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CF105  
71 Maint  
12-2

ANALYZED

SECURITY CLASSIFICATION - ~~CONFIDENTIAL~~

Classification cancelled / Changed to UNCLASS

By authority of AVES

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ARROW 1

MAINTENANCE INSTRUCTIONS

INSTRUMENTS - PRESSURE RATIO INDICATION

71/MAINT 12/2

14 Jan. 1958

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COMPONENT DATA

M.D.R. E11/69	Indicator - Engine Pressure Ratio (Left)
M.D.R. E11/70	Indicator - Engine Pressure Ratio (Right)
M.D.R. E183	Transducer - Engine Pressure Ratio (Left)
M.D.R. E184	Transducer - Engine Pressure Ratio (Right)



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## 1. DESCRIPTION

### 1.1 General

- 1.1.1 The purpose of the Pressure Ratio Indicating System is to sense the engine air intake pressure and the turbine discharge outlet pressure and provide a direct indication of the ratio between the two pressures. The pilot uses this indication to set the power levers for optimum power for any flight condition.
- 1.1.2 Each engine system consists basically of a pressure ratio indicator and a pressure ratio transducer and is calibrated to indicate a pressure ratio of 1.0 to 3.5 ins. Hg inclusive.
- 1.1.3 The transducer consists of a pressure ratio transmitter which converts the engine pressure ratio to electrical signals.
- 1.1.4 The indicator is of the dial type, with a single pointer to give a visual indication of the ratio of the engine air intake (Pt<sub>2</sub>) and the turbine discharge (Pt<sub>7</sub>) pressures.
- 1.1.5 Pressure probes located on each engine pick up the total pressures existing at the engine air intake (Pt<sub>2</sub>) and the turbine discharge outlet (Pt<sub>7</sub>). These pressures are transformed into an electrical signal by the transducer and transmitted to the indicator.
- 1.1.6 Each system derives a 115 volt AC supply from the "A" phase of the primary AC bus. (Ref. drawing 7-1100-3, Sht. 4.)

### 1.2 Operation

- 1.2.1 The pressure of the engine air intake (Pt<sub>2</sub>) is introduced directly into the transducer case, where the pressure works against a sealed evacuated bellows. The pressure of the turbine discharge outlet (Pt<sub>7</sub>) which has been contaminated by burned gases, is introduced into the transmitter directly into a second bellows assembly, so that the burned gases cannot contaminate the internal mechanism of the transducer. The two pressures cause differential bellows movement, which applies a force on a sensing arm consisting of a motor-repositioned capacitor type pick-off. The resultant movement of the sensing arm transmits an electrical signal expressing the ratio between the forces applied to each bellows. This signal is amplified and fed to a reset motor which positions the synchro rotor within the transducer and at the same time repositions the capacitor plates to cancel the original signal. The positioning of the synchro rotor is the final expression of





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1.2.1 (Continued)

ratio within the transducer. This synchro position becomes an electrical signal containing direction information which is fed to the pressure ratio indicator through an interconnecting harness.

1.2.2 The synchro position signal from the transducer is received into the indicator by a synchro motor which is slaved to the synchro rotor in the transducer. This means that the position of the indicator synchro rotor will be exactly the same as the transducer synchro rotor. The shaft of the synchro motor will position the dial pointer of the indicator, giving a direct indication of the ratio of pressures existing between the engine air intake (Pt2) and the turbine discharge outlet (Pt7).

2. GROUND EQUIPMENT

2.1 Air Conditioner and Generator AC

2.2 MB-1 Pitot Static Test Set

2.2.1 The MB-1 test set will provide a means to carry out a system calibration test. It is a portable unit enclosed in a metal carrying case and comprised of the following:

- (a) 1 hand-operated vacuum pump.
- (b) 1 hand-operated pressure pump.
- (c) 6 needle-type control valves.
- (d) 1 pressure gauge, 10 to 100 ins. Hg.
- (e) 1 vacuum gauge, 0 to 30 ins. Hg.
- (f) 1 altimeter.
- (g) 1 machmeter
- (h) 1 temperature gauge.
- (i) 1 circular slide rule type computer.
- (j) 1 pitot test line.
- (k) 1 static test line.
- (l) various test line connections.



