

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

LIST OF EFFECTIVE PAGES

<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>
LEP	1	Aug 27/2004
	2 blank	Aug 27/2004
Contents	1	Aug 27/2004
	2 blank	Aug 27/2004
75-30-00	1	Feb 11/2000
Description and Operation	2	Feb 11/2000
75-30-00	201	Aug 27/2004
Maintenance	202	Aug 27/2004
Practices	203	Aug 27/2004
	204	Aug 27/2004
	205	Aug 27/2004
	206	Aug 27/2004
	207	Aug 27/2004
	208	Aug 27/2004
	209	Aug 27/2004
	210	Aug 27/2004
	211	Aug 27/2004
	212 blank	Aug 27/2004

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
COMPRESSOR BLEED VALVE - DESCRIPTION AND OPERATION	75-30-00
1. Description and Operation	1
COMPRESSOR BLEED VALVE - MAINTENANCE PRACTICES	75-30-00
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Removal/Installation	202
A. Removal of Compressor Bleed Valve	202
B. Installation of Compressor Bleed Valve	202
6. Cleaning/Painting	203
A. Cleaning	203
7. Inspection/Check	203
A. BOV Assembly	203
B. BOV Components	205
8. Approved Repairs	205
A. Disassembly of Metering Plugs	205
B. Assembly of Metering Plugs	205
C. Replacement of Bleed Valve Diaphragm	207
9. Adjustment/Test	209
A. Procedure	209

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

COMPRESSOR BLEED VALVE - DESCRIPTION AND OPERATION

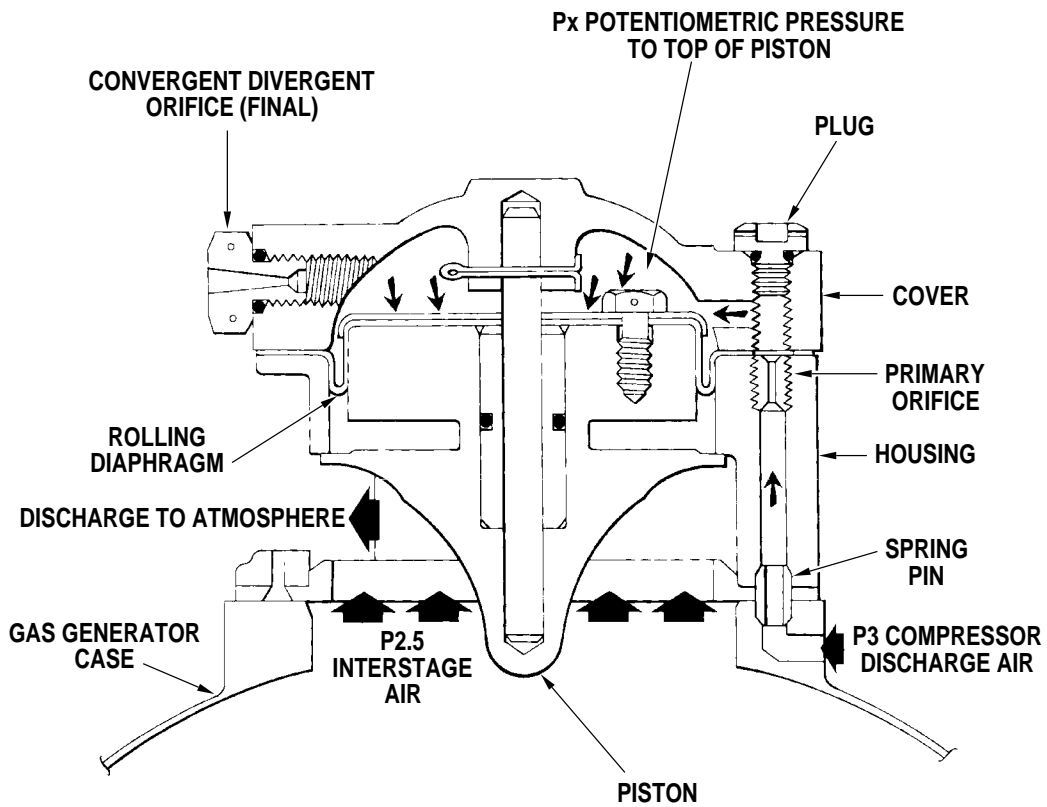
1. Description and Operation (Ref. Fig. 1)

The compressor bleed valve, located at the 7 o'clock position on the gas generator case, consists of a piston type valve operating in a ported housing. The piston is supported in the bore by a rolling diaphragm and a guide pin which permits full travel of the piston in either direction, to open or close the ports, while at the same time effectively sealing the air chamber at the top of the piston.

