

FILTER/DRYER MANUAL

FD-1500 FILTER DRYER

FD-1 SUPPLY GAS SYSTEM

FD-2 SUPPLY GAS SYSTEM



Becker Precision Equipment

Hydrotested to 2.5 Times Working Pressure FD-1500 is Sure to Work

Description

The Model FD-1500 Filter Dryer filters and de-hydrates supply gas for all Becker Control Instrumentation. The FD-1500 Filter-Dryer provides superior filtration and dehydration with 110 square inches of 10 micron filtering media and 2.0 pounds of silica gel. The FD-1500 incorporates an easy-to-replace "spin on" cartridge made up of a high quality, high capacity nylon and fiberglass filter element reinforced with stainless steel mesh. All FD-1500's are fully Hydrotested to 2.5 times the working pressure to ensure the integrity of the pressure vessel.

Features

- Protect Flexflo™ Pilots from excessive moisture, freezing and dirt.
- All FD-1500 are hydrostatically tested to 2250 psig to guarantee no leaks!
- FD-1500 incorporates built-in 2" pipe mount bracket standard
- FD-1500 Features a convenient spin-on replacement cartridge for easy change out.
- Machined (square) end of FD-1500 filter housing provides easy capability to access internals with an ordinary adjustable wrench
- High capacity silica gel absorbs up to 2.0 Lbs. of moisture.
- Superior capacity filter element.
- Quick change cartridge easily replaced.



Figure 1.0 - Model FD-1500 Filter Dryer

Specifications:

- MAOP: 1500 psig (10,340 Kpa)*
 Flow Capacity: 50 SCFM (1.4 m³/hr)
 Max. Temp: 10u nominal (110 in² filtration media)
 Dehydration: 2 lbs. (0.9 kg) silica gel water absorption
 Body: carbon steel
 Inlet Port: 1/4" NPT
 Outlet Port: 1/4" NPT
 Drain: 1/4" NPT
 Dimensions: 20" (508 mm) length
 4-1/2" (114 mm) diameter
 Mounting: 2" pipe mount standard for all loose equipment
 custom bracket (Standard for all Becker
 Control Valves / Actuators
 Weight: 29 lbs. (13 kg)

Figure 2.0 - Becker Regulators Model FD-1500 Filter Dryer (Cutaway View)

Cutaway view of Model FD-1500 Filter Dryer show main components and inner workings. The Model FD-1500 is equipped with a high quality screen-reinforced fiberglass filtering media to prevent contaminants from damaging downstream instrumentation. Additionally, the FD-1500 carries enough desiccant drying media to absorb up to 2.0 Lbs. of entrained moisture. The FD-1500 assembly incorporates a simple replacement cartridge that incorporates filtration and drying in a one convenient module.

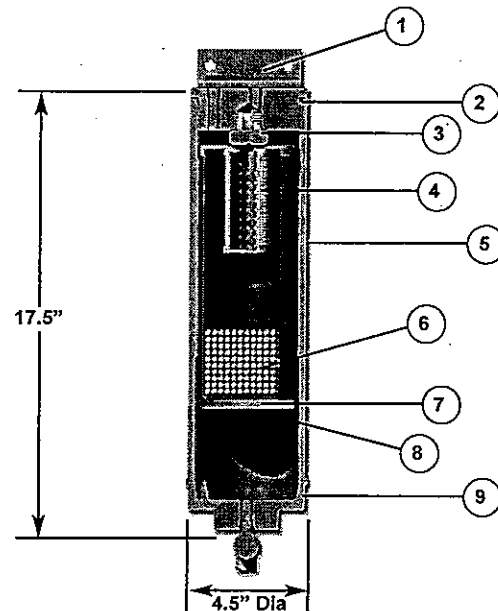


Table 1.0 - Model FD-1500 Components

Item	Description	Material	Part Number
1	Top Filter Flange	Carbon Steel	21-3012
2	O-ring (Filter Housing)	Buna-N	95-3652
3	O-ring (Replacement Cartridge)	Buna-N	95-2653
4	Replacement Cartridge	PVC Tube external w with aluminum threads	21-3030
5	Filter Housing	Carbon Steel	21-3021
6	Silica Gel		21-0100
7	Plug	Plated Steel	
8	Course Filter Element		22-2510
9	Needle Valve	Plated Steel	

Table 2.0 - Model FD-1500 Port Definitions

Port ID	Description	Port Size
A	Inlet	1/4" FNPT
B	Outlet	1/4" FNPT
C	Drain	1/4" FNPT



Model FD-1500 Filter-Dryer



Figure 3.0 - Regulators Model FD-1500 Filter Dryer (Exploded View)
Exploded View of the Model FD-1500 illustrates the simplicity of the unit.

