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JUNE 1957

LOW PRESSURE PNEUMATIC SYSTEM

REPORT No. 72/SYSTEMS 18/29

ENGINEERING DIVISION

AVRO AIRCRAFT LIMITED

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ARROW 2

LOW PRESSURE PNEUMATIC SYSTEM

REPORT NO. 72/SYSTEMS 18/29

JUNE 1957

This brochure is intended to provide an accurate description of the system(s) or service(s) for purposes of the Arrow 2 Mock-up Conference, and is not to be considered binding with respect to changes which may occur subsequent to the date of publication.

COMPILED BY D. Royston. **APPROVED BY** Alan R. Bailey

ENGINEERING DIVISION

AVRO AIRCRAFT LIMITED

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1. Introduction

There are two basic low pressure pneumatic systems used in the ARROW 2:

1.1 The equipment pressurizing system, draws air from the aircraft air conditioning system, which is used to pressurize the canopy seals, armament pack seals, crew member anti-"G" suits, the electronic system wave guides, the Astra I scanner drive hydraulic system reservoir, and a radome fluid de-icing system.

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

2.1.2 Anti "G" Suits (Figs. 3 and 5)

The air is led to the air pressure regulating valves supplying the pilots' and navigators' anti-"G" suits. These valves admit air to the "G" suits at the proper pressure, when under varying degrees of positive acceleration. The valves are themselves, controlled by the "G" force acting on them, and are adjusted to provide initial pressurization of the suits at a value between 1.5 and 1.8G, with subsequent pressurization varying as the 'G' force, up to a maximum of approximately 10 psig at 8G. (Ref. Fig. 5). Each "G" valve incorporates a relief valve to limit the suit pressure to the maximum value under acceleration forces in excess of 8G.

Connection between 'G' valve and anti-G suit is made through the crew members' composite leads disconnect (described in

para. 2.3 of Brochure 72/Systems 21/30 "Oxygen System").

2.1.3 Canopy Seals

A branch line, upstream of the Anti G Valves, is taken to the canopy seal control valve (Ref. Fig. 3). 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 to 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 pilots' and navigators' canopy seals. The energizing of the solenoid is accomplished by the closing of two series wired micro switches, each of which is actuated by a separate canopy locking handle in the respective cockpit. Thus the locking of both canopies is required to inflate the seals, and conversely, the unlocking of either canopy will deflate the seals and vent the pressure to atmosphere.

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

2.1.4 Armament Pack Seals

There are three armament pack seals, 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 armament pack seal control valve (Fig. 4).

The seal control valve is energized after the armament pack has been replaced on the aircraft, as the system is armed before take off. The valve is de-energized and the seals deflated before the pack is removed from the aircraft.

2.1.5 Astra I Hydraulic Reservoir Pressurization

System pressure is piped to the Astra I scanner drive hydraulic system reservoir, through a combined check and relief valve. This keeps the suction line of the scanner drive hydraulic pump pressurized under all flow conditions.

2.1.6 Astra I Wave Guide Pressurization

System pressure is also applied to the Astra I system for wave guide pressurization.

2.1.7 Radome De-Icing

The main pressure supply line is continued forward to a pressure reducing valve, from which the air, at a reduced pressure of 10 psi, is used to maintain pressurization in the de-icing fluid container, and to purge the de-icing fluid lines.

2.2 Pitot Static System (Fig. 2)

There are two sources of pitot-static pressure, a nose boom and a fin probe (Fig. 6 & 7). The fin probe supplies pitot and static pressure for the emergency damping system only.

The remaining instruments, i.e. the ASI, the air data computer and the normal damping system transducers, receive pitot pressure reference from the nose boom source.

The nose boom has two sources of static pressure, the primary and the secondary.

The static reference for the normal damping system, the air data computer and the front cockpit altimeter is obtained from the primary nose boom source. The static reference for the front cockpit ASI, rate of climb indicators, the rear cockpit altimeter, and the cockpit pressure and safety valve controllers, is obtained from the secondary nose boom source.

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.

