SECTION 2

STARTING AND GROUND CHECKING

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LIST OF CHAPTERS

Note.—*A list of contents appears at the beginning of each chapter*

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Chapter 1

PREPARING FOR SERVICE

***Note.**—This chapter applies to Avon Mk. 10801 and 11401 Engine Change Units.*

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1. This chapter outlines the operations necessary to prepare a newly installed, or previously stored, engine for service. A full description of each operation will be found in the appropriate sections of this volume or in the aircraft Air Publication.

2. It is assumed that all installation checks have been completed as described in Section 1, Chapter 1, and that the air-intake cowling is in position. All other cowlings may be left off to facilitate external checks and adjustments.

Preparing for ground running

3. The battery master switch must be OFF and the cartridges removed from the turbo-starter, as described in Chapter 2, before commencing work on the engine.

4. Use a ground battery or other suitable external source of electrical supply when making checks.

5. Bleed the fuel system of air and inhibiting oil as described in Section 3, Chapter 1. If more than one L.P. pump is fitted to the aircraft fuel system each pump should be operated in turn during bleeding, to clear air from the fuel delivery pipes.

6. Check that the accessory gearbox contains oil to the correct level on the dipstick.

7. Ensure that transportation blanks and sealing tapes are removed from all outlets to atmosphere.

8. Switch on the fuel pump isolating valve and listen for the click of the solenoid, then switch to NORMAL.

9. Check that each igniter unit is operating satisfactorily as described in Section 3, Chapter 1.

10. Check the operation of the engine anti-icing equipment by making the electrical and functional checks described in Section 3, Chapter 1.

11. Remove the cover from the jet pipe rear end and manually check the jet pipe " eyelid " flaps for freedom of movement. Return the flaps to the closed position.

12. Select REHEAT on the throttle lever and check the electrical operation of the reheat system as described in Section 3, Chapter 1.

13. Check that there are no loose articles in the vicinity of the engine, and remove the covers from the air-intake preparatory to ground run.

Ground test

14. Ground test the engine in accordance with the instructions contained in Section 2, Chapter 2. Check the fuel and oil system for leaks and, when the engine is running down after it has been switched off, note that there are no rubbing sounds from the rotating assembly and observe that the fuel drains are functioning satisfactorily.

Cowlings

15. After ground test the cowlings should be cleaned internally and fitted as described in the relevant aircraft Air Publication. Care must be taken to see that all the couplings to atmospheric vents are correctly aligned.

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Chapter 2

STARTING AND CHECKING

Note.—*This chapter applies to Avon Mk. 10801 and 11401 Engine Change Units*

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LIST OF ILLUSTRATIONS

Precautions

1. The life of a turbo-jet engine is adversely affected by high jet pipe temperature and by rapid changes of temperature, therefore, unnecessary starts, sudden accelerations and prolonged running at maximum conditions should be avoided.

2. The jet pipe temperature must not be allowed to exceed the maximum figure quoted in the Operating Limitations; the idling figure quoted may be exceeded momentarily, however, during starting.

3. The acceleration control unit is fitted to minimize the possibility of surge. If during acceleration the engine shows any signs of instability or excessive jet pipe temperature, close the throttle immediately and, if the engine is then running normally, open the throttle slowly to the desired r.p.m.

4. Operation of reheat on the ground must be kept to a minimum.

5. The three cartridges in the triple breech turbo-starter may be fired at intervals of one minute; ten minutes must elapse however, from the firing of the last cartridge, before reloading.

Starting preliminaries

6. Ensure that the aircraft is headed into wind, with chocks in position, and that the ground in the vicinity is free from loose stones and debris. All personnel must be kept clear of the air-intakes and the jet pipe and must observe the precautions listed in A.M.O. A.439/52. The cabin pressurizing system should not be turned on before starting. If the engine temperature is below minus 40 deg. C., it must be heated by some external means before attempting to start.

Starting drill

7. The following sequence of operations must be observed when starting the engine:—

Turbo-starter	LOAD
Throttle	CLOSED
Accumulator isolation switch	ON
Starter master switch	ON
Ignition switch	ON
Fuel master switch	ON
L.P. fuel cock	ON
L.P. fuel cock (Reheat)	ON
Fuel pump isolation switch	NORMAL
Fuel auto override switch	TAKE OFF

When the fuel pressure warning indicator turns black

H.P. fuel cock and without delay	ON
Starter button	PRESS to fire cartridge

8. The cartridge will fire over a period of 2 to 3 seconds during which time the engine speed will rise, light up will occur and the engine will accelerate up to, and run at the correct idling r.p.m. and jet pipe temperature without any throttle adjustment.