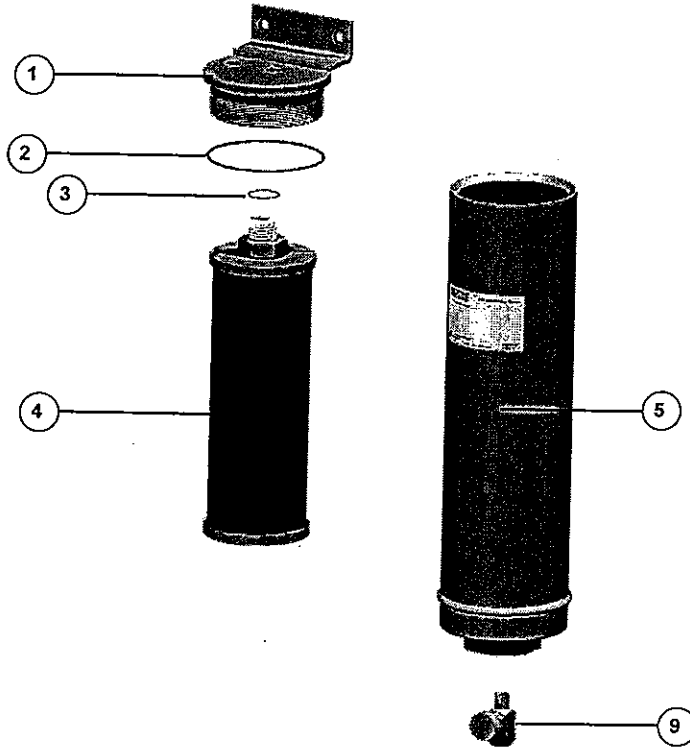


Table 3.0 - Model FD-1500 Components

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7	Plug	Plated Steel	
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9	Needle Valve	Plated Steel	

Models Available
FD-1500 Filter Dryer
FD-1500 Replacement Cartridge

Part Number 21-3010
Part Number 21-3009

Becker incorporates the Model 1500 Filter Dryer in these High Quality Supply Gas Systems:

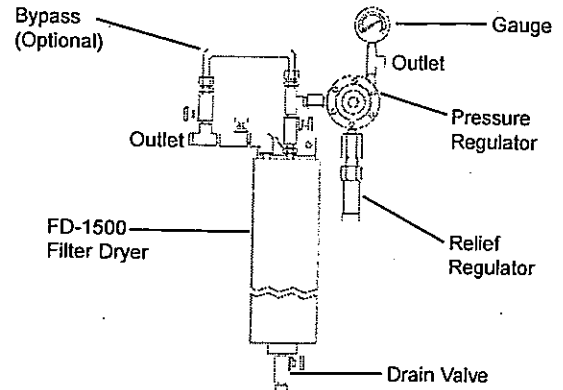


Figure 4.0 - Becker's Model FD-1 Supply Gas System incorporates the Model FD-1500 Filter-Dryer. The FD-1 provides an economical Supply Gas System with complete regulation, filtration, dehydration and relief in a single package.

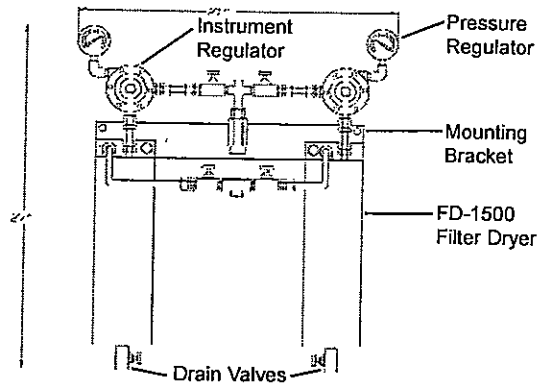


Figure 5.0 - Becker's Model FD-2 Supply Gas System incorporates two Model FD-1500 Filter-Dryers. The FD-2 provides a top-of-the-line Supply Gas System with complete redundancy of regulation and filtration.

Toll-Free Assistance!

(800) 323-8844
USA & Canada



Dresser Flow Control, Becker Operations
1550 Greenleaf Avenue
Elk Grove Village, Illinois 60007 USA
Phone: 847-437-5940
Fax: 847-437-2549
Toll Free: 800-323-8844

E-mail: becker@flowcontrol.dresser.com
Website: www.bpe950.com

Model FD-1 Supply Gas System "The Economical Supply Gas System"

The Model FD-1 Supply Gas System provides filtered, dehydrated, regulated supply gas necessary for control valve operation. The FD-1 incorporates all necessary components to form one convenient, fully-tested, pre-adjusted package. The FD-1 provides an economical supply gas system for all instrumentation supply gas requirements.