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.
Hose Ass'y - L/P Pneumatic Pilot's Canopy Hose	2	CS-H-131-3B-0170	E355	
Hose Ass'y - L/P Pneumatic Inst. Piping	1	CS-H-131-4B-0100	E355	
Hose Ass'y L/P Pneumatic Inst. Piping	1	CS-H-131-4A-0190	E355	
Hose Ass'y L/P Pneumatic Inst. Piping	1	CS-H-131-4B-0190	E355	
Hose Ass'y L/P Pneumatic Pilot's	1	CS-H-131-4B-0194	E355	
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. Nav.	1	AVRO 7-1053-121	E343	B.F. Goodrich Co.
Seal - Canopy Inflating R.H. Nav.	1	AVRO 7-1053-122	E343	B.F. Goodrich Co.
Valve - Anti "G"	2	AVRO 7-1852-12	MIL-V-9370	Alar Products Inc.

Description	Qty.	Part No.	Spec.	Manufacturer and Part No. Where Applicable
Valve - Canopy and Armament Pack Seal Control	2	AVRO 7-1852-14	E332	Surface Combustion
Armament Pack Seal	1	AVRO 7-1854-11	E563	
Armament Pack Side Seals	1 1	AVRO 7-1854-15011 AVRO 7-1854-15011		
Check Valve	1	AVRO 7-1852-62		
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.

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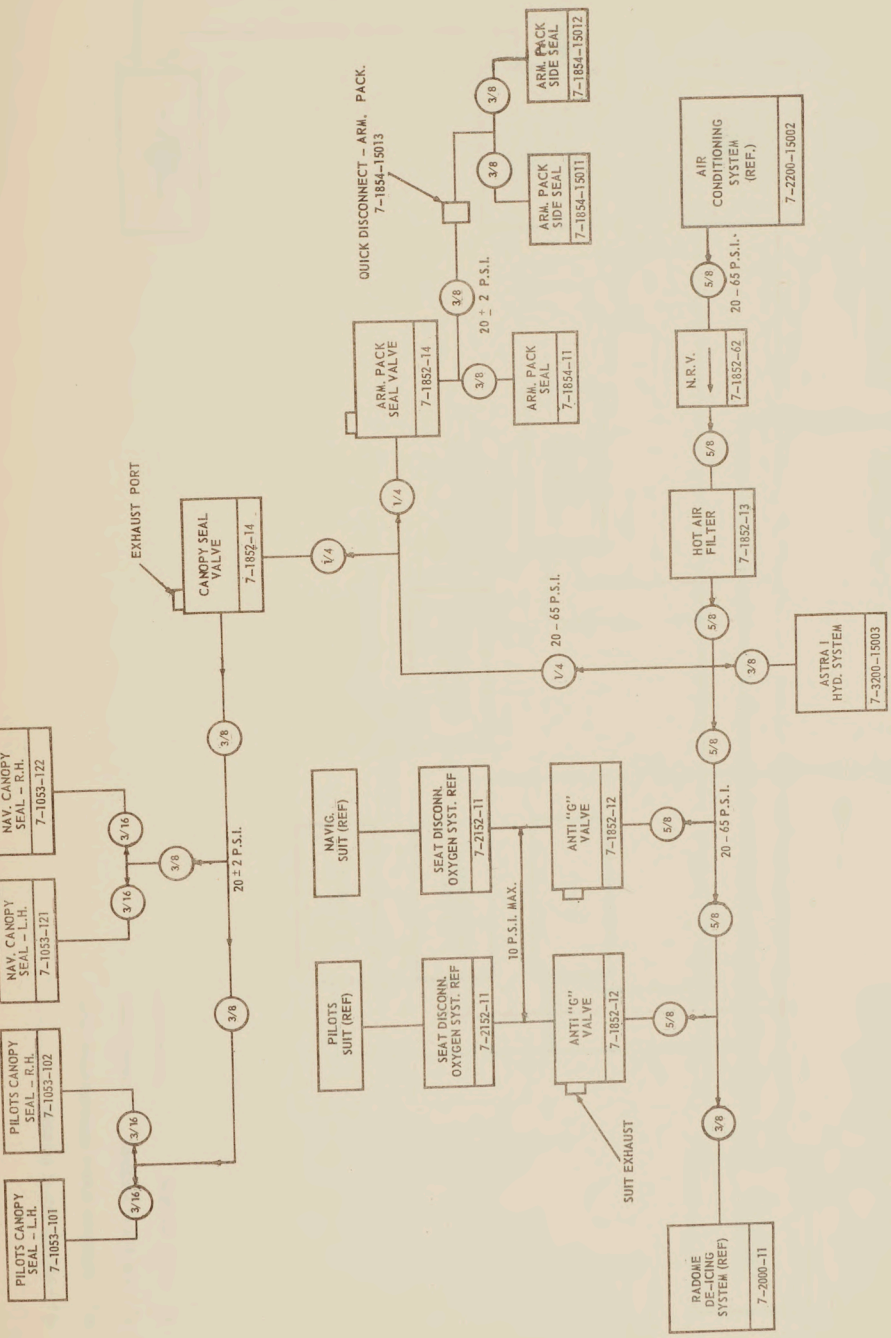