The bleed valve is bolted to the ported flange on the gas generator case. A hollow spring pin protruding from the valve mounting flange serves to align the compressor discharge (P3) air hole in the gas generator case flange with the bleed valve P3 passage.

P3 air is taken through a primary metering plug to a convergent-divergent metering orifice, which vents to ambient atmosphere. The convergent-divergent orifice is designed to create a choked flow over the necessary engine operating range, resulting in a fixed pressure ratio $P3/P_x$, where P_x is the control pressure between the primary metering plug and the convergent-divergent orifice acting on the bottom of the piston. The position of the floating piston is dependent on the balance of forces between compressor interstage air P2.5 and P_x . At low engine power, where P2.5 is much greater than P_x , the valve is fully open. As power is increased, the force from P_x pressure increases and balances the force from the P2.5 pressure, and the piston starts to close. The valve does not snap shut since P2.5 pressure increases as the valve is closed. This results in a progressive closing at constant $P3/P2.5$. At high power the valve is completely closed and P_x is higher than P2.5. As this is a pressure ratio control, it will maintain constant $P3/P2.5$ when it is modulating, regardless of altitude and ambient temperature.

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242



C3782

Compressor Bleed Valve - Cross-Section
Figure 1

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

COMPRESSOR BLEED VALVE - MAINTENANCE PRACTICES

1. General

- A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00 STANDARD PRACTICES of this manual to familiarize themselves with general procedures.
- B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.
- C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03, which is 0.025 inch diameter, and will not be specified in instructions.

2. Consumable Materials

The consumable materials listed below are used in the following procedures.

<u>Item No.</u>	<u>Name</u>
PWC05-007	Fluid, Check, Leak
PWC09-003	Compound, Silicone Sealing
PWC09-020	Compound, Lubricating
PWC11-013	DELETED (Use PWC11-021)
PWC11-014	Alcohol, Isopropyl
PWC11-016	DELETED (Use PWC11-014)
PWC11-021	Compound, Carbon, Removing
PWC11-026	DELETED (Use PWC11-014)
PWC11-027	Solvent, Petroleum

3. Special Tools

Not Applicable

4. Fixtures, Equipment and Supplier Tools

The fixtures, equipment and supplier tools listed below are used in the following procedures.

<u>Name</u>	<u>Remarks</u>
Air Pressure Regulator Shut-off Valve (Air Line)	100 psi input, 0 to 100 psi output
Pressure Gage	0 to 75 psi, accuracy \pm 5 %

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

5. Removal/Installation

A. Removal of Compressor Bleed Valve (Ref. Fig. 201)

CAUTION: KEEP THE COMPRESSOR INLET AREA CLEAR OF ALL FOREIGN OBJECTS THAT COULD BE INGESTED BY THE ENGINE AND CAUSE SERIOUS INTERNAL DAMAGE.

NOTE: In order to gain access to the bleed valve, remove full width of air inlet screen (Pre-SB1242) (Ref. 72-20-00).

- (1) Remove the four bolts (2) and washers (3) securing the bleed valve (1) to the gas generator case.
- (2) Withdraw the bleed valve from the gas generator case together with the spring pin (5).
- (3) Remove and discard the preformed packing (4) from the spring pin.
- (4) Check that P3 input line to bleed valve is free from obstructions.
 - (a) Apply clean, dry compressed air at P3 port of bleed valve mounting boss in gas generator case.

NOTE: There must be free air flow.

