

PRATT & WHITNEY CANADA
MAINTENANCE MANUAL
MANUAL PART NO. 3013242

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AIR SYSTEMS - DESCRIPTION AND OPERATION

1. General

Three separate air systems are provided for the engine; one system for bearing compartment sealing, the second for cooling air, and the third for the compressor bleed valve and airframe services. The compressor discharge air involved with engine control is dealt with in 73-10-07.

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

A. General

Air pressure is utilized to seal the Nos. 1, 2 and 3 bearing compartments and to cool the compressor and power turbine disks and compressor turbine guide vanes. Pressure air is used in conjunction with labyrinth seals which consist of two separate parts. One part is in the form of a plain rotating surface, sometimes vented; the other part consists of a stationary circular seal with deep annular grooves in the bore. These parts together form an air seal when matched. The running clearance between each pair of rotating and stationary parts is kept to a minimum.

Compressor interstage air (P2.5) is utilized to provide a pressure differential across the labyrinth seal located in front of the No. 1 bearing. The air is bled through the slots in the hub of the third-stage compressor spacer and into the center of the rotor assembly. Air then flows rearward through the passages in the compressor disks and out to an annulus in the center of the labyrinth seal through passages in the compressor rear hub. The air is metered through the labyrinth to form the pressure seal. Air flowing forward through the seal feeds into the inlet air stream, while air flowing to the rear vents into the accessory gearbox together with the scavenged oil; it is then separated by the centrifugal breather impeller and bled overboard.

The No. 2 bearing is protected by a single labyrinth seal at the front end and a double seal at the rear. Pressure air for this area is bled from the labyrinth seal connecting it to the turbine cooling air system. The air flows through passages in the No. 2 bearing support, equalizing pressure at the front and rear of the bearing compartment, and ensures a pressure seal in the front and rear labyrinths. The No. 2 bearing cavity seal air is dumped into the accessory gearbox through the bearing oil scavenge line.

The compressor and power turbine disks are cooled by the compressor discharge air from the diffuser exit zone down the rear face of the large exit duct. The air is then metered through holes in the compressor turbine vane support flange of the gas generator case into the turbine hub baffles; this air splits into three paths. One metered path directs air to cool the rear face of the compressor turbine disk, the second path pressurizes the No. 2 bearing front labyrinth seal, while the balance passes through holes in the compressor turbine disk hub and into the centerbore. A portion of this air is metered over the front face of the compressor turbine disk by the interstage baffle. The remaining air passes through a hole in the center of the interstage baffle and into a zone immediately to the rear of the power turbine disk. The balance is passed through holes in the hub to pressurize the No. 3 bearing double labyrinth seal. Air bleeding forward through the seal is returned to the accessory gearbox via the No. 3 and 4 scavenge oil line, while air bleeding to the rear through the seal is metered over the front face of the power turbine disk.

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Cooling air passing over the front and rear faces of the compressor and power turbine disks is dissipated into the main exhaust gas stream at the blade roots. The Nos. 1, 2 and 3 bearing cavity leakage air is carried with the scavenged oil into the accessory gearbox where it is separated from the oil by the centrifugal breather and vented to the atmosphere.

B. Compressor Bleed Valve

The compressor bleed valve, located on the gas generator case at the 7 o'clock position, automatically opens a port in the gas generator case to spill the interstage compressor air (P2.5) and prevent compressor stall. The bleed valve remains closed at higher gas generator speeds.

