ARROW 1

MAINTENANCE INSTRUCTIONS

ANALYZED

INSTRUMENTS-TURBINE EXHAUST TEMPERATURE

INDICATION 71/MAINT 12/4

SECURITY CLASSIFICATION - CONFIDENTIAL

ARROW 1

MAINTENANCE INSTRUCTIONS

INSTRUMENTS - TURBINE EXHAUST TEMPERATURE INDICATION

71/MAINT 12/4

3 Dec. 57

Prepared: _____
For Maintenance and Reliability Section

Approved: _____
For Technical Design Department

Approved: _____
For Equipment Design Department

Authorized: _____
Project Designer

ENGINEERING DIVISION, AVRO AIRCRAFT LIMITED, MALTON, ONTARIO

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1. DESCRIPTION

1.1 General

1.1.1 A Turbine Exhaust Temperature Indicating System is provided for each engine by two-self-excited chromel-alumel thermocouple circuits.

1.1.2 Each circuit consists of four parallel-connected thermocouples located on the turbine discharge shroud ring of the engine and an indicator which is located on the pilot's main instrument panel. (Ref. dwg. 7-1100-3 sht 4).

1.1.3 The indicator is a hermetically sealed transistorized unit, incorporating a self-balancing bridge, internal thermocouple cold junction compensation, an extremely accurate reference voltage, a DC to AC transistor modulator containing no moving contacts, a high-gain transistor amplifier and an internal warning switch. The indicator has the necessary motor, gears, rebalance and rate potentiometer and dial housed in a 2" dia. case.

1.2 Operation

1.2.1 The thermocouple signal is compared at the exhaust temperature indicator with a rebalance potentiometer signal and the error voltage is converted to AC by the 400 cycle modulator. The rebalance potentiometer is energized by a reference voltage which utilizes the Zener characteristics of a silicon diode. The AC from the modulator is amplified by the transistor amplifier. The output stage of the amplifier supplies one phase of a two phase AC motor which mechanically drives the pointer. The other phase of the motor is fed from the "A" phase of the 115 volt AC primary bus-bars. A warning flag will appear on the dial when the system power is removed.

2. GROUND EQUIPMENT

2.1 Air Conditioner and Generator AC

2.2 Extension Cable

2.3 Veritherm Temperature Test Set

2.3.1 The veritherm test set provides a means of heating the thermocouple probes on the exhaust shrouds to accurate temperature. It is enclosed in a metal carrying case and comprises the following:

2.3.1.1 Four Heater Units

2.3.1.2 Control Panel

2.3.1.3 Junction Box

2.3.1.4 Harness Cable

2.3.2 The amount of heat supplied is adjusted by turning a knob on the control panel. Similarly, the resulting average temperature of the four thermocouples can be accurately read at the control panel. Means are also provided for checking the insulation of the thermocouple circuit and for measuring lead and harness resistances.

2.3.3 The TEMPERATURE dial on the control panel makes ten revolutions in covering the range 0-1000°C. The "hundreds" are read in the window at the top of the dial, while "tens" and "units" are read from the dial which rotates with the knob.

3. FUNCTION TESTS

The function tests of this system will be comprised of two separate and individual tests as follows:

3.1 Engine Run Test

3.1.1 Preparation for Test

3.1.1.1 Ensure that the L and R engine TURBINE DISCHG. TEMP. circuit breakers, located on the forward power circuit breaker panel E1, are in the closed position.

3.1.2 Test Procedure

3.1.2.1 With the left engine running, check that the left engine turbine exhaust temperature indicator is functioning correctly.

3.1.2.2 With the right engine running, check that the right engine turbine exhaust temperature indicator is functioning correctly.

3.2 Calibration Test

3.2.1 Preparation for Test

3.2.1.1 Move both engines into installation position. This will facilitate the use of a minimum length of thermocouple test extension cable.

3.2.1.2 To the appropriate engine under test, connect the extension cable from the thermocouple disconnect to the aircraft disconnect.

3.2.1.3 Remove the thermocouples (with the electrical connections still retained) from each engine exhaust shroud ring.

3.2.1.4 Plug the harness cable into the socket on the control panel and connect the veritherm test set to a 115 volt AC supply.

