

**Fermilab**

**Particle Physics Division  
Mechanical Department Calibration  
Standards/Procedures**

**Number:** MD-CALPROC-004

**Date:** 6/26/2009

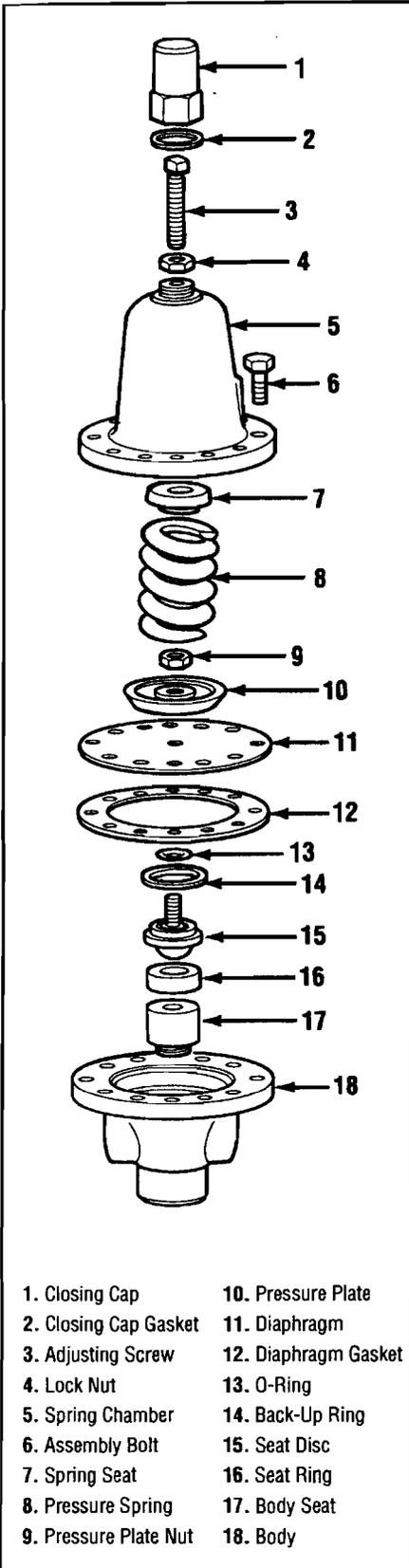
**Manufacturer:** Tyco

**Model:** Tyco FR FR-6 Cryogenic Back Pressure or Economizer  
Valves

**Reviewer(s):** *James E. Tweed*

**This Procedure is used for:**

Calibration of Cashco back pressure regulators.



## DESCRIPTION

The Types FR and FR-6 are designed to function as Back Pressure or Economizer valves in Cryogenic Circuits. The Back Pressure function is to open at a preset pressure and relieve inlet pressure to the discharge side into a lower pressure. The Economizer function is to open at a preset pressure, above the Pressure Build set pressure, and continue to open as gas head pressure from heat leak builds during non-use periods of the system. The Economizer by-passes gas head pressure directly to the Final Line circuit, when system draw resumes, to draw down the excess pressure rapidly and recloses before the Pressure Build regulator opens. FR Series valves are not emergency relief devices, but are designed for continuous pressure regulation.

## SPECIFICATION DATA

**Service:** Cryogenic liquids and gases. Well suited for systems where high flows are required. For use in the economizer circuit.

**Sizes:** 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2"

**Connections:** Threaded female side inlets (2), and bottom outlet.

**Body:** Bronze

**Temperature Rating:** +150°F (339°K) to -320°F (78°K)

**Maximum Pressure:** FR: 400 psi; FR-6: 600 psi

**Maximum Set Pressure:** Refer to Bulletin CRY

**Capacity:** For specific capacity information, consult the factory.

## CONSTRUCTION

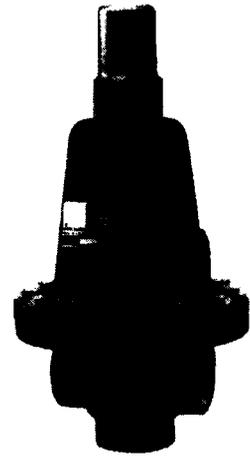
Bronze body, with a Bronze Spring Chamber; Stainless Steel Seat Disc, Pressure Spring, and Back-up Ring; Phosphor Bronze Diaphragm and Teflon O-ring Diaphragm Seals.