Usage:

All pneumatic instrumentation

Incorporates the Following Components:

- High Pressure Supply Gas Regulator (qty. 1)
- Model RV Relief Valve (qty. 1)
- Model FD-1500 Filter/Dryer (qty. 1)

Features:

- Package system provides regulated, filtered, dry supply gas for instrumentation and actuators.
- Single supply gas regulator and FD-1500 Filter-Dryer is an economic package.
- Protect control instrumentation from dirt, freezing, and excessive moisture.
- All tubing and tubing fittings 316 SS.
- Available with all 316 SS hardware (optional).
- Complete with 2.5" SS Liquid-filled gages standard.
- Quick change cartridges easily replaced without shut-down.
- Standard mounting accepts panel mount or 2" pipe

Models Available:

- FD-1 without bypass (standard): PIN Number D1-0042
- FD-1 with bypass: PIN Number D1-0043
- FD-1 without bypass (stainless steel hardware): PIN Number D1-0044
- FD-1 with bypass (stainless steel hardware): PIN Number D1-0045

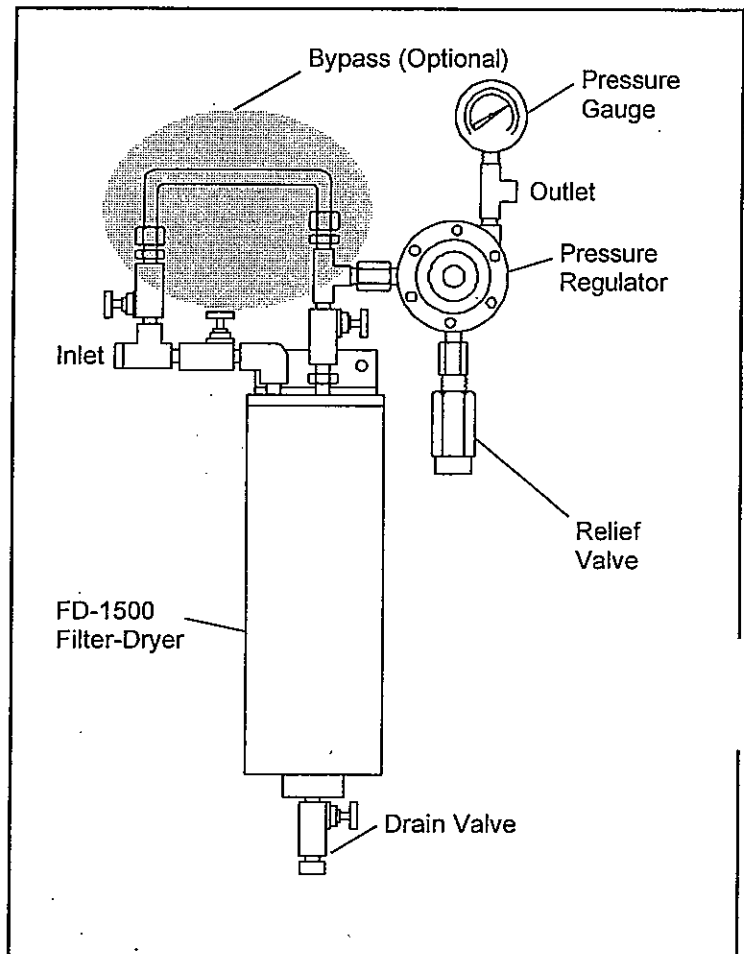


Figure 1- Model FD-1 Supply Gas System with Bypass

Specifications:	
MAOP:	1500 psig (10,340 kPa) *all units hydrotested to 2250 psig (15,510 kPa)
Flow Capacity:	50 SCFM (1.4 m ³ /hr)
Max.Temp:	200°F (93°C)
Filtration:	10μ nominal (110 in. ² filtration media)
Dehydration:	2 lbs. (0.9 kg) silica gel water absorption
Body:	carbon steel
Inlet Port:	¼" NPT
Outlet Port:	¼" NPT
Drain:	¼" NPT with needle valve
Dimensions:	28" (711 mm) x 11 1/4" (286 mm)
Mounting:	2" pipe mount standard for all loose equipment custom bracket (standard for all Becker control valves)
Weight:	29 lbs. (13 kg)
Coating:	Sprayed epoxy coating

Becker Also Manufactures the Following Filter-Dryer Products:

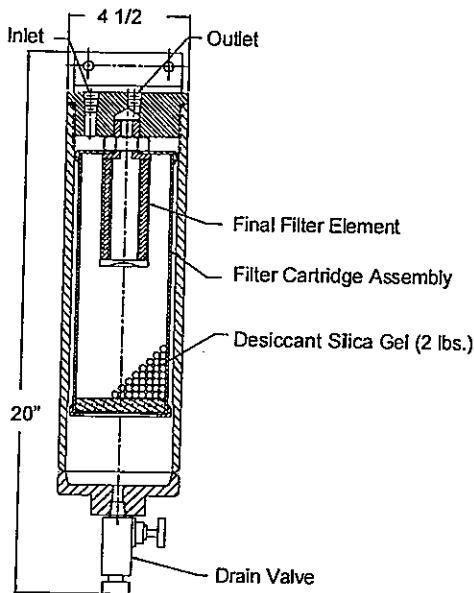


Figure 2- Becker's Model FD-1500 Filter-Dryer filters and dehydrates supply gas for control valves. The FD-1500 is the heart of the FD-1 and FD-2 Supply Gas System, providing superior dehydration and filtration of instrumentation supply

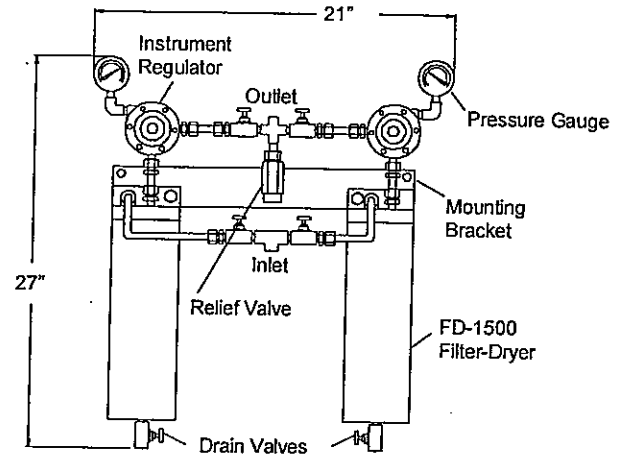


Figure 3- Becker's Model FD-2 provides increased security over the FD-1 by utilizing redundant FD-1500 Filter-Dryers and High Pressure Supply Gas Regulators. The result is a virtually uninterrupted supply gas.