B. Installation of Compressor Bleed Valve (Ref. Fig. 201)

CAUTION: KEEP THE COMPRESSOR INLET AREA CLEAR OF ALL FOREIGN OBJECTS THAT COULD BE INGESTED BY THE ENGINE AND CAUSE SERIOUS INTERNAL DAMAGE.

NOTE: When the compressor bleed valve has been stored for a period exceeding 24 months, the valve must be returned to an approved service facility for retesting and calibration, prior to use.

- (1) Fit a new preformed packing (4) over the spring pin (5) and insert the pin into the base of the bleed valve (1).
- (2) Make sure the piston (6) is free to travel. Locate the bleed valve on the mounting pad of the gas generator case, making sure the spring pin (5) enters the alignment hole in the pad and dowel pin in the base of valve is correctly seated.
- (3) Secure the valve with four bolts (2) and washers (3). Tighten the bolts 16 to 20 lb.in., and secure with lockwire.
- (4) Install any parts in the air inlet screen area that were removed in order to gain access to the valve (Ref. 72-20-00).

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

6. Cleaning/Painting

A. Cleaning

(1) Clean all the disassembled parts (Ref. Para. 8.) of the compressor bleed valve:

- (a) Clean all the metallic parts in petroleum solvent (PWC11-027) and allow to drain. Dry with clean, dry compressed air.
- (b) Clean the bore of the spacer sleeve with a swab moistened with isopropyl alcohol (PWC11-014). Since the spacer is a graphite-filled polyamide-resin sleeve, all dark traces cannot be removed.

WARNING: CARBON REMOVING COMPOUND (PWC11-021) IS TOXIC AND CAUSTIC. IT IS RAPIDLY ABSORBED THROUGH THE SKIN CAUSING SEVERE BURNS AND CAN BE FATAL IF SWALLOWED. ALL PRECAUTIONS MUST BE TAKEN TO PREVENT CONTACT WITH SKIN AND EYES AND INHALATION OF VAPORS MUST BE AVOIDED. IF EYE OR SKIN CONTACT SHOULD OCCUR, WASH THOROUGHLY WITH WATER FOR AT LEAST 15 MINUTES. IF ACCIDENTLY SWALLOWED, GET MEDICAL ATTENTION IMMEDIATELY.

- (c) Soak the primary slotted metering plug and final metering plug in cold carbon removing compound (PWC11-021) for two hours at room temperature. Do not intermingle parts from different valves since the orifices are calibrated as a set to the assembly from which they were removed. Dry the exterior of the plugs with lint-free cloth and blow out the orifice using clean, dry compressed air.
- (d) If the metering plugs remain contaminated or blocked after soaking, use a wooden dowel to remove carbon deposits and repeat the cleaning procedure.

NOTE: If the plugs cannot be cleaned satisfactorily, return the complete valve assembly to an approved overhaul facility.