All parts commercially cleaned for cryogenic service.

## GENERAL INSTALLATION INSTRUCTIONS

When installing the valve, connect the supply line to either the right or left hand body connection. The other right or left hand connection should be connected to the service line or plugged depending on the type of installation. The bottom connection, which is indicated by an arrow on the body, should be connected to the bypass or final vaporizer line.

For ease of operation and maintenance, it is



## Type FR FR-6

## CRYOGENIC

## BACK PRESSURE OR ECONOMIZER VALVES

This Bulletin No.	<b>TS-FRCRY</b>
Date Of This Issue	<b>MARCH 2000</b>
Supersedes Bulletin No.	<b>TS-FRCRY</b>
Dated	<b>APRIL 1999</b>

suggested that manual shut-off valves be installed upstream and downstream from the valve. Before installing the valve, the piping and valve should be thoroughly flushed out to remove any foreign material. Use a compatible sealant on the male pipe threads and do not over tighten the valve connections.

## OPERATING INSTRUCTIONS

### Adjusting the Back Pressure

The regulator's back pressure setting is adjusted by turning the adjusting screw (3) at the top of the spring chamber after removing the closing cap (1) and loosening the adjusting screw lock nut (4). To obtain a higher pressure setting, turn the adjusting screw clockwise (into the spring chamber). To lower the pressure setting, turn the adjusting screw counter-clockwise (out of the spring chamber). Tighten the adjusting screw lock nut after the adjustment has been made and install the closing cap.

## INSTALLATION, MAINTENANCE & REPAIR PARTS INFORMATION

(828) 669-3700 • www.cashvalve.com

Tyco Valves & Controls LP, Black Mountain Facility, 953 Old US 70, Black Mountain, NC 28711

## MAINTENANCE INSTRUCTIONS

The following procedures are provided for servicing the Types FR and FR-6 back pressure relief valves. Repair parts can easily be installed without removing the valve from the line.

**CAUTION:** Before attempting to replace any spare parts be sure to shut off all pressure connections to the valve. With the valve closed, however, system pressure could still be locked between the shut-off valve and the inlet and/or outlet sides of the relief valve. Before proceeding with any valve service be certain to relieve the pressure from BOTH sides of the valve.

Refer to the Type FR exploded view for parts identification.

### Servicing the Pressure Spring (8), Diaphragm(s) (11), O-Ring (13), Seat Disc (15) and Seat Ring (16)

1. Remove the closing cap (1). Inspect and if necessary replace the cap gasket (2).
2. Loosen the lock nut (4) 1/4 turn and turn the adjusting screw (3) counter-clockwise until the pressure spring (8) is no longer under tension.
 

**NOTE: When installing the adjusting screw during reassembly, turn the screw clockwise until the lock nut just touches the spring chamber. When the valve is placed in service the pressure setting should be very close to the original setting.**
3. Remove the assembly bolts (6) securing the spring chamber (5) to the valve body (18). During reassembly, tighten the screws evenly.

4. Lift the spring chamber (5) from the valve body. Then remove the spring seat (7), pressure spring (8), and diaphragm ring (FR-6 only).
5. The Diaphragm assembly, consisting of the pressure plate nut (9), pressure plate (10), diaphragm(s) (11), O-ring (13) or back-up ring (14) and seat disc (15) can now be lifted off the body (18). Disassemble the parts by unscrewing the pressure plate nut (9) from the seat disc. Inspect all parts and replace if necessary. The diaphragm gasket (12), below the diaphragm should be replaced when new diaphragm(s) (11) are installed.

