

Group E ENGINE INSTRUMENTS

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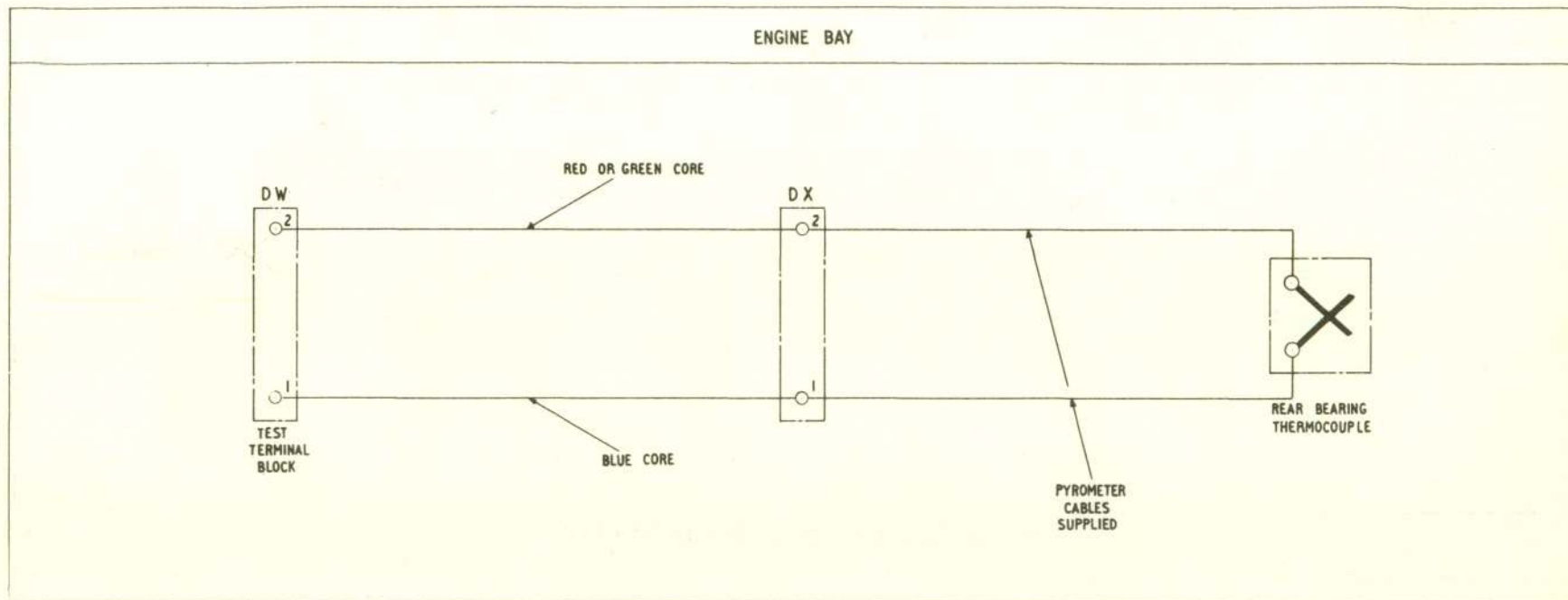


Fig. 1. Rear bearing thermocouple - EA

INTRODUCTION

1. This group describes the purpose, and method of operation, of all engine instruments installed in the aircraft, together with the necessary servicing notes. The information concerning each instrument is brief in nature, and where a more detailed description is required, reference should be made to the specialist Air Publications mentioned in the text.

DESCRIPTION

Rear bearing thermocouple

2. A thermocouple is fitted at the rear bearing location of the engine.

Manufactured of copper and constantan, the couple, complete with leads, is positioned in the engine bay and is not connected to any indicating instrument. The leads terminate at T.B. DW, affording a point at which a suitable test instrument can be connected to ground check the temperature of the rear bearing. The thermocouple and leads have a specific resistance, and a Mk.1 temperature indicator may now be used as described in A.P.1275A, Vol.1, Sect.4.