Failure to start

9. If the cartridge fails to fire or the engine fails to light up, turn the H.P. cock to OFF and switch off the ignition immediately. After completion of the starting cycle a further attempt to start can be made; if unscucessful after three attempts refer to Part 3, Sect. 1 — Running Defects.

10. After a failure to start there is normally no necessity to 'blow through' the engine. If in doubt, however, excess fuel may be removed by motoring the engine over with the H.P. cock and the ignition switch at OFF; the starter master switch must remain at ON. If internal fire is suspected all fuel pumps and cocks must be at OFF when motoring the engine over.

Ground checks

11. After starting, check that the engine stabilizes at normal idling speed, that the oil pressure is registering, and that the jet pipe temperature does not exceed the limits given in the Operating Limitations.

12. Open the throttle until the engine speed is 4,500 r.p.m. and check that the oil pressure is not less than 10 lb. per sq. in.

13. Open the throttle further until 6.000 r.p.m. is obtained then set the fuel pump isolating switch to ISOLATE; correct functioning will be indicated by a slight change in r.p.m.

14. Reset the isolating switch to NORMAL.

15. Open up to 7,500 r.p.m. and check that the oil pressure is not less than 15 lb. per sq. in.

16. Fully open the throttle and check that the governed r.p.m. and jet pipe temperature are within the limits specified in the Operating Limitations; at low ambient temperatures the engine may underspeed to as low as 7,800 r.p.m. at full throttle, but maximum thrust will be maintained. Running time at take-off conditions must be kept to a minimum.

Reheat check

17. Select 'Reheat' by moving the throttle lever fully forward through the gate and check that:—

(1) The response is obtained within 1 to 2 seconds.

(2) The nozzle position indicator turns to BLACK within 2 seconds, denoting correct operation of the variable nozzle.

