51

MAY 1958 CONFIDENTIAL

UNCLASSIFIED

ARROW 2

LOW PRESSURE PNEUMATIC SYSTEM

REPORT NO. 72/SYSTEM 18/29-2

ENGINEERING DIVISION,

AVRO AIRCRAFT LIMITED.

ARROW 2

LOW PRESSURE PNEUMATIC SYSTEM

REPORT NO. 72/SYSTEM 18/29-2

MAY 1958

This brochure is intended to provide an accurate description of the system(s) or service(s) for the ARROW 2 at the time of writing, and is not to be considered binding with respect to changes which may occur subsequent to the date of publication.

REVISED BY B. L. Gilbertson APPROVED BY D. Rayston

AUTHORIZED BY A R Bailey

Engineering Division
Avro Aircraft Limited
Malton - Ontario

UNCLASSIFIED

SECURITY WARNING

This document is classified "CONFIDENTIAL" and is intended solely for the use of the recipient and such persons as have been delegated to use it in the course of their duty, and may only be used in connection with work performed for or on behalf of Her Majesty's Canadian Government.

The unauthorized retention or destruction of this document or disclosure of its contents to any unauthorized person is forbidden.

Failure to comply with any of the above instructions is an infraction of the Official Secrets Act.

Any unauthorized person obtaining possession of this document, by finding or otherwise, must forward it, together with his name and address, in a registered envelope, to the Engineering Division, Avro Aircraft Ltd., Malton, Ontario, Canada.

This is copy Number 1 15

Issued to .....

Date .....

UNCLASSIFIED

TABLE OF CONTENTS

1.0 Introduction

2.0 Description of Systems

2.1 Equipment Pressurizing System
2.2 Pitot-Static System

Appendix 1 - Equipment List

LIST OF ILLUSTRATIONS

Figure 1 - Schematic - Equipment Pressurizing System

Figure 2 - Schematic - Pitot-Static System

1. INTRODUCTION

The ARROW 2 is equipped with two basic low pressure pneumatic systems.

(a) Equipment Pressurizing System

The equipment pressurizing system draws air from the aircraft air conditioning system. This air is used to pressurize the canopy seals, weapon pack seals, anti-g suits, and the ASTRA I system.

(b) Pitot-Static System

The pitot-static system uses air pressure reference from a nose boom and fin probe for flight instruments, flight and fire control systems, and cabin pressure control valves.

2. DESCRIPTION OF SYSTEMS

2.1 Equipment Pressurizing System (Ref. Fig. 1)

2.1.1 Air Supply

The air supply for the equipment pressurizing system is obtained from the water evaporator in the air conditioning system at pressures up to 65 psig. From the water evaporator, the air passes through a check valve and a 10 micron filter. The filter contains a water trap so that moisture may be drained periodically from the system.

2.1.2 Anti-g Suits

The air is led to the air pressure regulating valves supplying the pilot's and obs/AI's anti-g suits. These valves admit air to the suits at the appropriate pressure. The valves are controlled by the g force acting on them, and are adjusted to provide initial pressurization of the suits when accelerations are between 1.5 and 1.8 g. Subsequent pressurizing varies with the g force;

the valves being adjusted to supply a maximum of approximately 10 psig at 8g. Each g-valve incorporates a relief valve to limit the suit pressure to the maximum value when acceleration forces are in excess of 8g.

The g-valve and the anti-g suit are connected through the crew members' composite leads disconnect (Ref. para. 2.3 of Brochure 72/Systems 21/30 "Oxygen System").

2.1.3 Canopy Seals

Pressurized air is supplied to the canopy seal control valve (Ref. Fig. 1). This valve is a composite unit consisting of a three-way, solenoid-operated, control valve, with an initial pressure regulating stage and integral pressure relief valve. The output pressure, which is regulated between 18 and 22 psig, is vented to atmosphere when the solenoid is not energized. Upon energizing the solenoid, the air pressure is directed to the front and rear cockpit canopy seals. The solenoid is energized by the closing of two series-wired micro-switches, each of which is actuated by the canopy locking handle in each cockpit. The locking of both canopies is therefore required to inflate the seals; the unlocking of either canopy will deflate the seals.