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FIG. 1 SCHEMATIC EQUIPMENT PRESSURIZING SYSTEM.

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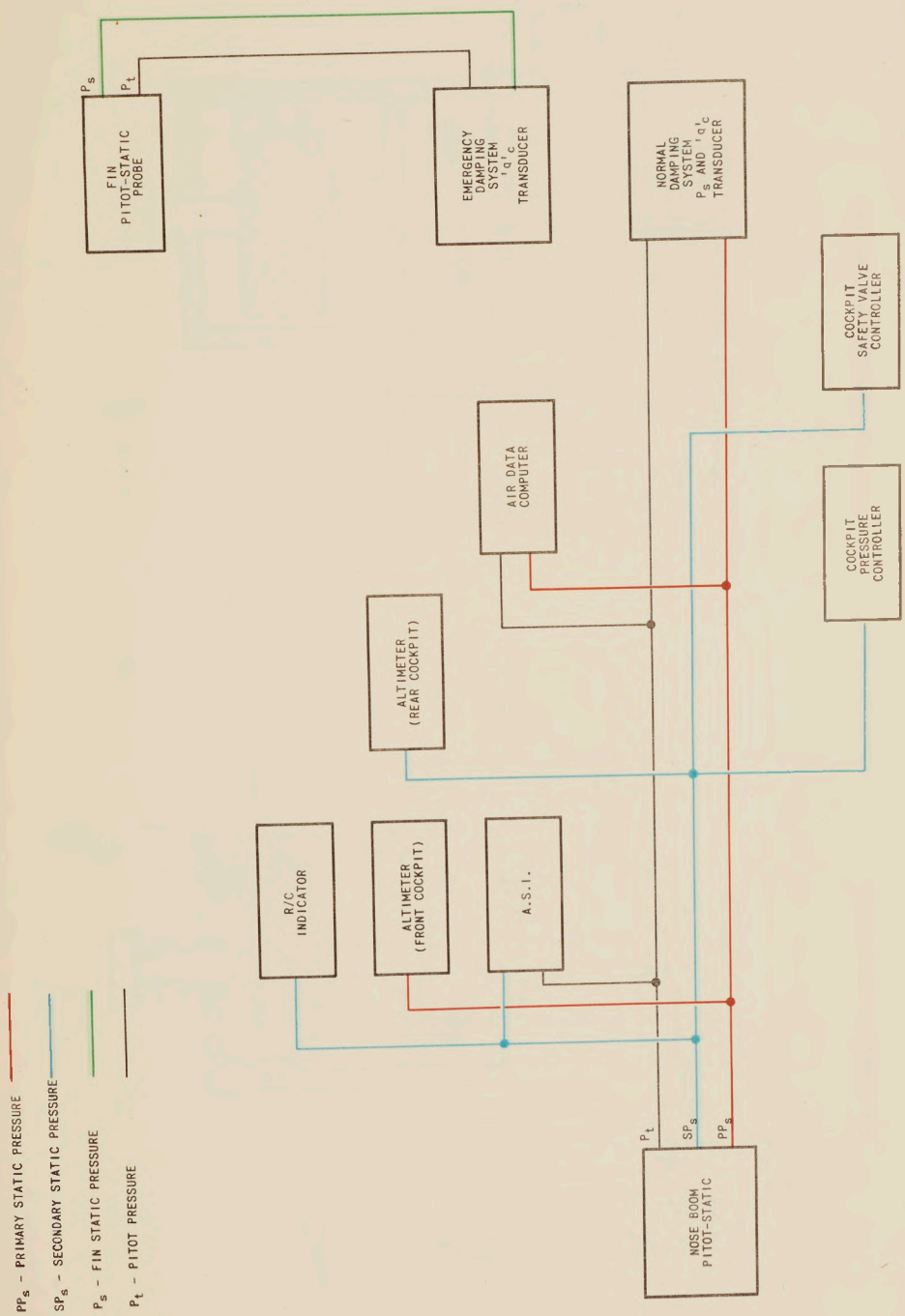

