

## **Engine Troubleshooting & Maintenance**

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### **Engine problems**

When an engine will not start, first check for spark. Pull the spark plug and connect it to the high tension lead. Place the plug on the engine block and crank or pull the recoil starter and look for spark. Sometimes in sunlight it is impossible to see the spark. It might be possible to hear the spark and, lastly, if you get an electrical jolt then this confirms spark is present.

While the plug is removed, place a finger over the plug hole and crank the engine. Check for compression. Lastly, check for fuel. Remove the air cleaner, open the throttle and squirt gas into the cylinder. If the engine fires then stops, or runs only for a short time (1-2 seconds), this indicates that the engine is not getting fuel. Check the tank level, primer, filter, fuel line and quick connects, if installed. To pinpoint the problem, rig up a separate fuel supply directly to the carburetor. If the engine runs properly, disconnect the temporary fuel supply and move along the fuel line, changing components until the culprit is found.

The three fundamentals to check are spark, compression and fuel. Engines will not function if any of these are missing. Always check the easiest things first. When there is no spark, check the kill switch. Next, begin replacing components, coil, cdi and finally, remove the flywheel and check the magneto.

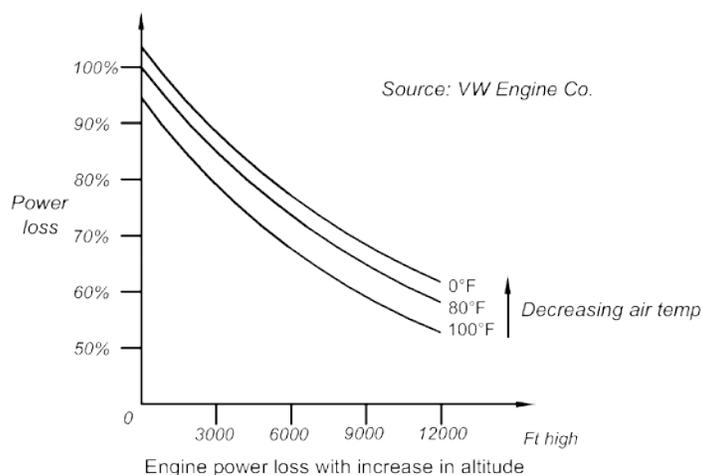
Normal compression should be between 100 and 120 p.s.i. If compression is low, the engine will be difficult to start. If no compression, the engine will have to be dismantled and repaired.

The fundamental rules for the mechanic are 1) Always check simple things first, and 2) Check one thing at a time.

### **Engine adjustment**

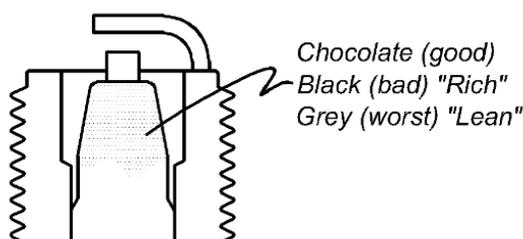
Modern materials limit the maximum power any engine can generate. Running an engine at the maximum temperature, just below the melting point of its constituent materials, will produce the maximum power. It's in our interest to tune the engine so that full power is developed, yet the engine does not melt.

Think of an engine as an oxyacetylene cutting torch. When more fuel (acetylene) is added, the flame temperature drops but when more oxygen is added the temperature goes up. It's exactly the same with an engine.



Oxygen varies depending on air temp and pressure. High altitude means low air pressure. Hot weather means low oxygen. With varying oxygen, the fuel also must be adjusted or the engine can melt. Fuel supply is regulated either by injectors, which are computer controlled, or by a carburetor. When an engine runs with too much fuel it is said to be running rich. When there is too little it is running lean. Of the two, running lean is the most dangerous. The engine will develop more power but will be close to melting. Rich and lean have nothing to do with the quantity of lubricating oil. Engines must have lubricating oil or they will seize. See Engine Altitude and Air Temperature graphs in the engine Appendices at the back of this manual.