- 2.2.2 The pressure and vacuum applied in ins. Hg can be determined by operating the pressure and vacuum hand pumps and observing the readings on the pressure and vacuum gauges.

### 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 PRESS. RATIO current limiters, located on the aft circuit limiter panel E20, are in closed position.

##### 3.1.2 Test Procedure

- 3.1.2.1 With the left engine running, check that the left engine pressure ratio indicating system is functioning correctly.
- 3.1.2.2 With the right engine running, check that the right engine pressure ratio indicating system is functioning correctly.

#### 3.2 Calibration Test

##### 3.2.1 Preparation for Test

- 3.2.1.1 Remove the hydraulics compensator access panel at Stn. 665.
- 3.2.1.2 Disconnect the INLET connections at the L and R engine transducers.
- 3.2.1.3 Disconnect the EXHAUST connections at the L and R engine transducers.
- 3.2.1.4 Connect the PITOT test line of the MB-1 test set to the EXHAUST port of the left engine transducer.
- 3.2.1.5 Connect the STATIC test line of the MB-1 test set to the INLET port of the left engine transducer.
- 3.2.1.6 Connect the air conditioner and generator AC to the aircraft.
- 3.2.1.7 Select the MASTER ELEC. switch to the ON position.



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### 3.2.2 Left Engine Test

- 3.2.2.1 Close the two VENT valves, the CROSS BLEED valve and the SHUNT VALVE and open the PRESSURE SOURCE and VACUUM SOURCE valves on the MB-1 test set.
- 3.2.2.2 Using the VACUUM PUMP for engine inlet pressure and the PRESSURE PUMP for engine exhaust pressure, set up the pressures as indicated in TABLE 1.
- 3.2.2.3 On completion of the tests as indicated in TABLE 1, return the left engine system to normal by slowly opening the two test set VENT valves.
- 3.2.2.4 Disconnect the PITOT test line from the EXHAUST port of the left engine transducer.
- 3.2.2.5 Disconnect the STATIC test line from the INLET port of the left engine transducer.

### 3.2.3 Right Engine Test

- 3.2.3.1 Connect the PITOT test line to the MB-1 test set to the EXHAUST port of the right engine transducer.
- 3.2.3.2 Connect the STATIC test line of the MB-1 test set to the INLET port of the right engine transducer.
- 3.2.3.3 Close the two test set VENT valves.
- 3.2.3.4 Using the VACUUM PUMP for engine inlet pressure and the PRESSURE PUMP for engine exhaust pressure, set up the pressures as indicated in TABLE 1.
- 3.2.3.5 On completion of the tests as indicated in TABLE 1, return the right engine system to normal by slowly opening the two test set VENT valves.





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TABLE 1

MB-1 TEST SET VACUUM INS. HG. GAUGE	MB-1 TEST SET PRESSURE INS. HG. GAUGE	PRESSURE RATIO INDICATOR READING INS. HG. ABS.
0	42.00	2.4 $\pm$ .05
10	40.00	3.5 $\pm$ .05
10	28.00	2.9 $\pm$ .05
10	16.00	2.3 $\pm$ .05
20	3.00	3.3 $\pm$ .05
5	21.00	2.0 $\pm$ .05
0	15.00	1.5 $\pm$ .05

### 3.3 Completion of Tests

- 3.3.1 Disconnect the PITOT test line from the EXHAUST port of the right engine transducer.
- 3.3.2 Disconnect the STATIC test line from the INLET port of the right engine transducer.
- 3.3.3 Connect the aircraft INLET and EXHAUST connections to the L and R engine transducers.
- 3.3.4 Replace the hydraulics compensator access panel at Stn. 665.
- 3.3.5 Select the MASTER ELEC. switch to the OFF position.
- 3.3.6 Disconnect the air conditioner and generator or AC from the aircraft.

