STARTING & OPERATING
INSTRUCTIONS

NENE II. V.H. AUST.

TURBO-JET AERO-ENGINES
IN
VAMPIRE AIRCRAFT

COMMONWEALTH AIRCRAFT CORPORATION
PTY. LTD., MELBOURNE

PART NO. CA 20020

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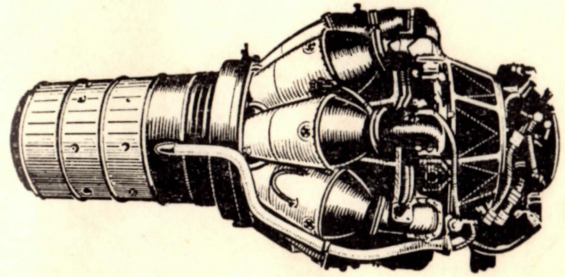

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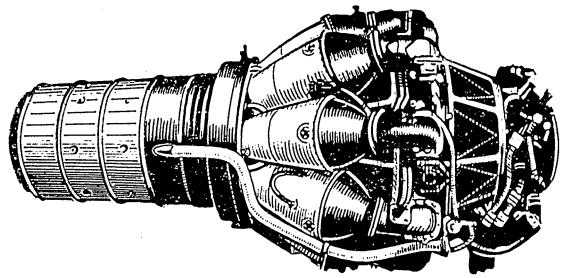

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INTRODUCTION

This manual deals with the "Nene" II. VH (Aust.) engine, as installed in the "Vampire" aircraft. It contains starting and ground running instructions for ground engineers, and starting and operating instructions for pilots.

The life of a turbo-jet engine depends mainly on the temperatures to which it is subjected, the number of times it is heated up and cooled down and the rapidity with which this heating and cooling is done. For this reason, abnormal accelerations, prolonged idling, unnecessary ground runs and re-lighting in the air should be avoided.

In no instance must the jet pipe temperatures exceed the limitations given. They are critical.

Note.—This manual does not supersede any relevant R.A.A.F. technical requirements, which must take precedence over any recommendations contained herein.

CONTENTS

OPERATIONAL LIMITATIONS

FUEL.—See R.A.A.F. Engine General Instruction No. 46.

CONDITION.	Max. r.p.m.	Max. Jet. Pipe Temp.	Time Limit.
TAKE-OFF -	12,300	760°C.	5 min.
CLIMB - -	12,000	710°C.	30 min.
COMBAT - -	12,300	760°C.	5 min.
CRUISE - -	11,600	650°C.	Unrestricted.
IDLING ON GROUND -	2,500 ± 200	550°C.	
20,000 - 30,000 ft.	4,000	550°C.	
30,000-ft. and above -	6,000	550°C.	

OIL.—See R.A.A.F. Engine General Instruction No. 46.

TEMP. °C. (when gauge is fitted).		Consumption.
INLET.		1 pint per hour maximum.
80°C. max. Minus 40°C. min.		
PRESSURE.		
11,600 r.p.m. and above.	Idling.	
20 p.s.i. min.	3 p.s.i. min.	

GENERAL.—The life of a jet engine depends mainly on the temperatures to which it is subjected and the number of times it is heated up and cooled down. It is therefore desirable to eliminate **unnecessary** ground runs, accelerations and idling and re-lighting in the air. **Jet pipe temperatures are critical and must not be exceeded. Over-speeding may easily lead to excessive jet pipe temperatures.**

STARTING AND GROUND RUNNING INSTRUCTIONS FOR GROUND ENGINEERS

PRELIMINARIES.

Fully charged 24-volt 230 amp.-hour ground battery starting equipment should be used for starting.

It is assumed that a newly-installed engine has been prepared before attempting to start, i.e., fuel system primed, oil system filled and that in all cases the intake covers have been removed. See that the aircraft is headed into wind and that the ground in the vicinity is free from debris. Check that there is fuel in the tanks, and that the low-pressure cocks are OPEN before rotating the engine. The fuel pumps are fuel-lubricated. Failure to observe this rule will result in damaged pumps.

All personnel should keep clear of both air intakes and jet pipes.

NORMAL STARTING PROCEDURE.

Start engine as follows:

Ground batteries - -	PLUGGED IN.
Ground/flight switch -	SET TO FLIGHT
L.P. and H.P. fuel cocks -	TURN ON.
Throttle lever - -	FULLY CLOSED.
Supercharger safety switch - - -	SWITCH ON.
Booster Coil - - -	SWITCH ON.
When fuel pressure warning light goes OUT -	PRESS STARTER BUTTON FOR ABOUT TWO SECONDS.