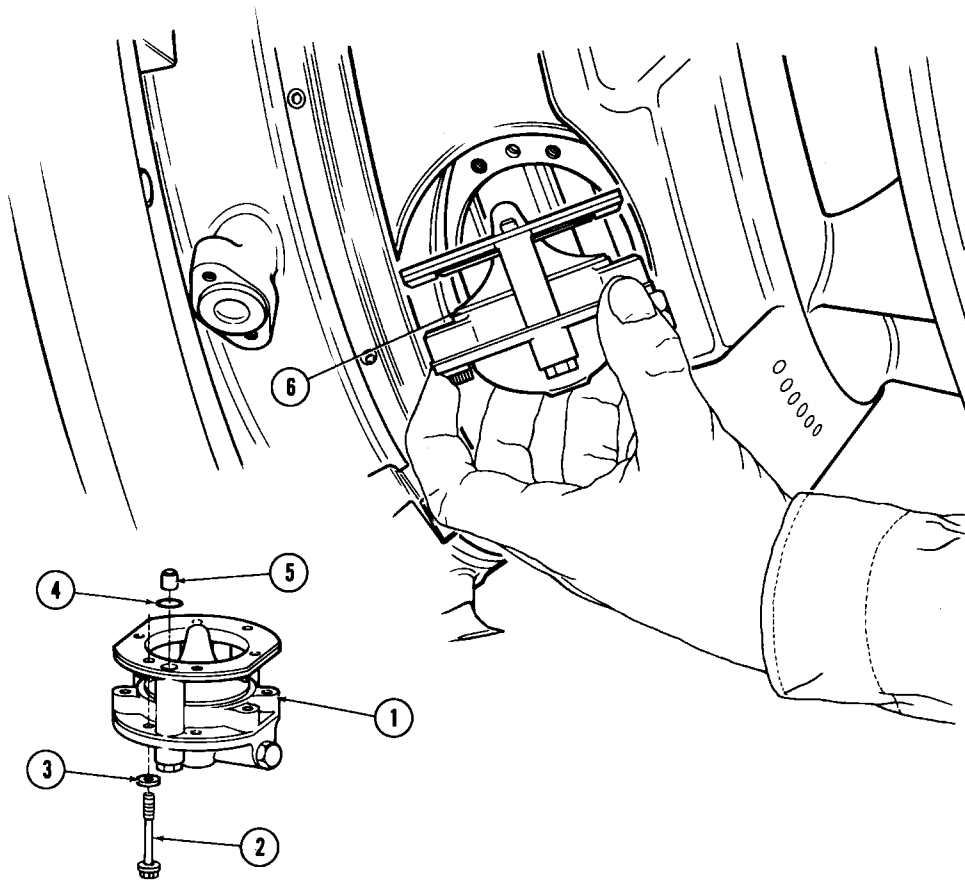
7. Inspection/Check

NOTE: Return the compressor bleed valve to an approved overhaul facility for the replacement of components, except where repair is permitted (Ref. Para. 8.).

A. BOV Assembly (Ref. Fig. 202)

- (1) Examine for cracks, dents, nicks and other damage.
- (2) Examine sealing and mating surfaces for scratches, galling, scoring and other surface damage, particularly those parts affected by travel of piston and rolling diaphragm (viewable through exit ports).
- (3) Examine bleed valve seat for surface damage at piston contact face.
- (4) Check for integrity of the diaphragm.
- (5) Do a leak check (Ref. Adjustment/Test).

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242



C3830C

Removal/Installation of Compressor Bleed Valve (Typical)
Figure 201

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

Key to Figure 201

1. Compressor Bleed Valve
2. Bolt
3. Washer
4. Preformed Packing
5. Spring Pin
6. Valve Piston

B. BOV Components (Ref. Fig. 202)

- (1) When a compressor bleed valve has been disassembled and cleaned (Ref. Paras. 6. and 8.), inspect the components:
 - (a) Examine the valve housing (4) and cover (1) for cracks, dents, nicks and other damage.
 - (b) Inspect the sealing, sliding and mating surfaces for scratches, galling, scoring and other surface damage, particularly those parts affected by the travel of the piston and rolling diaphragm.