3.2.1.5 Connect the air conditioner and generator AC to the aircraft.

3.2.2 Right Engine Test

3.2.2.1 Place the four heaters of the test set adjacent to and in a position to receive the thermocouples.

3.2.2.2 Slide the thermocouples into the four heaters.

3.2.2.3 Select the test set line switch to the ON position.

3.2.2.4 Turn the test selector switch to the TEMP. TEST position. A pilot light will indicate if the supply voltage is on.

3.2.2.5 Increase the heater voltage to the maximum by turning the POWER INPUT knob on the test set fully clockwise. This gives the fastest possible warm up to the required test temperature. As the pointer of the balance indicator on the test set approaches centre scale, reduce the heater voltage to a value which will stabilize the temperature at the desired value.

3.2.2.6 Switch the aircraft MASTER ELECTRICS switch to the ON position.

3.2.2.7 Check that the warning flag on the turbine exhaust temperature indicator disappears.

3.2.2.8 Carry out the calibration tests within the temperature ranges as outlined in Table 1, at an approximate ambient temperature of 75°F.

TABLE 1

VERITHERM TEST SET SETTING	INDICATED TEMPERATURE AT TURBINE EXHAUST TEMP. INDICATOR	ACCURACY
150°C	150°C	± 10°C
250°C	250°C	± 10°C
350°C	350°C	± 10°C
450°C	450°C	± 10°C
550°C	550°C	± 5°C
650°C	650°C	± 5°C
750°C	750°C	± 5°C

3.2.2.9 Tap the turbine exhaust temperature indicator at each temperature level. Note the readings before and after tapping the indicator. The difference between readings before and after tapping should not exceed 2°C. The indicated temperatures should correspond with the figures in Table 1.

3.2.3 Left Engine Test

3.2.3.1 Repeat the procedures outlined in Para. 3.2.2 for the left engine.

3.3 Completion of Tests

3.3.1 Switch the MASTER ELECTRICS switch to the OFF position.

3.3.2 Check that the warning flags appear on the turbine exhaust temperature indicators.

3.3.3 Select the test set line switch to the OFF position.

3.3.4 Remove the thermocouples from the test set heaters.

3.3.5 Stow the heaters in the test set case.

3.3.6 Disconnect the test set and unplug the harness cable from the control panel.

3.3.7 Disconnect the air conditioner and generator AC.

3.3.8 Replace the thermocouples in the exhaust shroud rings of both engines.

3.3.9 Disconnect the thermocouples test extension cable.

4. PERIODIC INSPECTIONS

Carry out inspections as outlined in Arrow 1 Maintenance Report 71/MAINT 00/2 - Preliminary Maintenance Schedule.