Exhaust gas thermometer

3. The exhaust gas thermometer is

located on the starboard side of the main instrument panel and is independent of the main electrical supply. Operating on the thermocouple principle, the instrument shows the pilot the temperature of the exhaust gases so that he may operate the engine at maximum efficiency, and ensure that the safe working temperature of the engine is not exceeded. The resistance bulb is located in the upper portion of the engine rear cone. Further information may be obtained from A.P.1275A, Vol.1, Sect.4.

Engine oil thermometer

4. Indication of the engine oil tem-

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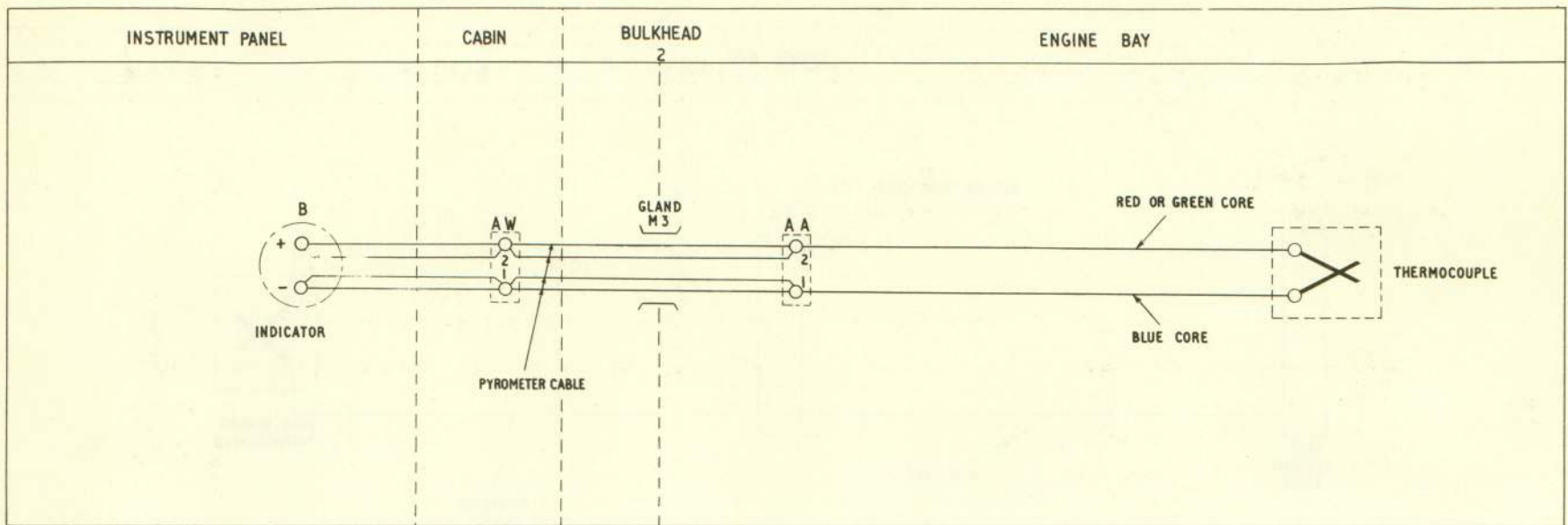


