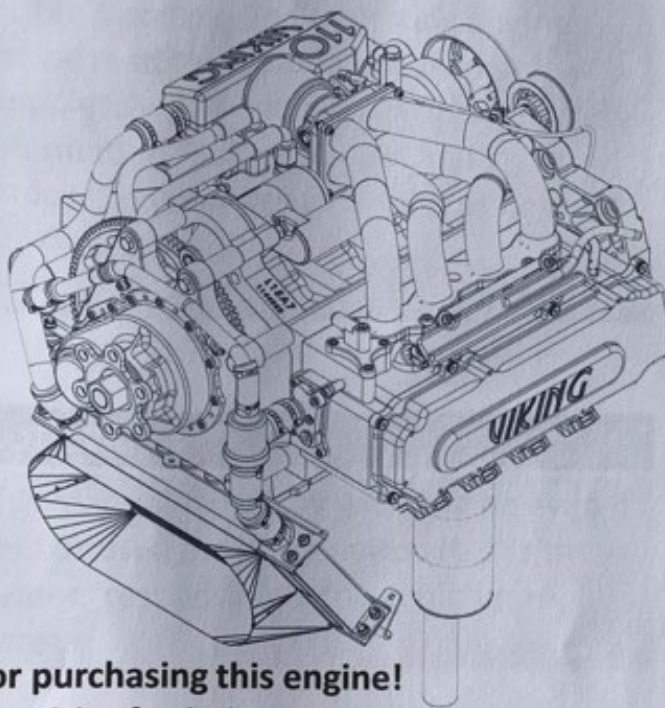


NTSB Investigation: ERA23FA188

EXCERPTS OF PILOT OPERATING HANDBOOK,
ENGINE OPERATIONS MANUAL

VIKING AIRCRAFT ENGINES INC.

110 ENGINE



Thank you for purchasing this engine!
We Keep the spirit of aviation
alive and affordable!

Important:



Read Safety Rules and Instructions Carefully Before Installing

Viking Aircraft Engines Inc.
735 S. Airpark Rd, Hangar C3
Edgewater, FL 32132
386-566-2616 / 386-461-8383
www.vikingaircraftengines.com

Photograph of manual located at the airplane's hangar

VIKING AIRCRAFT ENGINES

CHAPTER 5: ENGINE OPERATION

Your engine has already been run at the factory just as it was shipped to you. But it's always a good idea to make sure it runs before you go flying! (That's a joke).

You can test run your engine without a propeller installed if you keep the RPM below approximate 2000 and hold the duration to less than about two minutes. Without the prop, cooling airflow is non-existent, so don't let it run longer than it takes for the thermostat to open. You can tell when the thermostat opens because the radiators suddenly become very warm. If you have your propeller installed, obviously remain clear of it! Add a little pitch to the blades to improve airflow through the radiators and monitor the coolant temperature. Even with a prop, you are still lacking forward motion (assuming your wheels are chocked).

It is normal to hear some gearbox 'chatter' when running the engine at very slow speeds, particularly without a prop. The gearbox has very large toothed gears and needs resistance to keep the gears loaded. CH 530 VIKING HIRSH HQHQ

530
SURS 530 There is a spring loaded feature on the throttle adjusting screw that allow you to pull the RPM lower for slow taxi and during engine shut down.

Fluids

Add and check them now...

ENGINE OIL: Add 5w20 Synthetic-Blend or Mineral Oil.

Do not use full synthetic oil, as it will have trouble suspending the lead in 100LL fuel. (Use 100LL ONLY when 90 or higher octane auto fuel is not available) The Engine takes approximately 3.5 quarts / liters, but this varies depending on whether you have just changed your oil filter and whether the oil cooler and lines are full. If this is the first time you have run your engine, check the oil level again after about a minute of run time. The level should be at the upper mark of the dip stick. Tail-draggers should raise the tail of the aircraft to check the initial oil level, then lower the tail and check it again, remembering where the full indication is when the tail is on the ground, then marking the dip stick accordingly using a small file to notch the edge slightly.

Engine oil and filter should be changed at least every 50 hours. We do it at 25 hr intervals. We also send our oil to Blackstone Laboratories for an oil analyses report, then file this away to show wear over long periods. This is required as part of the Viking warranty, on the gearbox and engine.

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- **GEARBOX OIL:** 3.75 oz (110ml) Synthetic 75W-90 Mobile 1 GEAR OIL. This will bring the level to 3/4 full in your gearbox oil level inspection window. If you overfill or underfill the gearbox, the temperature will run slightly higher than normal. Gearboxes should not run hotter than the engine and usually run 10F below the engine coolant temperature.

Gearbox oil should be changed at least every 100 hours. We do ours at 25 hrs.