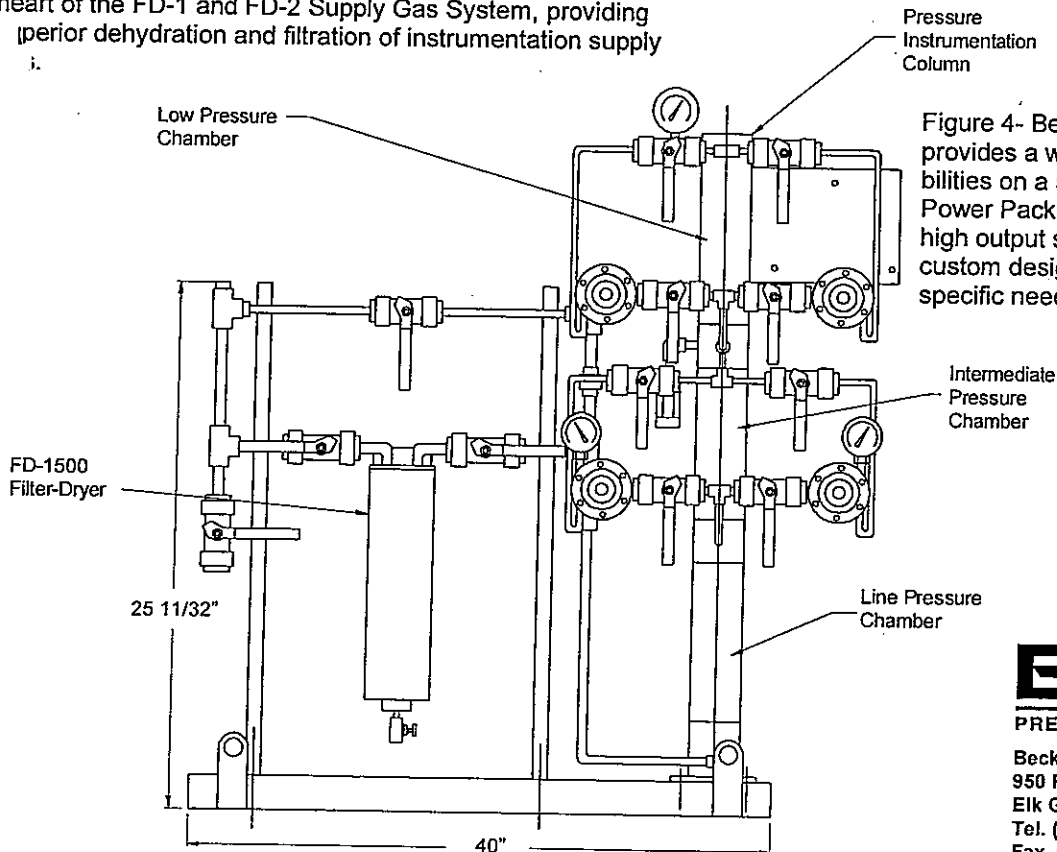


Figure 4- Becker's Power Pack System provides a wide range of supply gas capabilities on a skid-mounted package. The Power Pack is designed for high volume, high output systems. Several standard or custom designs are available to suit each specific need.

BECKER
PRECISION EQUIPMENT INC.

Becker Precision Equipment, Inc.
950 Pratt Boulevard
Elk Grove Village, Illinois 60007 USA
Tel. (847) 437-5940
Fax. (847) 437-2549
Toll-Free (800) 323-8844

E-Mail: Becker@bpe950.com
Website: www.bpe950.com

Becker Also Manufactures the Following Filter-Dryer Products:

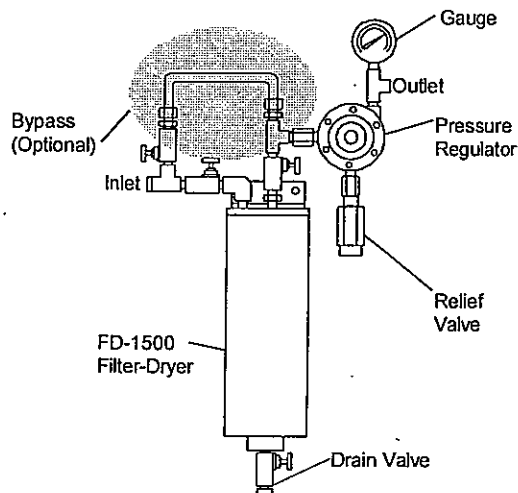
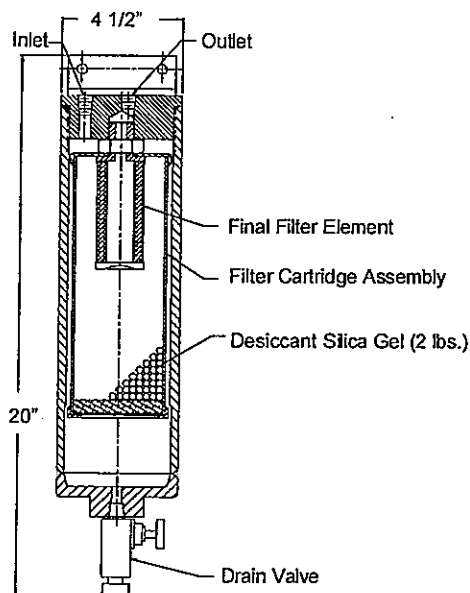


Figure 2- Becker's Model FD-1500 Filter-Dryer filters and dehydrates supply gas for control valves. The FD-1500 is the heart of the FD-1 and FD-2 Supply Gas System, providing superior dehydration and filtration of instrumentation supply gas.

Figure 3- Becker's Model FD-1 Supply Gas System incorporates the Model FD-1500 Filter-Dryer. The FD-1 provides an economical Supply Gas System with complete regulation, filtration, dehydration and relief in a single package.