Fig.2. Exhaust gas thermometer - EJ

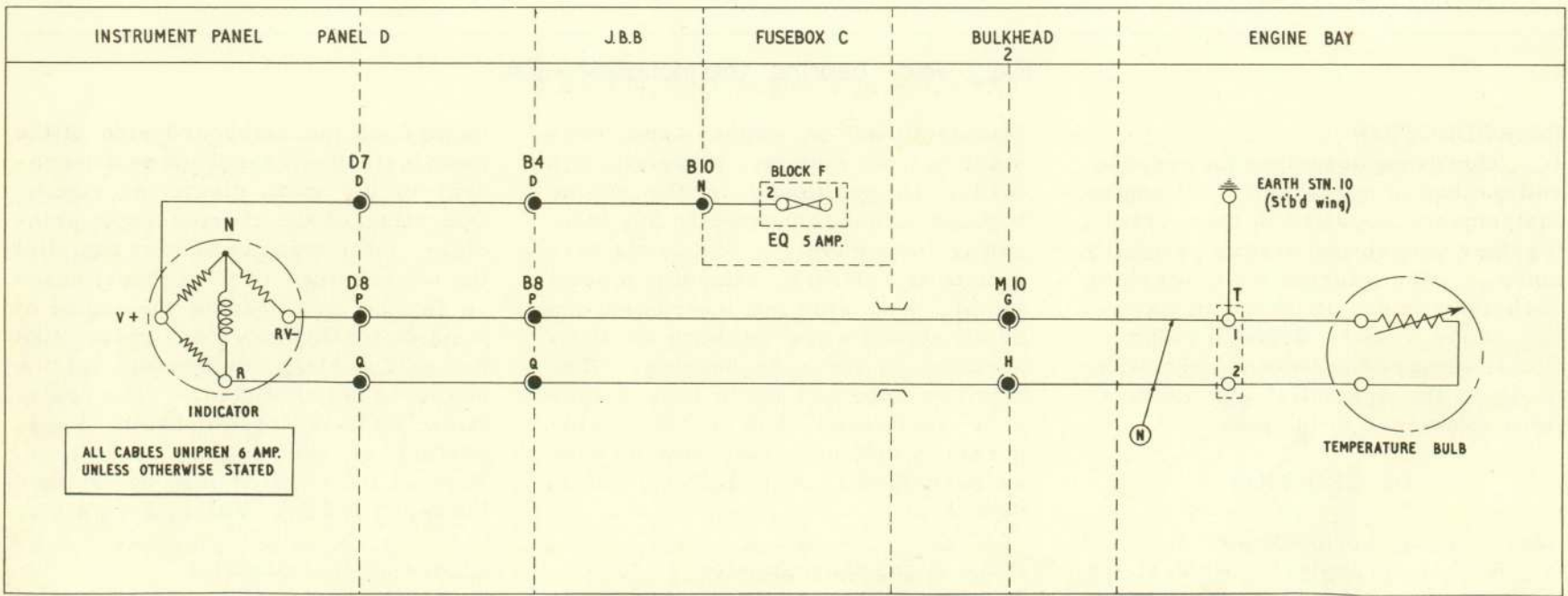


Fig.3. Engine oil thermometer - EQ

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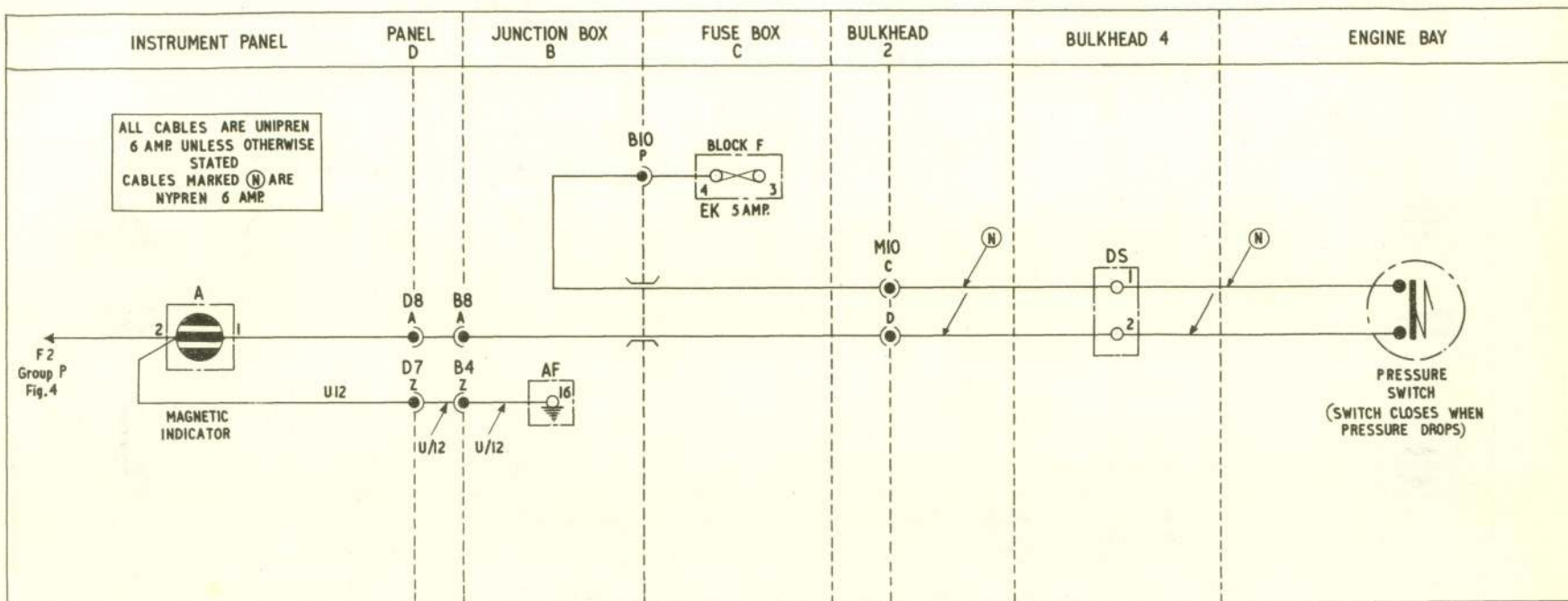


