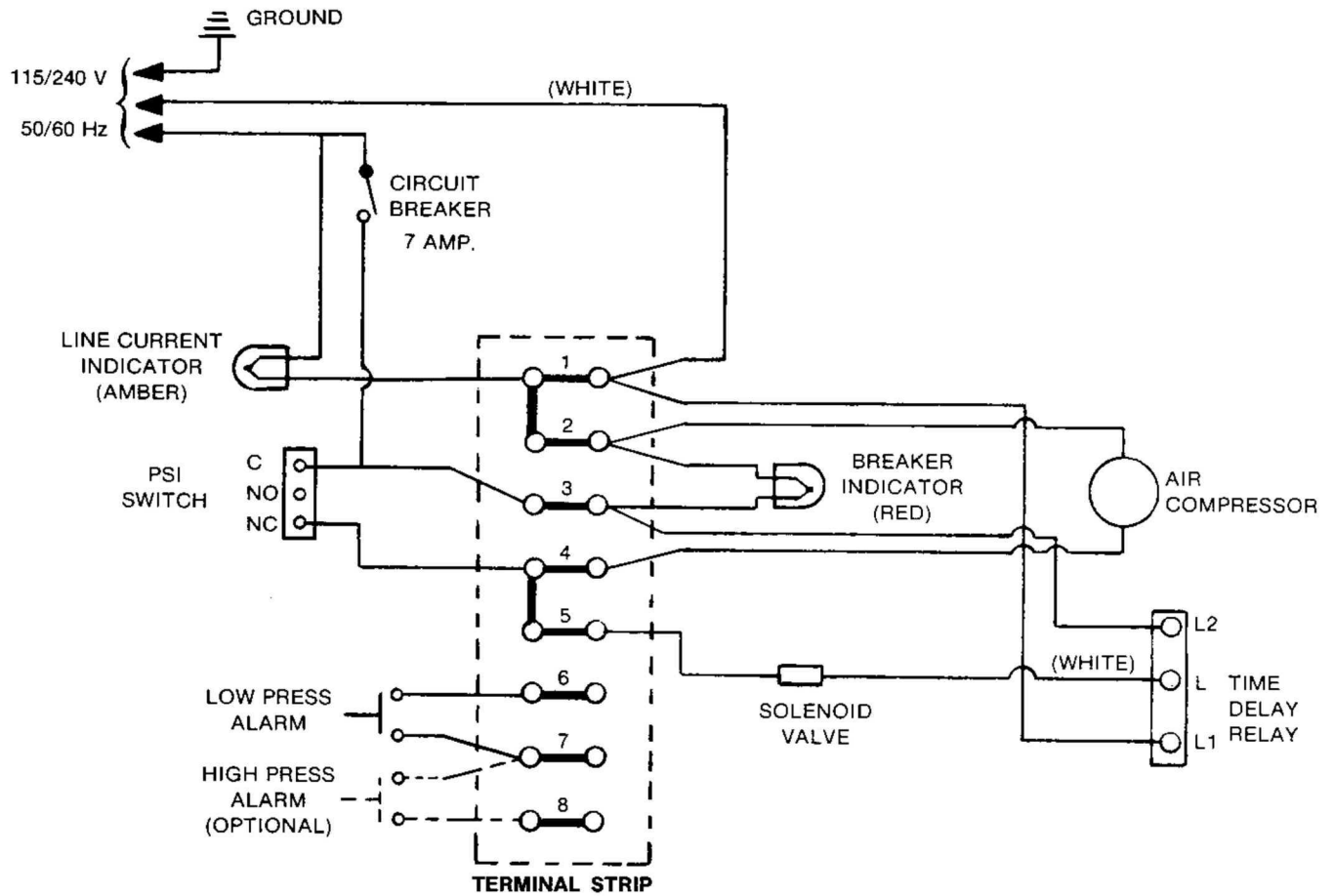
Disconnect the polyethylene tubing from the line and operate the unit discharging the air to atmosphere until the indicator shows blue.