8. Approved Repairs

A. Disassembly of Metering Plugs (Ref. Fig. 203)

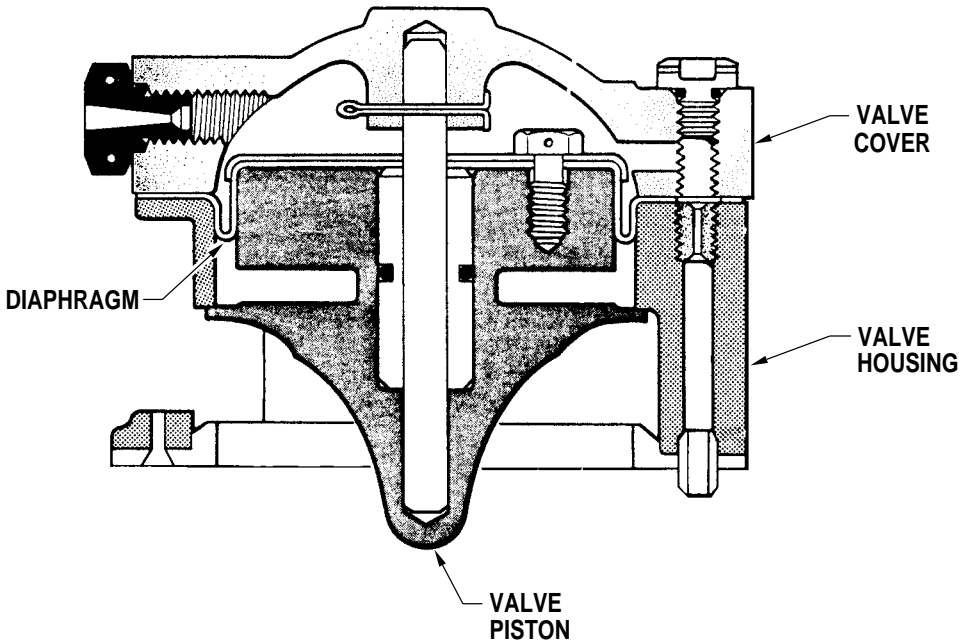
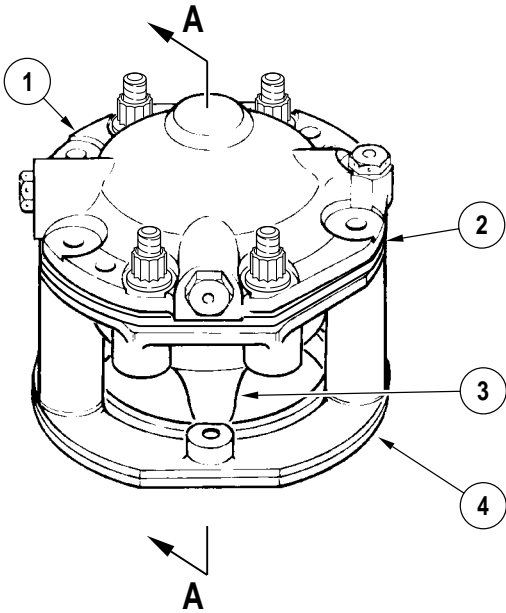
NOTE: Metering plugs should only be removed for inspection and/or cleaning requirements. Plugs must never be intermixed with parts from other valves or new parts fitted in the field.

- (1) Remove final metering plug (6) from valve cover (1). Remove preformed packing from plug.
- (2) Remove blanking plug (5) from cover (1) and primary metering plug (10) from valve housing (12), using appropriate screwdriver.

B. Assembly of Metering Plugs (Ref. Fig. 203)

- (1) After cleaning and inspection, assemble metering plugs:
 - (a) Install metering plug (10) in P3 cored passage of valve housing (12). Torque plug 10 to 20 lb.in.
 - (b) Install preformed packing on blanking plug (5), and fit plug in cover (1), torque 15 to 20 lb.in.
 - (c) Install new preformed packing on final metering plug (6) and install plug in valve cover (1). Do not torque plug at this time.

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242



SECTION A-A

C93827

Inspection of Compressor Bleed Valve
Figure 202

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

Key to Figure 202

1. Valve Cover
2. Diaphragm
3. Valve Piston
4. Valve Housing

(d) Do adjustment/test.

NOTE: If testing is done immediately after Repair procedure, operators may choose to leave blanking plug (2), and metering plug (10) installed. Make sure that no contamination enters open ports in valve cover (1).

C. Replacement of Bleed Valve Diaphragm (Ref. Fig. 203)

- (1) Remove four nuts (4) and washers (3) securing valve cover (1) to valve housing (12). Remove cover.
- (2) Remove three bolts (7) securing diaphragm retaining plate (8) and diaphragm (9) to piston (11). Remove retaining plate and diaphragm. Refer to Para. 7. for inspection of components.
- (3) Lightly smear top of piston (11), mating face of housing (12) and both flange mating faces of diaphragm with compound (PWC09-003) paying particular attention to area around metering plug (10). Make sure metering plug is dry and cavity is free of compound.
- (4) Install new diaphragm (9) with overall fabric surface and identification ink stamp against piston, and diaphragm retaining plate (8) on valve piston, making sure skirt of diaphragm is correctly positioned on studs of valve housing and offset hole is aligned with P3 cored passage. Secure diaphragm and retaining plate with three bolts (7).
- (5) Push piston through towards seat end of valve housing until diaphragm skirt is correctly seated on studs.
- (6) Holding diaphragm skirt securely on flange, make sure diaphragm rolls correctly between piston and housing when piston is moved up and down in housing.