Fig. 4. Fuel pressure indicator - EK

perature is given by an electrically operated instrument mounted at the lower centre of the instrument panel. The dial calibration is from -50 to +150 deg. C and the gauge operates on the ratiometer principle in conjunction with a resistance bulb installed in the engine oil filter. Further information concerning oil thermometers and their principle of operation will be found in A.P. 1275A, Vol. 1, Sect. 4.

Fuel pressure indicator

5. A magnetic indicator located on the lower starboard side of the instrument panel indicates whether or not the fuel pressure is being maintained;

under normal operating conditions the indicator will show a black segment. If there is an excessive fall in the fuel pressure, a pressure switch connected into the main fuel line will close its contacts and complete the circuit to the indicator which will then show a white segment. A description of the indicator will be found in A.P. 4343B, Vol. 1, Sect. 18.

Fuel transfer indicator

6. Two magnetic indicators, located on the upper starboard side of the instrument panel, show when fuel is being transferred from the wing-tip tanks. The contacts of the pressure-

operated switch are opened by the pressure of fuel during the period of fuel transfer, and the indicators under normal operating conditions will show a black segment. In the event of fuel failure, the pressure switch contacts close, and the indicator will show a white segment. These indicators are further described in A.P. 4343B, Vol. 1, Sect. 18. The fuel system for the aircraft is described in Sect. 4, Chap. 2 of this book.