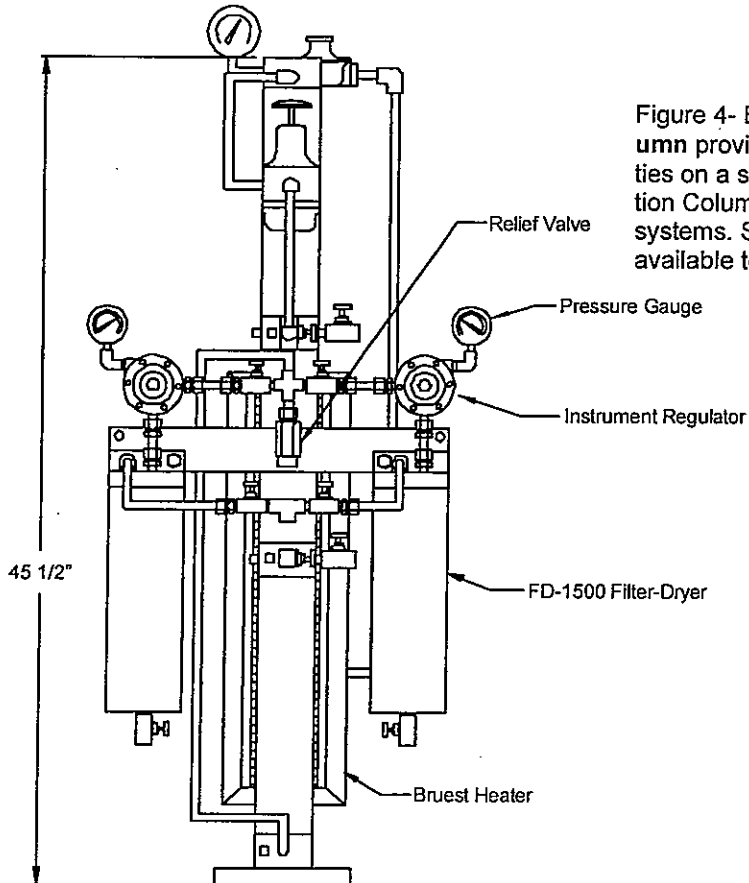


Figure 4- Becker's Pressure Instrumentation Column provides a wide range of supply gas capabilities on a skid-mounted package. The Instrumentation Column is designed for low volume, low output systems. Several standard or custom designs are available to suit each specific need.

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PRECISION EQUIPMENT INC.

Becker Precision Equipment, Inc.
950 Pratt Boulevard
Elk Grove Village, Illinois 60007 USA
Tel. (847) 437-5940
Fax. (847) 437-2549
Toll-Free (800) 323-8844

E-Mail: Becker@bpe950.com
Website: www.bpe950.com

Model FD-2 Supply Gas System

The Model FD-2 instrumentation supply gas/dehydration system provides filtered, dehydrated, regulated supply gas necessary for control valve operation. The FD-2 incorporates all necessary components to form one convenient, fully-tested, pre-adjusted package. The FD-2 provides the ultimate protection for supply gas. Dual supply gas regulators and dual FD-1500 Filter/Dryers are installed in parallel to provide uninterrupted service.

Usage:

All pneumatic instrumentation

Incorporates the Following Components:

- High Pressure Supply Gas Regulator (qty. 2)
- Model RV Relief Valve
- Model FD-1500 Filter/Dryer (qty. 2)

Features:

- Package system provides regulated, filtered, dry supply gas for instrumentation and actuators.
- Dual supply gas regulators and FD-1500 Filter-Dryers provide uninterrupted service.
- Protect control instrumentation from dirt, freezing and excessive moisture.
- All tubing and tubing fittings 316 SS.
- Available with all 316 SS hardware (optional).
- Complete with 2.5" SS Liquid-filled gages standard.
- Quick change cartridges easily replaced without shutdown.
- Standard mounting accepts panel mount or 2" pipe mount.

Models Available:

- FD-2 (standard): PIN Number D1-1028
- FD-2 (stainless steel hardware): PIN Number D1-1029

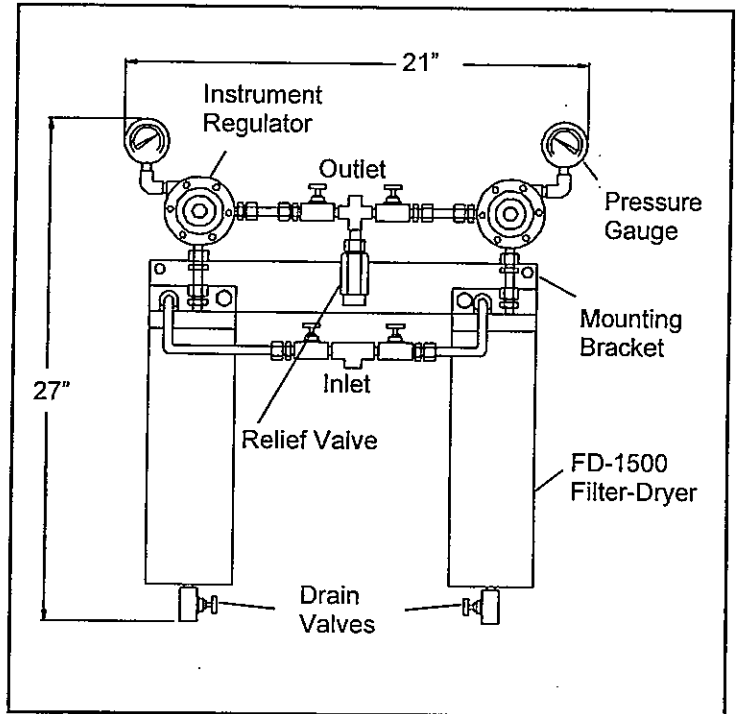


Figure 1- Model FD-2 Supply Gas System

Specifications:

MAOP:	1500 psig (10,340 kPa) *all units hydrotested to 2250 psig (15,510 kPa)
Flow Capacity:	50 SCFM (81.0 m ³ /hr)
Max Temp:	200°F (93°C)
Filtration:	10µ nominal (1.10 in. ² filtration media) per cartridge
Dehydration:	2 lbs. (0.9 kg) silica gel water absorption per cartridge
Body:	carbon steel
Inlet Port:	1/4" NPT
Outlet Port:	1/4" NPT
Drain:	1/4" NPT with needle valve
Dimensions:	27" (685 mm) x 21" (533 mm)
Mounting:	2" pipe mount standard for all loose equipment custom bracket (standard for all Becker control valves)
Weight:	65 lbs. (143 kg)
Coating:	Sprayed epoxy coating

bpe REPLACEMENT PROCEDURE FOR MODEL FD-1500 FILTER/DRYER

INTRODUCTION

The **bpe** filter/dryer is a durable unit designed to provide dry, clean instrumentation gas by removing particles, free water, and water vapor from natural gas.

The design of the FD-1500 incorporates a replaceable "Spin on" cartridge inside a carbon steel housing. Gas enters the unit from the top and continues around the narrow passageway between the housing and the cartridge increasing the velocity of the gas. The gas enters the cartridge from the bottom, resulting in a complete change in direction of the flow. This change in direction in gas flow causes the free water to separate from the gas. A three-inch space between the bottom of the housing and the cartridge allows for collection of free water. The gas then enters the replaceable cartridge. The replacement cartridge has three main components:

1. A primary filter to remove larger particles.
2. 2 lbs. of silica gel (desiccant) which can absorb 1 lb. of water vapor and free water.
3. A secondary fine filter with 110 square inches of media to strain particles as small as 10 microns.

The FD-1500 provides adequate capacity to flow sufficient gas for instrumentation. The maximum operating pressure is 1500 psig (each FD-1500 is hydrostatically tested to 2250 psig). The flow capacity of the entire unit is 50 scfm due to the fittings, etc. The capacity of the fine filter itself at 1500 psig and 10 psid differential pressure is 212 scfm.

The FD-1500 will provide reliable use if the following replacement procedure for the cartridge is observed.

Becker Precision Equipment
1550 Greenleaf Ave.
Elk Grove Village, IL., 60007
FAX (847) 437-2549

bpe



Phone Toll Free
(800) 323-8844

bpe REPLACEMENT PROCEDURE FOR MODEL FD-1500 FILTER/DRYER

THE EXPECTED LIFE OF THE DECICANT IN THE FILTER/DRYER REPLACEMENT CARTRIDGE MODEL FD-1500

The life cycle of the desiccant depends on the following factors:

1. The amount of desiccant in the FD-1500.
2. The amount of water in the gas.
3. The amount of gas flowing through the FD-1500.

The useful life expectancy of the dryer can be calculated by the formula:

$$T = \frac{W_d}{W_a \times Q}$$

Where:

T = life cycle (hours)

W_d = desiccant absorption capability (1 lb. for the FD-1500)

W_a = amount of water in the gas (lb./mmscf) for commercial grade natural gas, $W_a = 7 \text{ lb./1 mmscf}$

Q = gas consumption (scfh)

The last factor Q is the most difficult to predict, it can fluctuate from 0 consumption as in the case of bpe monitor control valves to a substantially large number as in the case of very active control valves. It is good practice to use $Q = 20 \text{ scfh}$. This value represents a steady state consumption for many instruments that bleed.

Useful average life for bpe FD-1500 dryer:

$$T = \frac{1 \text{ lb.}}{7 \text{ lb./mmscf} \times 20 \text{ scfh}} = 7142 \text{ hours} \approx 1 \text{ year}$$

It is a good practice to replace or regenerate the desiccant once a year.

Becker Precision Equipment
 1550 Greenleaf Ave.
 Elk Grove Village, IL., 60007
 FAX (847) 437-2549



Phone Toll Free
 (800) 323-8844

bpe REPLACEMENT PROCEDURE FOR MODEL FD-1500 FILTER/DRYER

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Warning: It is common practice to check the condition of the dryer by opening the blow down needle valve provided at the bottom of the FD-1500. This inspection can only identify the presence of free water flowing with the gas.