After five (5) seconds, engine r.p.m. will rise and light-up will occur. The jet pipe temperature may momentarily exceed the idling limit quoted, but should soon settle down to this figure. The engine will normally accelerate to the correct idling r.p.m. and jet pipe temperature, and should run at these conditions without any throttle adjustment. Check oil pressure—3 p.s.i. minimum. DO NOT open the throttle before idling speed is obtained. An engine may fail to accelerate to idling with the jet pipe temperature steadily increasing. Should the jet pipe temperature reach 600°C., close the high-pressure cock and stop the engine.

FAILURE TO START.

If the engine fails to start close the high-pressure cock and investigate the reason before a second attempt is made. With the high-pressure cock still closed, check that fuel has drained from the burner manifolds and combustion chambers.

The engine must be allowed to stop rotating before any attempt is made to re-start.

Before attempting a second start, investigate the state of the starting equipment.

GROUND RUNNING.

After starting, allow the engine to run at idling speed, then check that at least 3 p.s.i. oil pressure is indicated on the gauge and that jet pipe temperature does not exceed 550°c.

Open up to 7,500 r.p.m., checking that the generator warning light goes out (usually at

5,000 r.p.m.). Carry out any airframe checks, such as hydraulics, vacuum pump functioning, &c.

Open up to 9,000 r.p.m. TURN ON the fuel-pump isolating switch (warning light ON), checking that a rise in r.p.m. occurs, then turn OFF, ensuring that the warning light goes out.

Open up to full throttle, pausing at 11,600 r.p.m. to note that a minimum oil pressure of 20 p.s.i. is given.

At full throttle, check that the governed speed is 12,300 r.p.m. and that jet pipe temperature does not exceed 760°C. It should normally be about 735°C., but will increase as engine life increases.

Perform ONE acceleration of not less than ten seconds from idling to take-off r.p.m.

During acceleration, the jet pipe temperature may momentarily exceed the maximum, but should drop to the normal figure when the r.p.m. has stabilised.

If the throttle is opened too quickly, surging may occur. This sounds like a quick rumble and must be avoided.

Do not run the engine on the ground for longer than necessary, or the jet pipe temperatures may become excessive.

Allow the engine to run at approximately 7,500 r.p.m. for about one minute before stopping.

STOPPING THE ENGINE.

The following procedure should be followed:

High-pressure cock	- TURN OFF.
Throttle - - -	- CLOSE.
Supercharger safety switch - -	- TURN OFF.
Ground/flight switch	- SET TO GROUND.

The low-pressure cock should NOT be turned off with the high-pressure cock, when the engine is running, as this will evacuate the low-pressure fuel lines, with possibility of damage to the pumps.

Check that the engine runs down freely; the time taken to run down from idling speed will be affected by the number of accessories driven by the engine, but any undue friction will be noticeable.

See that fuel drains from the burner manifolds through the orifice in the fuselage. Check the oil level in the sump after the engine has stopped.

STARTING AND OPERATING INSTRUCTIONS FOR PILOT

STARTING.

24-volt ground batteries of at least 230 amp.-hours' capacity should be used. See that the aircraft is headed into the wind and that the ground in the vicinity is free from debris.

Start engine as follows:

Ground/flight switch	- SET TO FLIGHT.
L.P. and H.P. fuel cocks	- TURN ON.
Throttle lever - -	- FULLY CLOSED.
Supercharger safety switch - -	- SWITCH ON.
Booster coil - -	- SWITCH ON.
When fuel pressure warning light goes OUT	- PRESS STARTER BUTTON FOR ABOUT TWO SECONDS.

After five seconds, the engine speed will begin to rise and light-up will occur. The jet pipe temperature may momentarily exceed the idling limit, but should soon settle down to this figure. The engine will normally accelerate to the correct idling r.p.m., and jet pipe temperature, and should run at these conditions without any throttle adjustment. DO NOT open the throttle before idling speed is obtained.

Check that oil pressure is 3 p.s.i. minimum at idling.

An engine may fail to accelerate to idling with jet pipe temperature steadily increasing. Should the jet pipe temperature reach 600° C., close the high-pressure cock and stop the engine.

Should the engine fail to start close the high-pressure cock. A further attempt to start should not be made until fuel has ceased to drain from the engine and a check has been made of the condition of the ground-starting equipment. The engine must be allowed to stop rotating before any attempt is made to re-start.

Vibration from engine accessories should not be mistaken for engine roughness.

Check that the ground starting equipment is disconnected before taxying.

TAXYING.

Taxi without delay on account of the high fuel consumption at idling (approx. 70 g.p.h.).

