

QC
Avro
CF105
72-Sys.19-80

46

Report 72/System 19/80
PROPOSAL FOR INTRODUCTION OF DUAL
PRESSURE RANGE VARIABLE DELIVERY
PUMPS INTO THE UTILITY ~~AND~~ JLIC
SYSTEM **SECRET**



A. V. ROE CANADA LIMITED
MALTON, ONTARIO

SECRET

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT Arrow 2

REPORT NO. 72/System19/80

FILE NO.

NO. OF SHEETS

TITLE:



PROPOSAL FOR INTRODUCTION OF
DUAL PRESSURE RANGE VARIABLE
DELIVERY PUMPS INTO THE
UTILITY HYDRAULIC SYSTEM

Classification cancelled/changed to _____
by authority of _____ (date) _____
Signature _____

PREPARED BY J. Moors

DATE Dec. 26/57

CHECKED BY

DATE

SUPERVISED BY

DATE Dec 27,

APPROVED BY

DATE Dec '57

ISSUE NO.	REVISION NO.	REVISED BY	APPROVED BY	DATE	REMARKS

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VICKERS AIRCRAFT LIMITED
MELTON, ONTARIO

TECHNICAL DEPARTMENT

REPORT NO. 72/System 19/80

SHEET No. 1 of

AIRCRAFT	Arrow 2	Title: PROPOSAL FOR INTRODUCTION OF DUAL PRESSURE RANGE VARIABLE DELIVERY PUMPS INTO THE UTILITY HYDRAULIC SYSTEM	PREPARED BY	DATE
			J. Moors	Dec. 26/57
			CHECKED BY	DATE

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1. INTRODUCTION

The following system is proposed to replace the existing constant delivery pumping system now used in the utility hydraulic system. The reason for proposing this change to the pumping system is so that the radar scanner system may be driven from the utility hydraulic system instead of from the flying control system as it is now. This change will improve the reliability of the F/C hydraulic system. The current utility hydraulic system is a press-regulated type and is not suitable to drive a continuous operating system such as the scanner.

This proposal uses two, 20 gpm variable delivery dual pressure range pumps. These pumps are capable of pumping on low range (1000 psi) for scanner operating and on 4000 psi (high range) for landing gear, armament, etc.

2. METHOD

Under normal flight conditions the pumps will be on low pressure range and the radar scanner will receive oil directly from the pumps at 1000 psi, for landing gear, armament etc. operation 4000 psi is demanded on selection and cancelled to 1000 psi on completion of cycle.

When the pumps are on high range the fluid to the scanner passes through a pressure reducing valve and the pressure is maintained to the scanner at 1000 psi.

3. OPERATION OF DUAL PRESSURE RANGE PUMPS

The Vickers variable displacement, dual range pressure pumps used in this system can be switched from low range (1000 psi) to high range (4000 psi).

Referring to Fig. 2

In normal flight, 90 psi will be acting at 'D' and 1000 psi at 'A'. This will yield a throttled pressure at 'B' which controls the movement of the pump yoke. The result of these pressures at 'D' and 'A' will position the pump yoke so that the output pressure will remain at 1000 psi.

Positioning of the pump control valve is through electrical circuitry. When the pump control valve is energized, pump pressure is fed to port 'D' resetting the spring in the dual

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AERO AIRCRAFT LIMITED
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REPORT NO. 72/System 19/80

SHEET NO. 2 of

TECHNICAL DEPARTMENT

AIRCRAFT

Arrow 2

Title: PROPOSAL FOR
INTRODUCTION OF DUAL
PRESSURE RANGE VARIABLE
DELIVERY PUMPS INTO
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3. OPEFATION OF DUAL PRESSURE RANGE PUMPS (Cont'd)

range control valve. A higher pressure at 'B' is now required to put the dual range control valve spool in equilibrium, thus raising the pumping pressure to 4000 psi.

4. ESTIMATED WEIGHT ANALYSIS OF PROPOSED DUAL RANGE SYSTEM

The following is a list of items which have been deleted from the old system and a list of items to be added to the proposed dual range system.

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5. ESTIMATED WEIGHT ANALYSIS OF PROPOSED DUAL RANGE SYSTEM (Cont'd)

Utility Hydraulic System

Deleted:

	<u>Wt.</u>
2 - Pumps 7-1958-21 @ 16#	32.0 lbs.
1 - Pressure Regulator 7-1958-51	5.5
1 - By-pass Control 7-1956-353	3.0
1 - Thermal By-pass 7-1956-383	1.9
1 - 5" Ø Accumulator 7-1958-185	5.0 (incl. oil)
1 - Charging Valve MS28889	
1 - 200 cu. in. Accumulator	18.0 (incl. oil)
	<u>65.4</u>

Added:

2 - Pumps - Variable Disp. Vickers @ 32#	64.0 lb.
2 - Check Valves	1.5
1 - Pressure Reducing Valve	1.8
1 - Thermal By-pass	1.0
1 - By-pass Relief Valve	1.5
1 - Pump Control Valve	<u>1.0</u>
TOTAL	<u>70.8</u>

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5. (cont'd)

Flying Controls System

<u>Deleted:</u>	<u>Wt.</u>
1 - Motor Vickers No. 3906-30	2.10
1 - Pump Vickers No. 3909-25	4.90
1 - Flow Control Valve 601787	.60
1 - Check Valve	.40
1 - Stop Valve	1.00
1 - N ₂ Charge Valve	.75
1 - 80 in. Accumulator	8.25
1 - Reservoir (R.C.A.)	<u>8.30</u>
Added: <u>0</u>	<u>26.30</u> lbs.
Total weight added to Utility System	70.8 lb.
Total weight deleted from Utility System	65.4
Net weight added to Utility System	<u>5.4</u>
Total weight deleted from Flying Controls	26.3 lbs.
Net weight saved to A/C - 20.9 lbs. less wiring.	

CONCLUSION

1. The introduction of a dual pressure range pumping system in the utility hydraulic system will result in a lighter aircraft hydraulic system (20 lb. wt. saving) and nine less hydraulic items of equipment.
2. As described, the system will not cater for the nitrogen compressor power under discussion for the IR guidance system. It will be possible to provide this power without a major change in concept.
3. The missile extension time will be changed as shown in table below.

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3. (cont'd)

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	Current System	Proposed System
Door Opening Time	0.5 secs	0.5 secs
Missile Extension Time	1.50 secs	1.85 secs

4. The utility compensator size will have to be increased due to the larger fluid capability of the system. Estimated volume required 1050 cubic inches. The existing volume is 935 cubic inches.

5. Equipment - requirements and development
Pumps These pumps will be the same as the flying control pumps with the additional dual range modification.

Remaining valves are of a conventional type.

6. It is anticipated that the existing utility heat exchangers can be used without change and that the section of the R.C.A. heat exchanger now used for the scanner may be deleted. This is now under study.