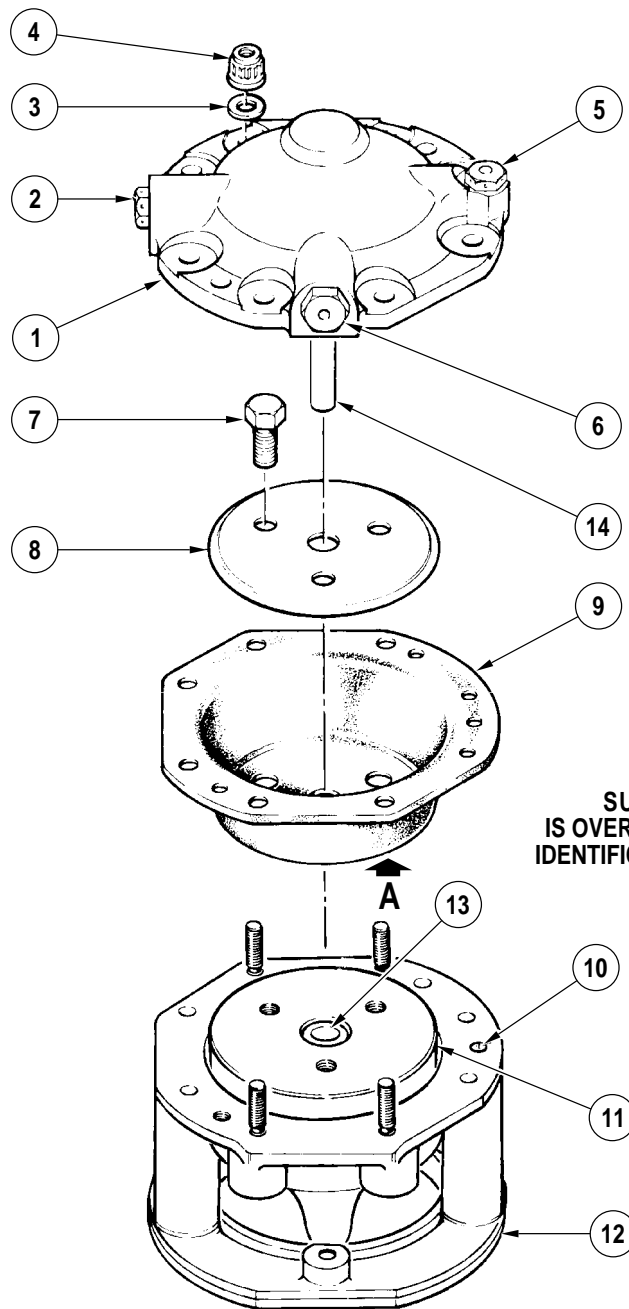
CAUTION: RETAINER MUST BE EXACTLY CENTERED TO MAKE SURE THAT THE EDGE DOES NOT TEAR OR CUT DIAPHRAGM.

- (7) Tighten diaphragm and retaining plate bolts (7), torque 11 to 15 lb.in., and lockwire.
- (8) Locate valve cover (1) on valve housing (12), passing guide pin (14) through center hole of diaphragm retaining plate and diaphragm.

NOTE: Make sure skirt of diaphragm is correctly seated on housing flange as cover is finally positioned on housing studs.

- (9) Secure valve cover to valve housing with four washers (3) and self-locking nuts (4). Tighten nuts and torque to 16 to 20 lb.in. Make sure diaphragm still rolls correctly.