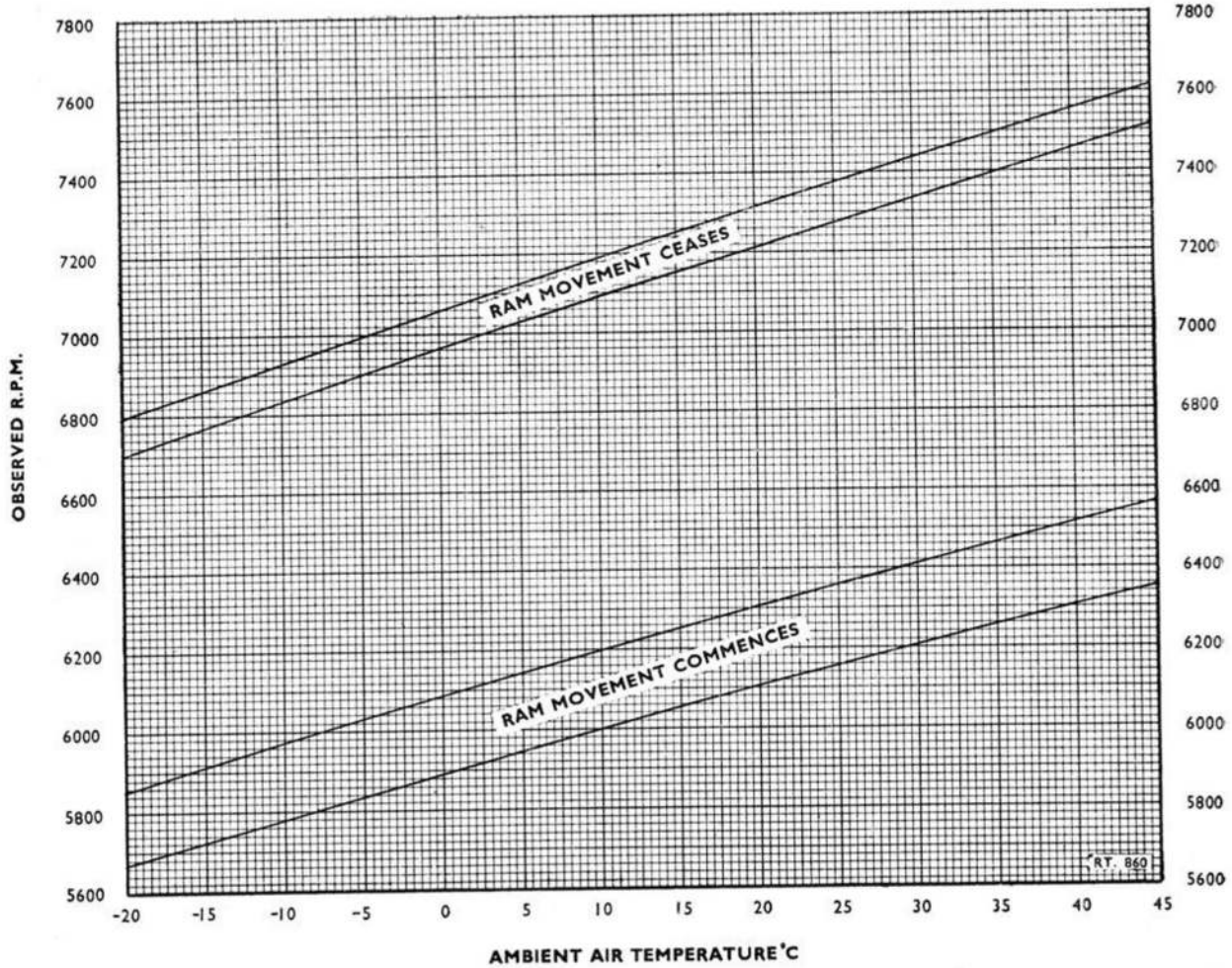

Fig. 1. R.p.m./temperature correction—Intake guide-vane ram operation

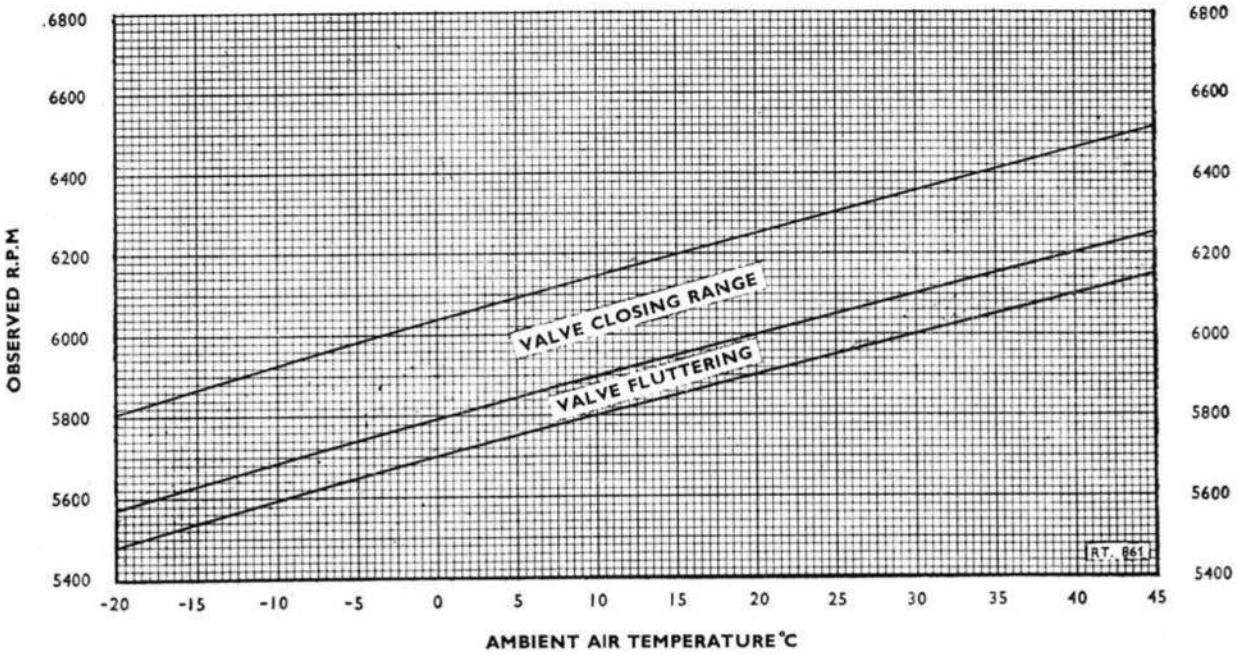

Fig. 2. R.p.m./temperature correction—Bleed valve closing

(3) The ' hot gas ' warning light is out.

(4) The jet pipe temperature is not higher than, or more than 10 deg. C. lower, than that given under stabilized non-reheat full throttle conditions.

18. Cancel ' Reheat ' by returning the throttle lever through the gate to the normal full throttle position, pausing for at least one second before returning to stabilized idling conditions.

19. Operation of reheat during ground checks must be confined to the absolute minimum necessary to perform the preceding checks.