(An access panel is provided, to allow the rear canopy locking handle to be operated from the front cockpit, should the aircraft be flown solo).

2.1.4 Weapon Pack Seals

Three weapon pack seals are fitted; one on the aircraft, and two side seals attached to the pack. Pressure at 18 to 22 psig is applied to the seals upon actuation of the weapon pack seal control valve. The seal control valve is automatically controlled by limit switches, and is energized after the weapon pack has been replaced on the aircraft, and is automatically de-energized, and the seals deflated before the pack is removed from the aircraft.

2.2 Pitot-Static System (Fig. 2)

Pitot-static pressure is supplied from the nose boom and fin probe. The fin probe supplies pitot and static pressure for the emergency damping system only. The air-speed indicator, the air data computer, and the normal damping system transducers receive pitot pressure reference from the nose boom source.

The nose boom includes primary and secondary sources of static pressure. The need for two nose boom static sources is governed by the allowable response time for the normal damping system static reference, as determined by the system volume. The static reference for the normal damping system, the air data computer, the front cockpit altimeter, and the aileron control altitude switch, is obtained from the primary nose boom source. The static reference for the front cockpit air-speed indicator, the rate-of-climb indicator, the rear cockpit altimeter, and the cockpit pressure and safety valve controller is obtained from the secondary nose boom source.

2.2.1 Air Data Computer

Static and pitot pressures are piped to the air data computer pressure sensors. The two pressure measurements, together with air temperature and angle of attack measurements, are then fed into the air data computer, and the various combinations analyzed to obtain the required output. The outputs consist of corrected static pressure, outside air temperature, true air speed, altitude error, altitude rate-of-change, altitude, computed angle of attack, Mach number rate change, true Mach number, Mach error, air density times speed of sound and differential pressure.

2.2.2 Aileron Control Altitude Switch

The aileron control altitude switch is a part of the automatic flight control system. The switch is set to operate at a pressure altitude of 45,000 feet, at which point an electrical circuit is energized to deflect both ailerons up four

degrees (Ref. Flying Controls System Report No. 72/Systems 15/28).

2.2.3 Cockpit Pressure Controller

The cockpit pressure controller senses and compares ambient static pressure with cockpit pressure. The cockpit exhaust valve is then opened or closed to maintain the desired cockpit pressure, as established by a pre-determined schedule. (Ref. Air Conditioning System Report No. 72/Systems 22/48).

2.2.4 Cockpit Safety Valve Controller

The cockpit safety valve controller is incorporated to prevent structural damage to the cockpit from overpressurization. This is accomplished by exhausting excessive cockpit pressure, in the event of failure of the cockpit pressure controller. The valve senses ambient static pressure, which regulates the valve operation in accordance with a pre-determined schedule. (Ref. Fig. 1 Air Conditioning System Report No. 72/Systems 22/48).

2.2.5 Damper System

From the P_s and qc transducers, the functions of pitot and static pressures are introduced to the normal and emergency damping systems for the scheduling of damper inputs, to obtain the required rudder co-ordination angle and elevator angle per g, etc.

The qc transducer, also monitors the qc actuator system to establish the setting of the rudder hinge moment limiter for any particular airspeed.

APPENDIX 1

EQUIPMENT LIST

LOW PRESSURE PNEUMATIC SYSTEM

Description	Qty.	Part No.	Spec.	Manufacturer and Part No. Where Applicable
Filter - Hot Air	1	AC-621-2 AVRO 7-1852-13	AVROCAN E328	A/C Porous Media Inc.
Seal - Canopy Inflating L.H. Pilot's	1	AVRO 7-1053-101	E343	B.F. Goodrich Co.
Seal - Canopy Inflating R.H. Pilot's	1	AVRO 7-1053-102	E343	B.F. Goodrich Co.
Seal - Canopy Inflating L.H. obs/AI	1	AVRO 7-1053-121	E343	B.F. Goodrich Co.
Seal - Canopy Inflating R.H. obs/AI	1	AVRO 7-1053-122	E343	B.F. Goodrich Co.
Valve - Anti 'g'	2	AVRO 7-1852-12	MIL-V-9370	Alar Products Inc.
Valve - Canopy and Weapon Pack Seal Control	2	AVRO 7-1852-14	E332	Surface Combustion
Weapon Pack Seal	1	AVRO 7-1854-21	E563	
Weapon Pack Side Seals	1	AVRO 7-1894-11	E563	
	1	AVRO 7-1854-15012		
Check Valve	1	111-5651-22		Parker
Pitot-Static Fin Probe	1	AVRO 7-1850-47	E541	Aero Research Instrument Co.
Pitot-Static Nose Boom Probe	1	AVRO 7-1851-21	E560	Buffalo-Instrument Corp.