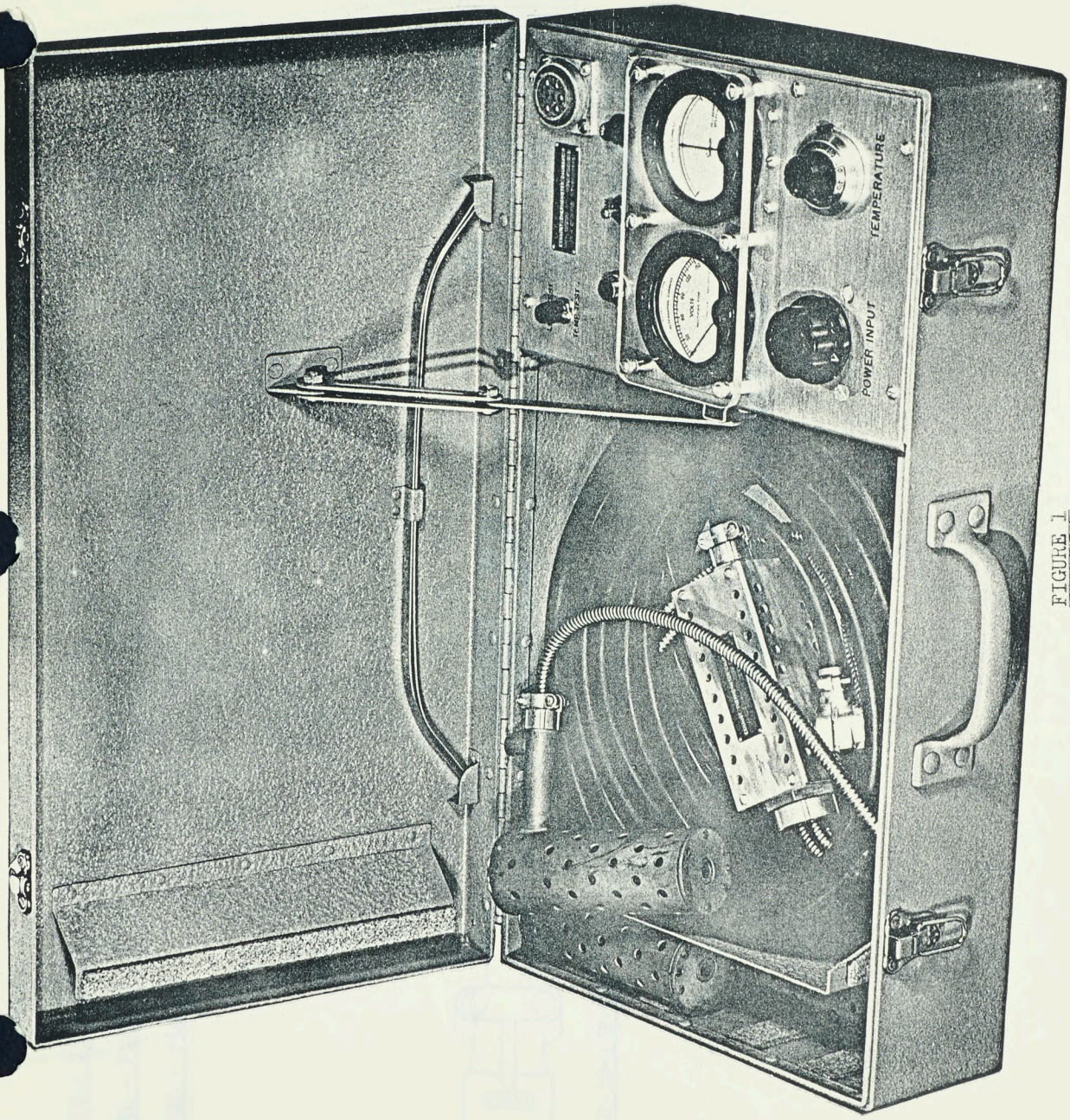

FIGURE 1

VERITHERM TEMPERATURE TEST SET

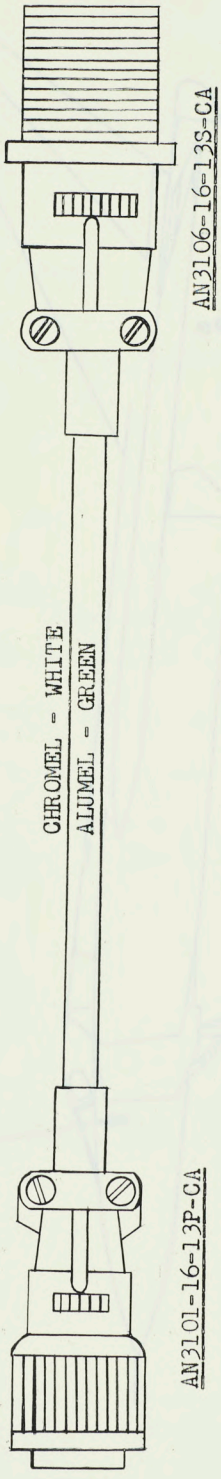

FIGURE 2

THERMOCOUPLE TEST EXTENSION CABLE

LENGTH - 23 ft.