TACHOMETER AND ENGINE MAX R.P.M. CONTROL

Tachometer

7. The engine tachometer system

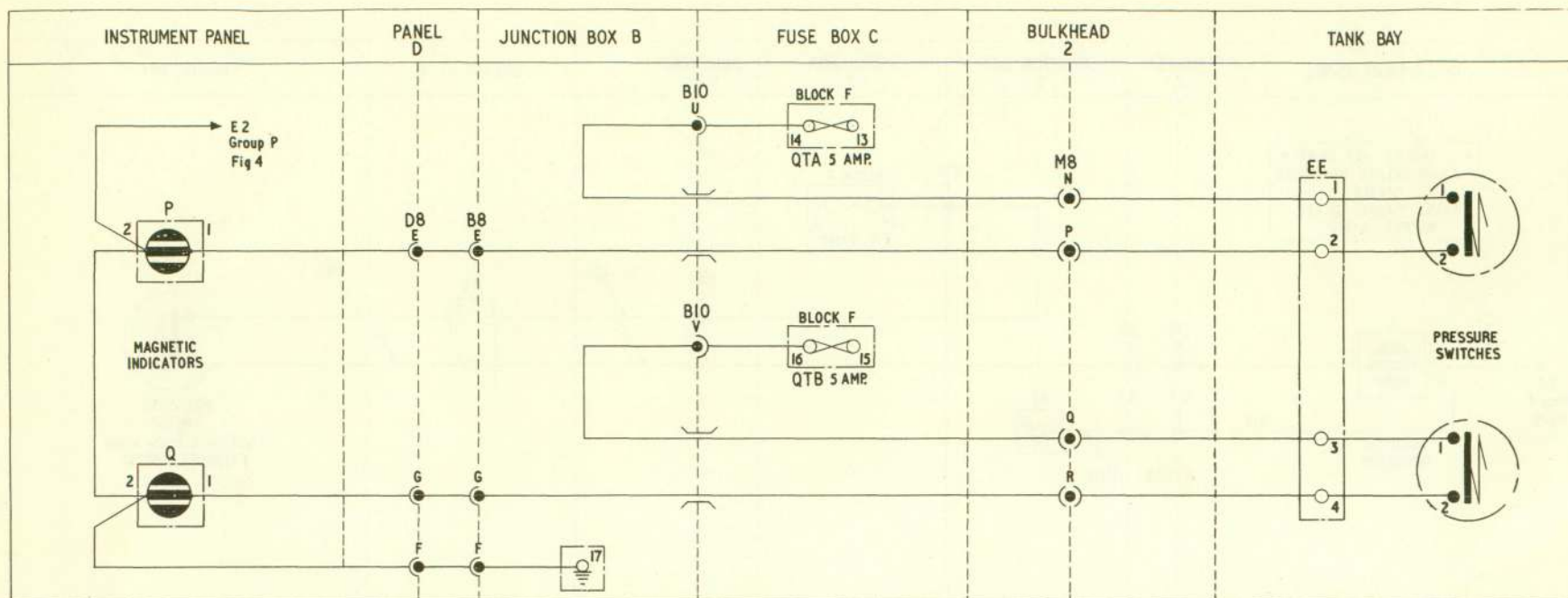


Fig. 5. Fuel transfer indicators-QT

comprises an engine-driven generator Mk.8 working in conjunction with an indicator Mk.10A. The indicator is mounted on the lower starboard side of the instrument panel and is calibrated from 1200 to 12000 r.p.m. The dial has an outer scale graduated in hundreds of r.p.m. and an inner scale in thousands of r.p.m.

8. The tachometer generator is mounted on top of the engine, immediately forward of the generator drive gearbox, and operates at engine speeds up to 6000 r.p.m., the ratio of indicated speed to generator speed being 2:1. To prevent the ingress of engine oil, the generator is fitted with

a synthetic rubber seal at the drive end.