Acceleration check

20. Run the engine at 2,800 r.p.m. and check that it accelerates satisfactorily up to 6,000 r.p.m. in not less than 8 seconds. If these conditions are fulfilled, make a rapid acceleration from 2,800 r.p.m. to full throttle and check that the engine accelerates to governed speed in $9\frac{1}{2}$ to $11\frac{1}{2}$ seconds. It should be noted that accelerations will be slower at high air temperatures.

Intake guide-vane ram check

21. With the anti-icing switch in the OFF position, slowly open the throttle and check that the intake guide-vane ram moves from the 40 deg. position and reaches the zero incidence position within the range of engine speeds shown in fig. 1.

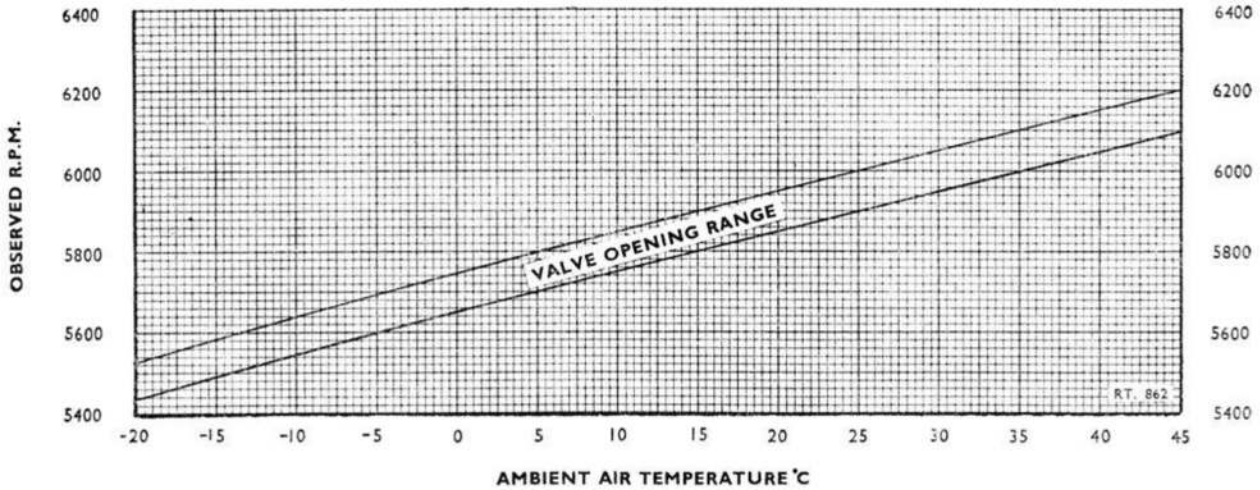

Fig. 3. R.p.m./temperature correction—Bleed valve opening

Bleed valve check

22. Check the correct functioning of the bleed valves by feeling the bleed valve ducts when slowly opening the throttle. The bleed valves should commence to 'flutter' and finally close within the ranges laid down in fig. 2. When the throttle is slowly closed the bleed valves should open as shown in fig. 3, and at not less than 50 r.p.m. below the 'flutter' point.

Stopping the engine

23. The following sequence of operations must be observed when stopping the engine:—

Throttle	CLOSED
H.P. cock	OFF
Starter master switch	OFF
Ignition switch	OFF
Fuel master switch	OFF
Accumulator isolation switch	OFF

24. Check that the engine runs down freely and that there are no rubbing noises from the rotating assembly. After the engine has stopped check the oil level and replenish if necessary as described in Part 2, Sect. 3, Chap. 1.

Loading the cartridges

25. For the correct type of cartridges refer to the Leading Particulars.

26. Ensure that the starter master switch is at OFF, then open the starter fairing nose cap; the three breech caps will then be exposed.

27. Depress the large central plunger in each breech cap star wheel and unscrew the cap until the ratchet disengages. Release the button, then fully unscrew the breech cap.

28. Assemble a new cartridge into each breech cap, ensuring that the rim of the cartridge casing is gripped by the two spring loaded claws in the cap, then insert each assembly into the breech barrel and screw the cap into position; the ratchet will engage, indicated by clicking as the cap is screwed home. It is important that each cap should be screwed finger tight only or jamming will result. Close the starter fairing nose cap.

Unloading the cartridges

29. To remove the cartridges from the starter, unscrew each breech cap as previously described and withdraw the cap and cartridge assembly. Remove the cartridge from the cap by depressing the two small plungers in the breech cap, to lift the spring-loaded claws which grip the rim of the cartridge casing, and withdraw the cartridge.

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