OPERATING INSTRUCTIONS

REFERENCE RPM AND POWER CHECK

(This EO replaces EO 10A-1-1N dated 15 Mar 63)

1 The method of testing engines fitted with constant speed propellers by running up to take off power does not provide a true indication of general engine condition but merely indicates that the propeller governor is functioning properly, i.e., maintaining a predetermined maximum RPM, and that the engine is operating smoothly. With the propeller control in full fine pitch maximum RPM is reached at a manifold pressure below take off boost and any further throttle opening beyond this point will only produce an increase in manifold pressure without a corresponding increase in RPM. A reduction of power such as that caused by a dead cylinder would result in a different propeller pitch as provided by the governor with no difference in RPM. Thus the power loss would be undetected. Running up to take off power for testing purposes also has a very detrimental effect on engine life and should be avoided as much as possible.

ESTABLISHMENT OF DATUM MANIFOLD PRESSURE

2 It is apparent from the above, for the purposes of power checking an engine, that a datum manifold pressure must be selected which is below the amount that will provide sufficient RPMs to move the propeller off the low pitch stops. Exhaustive tests were conducted to determine the most suitable datum. The results established that Observed Field Barometric Pressure (OFBP) provided the required conditions. Exceptions to the use of OFBP are:-

(a) Harvard Aircraft - The constant speed range is entered at 31" Hg, therefore the datum manifold pressure to be used is OFBP minus 2" Hg.

(b) Aircraft, which when operated at a manifold pressure equivalent to OFBP, are in a restricted RPM range as stated in AOIs for the type concerned. The datum manifold pressure to be used is OFBP, plus the least increase of manifold pressure required to bring the RPM out of the restricted range. This increase is to be used as a constant. The datum manifold pressure will then be OFBP plus this constant. The constant is to be noted on the reference RPM placard. Observed Field Barometric Pressure is defined as the manifold pressure indicated on the boost gauge with the engine at rest.

3 By operating an engine to the above datum, the RPM of a completely serviceable engine will be a constant under all changing conditions of altitude and barometric pressure. Correction for outside air temperature variations may be made on the basis that 1°C (1.8°F) rise or fall from standard temperature of 15°C (59°F) will cause one RPM rise or fall respectively. Correction for wind velocity may be made on the basis that 1 MPH head wind will cause a 2 RPM increase. Run up with tail into wind must not be performed under any circumstances. Run up in a cross wind may cause slight surging, and should be avoided. This corrected constant RPM a serviceable engine will produce at datum manifold pressure, is reference RPM. Failure to achieve this under test will indicate

engine malfunction. This test is valid as changes in altitude and barometric pressure are virtually self-compensating in that changes in the density of the air inducted by the engine which can increase or decrease power output act equally on the drag properties of the propeller to produce a constant RPM.

4 With aircraft fitted with fixed pitch propellers and normally aspirated engines, datum manifold pressure cannot be observed field barometric pressure as this manifold pressure cannot be reached with the engine operating. For this type of aircraft in all cases datum manifold pressure will be full throttle, where again variations in altitude and barometric pressure will be self-compensating, temperature and wind velocity corrections can be made, and a reference RPM established.

5 The ideal reference RPM would be one standard figure for each type of aircraft, but tests have proved this impracticable. Engine position, differences in components, i.e., tachometers, tachometer generators, slight variations in propeller pitch settings, difference in carburettors etc., affect RPM to such an extent that an individual reference RPM must be established for each engine installed. In multi engine installations comparing one engine RPM against another provides a poor basis for checking engine condition as both engines may be in equally poor condition and produce identical RPM.

ESTABLISHMENT OF REFERENCE RPM

6 A reference RPM is to be initially established on an engine when it is installed, or for those engines presently installed, at the next Periodic Inspection. Also under any of the following conditions, a re-adjustment to the reference RPM is mandatory:-

(a) On fitment of a carburettor.

(b) On fitment of a propeller.

(c) If propeller fine pitch stop setting is altered.

(d) After any repairs and/or replacement of the RPM indication system that could affect the RPM reading.