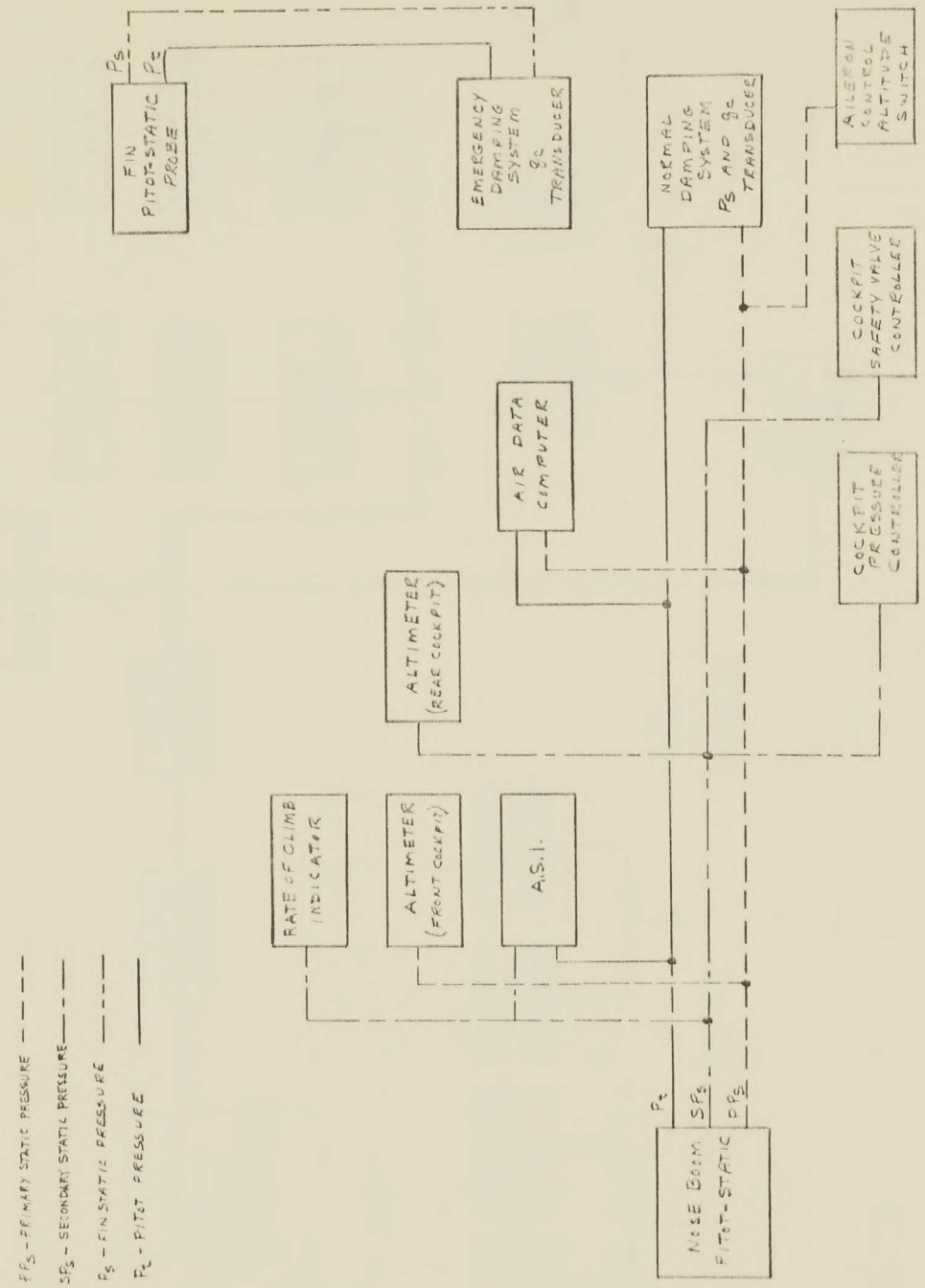

FIG. 2 SCHEMATIC PITOT-STATIC SYSTEM