### 4. PERIODIC INSPECTIONS

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



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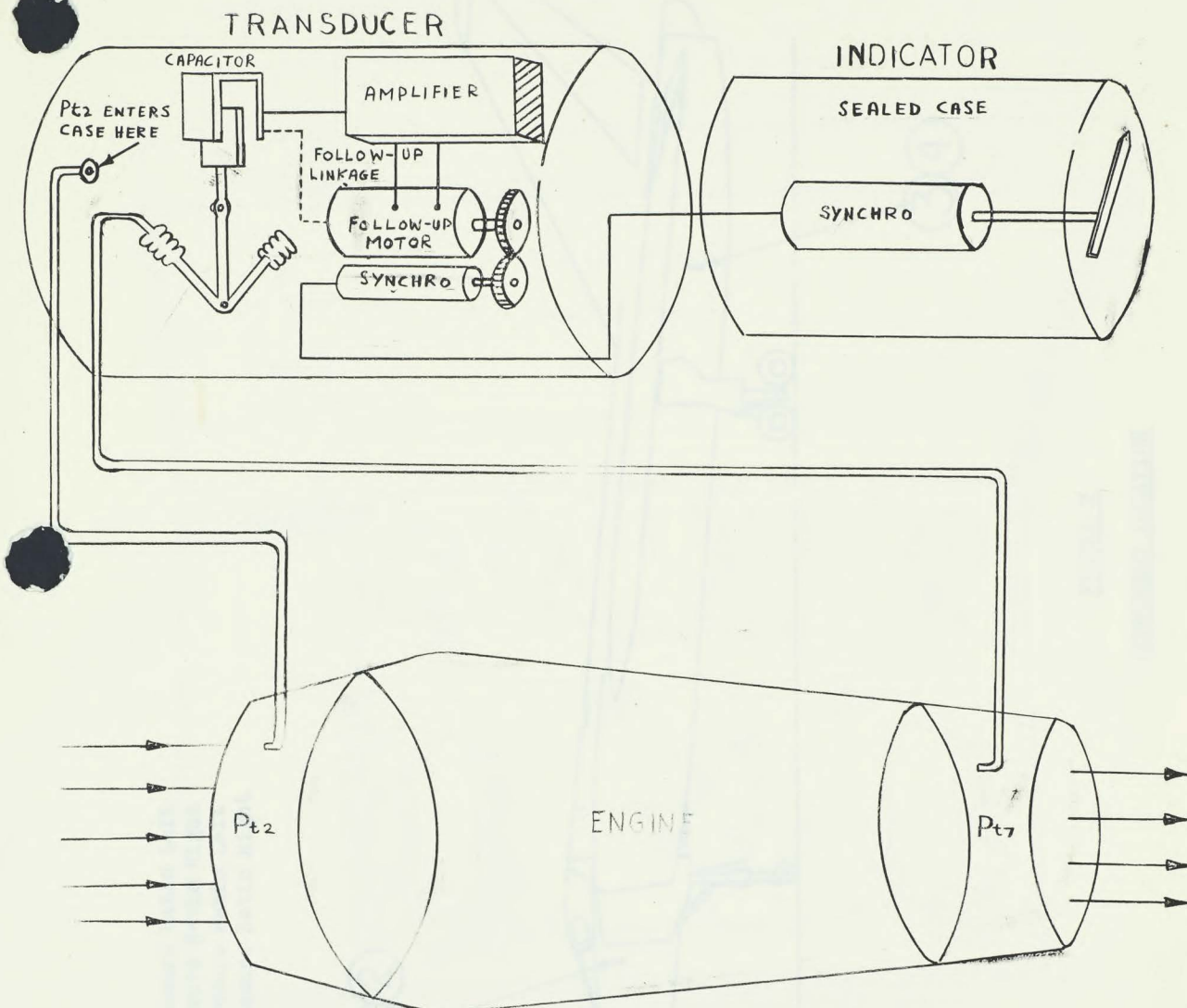


FIGURE 1  
PRESSURE RATIO SYSTEM (SCHEMATIC)