C. Air Supply for Airframe Services

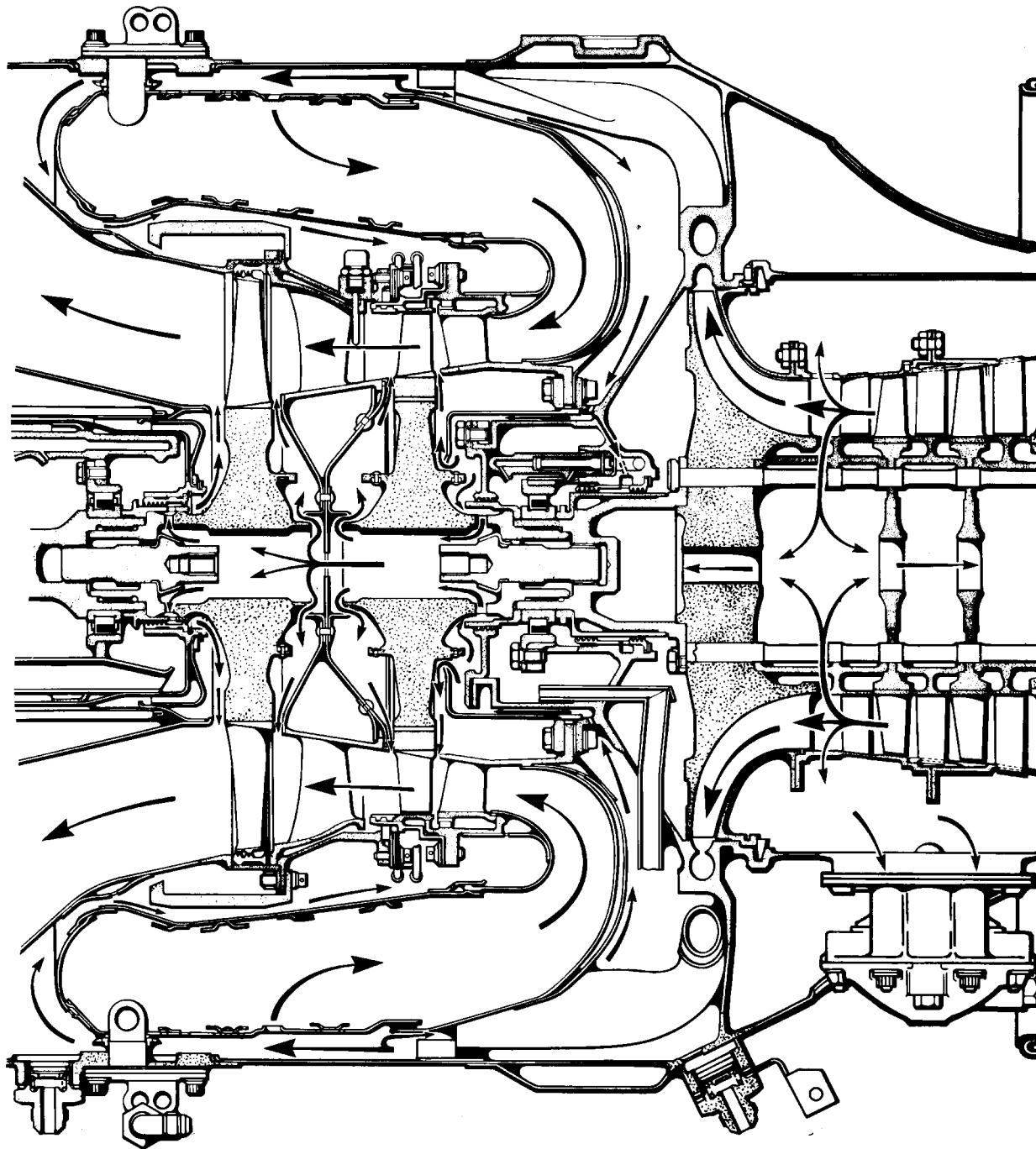
A pad located on the left side (11 o'clock position) of the gas generator case enables airframe-supplied equipment to utilize engine P3 compressor discharge air pressure. The pad is connected through internal passages to the diffuser zone in the gas generator case.

3. Fault Isolation

For detailed fault isolation of the air system, refer to Chapter 72-00-00, FAULT ISOLATION.