### 6.3 Unit Turns ON and OFF Very Rapidly Before Line is Pressurized

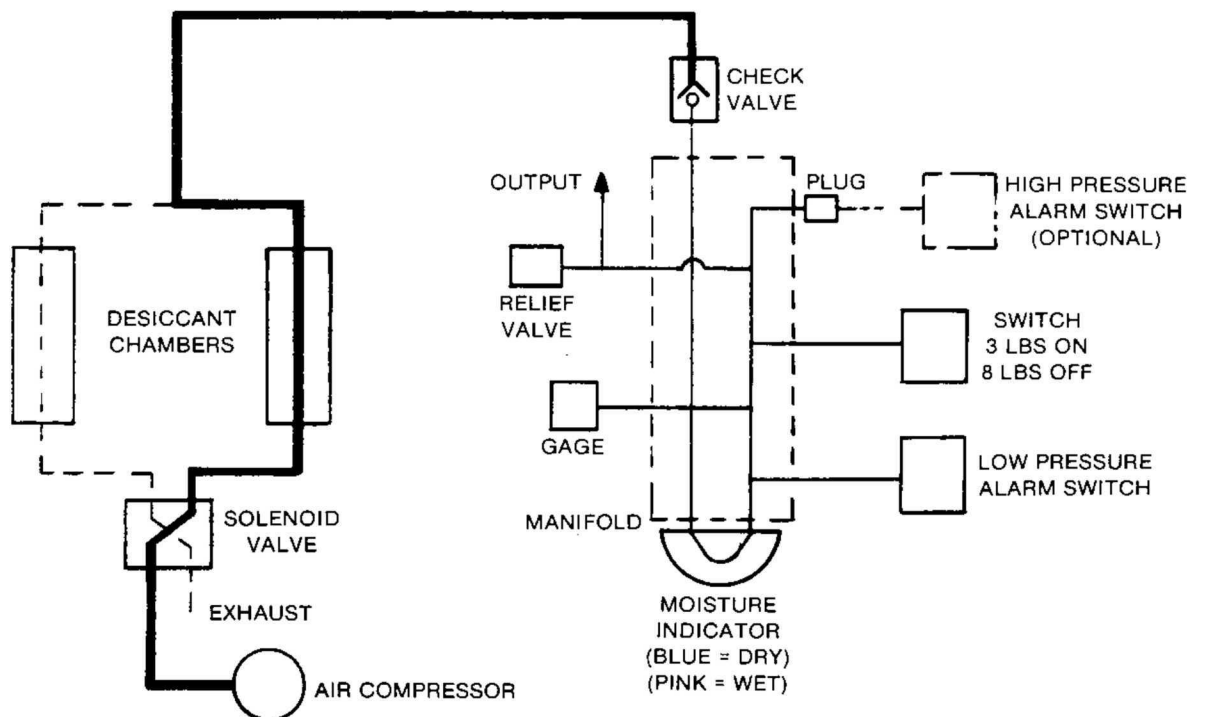
- 6.3.1 Look for and correct a kink in the tubing connecting the unit to the line.
- 6.3.2 The line being pressurized is too restrictive (pneumatic resistance too high). Introduce a surge volume (pneumatic cushion) between the unit and the line.
- 6.3.3 ON/OFF differential is misadjusted. Re-adjust per Section 4.4.

### 6.4 Unit Runs Excessively (More than 30%)

- 6.4.1 Check both the transmission line and the polyethylene interconnecting tubing for leaks. Repair any found.
- 6.4.2 Check the unit's internal piping for leaks. Repair any found.
- 6.4.3 Check the dehydrator outlet check valve for back leakage by removing it, back-pressuring it, and bubble-checking it. It must be bubble-tight. If it is not, replace the Sealing O-ring.



**ELECTRICAL SCHEMATIC DIAGRAM**



**PNEUMATIC SCHEMATIC DIAGRAM**



## SPARE PARTS LIST

### APD Series Dehydrators

<u>Item</u>	<u>QT/Unit</u>	<u>P/N</u>
Lens-O-Ring	1	520681-023
Felt Pad Spring	1	913578
Felt Pad	1	913588
Color-Change Moisture Indicator Gel	2 oz.	913632
Lens	1	914029
Wire Screen	1	914030
Coupling Nut	1	914057
** Pressure Switch	1	916748 (916751 for APD-20L)
Pressure Gauge	1	913568
* Circuit Breaker Switch	1	913591
Compressor, 115 V 50/60 Hz (for APD-20)	1	921315-001
Compressor, 230 V 50/60 Hz (for APD-22)	1	921315-002
Compressor, 115 V 60 Hz (for APD-70, 73)	1	915348
Compressor, 230 V 50 Hz (for APD-72)	1	915408
Valve, Solenoid, 115 V 50/60 Hz	1	933843-001
Valve, Solenoid, 230 V 50/60 Hz	1	933843-002
Vibration Insulator	4	913606
* Red Light	1	913654-001
* Amber Light	1	913654-002
Time Delay Relay, 115 V 50/60 Hz	1	913743-001
Time Delay Relay, 230 V 50/60 Hz	1	913743-002
Chassis Mounting Foot	4	914543
* Filter Assembly	1	914714
* 3/8" Polyethylene Tubing (black)	22'	913348
* 3/8" Nylon Tubing (white)	1'	913928-012
* 1/4" Polyethylene Tubing	3'	913566-036
* Male Connector 3/8" Tubing to 1/8" MPT	1	913344
Male Connector 3/8" Tubing to 1/4" MPT	1	913345
Male Connector 1/4" Tubing to 1/4" MPT	1	913584
* Plastic Connector Sleeve 1/4"	1	913614-001
* Plastic Connector Sleeve 3/8"	1	913614-003

\* Included in APD-20 and APD-70 Series Maintenance Parts Kit P/N 920641.  
See Page Five, Section 5 for Compressor Service Kits.

\*\* For unit manufactured on or before 7/2002, use P/N 913481.

### WARRANTY

The Seller warrants that, at the time of shipment, the products manufactured by the Seller are free from defects in material and workmanship. The Seller's obligation under this warranty is limited to replacement or repair of such products within one year from the date of shipment.

The Seller is in no event liable for consequential damages, installation cost or other costs of any nature

as a result of the use of the products manufactured by the Seller, whether used in accordance with instructions or not.

This warranty is in lieu of all others, either expressed or implied. No representative is authorized to assume for the Seller any other liability in connection with the Seller's products.

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## RADIO FREQUENCY SYSTEMS