If no water is found and the gas appears very dry, it does not necessarily mean that the desiccant does not require replacement. The absorption rate of the desiccant depends only on the variables in the formula on the previous page.

The following table is provided to identify if water fall out has occurred which may cause freezing problems in the instruments:

Table 4-33 Equilibrium Moisture Contents of Natural Gases Above the Critical Temperature

PSIA											
	14.7	100	200	300	400	500	600	700	800	900	1000
-36	9.10	1.50	0.88	0.66	0.55	0.49	0.44	0.41	0.39	0.37	0.36
-32	11.5	1.90	1.10	0.80	0.68	0.59	0.54	0.50	0.47	0.45	0.43
-28	14.4	2.40	1.30	0.99	0.82	0.72	0.65	0.60	0.57	0.54	0.51
-24	17.8	2.90	1.60	1.20	1.00	0.87	0.79	0.72	0.68	0.64	0.61
-20	22.0	3.60	2.00	1.50	1.20	1.10	0.95	0.87	0.81	0.77	0.73
-16	27.0	4.40	2.40	1.80	1.50	1.30	1.10	1.00	0.97	0.92	0.87
-12	33.1	5.40	3.00	2.20	1.80	1.50	1.40	1.20	1.20	1.10	1.00
-8	40.5	6.50	3.60	2.60	2.10	1.80	1.60	1.50	1.40	1.30	1.20
-4	49.3	7.90	4.30	3.10	2.50	2.20	1.90	1.80	1.60	1.50	1.50
0	59.8	9.50	5.20	3.70	3.00	2.60	2.30	2.10	1.90	1.80	1.70
4	72.1	11.4	6.20	4.50	3.60	3.10	2.70	2.50	2.30	2.10	2.00
8	86.8	13.7	7.40	5.30	4.30	3.60	3.20	2.90	2.70	2.50	2.40
12	104	16.4	8.80	6.30	5.10	4.30	3.80	3.40	3.20	3.00	2.80
16	124	19.5	10.5	7.50	6.00	5.10	4.50	4.00	3.70	3.50	3.30
20	148	23.2	12.4	8.80	7.00	5.90	5.20	4.70	4.30	4.00	3.80

Becker Precision Equipment
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 Elk Grove Village, IL., 60007
 FAX (847) 437-2549



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 (800) 323-8844

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PSIA

°F	14.7	100	200	300	400	500	600	700	800	900	1000
20	176	27.4	14.6	10.4	8.20	7.00	6.10	5.50	5.10	4.70	4.40
24	208	32.4	17.2	12.2	9.70	8.20	7.20	6.40	5.90	5.50	5.10
28	246	38.1	20.2	14.3	11.3	9.50	8.30	7.50	6.80	6.30	5.90
32	289	44.7	23.7	16.7	13.2	11.1	9.70	8.70	7.90	7.30	6.90
34	313	48.4	25.6	18.0	14.2	11.9	10.4	9.30	8.50	7.90	7.40
36	339	52.4	27.7	19.4	15.3	12.9	11.2	10.0	9.20	8.50	7.90
	367	56.6	29.9	20.1	16.5	13.9	12.1	10.8	9.80	9.10	8.5°
40	396	61.1	32.2	22.6	17.8	14.9	13.0	11.6	10.6	9.80	

Reference: Gas Engineers Handbook 1st edition

THE ABOVE TABLE CAN BE USED AS FOLLOWS:

Assume that the pipeline pressure is 1000 psig at 40°F. This gas can hold 9.1 lb./mmscf of water.

Assume that the pressure will be cut from 1000 psig to 100 psig at the supply regulator.

Assume that for every 100 psig drop in pressure the gas will drop 7°F in temperature. In this case, the temperature will drop from 40°F to -23°F (1000 psig - 100 psig / 100 psig x 7°F = 63°F).

From the table, look up 100 psig and -23°F (or the closest value). If the number is below 7 lb./mmscf, water will fall out of the gas and the desiccant should be replaced once a year to prevent problems as a result of freezing.

The above test procedure indicates the predicted service life of the bpe FD-1500 filter/dryer cartridge assembly. Should you require any additional information or assistance, please feel free to telephone using our toll free number, 1-800-323-8844

Becker Precision Equipment
 1550 Greenleaf Ave.
 Elk Grove Village, IL., 60007
 FAX (847) 437-2549



Phone Toll F
 (800) 323-8844

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1550 Greenleaf Ave. Elk Grove Village, Illinois 60007
Tel: (847) 437-5940; Toll Free: (800) 323-8844; Fax: (847) 437-2549