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FIG. 2 SCHEMATIC PITOT-STATIC SYSTEM

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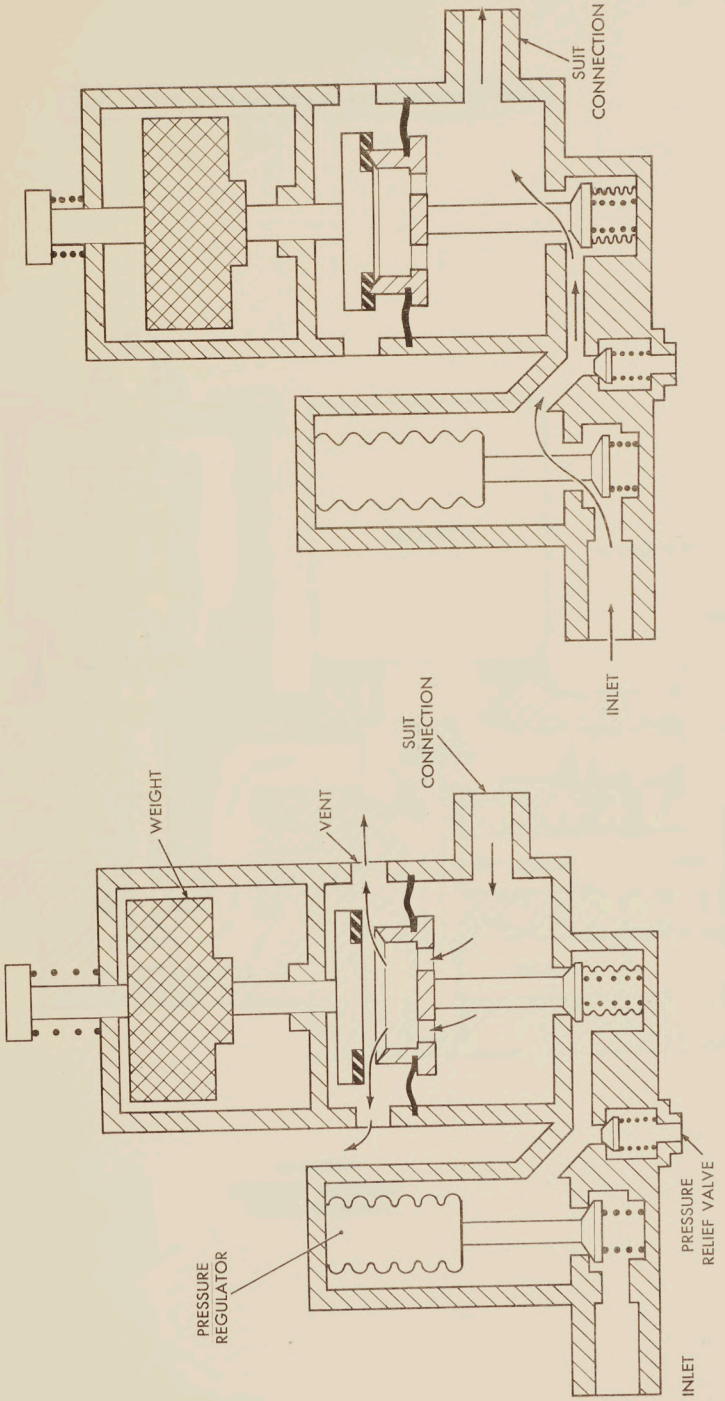