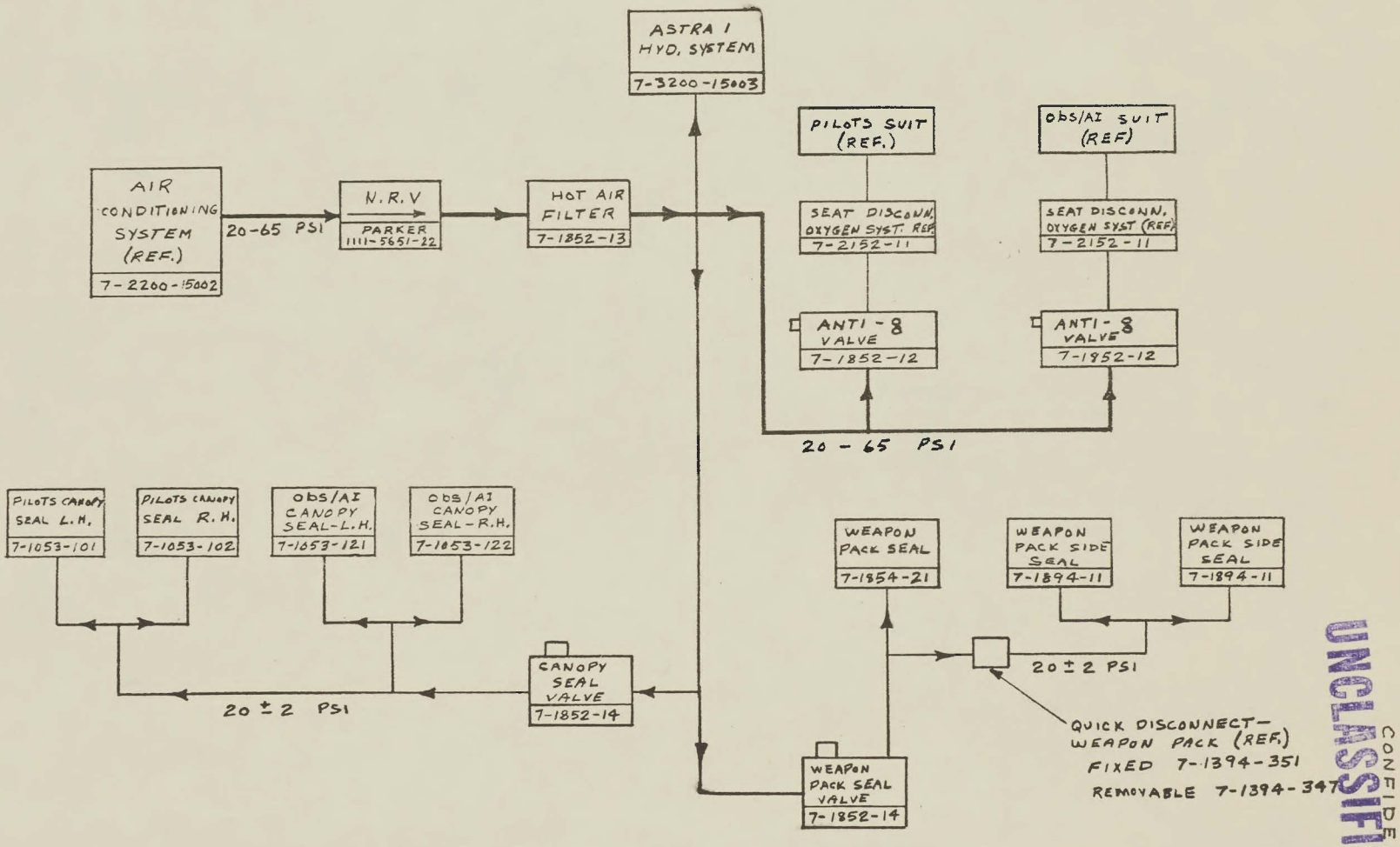

FIG. 1 EQUIPMENT PRESSURIZING SYSTEM