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242



NOTE
SURFACE A
IS OVERALL FABRIC WITH
IDENTIFICATION INK STAMP

C3808B

Disassembly/Assembly of Compressor Bleed Valve
Figure 203

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

Key to Figure 203

1. Valve Cover
2. Blanking Plug
3. Washer
4. Self-locking Nut
5. Blanking Plug (Orifice Access)
6. Metering Plug - Convergent-Divergent Orifice
7. Bolt
8. Retaining Plate
9. Diaphragm
10. Metering Plug - Primary Orifice
11. Valve Piston
12. Valve Housing
13. Spacer Sleeve
14. Guide Pin

(10) After assembly of replacement diaphragm and/or installation of cleaned metering plugs, do adjustment/test.

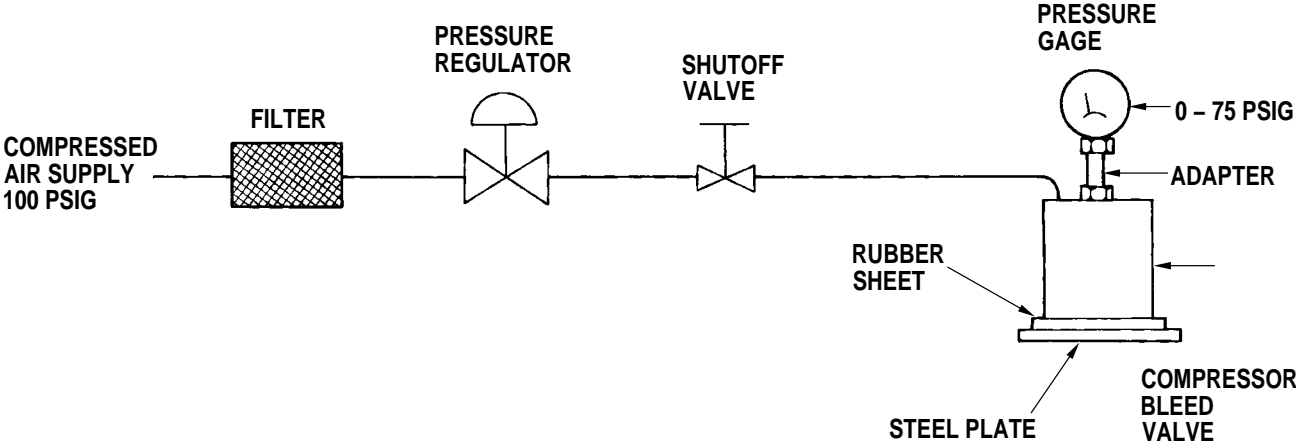
(11) After tests, retorque cover retaining nuts (4) (Ref. step (9)).

9. Adjustment/Test

A. Procedure (Ref. Fig. 204)

- (1) Remove spring pin from base of valve and retain pin.
- (2) Place valve on flat rubber sheet, mounted on steel plate, and secure valve to plate using a suitable C clamp, so that P3 inlet port in base of valve is air tight.
- (3) Remove plug (2, Fig. 203) and preformed packing from valve cover (1) and install pressure gage in plug hole. Use suitable thread adapter if required.
- (4) Remove metering plug (6) from boss on valve cover and remove preformed packing.
- (5) Connect a clean, dry compressed air supply to metering plug hole in valve cover (Ref. Fig. 204).
- (6) Set pressure regulator to zero output and open shut-off valve. Using pressure regulator, increase pressure to 40 ± 5 psig.
- (7) Apply leak test fluid (PWC05-007) to all air line connections and check for leakage. Rectify as required.
- (8) With gage reading between 35 to 45 psi, note reading and close shut-off valve. Leakage over a period of five minutes must not exceed 10 psig. If leakage rate is exceeded, replace compressor bleed valve diaphragm (Ref. Approved Repairs).

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242



C1883A

Leak Test Rig - (Typical)
Figure 204

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

- (9) Remove air supply connection at metering plug boss. Install new preformed packing on metering plug (6, Fig. 203) and install plug in valve cover (1). Tighten plug, torque to 35 to 40 lb.in., and lockwire.
- (10) Remove pressure gage and adapter, if fitted, from valve cover. Install preformed packing on plug (2) and install plug in valve cover. Tighten plug, torque to 15 to 20 lb.in., and lockwire.
- (11) Remove C clamp, rubber sheet and steel plate from bleed valve and reinstall spring pin in P3 inlet port in base of valve.