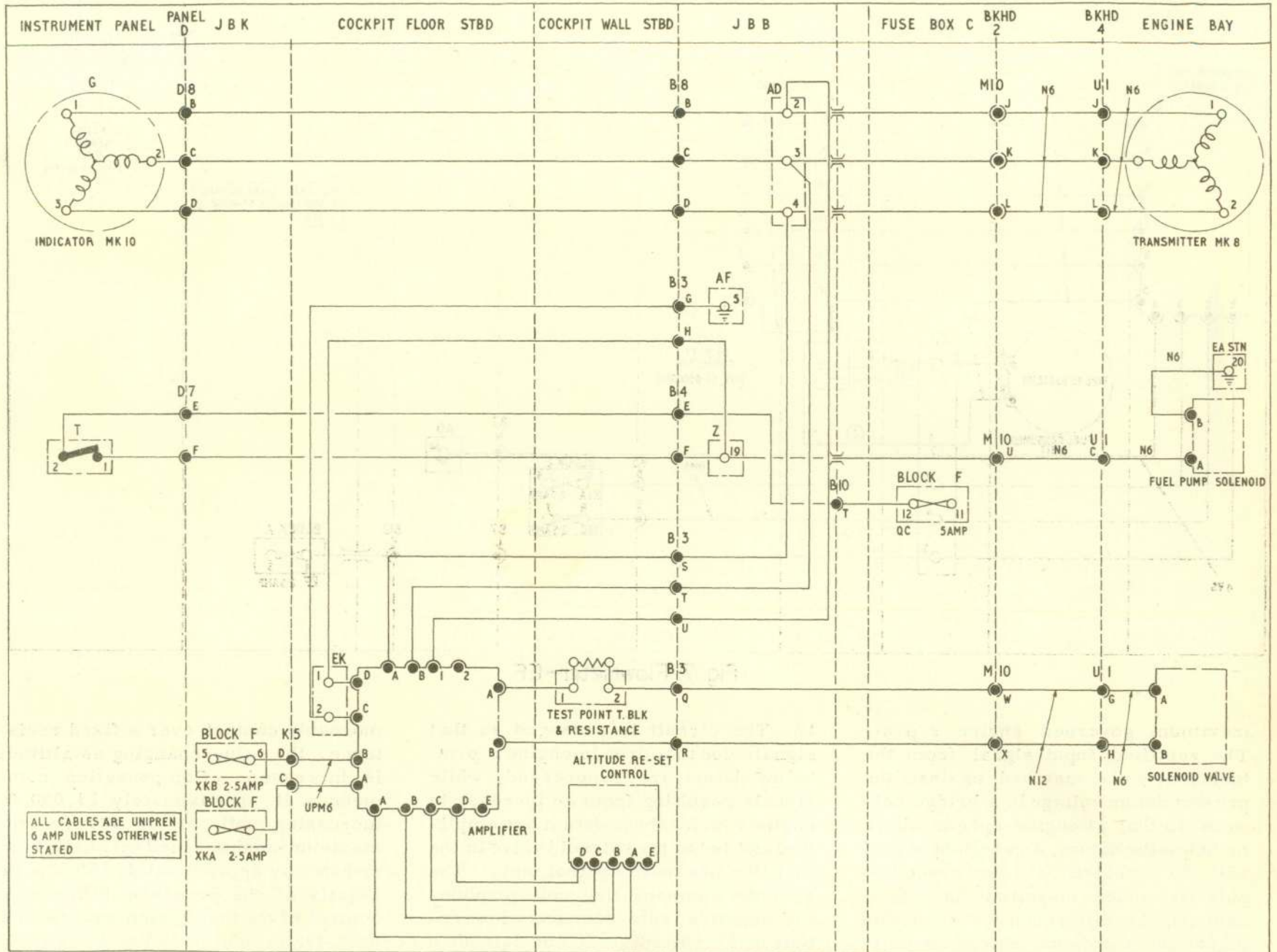
9. Further information concerning the tachometer generator will be found in A.P.1275A, Vol.1, Sect.1, and standard serviceability tests and tolerances for the indicator will be found in the same book.

Engine max. r.p.m. control

10. Description: The engine fuel system fitted to the Ghost engine Mk.105 on this aircraft is regulated by an engine maximum r.p.m. control system comprising a servo throttle unit, a magnetic amplifier and an altitude compensating unit. This installation

simplifies engine handling in flight at altitude, under operational conditions, and provides a control system which automatically compensates for the inherent rise in jetpipe temperature at altitude and is not influenced by changes in the specific gravity of the fuel. The control system is fully described in A.P.4320A and C, Vol.1, Part 1, Sect.1.

11. Operation: The system is essentially an engine top speed or maximum r.p.m. control. An a.c. signal is taken from the tachometer system and is fed to a discriminator and rectifier circuit. The discriminator circuit can be adjusted to set the



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Fig.6 Tachometer and engine r.p.m. control