1. Indicator - Pressure Ratio Left
2. Indicator - Pressure Ratio Right
3. Transducer - Pressure Ratio Left
4. Transducer - Pressure Ratio Right

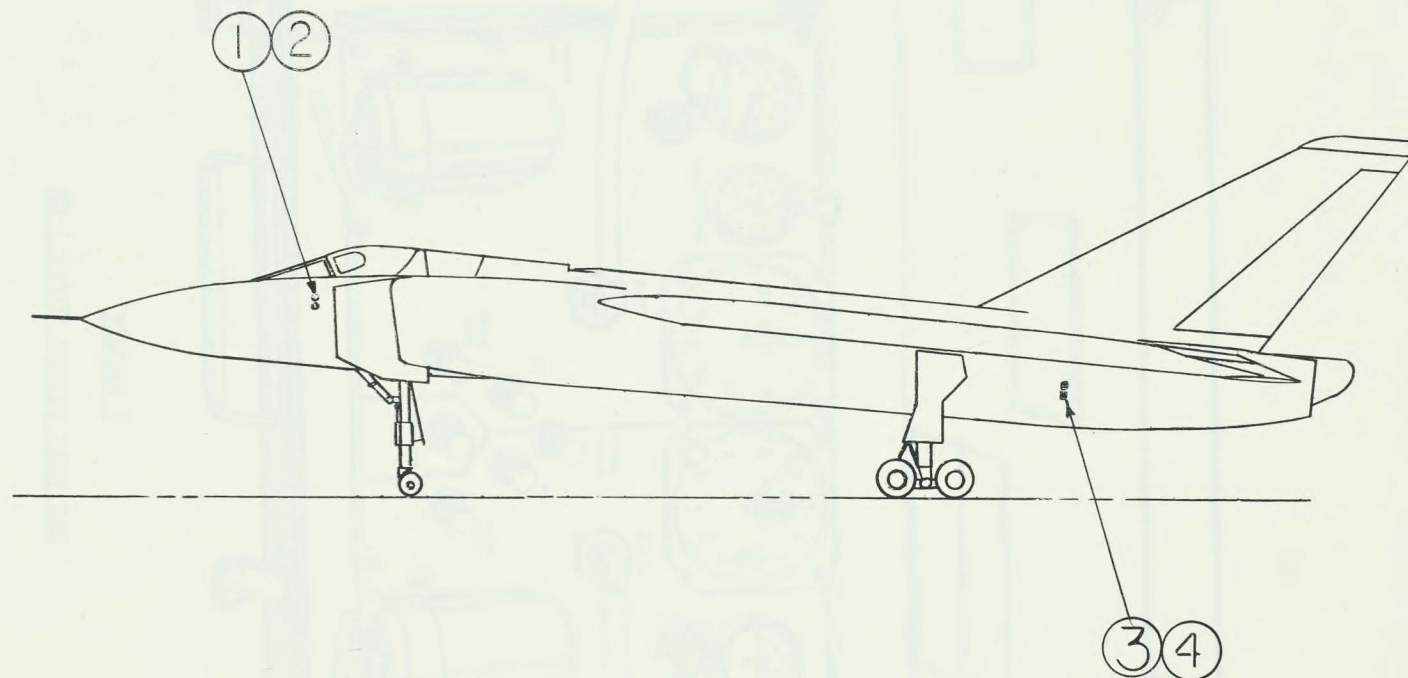


FIGURE 2  
COMPONENT LOCATION



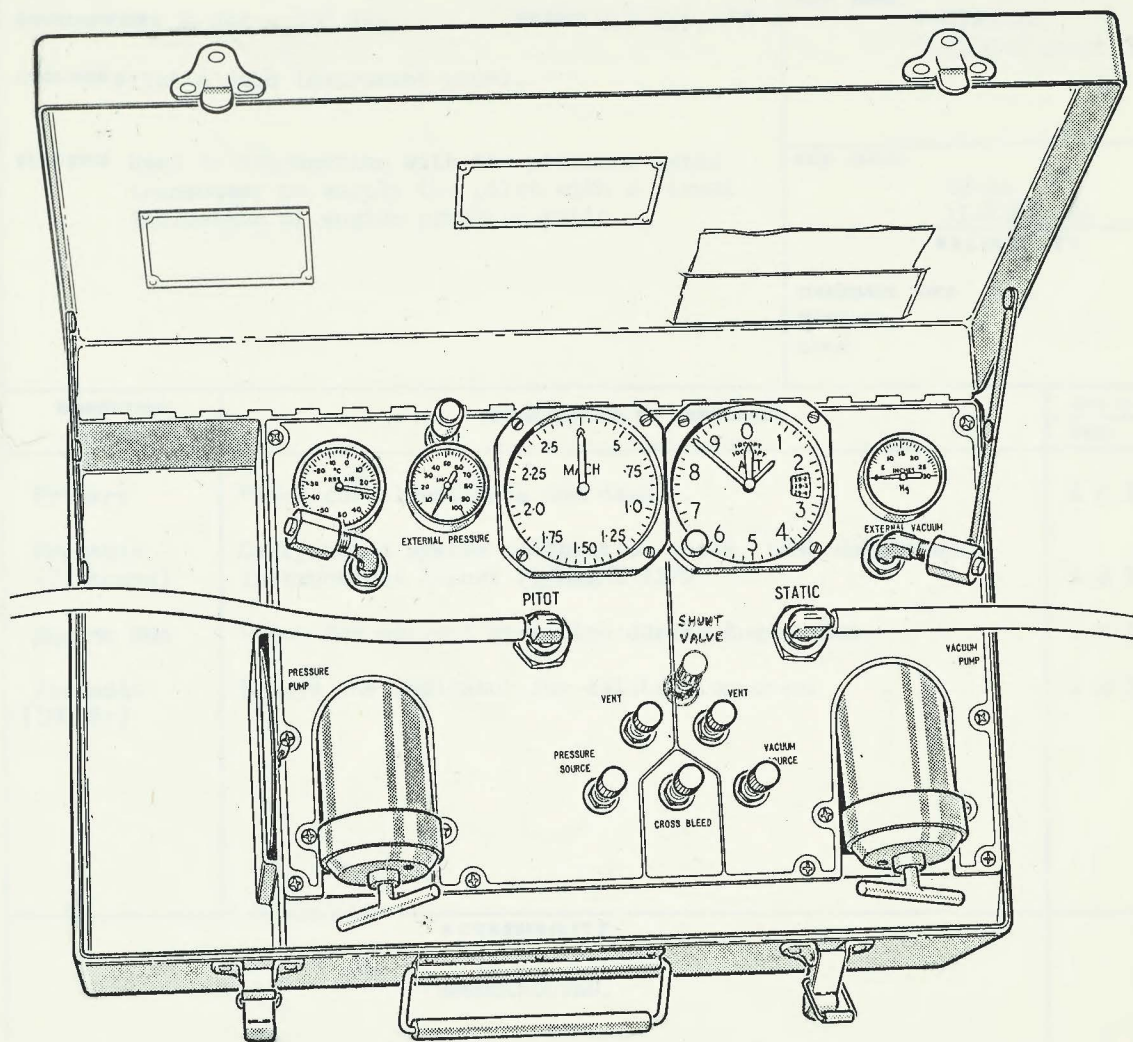


FIGURE 3

MB-1 PITOT STATIC TEST SET

MAINTENANCE DATA RECORD				SYSTEM		REF. NO.	
AVRO AIRCRAFT LTD. Engineering Div.				INSTRUMENTS		E11/69-70	
DISTRIBUTION: STANDARD + S.H. Brown K. Knowlton.		A/C TYPE - CF-105 EFF. A/C - 25201		COMPONENT Indicator - Pressure Ratio L & R.			
MANUFACTURER'S PART NO. 24138 MANUFACTURER'S NAME Minneapolis - Honeywell AVROCAN SPEC. E.358 E.O. NO. ENVELOPE SIZE 5.75" x 2.0 dia. WEIGHT 0.7 est. LB. LOCATION Pilot's main instrument panel. FUNCTION Used in conjunction with the pressure ratio transducer to supply the pilot with a visual indication of engine pressure ratio.				AVRO PART NO. 7-1252-16			
				REF. DWGS. 7-0325-22 7-1100-2 sheet 3			
				REF. M.D.R. 12-14 11-E183-184			
				RELIABILITY OVERHAUL LIFE HRS. WASTAGE Q.T.R.			
INSPECTION PERIOD		OPERATION TO BE PERFORMED		MEN X MINUTES			
				EST.		ACTUAL	
Primary		Check for cleanliness and damage.		1 x 1			