(e) After any repair and/or replacement of the boost indication system, that could affect the boost reading.

(f) If it is noticed on a number of engine run-ups that the observed RPM is consistently higher than the previously established reference RPM.

CHECK TO ESTABLISHED REFERENCE RPM

7 A check to reference RPM is to be carried out whenever the engine is run up for a serviceability check. Aircrew are to include this check as part of their pre take off procedure. Technicians may use it for trouble shooting, and as a method of proving repairs and replacements carried out. This check is mandatory after the repair and/or replacement to any component that may affect the RPM. Specific items would be:-

(a) Spark plug(s).

CHECK TO ESTABLISHED REFERENCE RPM (Cont'd)

(b) Magneto(s) (timing adjust etc.).

(c) Ignition harness.

(d) Automatic mixture control.

PROCEDURE FOR ESTABLISHMENT AND CHECK OF REFERENCE RPM

INITIAL

8 Complete run up, ground tests, and test flight required after the engine installation or Periodic Inspection to ensure its serviceability.

CHECK

(a) Ensure the engine is serviceable in all respects. Ground run the engine. During the run-up of engines equipped with carburettors fitted with manual selection automatic mixture control, open throttle to produce 1700 RPM, move mixture control from auto rich to auto lean and observe any RPM change. If RPM decreases or increases more than 50 RPM, the automatic mixture control is to be changed or the carburettor replaced. An increase in RPM indicates "Rich" mixture and a decrease in RPM, "Lean".

NOTE

For engines fitted with torquemeters (R3350 series and P & W 2800), the foregoing check does not apply. Refer to applicable carburettor or engine EO for current RPM and torque settings and maximum allowable torque pressure drop.

(b) For both initial and check, proceed as follows utilizing the reference RPM check list, Appendix "A".

(1) Position the aircraft directly into wind.

(2) Record field barometric pressure as indicated on the manifold pressure gauge for the engine concerned. (This reading must be obtained when engine is stopped).

(3) Record the outside air temperature and the apparent wind velocity.

(4) Ensure propeller is in full fine pitch.

(5) Carburettor air "Cold". If "Hot" previously selected, allow 2 minutes to stabilize temperatures.

(6) Mixture control "Auto Rich".

CHECK (Cont'd)

(7) Open throttle to previously observed field barometric pressure, see para. 2, or full throttle, whichever applies, and record RPM obtained.

(8) Make the necessary correction for temperature and wind velocity to RPM obtained in sub-para. (7).

(9) Perform a total of three runs as above, the average of these runs is the reference RPM for the particular power plant combination.

(10) The reference RPM is to be placarded in the cockpit of the aircraft concerned and entered in the L14-1C, Miscellaneous Data.

9 When the reference RPM has been established, subsequent power checks may be compared to this figure and engine malfunctions determined if present. Where the observed RPM, corrected for temperature and wind velocity is less than the reference RPM by 50 RPM, the engine is unserviceable and remedial action will be necessary.

10 Reference RPM power checks are to be brought into effect when authorized by relevant Aircraft Operating Instruction.

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

Prepared by:
AMC/SAMO/PA1

REFERENCE RPM CHECK LIST

DATE _____

Aircraft Type and Number _____ Position in Aircraft _____

Engine Type _____ Engine Serial No. _____

	Test #1	Test #2	Test #3
(1) Mandatory checks performed refer to para. 7			
(2) Position Aircraft into wind			
(3) Record manifold pressure gauge reading (engine static)			
(4) Record outside air temp. in degree C			
(5) Record wind velocity MPH			
(6) Propeller pitch "Fine"			
(7) Carburettor air "Cold"			
(8) Mixture control "Auto Rich"			
(9) Record RPM obtained at field barometric pressure			
(10) Record correction in RPM required to compensate for outside air temp. (From item 4)			
(11) Record correction in RPM required to compensate for wind velocity (From item 5)			
(12) Record corrected RPM			
(13) Record reference RPM (average of three tests item (12)			
(14) Placard installed in cockpit			
(15) Reference RPM recorded in L14-1C			
(16) Check list filed in engine Log Book			
(17) Signature of person responsible			