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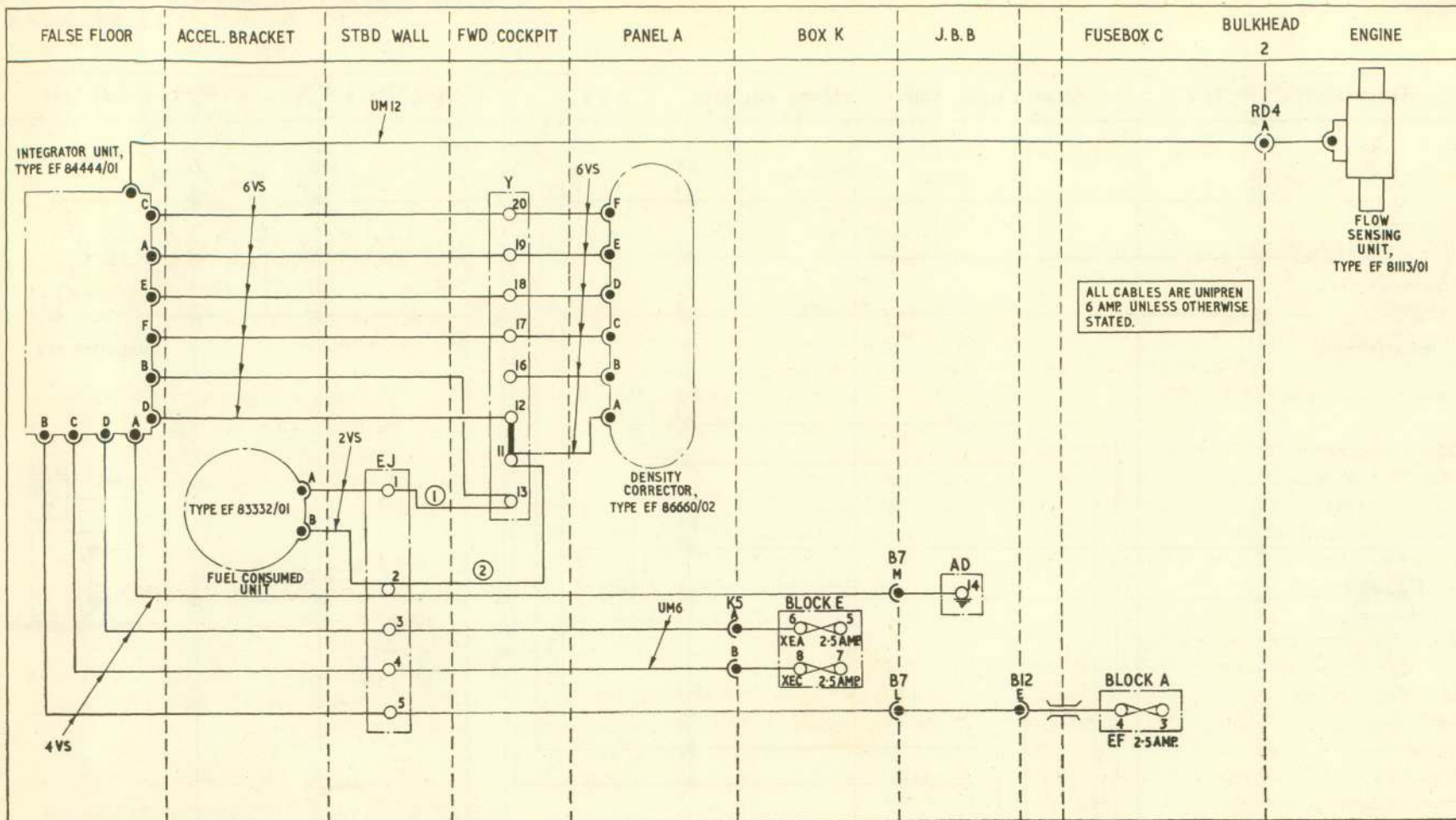


Fig. 7. Flowmeter-EF

maximum governed engine r.p.m. The rectified input signal from the tachometer is matched against the pre-set datum voltage in a bridge network so that at engine speeds above or below the datum, a resultant signal will be created of corresponding polarity whose magnitude is dependent on the difference between this signal and the datum reference voltage.

12. The circuit is arranged so that signals due to a drop in engine r.p.m. below datum are suppressed, while signals resulting from an increase in engine r.p.m. above datum are amplified and fed to the solenoid valve in the fuel line pressure control unit. The altitude compensating unit provides the negative rate compensation required at altitude. It consists of a barometric capsule which operates a

moveable contact over a fixed resistance, the value changing as altitude is increased. Compensation commences at approximately 23,000 ft. increasing until at 45,000 ft. the maximum engine speed will have been reduced by approximately 150 r.p.m. Details of the pressure differential control of the fuel system are given in A.P.4320A and C, Vol.1, Part 1, Sect.1.