**IMPORTANT:** Exercise care to ensure that the surface of the seat disc (15) is not scratched, marred or damaged during disassembly and reassembly.

6. Once the diaphragm assembly has been removed, the seat ring (16) which is sitting loosely on top of the body seat (17) can be lifted from the valve body.

**IMPORTANT:** Handle the seat ring carefully to avoid damage to the seat ring surface which contacts the seat disc (15).

7. Inspect all parts and replace if necessary. Reassemble in reverse order. After placing the valve back in service, adjust the delivery pressure setting as detailed under Operating Instructions.

### Servicing the Body Seat (17)

1. Remove the spring chamber and related parts as described under Servicing the Pressure Spring (8), Diaphragm(s) (11), O-rings (13), Seat Disc (15) and Seat Ring (16) above.

**IMPORTANT:** Before removing the body seat (17), be sure the top surface of the seat is protected from damage as this surface makes contact with the seat ring (16).

2. Remove the body seat by inserting a piece of hexagon bar stock (see table) into the top of the body seat, or alternatively, up through the bottom outlet connection into the bottom of the body seat. If removing the seat from the top, turn the hex bar to the left (counter-clockwise). If removing the seat from the bottom, turn the hex bar to the right (clockwise).

1/2"	7/16"	1-1/4"	1-5/16"
3/4"	9/16"	1-1/2"	1-1/16"
1"	11/16"	2"	1-1/8"

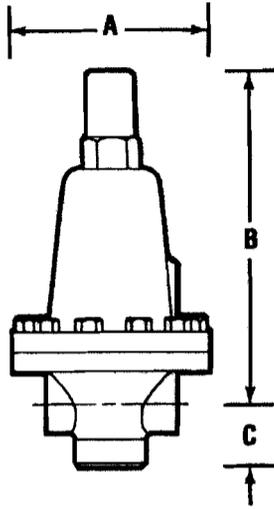
3. Examine the body seat (17) for wear or damage to the seating surface. Replace if necessary.
4. Place a small amount of compatible sealant on the threads of the body seat and install the seat in the valve body using care not to damage the surface which makes contact with the seat ring (16). After placing the valve in service, adjust the set pressure as outlined under Operating Instructions.

## REPAIR PARTS INFORMATION

Refer to the Type FR valve exploded view for parts identification.

## SPECIFICATIONS

Each Type FR and FR-6 back pressure valve is supplied with a pressure spring selected to provide the desired pressure setting. The range of adjustment, or satisfactory "working range", of individual springs is shown for each valve size. Each valve has the "set" pressure and range of adjustment stamped on the identification tag fastened to the valve. The ranges shown are recommended for best performance.



## SPRING RANGES

1/2"	#8483 0-20	#8484 10-50	#8485 40-90	#8486 75-200	#8487 100-400	#8487* 300-600	-
3/4"	#8488 0-10	#8489** 0-15	#8489 10-70	#8490 50-175	#7806 100-265	#7806* 200-400	-
1"	#8493 0-15	#8493** 10-35	#8494 20-75	#6964 40-200	#8495 50-250	#8495* 200-400	-
1-1/4"	#8493 0-15	#8493** 10-30	#8494 20-85	#6964 40-125	#8495 50-250	#8495* 200-400	-
1-1/2"	#8493 0-15	#8493** 5-20	#8494 10-55	#6964 30-100	#8495 40-160	#14300 100-250	#14300* 200-400
2"	#8493 0-15	#8493** 5-20	#8494 10-55	#6964 30-100	#8495 40-160	#14300 100-250	#14300* 200-400

\*NOTE: Requires special diaphragm ring and pressure plate.

\*\*NOTE: Requires different adjusting screw.