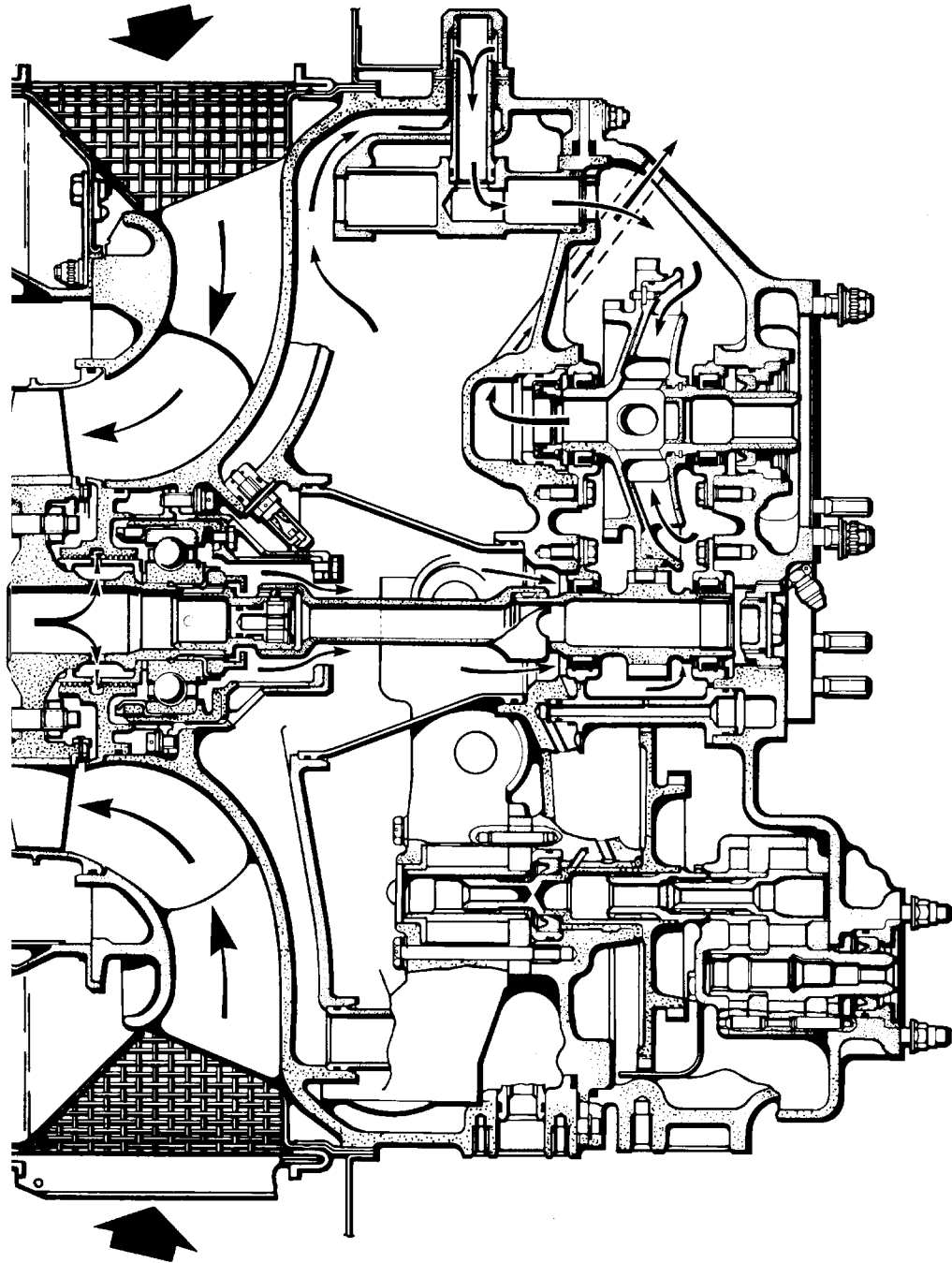
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C441C-1

Engine Airflow and Cooling Air
Figure 1 (Sheet 1 of 2)



C441C-2

Engine Airflow and Cooling Air
Figure 1 (Sheet 2)