ALUMEL - Pin A

CHROMEL - Pin B

ITEM	DESCRIPTION
1	Indicator - Turbine Discharge Temp. Left
2	Indicator - Turbine Discharge Temp. Right
3	Thermocouples - Turbine Discharge Temp. Left
4	Thermocouples - Turbine Discharge Temp. Right

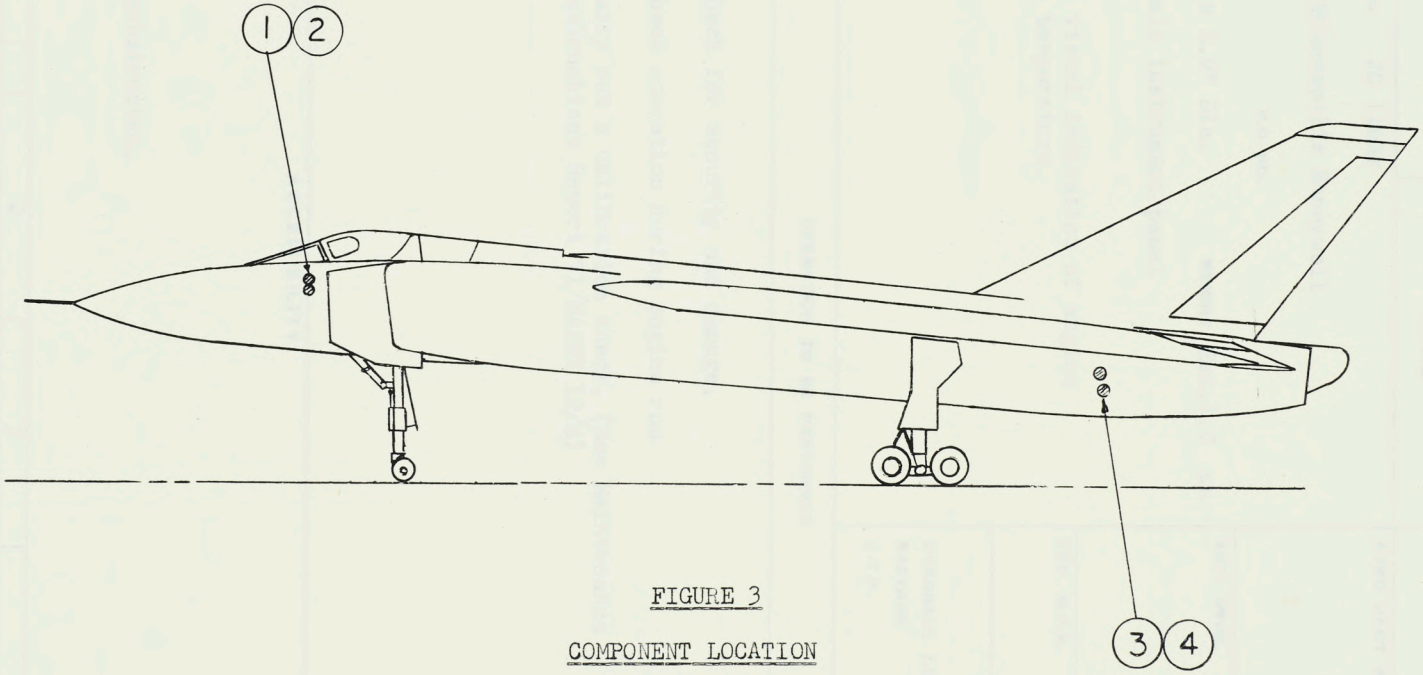

FIGURE 3

COMPONENT LOCATION

MAINTENANCE DATA RECORD

AVRO AIRCRAFT LTD. Engineering Div.

SYSTEM: INSTRUMENTS

REF. NO.: E11/67-68 12-15

DISTRIBUTION: STANDARD +
K. Knowlton
S. Brown

A/C TYPE – Arrow 1

EFF. A/C – 25201

COMPONENT: Indicator - Turbine Discharge Temperature

MANUFACTURER'S PART NO. JG 116A2

MANUFACTURER'S NAME Minneapolis Honeywell

AVROCAN SPEC. E402 E.O. NO.

ENVELOPE SIZE 6.40" x 2.0" Dia. WEIGHT Est.1.0 LB.

LOCATION Pilot's main instrument panel

FUNCTION Used as a visual indication of engine turbine discharge temperature.

AVRO PART NO. 7-1252-13

REF. DWGS. 7-1352-57
7-1100-2 sht 3
7-1100-3 sht 4

REF. M.D.R.