To check how an engine is running, look at the spark plug after the first half hour of operation. The plug color must be chocolate. If black, this indicates the engine is running rich; the black is unburned hydrocarbon. If grey, this is dangerous; it means the engine is about to melt. The grey is ash from the oil/fuel and particles of aluminum off the piston which are depositing on the plug. The engine is running lean.



In cold weather, i.e. below freezing or whenever engine icing occurs, the engine heat flap can be untied and attached to the underside of the air filter box where Velcro strips are provided. This directs heated air from the engine cylinders into the intake filters, which will correct the tendency for engine icing to develop. This is only available on Fuji engine equipped Neoteric craft.

The Hirth engine produces hot air from its air cooling system, part of which flows over the carburetors; this air is sufficient to prevent carburetor icing.

## Cautions

When replacing spark plugs, be sure that the plug is tight, but not too tight; it should be about 15 to 18 ft lbs. Coat threads with copper based anti-seize thread lubricant (Anti-Seize compound sealing lubricant 765-1363 is suitable). A loose plug can lead to the cylinder head melting. When mixing fuel for the engine, use proper 2-cycle oil, and use a good quality oil with a reputable brand name; snowmobile oil is preferred; use NAMMA TC- W3. Do not use synthetic oil. Mix 40:1, i.e. 16 oz of 2-cycle oil to 5 gallons (25ml oil to 1000 ml (1 liter) gas). Too much oil can cause carbon buildup inside the cylinder head, piston walls, the rings and their grooves; this can result in ring sticking followed by a subsequent loss of compression. The engine will then become difficult to start and to keep running. It is advised to use high octane gasoline when available; this lessens the possibility of pinging and pre- detonation.

## Engine maintenance

1. Always mix gasoline and oil unless the engine is equipped with an oil injection system. For oil injection engines, add oil 100:1 to gasoline until the oil delivery system can be monitored for proper performance.
2. For the first 10 hours of new engine operation, restrict maximum power to the minimum possible amount, no more than 10-15 seconds of full power bursts from time to time, and try to run the engine for longer periods, such as ½ hour at 4000 rpm, then 3000 and 5000, all for ½ hour intervals.
3. Mix gasoline (high octane is recommended) with North American Marine Manufacturers Association Standard TCW3 2 cycle oil 40:1 and mark the portable fuel tank 40:1 with a removable sign to prevent accident addition of gas without oil.
4. Engine idle should never exceed 1400 rpm. For 100 hp engines, minimum cranking speed is 500 rpm.
5. Exhaust gas temperature should not exceed 1350° F, while cylinder head temperature should remain below 535° F unless it is a liquid cooled engine, which runs at max 240° F, min 160° F.
6. Do not over rev an engine; 6500 is tops.
7. The Hirth engine company recommends torquing the cylinder and head bolts after the first 10 hours, but this is immensely difficult. Where possible, these are checked by Neoteric before engines are installed.
8. When the hovercraft has arrived at its place of use, check spark plug color after the first ½ hour test run. Make fuel mixture adjustments as required. Get the help of a snowmobile or motor bike mechanic to help if you are unsure of this task.
9. Always examine an engine for oil leaks and investigate such leaks whenever they are found.
10. Always wash the engine with fresh water after operating, then spray down with kerosene, WD40 or light machine oil. This will prevent corrosion and is especially important for salt water operation.
11. Whenever operating in a dusty region, remove engine air filters and clean in accordance with instructions found elsewhere in the manual.
12. Always inspect engine for cracks, loose bolts or fittings and check all belts for proper tension. Correct when needed.