Periodic (25 hours)		Carry out a system calibration check. (See maintenance instructions Report 71/MAINT 12/2		1 x 15			
Engine Run		Check for correct operation during Engine Run.		1 x 10			
Periodic (100 Hr)		Remove the indicator for calibration check		1 x 3			
ACCESSIBILITY UNOBSTRUCTED.							
ISSUE	1						
DATE	Dec. 4/57						
COMPILED	J. Ferguson						
CHECKED	K. Lowe						
APPROVED	R. F. Reid.						



[illegible]

MAINTENANCE DATA RECORD				SYSTEM		REF. NO.	
AVRO AIRCRAFT LTD. Engineering Div.				L/P Pneumatics		11-E183-184	
DISTRIBUTION: STANDARD + S. Brown K. Knowlton.		A/C TYPE - Arrow 1 EFF. A/C - 25201		COMPONENT Transducer - Pressure Ratio L & R.			
MANUFACTURER'S PART NO. 24094-2 MANUFACTURER'S NAME Airesearch Mfg. Co. AVROCAN SPEC. E.358 E.O. NO.				AVRO PART NO. 7-1858-13			
ENVELOPE SIZE 8.81" x 6.80" x 5.74" WEIGHT 4.9 LB.				REF. DWGS. 7-1858-15 L.H. 7-1858-17 R.H. 7-1858-1 7-1100-3 Sheet 4			
LOCATION Inside Fuselage at Stn. 662 - L & R Hand.				REF. M.D.R.			
FUNCTION Transforms Pressure Readings from the Engine Inlet and Exhaust into Electrical Signals. for use with the pressure ratio indicator (Ref. 7-1252-16) in the front cockpit to supply the pilot with visual indication of engine pressure ratio.				RELIABILITY OVERHAUL LIFE 1500 HRS. WASTAGE Q.T.R.			