NOTE: THIS IS A DIAGRAMMATIC REPRESENTATION ONLY

FIG. 3 ANTI-G VALVE

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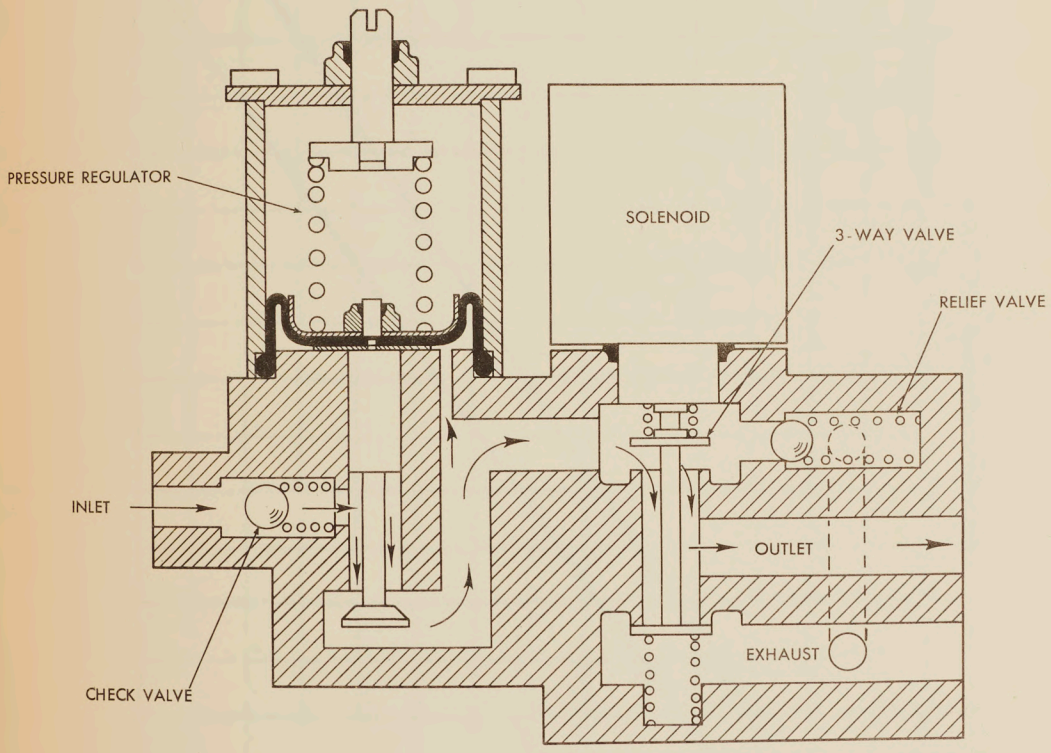
NOTE: THIS IS A DIAGRAMMATIC REPRESENTATION ONLY.



SHOWING:
SOLENOID ENERGIZED
SEALS INFLATING.