- **COOLANT:** These engines use **EVANS NPG+** waterless coolant. NEVER ADD WATER OR CONVENTIONAL ANTIFREEZE or you will contaminate the coolant! Additional coolant is available from the factory, or directly from Evans Cooling Inc. at www.evanscooling.com. Aircraft Spruce and most race shops also have it available. The boiling point of this coolant is 375F which is why we use it and why it needs no water. You will never boil over with this coolant.

Because there is no water, we can run very low pressure in the cooling system (No pressure cap) which is easier on hoses, clamps, gaskets, etc. Even though the coolant is less efficient than water, the overall cooling is better, around the hottest places in the engine, such as around the built-in exhaust manifold.

Your firewall mounted reservoir is typically about one third filled with a cold engine and about 1/2 full with the engine at operating temperature. It needs

some room for expansion as the coolant heats up. It also needs a vent hole on top. Unless you have a leak or air pockets in your cooling system, the level should remain good and the coolant is good for the life of the engine. Running the engine for a few minutes with the fill cap off helps to purge any air from the system. Repeating this process will push air out while the engine is warming, then draw coolant back in as the engine cools. Make sure the small coolant bleed hose from the top of the engine is submerged into the coolant in this tank at all times, for this to work.

- **BATTERIES:** Make sure they both have a good charge. Use the Odyssey batteries if you need ballast weight or the much lighter Shorai, if you do not. The Odyssey type batteries require a special type of charger. Never use a regular automotive charger and especially never use a trickle charger as these do not provide proper charge voltage or currents. When running with the alternator turned on, you should see between 14.0 and 14.2 volts with no loads. Under load, you will see slightly lower voltages, approx 13.5 volts. After sitting for a few days or weeks, the voltage may drop lower. Not to worry, these batteries have a shelf life of about eight years. Still, it's a good idea to buy new batteries every few years or rotate one out every couple of years.
- **FUEL:** These are high-compression, high-performance engines! Use 89 or higher octane fuel. Up to 10% ethanol is permitted.

Photograph of manual located at the airplane's hangar

VIKING AIRCRAFT ENGINES INC.

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A Word about Safety

You should have an ample supply of this on hand! Be sure that your hoist and sling are up to the job, that you have plenty of room on a solid, level floor, and when working with fuel and wires, have good ventilation and a fire extinguisher standing by.

Avoid letting any part of your body be underneath a suspended engine or airframe. Always consider what would happen if the engine shifted or fell. Please Be safe!

Storage

Your engine will arrive on a standard wooden shipping palette enclosed in a multi-layer cardboard or plywood container.



If you intend to install your engine within 6 months time, we recommend that you store the engine as it was shipped, in a dry location away from temperature and humidity extremes. A small amount of oil may accumulate in the cylinders during shipping and while the engine is vertical, but this will burn off in just a few seconds once the engine is running. A short burst of blue exhaust smoke can be expected when first run.

If you intend to store your engine for more than 6 months prior to installation, we recommend that you mount it to an engine stand. You may install engine and gearbox oil and turn the engine over periodically with the electric starter or even run the engine for short periods of time. The engine should never be left with auto type fuel in the fuel rail or fuel pumps for longer than 3 month intervals. The approved storage fuel is 100LL aviation fuel. 100LL was used to test run the engine at the factory, prior to shipping.

Although the mere reading of these instructions will not eliminate all dangers, the understanding and application of information herein will promote the proper use of the engine. Turning the engine over with the starter helps to distribute oil and keep moisture out of the cylinders. Starting the engine for short periods of time accomplishes the same thing. 100LL is also a superior fuel to prevent gum from forming inside the fuel injectors and fuel pumps during storage.

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Never run lower grade fuels! It can and will destroy your engine.

Starting the Engine

If this is the first time you have started your engine, it is wise to crank the engine over for several revolutions before turning on the ignition switch. This allows oil pressure to build up and purge the system of any air. It also assures that the cylinders are free of any oil that may have accumulated during engine shipment and helps to lubricate the cylinder walls and other bearings.

The engine will start best with the throttle closed. The ECU does not engage the spark until 2 revolutions have gone by. If the engine does not start within 5 revolutions of the prop, turn the ignition switch off and on again to reset the ECU's start sequence.

When the engine starts for the first time, it is not unusual to see a puff of smoke from the exhaust. This is oil burning off that collected in the cylinders during shipment. The exhaust pipes may also smoke for a little while as oil and anti-seize compounds burn off. Subsequent starts will be smoother than the initial start.

Note: It is very difficult to program the cold start sequence down here in Florida where it is never cold. We enlisted the help of some Canadian friends, but if starting is extremely difficult in very cold climates, please contact the factory. We do have solutions!

Idle Adjustment

The idle was set at the factory, but without a prop installed. This means it will probably idle too slow and you may hear some gearbox 'chatter'. The correct idle speed is 1700 engine RPM which equates to 750 prop RPM. Below this speed you will almost certainly hear some amount of gearbox chatter.