## DIMENSIONS

1/2"	4-3/4"	6-3/4"	1-5/8"	9-1/2"
3/4"	5-5/8"	8"	2"	14-3/4"
1"	6-1/2"	10-5/16"	2-1/4"	23-1/2"
1-1/4"	6-1/2"	10-7/8"	2-3/8"	24-1/2"
1-1/2"	7-1/2"	10-3/4"	2-5/8"	33"
2"	7-1/2"	11"	2-5/8"	35-1/2"

## HOW TO ORDER

To order repair parts, refer to the exploded view of the Type FR to identify the part required. When ordering, please use the part names listed and provide the valve serial number stated on the identification tag. Also state the following:

"Repair parts for Type FR (or FR-6) Cryogenic Service" and provide:

1. Valve size
2. Service
3. Inlet pressure range and set point
4. Outlet pressure (if any)
5. Temperature Range
6. Pressure Range
7. Part description
8. Quantity of each part
9. Valve assembly or serial number stated on the metal identification tag under the adjusting screw lock nut.

(828) 669-3700 • www.cashvalve.com

Tyco Valves & Controls LP, Black Mountain Facility, 953 Old US 70, Black Mountain, NC 28711

# ENGINEERING REQUIREMENT SHEET FOR MANUFACTURING ASSEMBLY & TEST

PRODUCT DESCRIPTION			PAGE 1 OF 4
BACK PRESSURE VALVE ASSEMBLY			<b>ED2046 Rev. E</b>
DISTRIBUTION	SIZE	TYPE	DATE
See ED4537	1/2" - 2"	FR	March 19, 2002

Replaces **ED2046D** Dated: **02/04/98**

Approved By: \_\_\_\_\_

⇒ Rev. E - Removed "Use Carborundum AA600-U8-WS Compound for lapping".

Particular points of construction, machining, assembling, testing, packing, operation, or use are to be recorded here as a requirement.

\*(Cryogenic)

### I. LAPPING

- ⇒
- A. Extreme care must be used at all times to keep lapping compound clean.
  - B. Ball seat and seat ring must be carefully and properly lapped to each other.
  - C. Seat ring and body seat must be carefully and properly lapped to each other.
  - D. Clean all lapped parts with brush and cleaning solvent.
- BODY PROOF TEST: Special body test specs are required for Premaberg BOC and Air Products UK LTD. See attached sheets.

### II. ASSEMBLY

- A. Clean all parts for oxygen service per Cash-Acme Spec. ED- 6364, inspecting body diaphragm and seat faces 100% for nicks, scratches, etc. (NOTE: Finishes specified on drawings.) Inspect 100% diaphragms and gaskets for cut outs or other defects that would affect the function of the valve. NOTE: After cleaning, the parts must be kept covered with plastic when not in use. This includes lunch hours, etc.
- B. Assemble, this includes protective closures, assembly cap screws to be tightened evenly and uniformly. Tighten cap screws opposite each other (not next to each other) until all are tightened. For recommended Torque Values, see chart below.

### III. TESTING AND ADJUST

- A. NOTE: Keep clean per Cash-Acme Spec. ED- 6364. NOTE: Special assembly test specs are required for Premaberg BOC and Air Products UK LTD. See attach sheets.
- B. Adjust valve to the maximum of spring range specified on factory order. Inspect for leaks through valve body walls around diaphragm and at cap screw holes.
- C. Readjust valve to set pressure specified on factory order. Pressure setting must be made at a point where you **just start to get flow**.
- D. Decrease inlet pressure to 10 % below set pressure specified. Bubble Test: No more than one bubble in 5 or more seconds is allowable.
- E. Replace protective closures upon completion of test.

TORQUE (IN/LBS.)		
Valve Size	Screw	Diap. Nut
1/2	150	175
3/4	200	250
1	250	300
1 1/4	250	300
1 1/2	300	480
2	350	480

**CASH VALVE**

(Form ED4548)