RELIABILITY

OVERHAUL LIFE 1500 HRS.
WASTAGE
Q.T.R.

INSPECTION PERIOD	OPERATION TO BE PERFORMED	MEN × MINUTES EST.	MEN × MINUTES ACTUAL
Primary	Check for security and damage.	1 x 2	
Engine Run	Check operation during engine run	1 x 15	
25 Hr.	Carry out a calibration check. (See Maintenance Instructions Report 71/MAINT 12/4)	1 x 10	

ACCESSIBILITY

Unobstructed.

ISSUE	1	2	3		
DATE	25 May.56	26 Mar.57	14 Nov.57		
COMPILED	WO2 Wentworth	Sgt McEgan	J. Ferguson		
CHECKED	D.Collingwood	D. Collingwood	Sgt McEgan		
APPROVED	G. Emmerson	R.F. Reid	R.F.Reid		

LUBRICATION NIL				
APPLICATION	MATERIAL	SPECIFICATION	FREQUENCY	ACCESS

DETAILS:

GROUND SUPPORT EQUIPMENT	
SPECIAL TOOLS FOR AIRCRAFT USE	SPECIAL TOOLS FOR BENCH USE
NIL	NIL
GROUND TESTING EQUIPMENT	**GROUND HANDLING EQUIPMENT**
Air Conditioner and Generator AC Engine Starting Unit Veritherm Temperature Test Set	Cockpit Access Stand

INTERCHANGEABLE	X	REMOVAL INSTRUCTIONS	MEN × MINUTES	
REPLACEABLE			EST.	ACTUAL
		Loosen 1 holding screw. Withdraw instrument from panel. Disconnect 1 electrical connector.		
		Remove and replace	1 x 5	

MAINTENANCE DATA RECORD

AVRO AIRCRAFT LTD. Engineering Div.

SYSTEM	REF. NO.
INSTRUMENTS	12-46

DISTRIBUTION: STANDARD +
K. Knowlton

A/C TYPE – Arrow 1
EFF. A/C – 25201

COMPONENT
Thermocouples - Turbine Discharge Temperature

MANUFACTURER'S PART NO. 77303-2

MANUFACTURER'S NAME Fenwal Incorp.

AVROCAN SPEC. E 402 E.O. NO.

ENVELOPE SIZE Pending WEIGHT Pending LB.

LOCATION Right and left engine, turbine discharge shroud ring.

FUNCTION To provide a signal of turbine discharge temperature.

AVRO PART NO.
N/A

REF. DWGS. 7-1100-2 sht 27
7-1100-3 sht 4

REF. M.D.R.

RELIABILITY

OVERHAUL LIFE 400 HRS.
WASTAGE
Q.T.R.

INSPECTION PERIOD	OPERATION TO BE PERFORMED	MEN × MINUTES EST.	MEN × MINUTES ACTUAL
Engine Run	Check operation during engine run.	1 x 15	
25 Hr.	Remove the thermocouples from both engine exhaust shroud ring and check for damage and cleanliness.	1 x 15	
	Carry out a calibration check. (See Maintenance Instructions Report 71/MAINT 12/4.)	1 x 10	

ACCESSIBILITY

Remove engines.

ISSUE	1				
DATE	18 Nov.57				
COMPILED	J. Ferguson				
CHECKED	Sgt McEgan				
APPROVED	R.F. Reid				

LUBRICATION NIL				
APPLICATION	MATERIAL	SPECIFICATION	FREQUENCY	ACCESS

DETAILS:

GROUND SUPPORT EQUIPMENT	
SPECIAL TOOLS FOR AIRCRAFT USE	SPECIAL TOOLS FOR BENCH USE
NIL	NIL
GROUND TESTING EQUIPMENT	GROUND HANDLING EQUIPMENT
Air Conditioner and Generator AC Engine Starting Unit Veritherm Temperature Test Set	Cockpit Access Stand

INTERCHANGEABLE	x	REMOVAL INSTRUCTIONS	MEN × MINUTES	
REPLACEABLE			EST.	ACTUAL
		Disconnect electrical connections. Remove two fixing bolts. Withdraw thermocouples from engine exhaust shroud ring.		
		Remove and replace	1 x 10	