13. Do not crank engine excessively. If it does not fire within 5-10 seconds, something is wrong. Check that the kill switch is engaged. Remove plugs and clean excessive oil. Replace plugs and restart.
14. Injectors can be used to prime the cylinder. Open throttle  $\frac{3}{4}$  of a turn and you will hear the injectors buzz.
15. Always inspect cooling systems and radiators; clear debris and make sure coolant level is sufficient. Also check pump belt.
16. Ensure there are no loose wires, especially battery terminals and engine ground wire.
17. When checking the engine for problems, endeavor to make one change at a time then check before making any additional changes.
18. To test fuel injected engines, a laptop program must be obtained from Hirth. The computer chip can be changed with different mapping.
19. Engine shut down temperature for air cooled engines should be under 300° F. cylinder head temp.
20. Always turn injected engines on and off using the fuel pump switch. Turn key on, then turn fuel pump switch to on and listen for fuel pump. Use the key to start the engine. To stop the engine, turn the fuel pump off first in order to depressurize the fuel system and stop the engine. Then turn the key off. The fuel pump can take up to 5 seconds to prime. Most hovercraft are equipped with some form of primer bulb needed to re-prime the fuel pump whenever fuel line air blockage occurs.

**Neoteric Hovertek™ lubrication**

***Fan shaft bearings:***

After every 25 hours, lubricate each fan shaft bearing with regular wheel bearing grease. Do not overgrease and damage bearing seals.

***Control bearings:***

Using SAE 30 oil, lubricate all rudder blade bearings, clevises, pins and rudder push pull cable.

***Torsion steering post:***

Lubricate reverse thrust cable drums, BMW reverse thrust levers and cables, throttle cables, seat sliding and rolling parts on SxS craft with SAE 30 oil.

***Engine:***

Choose an oil with a National Marine Manufacturers Association (NMMA) TC-W3 or similar standard 2 cycle engine oil and mix 40:1 with 95 octane gasoline.

**40 Gas :1 Oil**

1 US gallon	(=3785 ml):	0.025 US gallon	(=95ml)
8 US pints	(=1 US gal):	0.2 US pints	
128 fluid oz	(=1 US gal):	3.2 fluid oz	

***Trailer:***

Check and repack wheel bearings after 1000 miles. Lubricate winch with SAE 30 oil. Lubricate ball hitch with SAE 30 oil.

### Neoteric Hovertrek™ electrical fuses

Reverse thrust system :	could be round tube fuse or blade fuse 15 amp
Reverse thrust computer:	round tube fuses or blade 5 amp/computer (watertight holder; only models prior to 2008), new digital computer
Navigation lights, headlights, instrument lights:	20 amp blade fuse (for Conventional Resistance Light) 10 amp for current LED light.
Bilge pump and horn:	10 amp
Siren:	Current model: 20 amp blade built inside at back (Prior to 2006: outside at back.
Strobe or rotating light bar:	10 amp
Gauges:	10 amp
GPS:	Self-equipped fuse
Searchlight:	15 amp
Cigarette lighter plug and deck plug:	10 amp
Volt regulator:	30 amp
Side lights:	15 amp
Injected engine computer:	15 amp
Marine radio:	250 volt/6 amp

### Skirt repairs

Replace segments when worn or damaged. Operating your Neoteric Hovertrek™ with holes and tears in the skirt can be dangerous and is not recommended. If skirt damage is extensive, replace the entire skirt. With care and good operating procedures a skirt should last for 120 hours. Even under normal conditions, skirts take a great deal of punishment and might wear badly in as little as 25 hours. Damage is usually erosion, which is confined to the lower edges of the skirt. Wear patches can be inexpensively stitched over the worn area; use 16 oz. Neoprene Coated Nylon truck tarpaulin material, but any fabric material at hand will work, such as 7oz/sq yd nylon pack cloth. When one or more segments are torn, be sure to make speedy replacement since each damaged segment lowers the hoverheight slightly. This then increases the surface contact of all the skirts so that they will all wear more rapidly.