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AIRCRAFT:
ARROW 2

**SCHEMATIC —
UTILITY HYDRAULICS
SYSTEM**

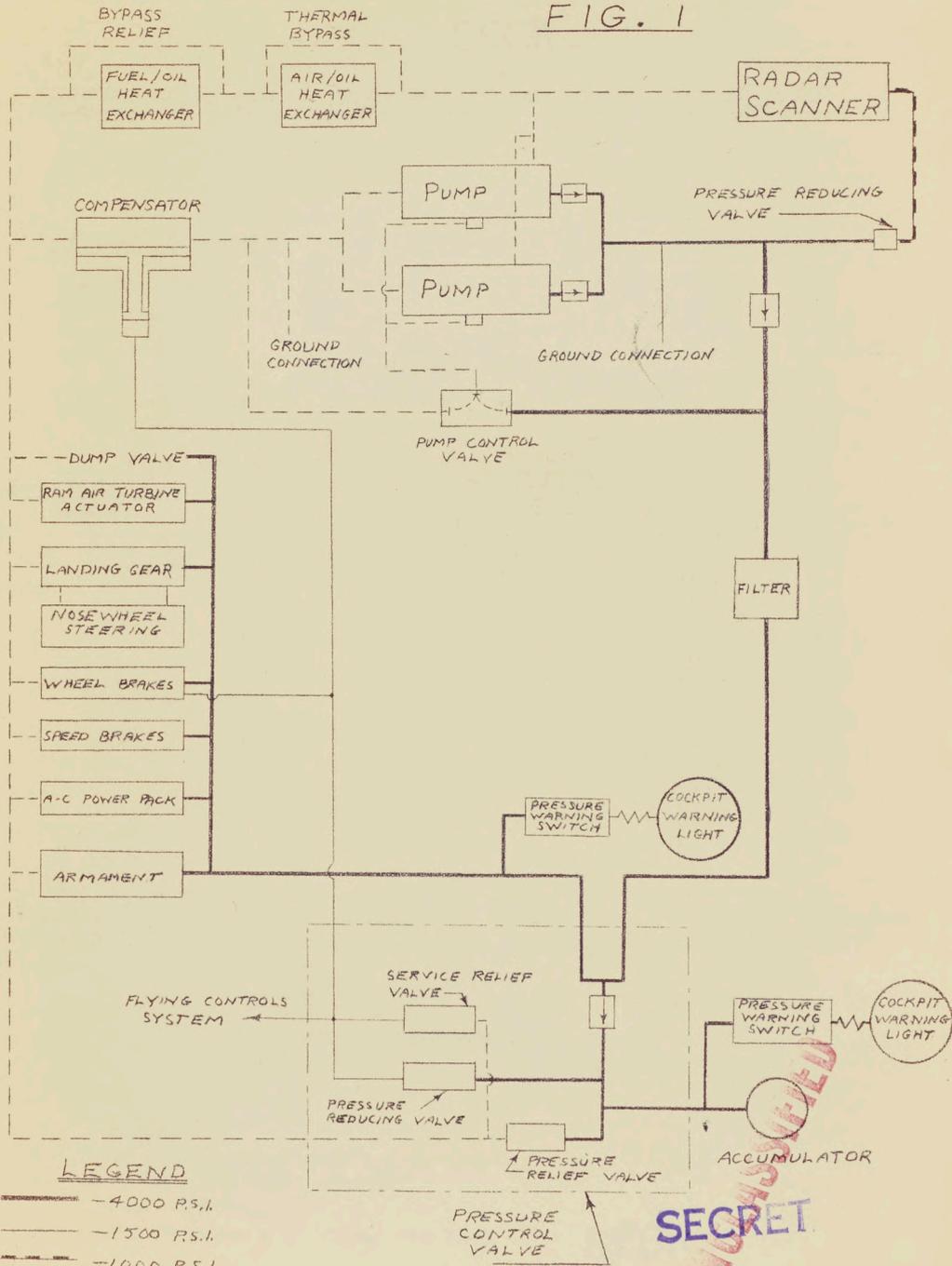
PREPARED BY
G EYOLFSON
W.M. VANCE

CHECKED BY
[Signature]

DATE
16 DEC. '57

DATE

FIG. 1



LEGEND

- 4000 P.S.I.
- 1500 P.S.I.
- 1000 P.S.I.
- 90 P.S.I.
- CHECK VALVE

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SHEET NO 7

AIRCRAFT

ARROW 2

DUAL PRESSURE RANGE
PUMP SYSTEM

PREPARED BY

DATE

J. M. MOORS
W. M. YANGE

16 DEC. 57

CHECKED BY

DATE

D. K. HAN

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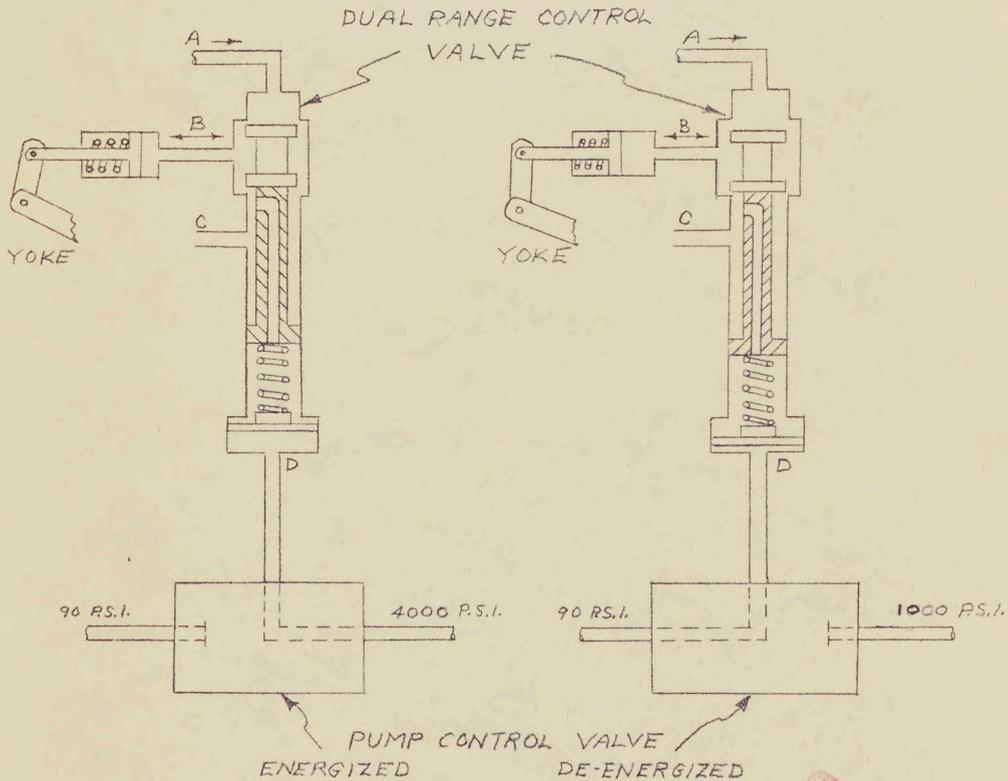
OPERATION OF DUAL PRESSURE RANGE PUMPS

HIGH RANGE

4,000 P.S.I.

LOW RANGE

1,000 P.S.I.



LEGEND

- A - HIGH PRESSURE FLUID
- B - CONTROL CYLINDER FLUID
- C - CASE DRAIN
- D - DUAL RANGE CONTROL FLUID

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