To set the idle, you will need a 10mm wrench and a small flat screw driver loosen the lock nut and turn the screw. Extend the screw to speed it up, retract the screw to slow it down. Because the throttle linkage gets in the way, this is best done with the engine stopped. You can leave the lock nut loose until you get the speed set right. Let the engine become fully warm. Repeat

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engine mount bolts per airframe manufacturers' recommendation or per the Standard Aircraft Maintenance Handbook. Always use new cotter pins.

{4} – Exhaust stud bolts are torqued to 280 inch-pounds (23 foot-pounds). New gaskets can be purchased from Viking.

{6} – We recommend Hawker Energy "Odyssey" dry-cell batteries or the lithium Ion Shorai batteries of much lighter weight. When a proper charge is maintained, these batteries will last for many years. We recommend a rotation strategy of periodically replacing one battery. How often is a matter of how well you maintain your aircraft and how heavily the batteries have been used.

Part Number: Odyssey PC-625 (625 cold cranking amps) or PC-680 (680 cold cranking amps) with terminal studs.

{7} – Use NGK brand Iridium Spark Plugs gapped to 0.044". A light tan colored insulator indicates optimal performance. A lighter color can indicate a lean condition while a darker color can indicate a rich condition. Always apply a small amount of anti-seize compound to the threads (avoiding the tip) when installing new spark plugs.

{8} – Inspect all cooling hoses on the engine and heater. Replace any sections which appear to be dried out, cracked, discolored, split, hardened, etc. Use only two-ply silicone hose. We highly recommend using Oetiker brand clamps.

{9} – Inspect all flexible intake ducts for signs of cracks or damage. For non-turbocharger installations, use SCAT type silicone duct. For turbocharged installations use ONLY two-ply SCEET type silicone duct.

{10} – Inspect all sections of flexible fuel line. Replace any sections which appear to be dried out, cracked, discolored, pinched, hardened, chaffing, etc. Use only "fuel-injection" type fuel hose or similar hose approved for high-pressure aircraft fuel system use (i.e. Aeroquip). Always use fuel-injection type clamps or Oetiker clamps. Never use regular automotive worm-screw clamps!

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Revision: 8

Date: 04/03/14

RV-12 PILOT OPERATING HANDBOOK



Aircraft Serial Number: 001

Aircraft N Number: N5436M

RV-12 PILOT OPERATING HANDBOOK

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Revision: 11

Date: 01/01/20

**SUMMARY OF
PERFORMANCE SPECIFICATIONS**

Gross Weight	1320 lb
Top Speed (@ gross weight)	117 KCAS
Cruise Speed (@ gross weight)	114 KCAS
Range (@ gross weight, 7500 ft, 30 min reserve)	425 nm
Rate of Climb (@ gross weight, V_y , 75 KCAS, sea level)	906 ft/min
Stall - Clean (@ gross weight, V_s)	45 KCAS
Stall Flaps Down (@ gross weight, V_{so})	41 KCAS
Total Fuel Capacity	19.8 US Gallons
Total Usable Fuel (See WARNING on page 2-6)	
Shallow Climbs & Level Flight	0 US Gallons
Descending Flight	0 US Gallons
V_x Climb:	3 US Gallons
Take Off	4 US Gallons
Approved Fuel types	
89 Oct or higher Automotive fuel 10% ethanol max	
110 LL Aviation Fuel if auto fuel not available	

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Revision: 11

Date: 01/01/20

PERFORMANCE (1320 lb)

Speed

Top Speed 117 kts
Cruise 5500rpm 7500 ft 114 kts
Cruise 5000rpm 7500 ft 101 kts
Stall - flaps up 45 kts

Ground Performance

Take-off Distance 700 ft
Landing Distance 525 ft

Climb/Ceiling

Rate of Climb 900 ft/min
Ceiling (estimated) 13,800 ft

Range 5500rpm 7500 ft 482 nm
Range 5000rpm 7500 ft 534 nm

GENERAL

This section lists all speeds used with airplane operating limitations. These limitations are also indicated in the aircraft by the form of placards, instruments color markings, and audio warnings. The placard placards, instrument color markings, and audio warnings are to be the authority on inconsistency unless with this manual.

WARNING

All operating limitations must be strictly adhered to for reasons of safety and serviceability.

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Revision: 11

Date:01/01/20

FUEL LIMITATIONS

Fuel

Type

89 AKI unleaded up to 10% ethanol automotive

110 LL aviation fuel may be used on a limited basis if automotive fuel is unavailable.

Capacity

19.8 US Gallons

WARNING

When the fuel level is less than 4 US Gallons, extreme caution should be used during climbs to ensure that the tank outlet remains submerged. Prolonged high pitch angles (greater than 8 degrees nose up), may result in fuel starvation and engine stoppage.

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