### Major fan and transmission repairs

- A. Remove fan intake screen.
- B. Disconnect fuel supply.
- C. Remove all electrical connections, mark each wire with a number and take note of connection. Wires will have to be cut. Mark all cut wires for identification during reassembly.
- D. Remove choke and throttle cables.
- E. Undo bolts holding engine mount feet to vibration mounts. Collect spacers and label their location.
- F. Remove thrust duct using a screwdriver. Remove or loosen set screw above fan hub key. This might be a square head set screw which is easy to remove. If it is

an Allen head set screw this is more difficult to loosen. Apply heat with a propane torch to the fan taper lock and concentrate around the set screw area as that will soften the Loctite.

- G. Remove the three 5/16 hex head bolts holding the taper lock bushing. Place two of these bolts in the threaded holes in the taper lock flange and tighten until the taper lock bushing separates. A wheel puller is needed to remove the taper lock off the fan shaft. Then the fan will come off.
- H. To remove the fan shaft: clean off any paint or corrosion on the fan shaft. Loosen the bearing clamps and tap the shaft through the bearings while spraying the shaft with WD40. Use a soft Aluminum or copper drift to force the shaft out through the bearings. Remove the large drive sprocket by loosening the small Socket Head screws on the B Lock assembly holding the sprocket to the shaft. Remove the belt. Remove the 3 Hex head bolts holding the Belt Sheave and loosen all engine mount bolts. Remove the bolt shims between the engine and the engine mount in order to loosen the belt. Start with the shims under the engine bolts closest to the front of the craft. Make sure to keep the shims together and when reassembling, the exact same shims must go back under the exact same engine bolt.
- I. Return the shaft and the complete fan to Neoteric with the taper lock for balancing the assembly after repairing.
- J. Remove the foam vibration isolation strip; it might have to be cut off.
- K. Undo the eight 7/16 hex stainless steel bolts holding the thrust shroud. Force the shroud back.
- L. Tilt machinery module forward and remove from craft.
- M. In operation, check belt adjustment; belt should run very slightly to the front of the craft. This is achieved with slightly thicker shims under the engine mounts toward the rear of the craft.
- N. Fan blades can be replaced through the opening created by removing the thrust duct. Work on fan blades is more easily achieved by removing the fan to the workbench. Take fan taper lock bolts out and screw them into threaded holes on taper lock. Tighten until taper is broken and fan is removed using a wheel puller and heat.
- O. To remove engine drive sprocket, undo sheave bolts, remove belt sheave flange, fit puller and tension, then heat evenly using propane or oxy-acetylene flame until sprocket breaks loose.
- P. Re-assembly:
  - Torque fan taper lock to 12 ft lb.
  - Torque sprocket locking hub to 7.5 ft lb.
  - Torque engine bolts to 55 ft lb.
  - Torque drive sprocket to 65 ft lb.
  - Torque bearing bolts to 65 ft lb.
  - Torque bearing lock collar 6 ft lb.
  - Torque engine intake manifold boots 6.6 ft lb.

## Repairs to controls

- A. **Rudders:** Rudder blades can be replaced using a Phillips screwdriver. In operation the rudders should move + or – 32 degrees.
  
- B. **Reverse Thrust Buckets:** Reverse thrust bucket bearings should be replaced when worn. If fiberglass body is damaged around plastic bucket bearing hole, re-glass before installing new bearings. Hovercraft manufactured after 2003 have bearings built into the body so maintenance should not be needed except for lubrication or repair.
  
- C. **Computer Controlled Reversers:** The fly by wire computer operated reverse thrust system consists of three components: two hand operated 10-ohm potentiometers, a computer, and two electrical actuators. The hand-operated potentiometer provides a voltage signal to the computer. A 10K-ohm potentiometer inside the actuator tells the computer the position of the actuator. The actuator position is then compared by the computer to the hand- operated potentiometer. If they are different +/- 12 volts DC is sent to the actuator, which moves until the signals are balanced. A 12-volt clutch in the actuator remains engaged while there is a power supply to the system.

Hand operated potentiometer specifications are: 10K ohm, sealed, 280 degrees of rotation potentiometer, stainless steel shaft and resistance coil type.