FIG. 4 CONTROL VALVE CANOPY AND ARMAMENT PACK SEAL

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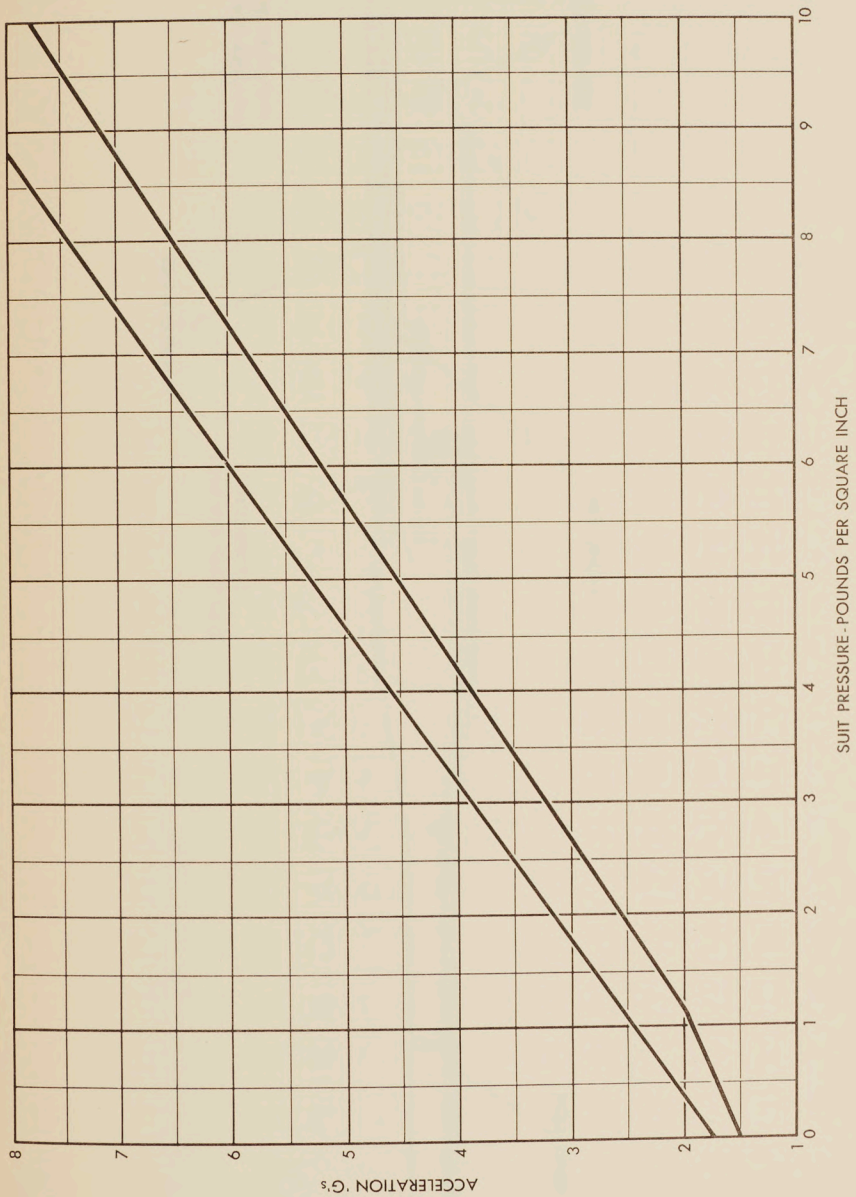

FIG. 5 SUIT PRESSURE VS "G"

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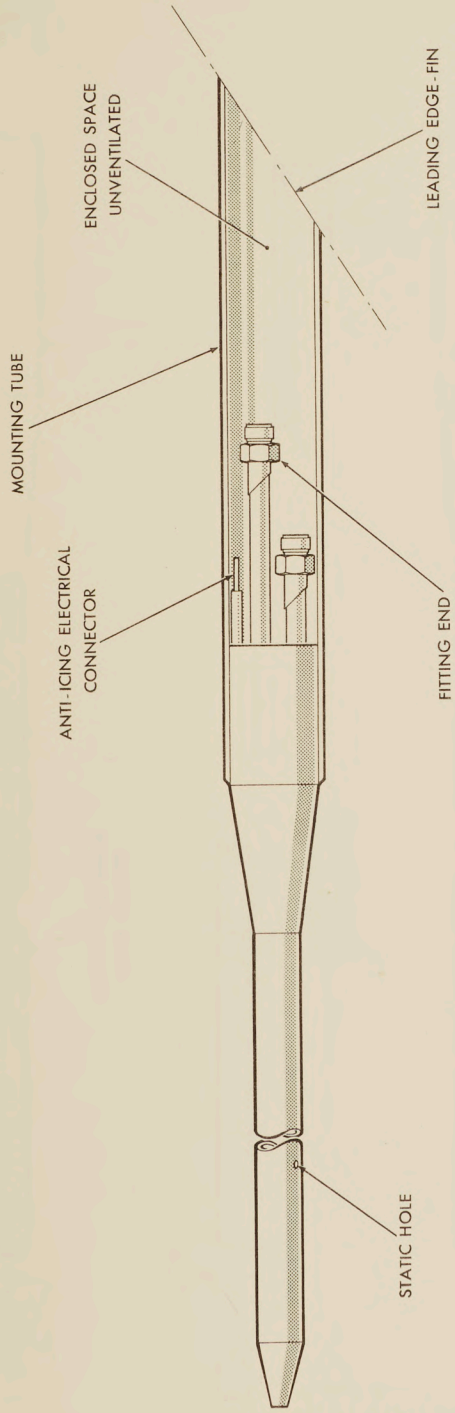