If the throttle is opened too quickly surging may occur. This sounds like a quick rumble, and must be avoided.

To prevent high jet pipe temperatures, do not taxi in the jet stream of another aircraft.

CHECKS PRIOR TO TAKE-OFF.

L.P. and H.P. cocks	- FULLY ON.
Supercharger safety switch	- ON.
Fuel pump isolating switch	- ON (warning light ON).
Idling r.p.m.	- 2,500 ± 200.
Generator warning light	OUT at 5,000 r.p.m.
Jet pipe temperature	- NOT EXCEEDING 760° C. AT TAKE-OFF R.P.M.

TAKE-OFF.

With brakes applied, open up until the aircraft starts slipping forward. Then release the brakes and open the throttle fully, avoiding excessive jet pipe temperature.

Having obtained a reasonable safety height:

Fuel pump isolating switch	- TURN OFF. (Warning light OUT.)

Failure to do this will result in abnormal rise in r.p.m. when climbing.

CLIMBING.

For maximum rate of climb use 12,000 r.p.m., at not more than 710° C. jet pipe temperature, throttling back gradually to hold r.p.m. constant.

CRUISING.

(1) General Flying.

Above 30,000 feet, any throttle movement must be carried out carefully and r.p.m. should not be permitted to fall below 6,000, otherwise combustion may cease.

Rapid opening of the throttle above 15,000 feet may cause surge or result in the flame being extinguished. In this latter event, close high-pressure cock immediately. Combustion may also be affected, if negative "G" is applied for more than fifteen (15) seconds.

(2) Cabin Pressure.

At high altitude, the minimum engine speed to maintain cabin-pressure may exceed the

idling limitation of the engine. Throttling back should therefore be carried out cautiously, watching the cabin-pressure warning light. Should the latter come ON, engine speed must be increased.

(3) .Re-lighting in the Air.

If combustion ceases, the high-pressure cock must be closed IMMEDIATELY.

If above 15,000 feet, no re-light should be attempted. If below 15,000 feet, re-lighting may be carried out however long the engine has been extinguished.

RE-LIGHTING ACTION IS AS FOLLOWS:

(**Note.**—High-pressure cock has already been closed.)

Throttle - - -	CLOSED.
Windmilling r.p.m.	750 — 1,000.
Re-light button - -	PRESS.
After 5 seconds - -	TURN ON H.P. COCK.
When J.P.T. starts to rise	RELEASE RE-LIGHT BUTTON.
When engine runs satisfactorily with normal J.P.T. - - -	OPEN UP TO DESIRED R.P.M.

IF ENGINE FAILS TO RE-LIGHT.

High-pressure cock must be turned OFF after thirty seconds, and the next attempt should be made after at least one minute windmilling, to dry out the engine.

Note.—Practice re-lighting is NOT to be encouraged.

COMBAT.

The performance of the aircraft is more sensitive to changes in air temperature than with a piston-engined aircraft. There can be considerable variations between sub-Arctic and tropical conditions.

It is important to maintain a high forward speed in combat climb.

Governed r.p.m. will increase with altitude, therefore care must be taken to avoid exceeding the engine limitations.

Care should be taken when opening the throttle, especially when above 15,000 feet. If this is done too rapidly, combustion may cease.

EMERGENCIES.

(1) **Combustion failure, due to mis-handling.** Proceed as instructed under "Re-lighting in the Air."

(2) **Engine on fire in flight, or engine failure.**

H.P. and L.P. cocks	TURN OFF.
Supercharger, safety switch - -	SWITCH OFF.

IF FIRE IS OBSERVED.

Aircraft speed -	LOW AS POSSIBLE.
Fire extinguisher switch - -	PRESS.

Note.—The engine must not be re-started after operating the fire extinguishing system, owing to the probable risk of the fire re-starting after fire fighting resources are exhausted.

(3) If a fault is suspected in the fuel system.

Fuel pump isolating switch - - TURN ON.

If combustion has ceased, carry out re-lighting, using the procedure given.

PRIOR TO LANDING.

Fuel pump isolating switch - - - TURN ON. (Warning light ON.)

Should either fuel pump or barometric pressure control fail, this will ensure approximately 85 per cent. thrust being available. It must be borne in mind that thrust response is not so rapid as on a piston engine, so that decision to go around again should be made in good time.

TO STOP ENGINE.

High-pressure cock - TURN OFF.

Supercharger safety switch - - - TURN OFF.

Fuel pump isolating switch - - - TURN OFF. (Warning light OFF.)

Ground/flight switch - SET TO GROUND.