INSPECTION PERIOD		OPERATION TO BE PERFORMED		MEN X MINUTES			
				EST.		ACTUAL	
Primary		Check Unit and connections for security		1 x 1			
Periodic (25 hours)		Carry out a System calibration check. (See Maintenance Instructions report 71/MAINT 12/2).		1 x 15			
Engine Run.		Check for correct operation during Engine Run.		1 x 10			
Periodic (100 Hours)		Remove Transducer For Calibration Check.		1 x 10			
ACCESSIBILITY Remove Hydraulic Compensator Access Panel at Stn. 665 - 30 screws. Remove #3 Service Panel - 34 Camlocs. Remove & Replace				1 x 18		1/2	
ISSUE	1	2					
DATE	Dec. 14/56	Dec. 4/ 57					
COMPILED	D. Collingwood	J. Ferguson					
CHECKED	Sgt. Foster	K. P. Lowe					
APPROVED	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
Engine Starting Unit, Air Conditioner & Generator AC MBI Pitot Static Test Set.	Cockpit Access Stand, Maintenance Platform 4G/1596.

INTERCHANGEABLE	REMOVAL INSTRUCTIONS	MEN X MINUTES	
REPLACEABLE		EST.	ACTUAL
	<p>Disconnect 1 Electrical Connector</p> <p>Disconnect 2 pipe lines.</p> <p>Remove 4 Mounting Bolts.</p> <p>Remove and Replace</p>	1 x 20	