FIG. 6 PITOT STATIC FIN PROBE

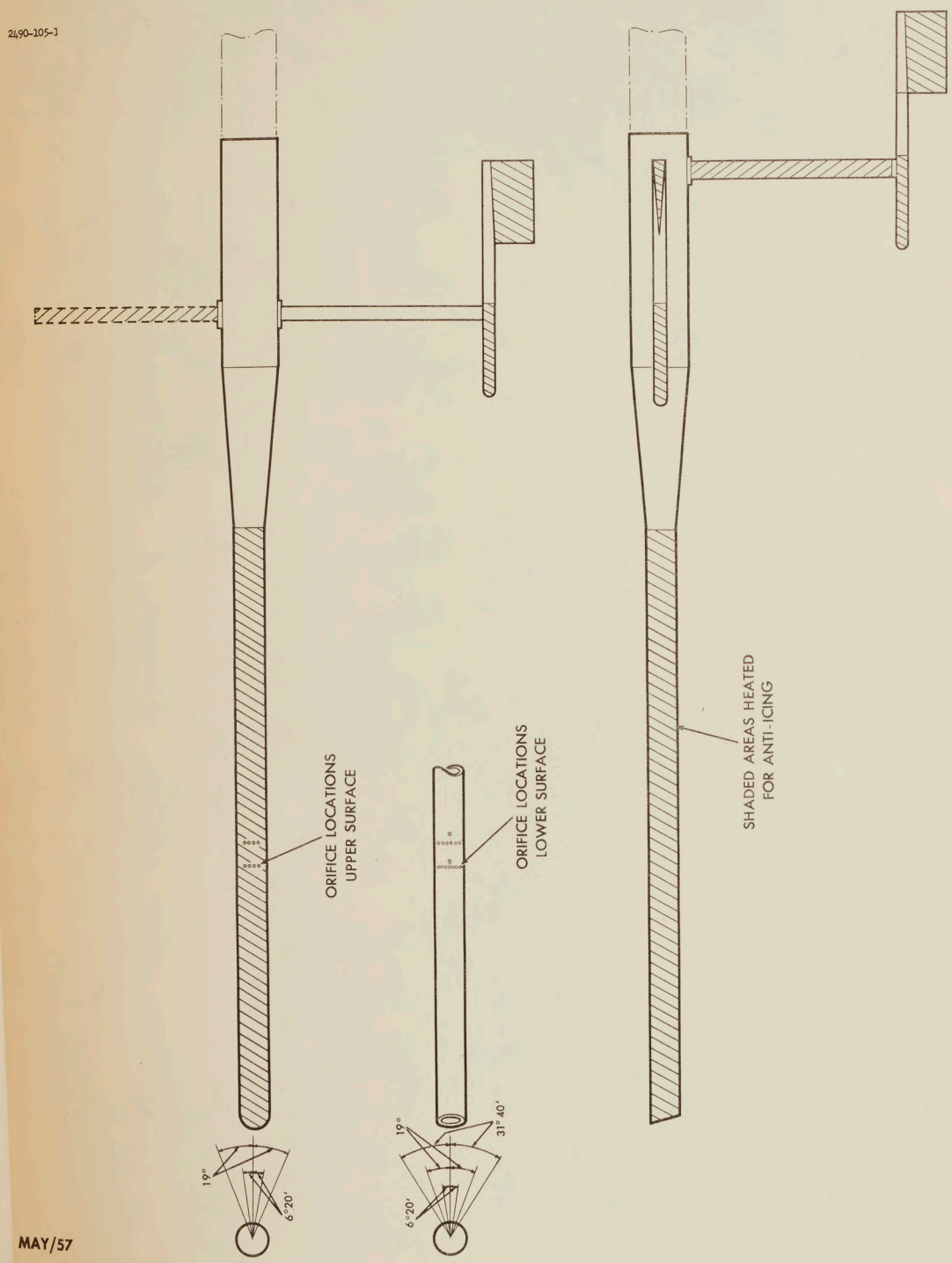

FIG. 7 PITOT STATIC NOSE BOOM PROBE