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13. The isolating switch may be used for take-off conditions if desired but should only be operated in flight in case of emergency.

WARNING . . .

During ground running or in flight under max. r.p.m. control, ensure that the a. c. power supply is not interrupted when the engine is at max. r.p.m. as overspeeding and serious damage may result.

Later aircraft will have the circuit modified to permit the use of a special test set which can be plugged in at a socket located adjacent to the resistance and test T.B. shown in the wiring diagram fig. 6.

Flowmeter indicator system

14. The Simmonds Flowmeter Indicator System consists of:- Flow Sensing Unit Type E.F. 81113/01, Density Corrector Type E.F. 86660/02, Integrator Unit type E.F. 84444/01 and Indicator Unit type E.F. 83332/01. For full descriptions of these units refer to A.P. 1275A, Vol. 1, Section 18.

Flow sensing unit

15. This unit is mounted in the Fuel supply line in the Engine Bay and provides an A.C. signal which is fed to the Integrator Unit. The frequency and voltage of this signal varies with the rate of flow of fuel through the sensing unit.

Density corrector

16. Mounted on Panel A, easily accessible to the observer's right hand, the Density Corrector provides electrical correction to the Sensing Unit signals to take Fuel Density into account.

Indicator Unit

17. This consists of a three digit counter mounted on the Accelerometer Panel and indicates the amount of fuel remaining in LBS.

Integrator unit

18. The electronic circuits necessary for the translation of rate of fuel flow into lbs weight of fuel are contained in the Integrator Unit, which is mounted in the Cockpit False Floor. The signals from the Sensing Unit and Density Corrector are mixed, pulsed and fed to the Indicator Unit. A self-contained Power Pack, fed from the aircraft D.C. and A.C. Power circuits, is also incorporated.

SERVICING

Rear bearing thermocouple

19. Ground testing: Connect an indicator, Engine Cylinder Temperature, Mk. 1 (Stores Ref. 6A/1305) to the terminal block DW on the starboard rib 1 in the engine bay, using a compensating lead, Type A (Stores Ref. 6A/841). This lead must be modified by shortening its length so that its overall resistance is re-

duced from the standard value of 1.75 ohms. to 1.55 ohms. It is essential that correct polarity is observed; the COPPER lead is identified with a RED or GREEN coloured sleeve while the CONSTANTAN lead is coloured with a BLUE sleeve. The COPPER lead must be connected to the positive terminal of the indicator.

20. The shunt fitted to the indicator must be removed for the purpose of the test and refitted before returning the indicator to stores on completion of tests.

Exhaust gas thermometer

21. The repair of a faulty indicator or thermocouple must not be attempted; defective items should be returned to the appropriate Maintenance Unit or replaced by new ones of the same type.

22. Whenever the indicator is removed from the aircraft, the two terminals should be linked together with a piece of wire to damp the pointer movement. Zero adjusting of the indicator pointer should be made at the periods specified in the relevant aircraft servicing schedule, and in the manner laid down in the Air Publication dealing with the instrument.

Engine oil thermometer

23. No servicing is required with this instrument other than checking the electrical wiring and calibration by

comparison with a master thermometer as described in A.P. 1275A, Vol.1, Sect.4. In-situ repair of this instrument is not possible; un-serviceable units should be returned to the appropriate repair authority.

24. For information on the servicing of the magnetic indicators refer to A.P.4343E, Vol.1, Sect.18.

Fuel pressure and fuel transfer indicators

25. The fuel transfer indicators are

similar to the type used to show if fuel pressure is being maintained. Reference should be made to A.P.4343E, Vol.1, Sect.18.

Tachometer

26. Neither the tachometer generator nor the indicator should be dismantled by units other than suitably equipped repair depots. If either item gives trouble, it must be returned to the appropriate authority and a new component fitted in its place.

Engine max. r.p.m. control

27. Full servicing details and setting-up instructions for this installation are given in A.P.4320A and C, Vol.1, Part 1, Sect.1.

Flowmeter indicator system
(LBS - LEFT)

28. Full servicing details and setting-up instructions for this installation are given in A.P.1275A, Vol.1, Sect.18.

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