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.

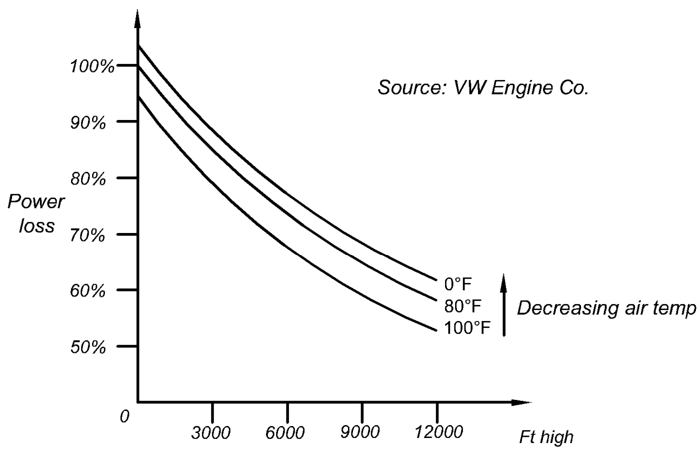
Normal compression should be between 100 and 120 p.s.i. If compression is low, the engine will be difficult to start. If no compression, the engine will have to be dismantled and repaired.

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.

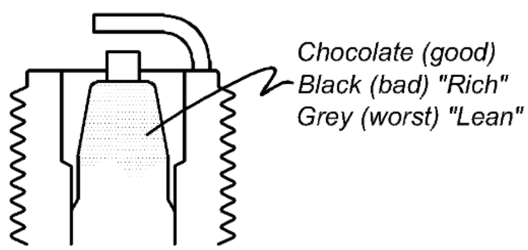
Think of an engine as an oxyacetylene cutting torch. When more fuel (acetylene) is added, the flame temperature drops but when more oxygen is added the temperature goes up. It’s exactly the same with an engine.



Engine power loss with increase in altitude

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. 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 torqueing 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 ¾ 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 Hovertrek™ 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 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
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.
G. Remove the foam vibration isolation strip; it might have to be cut off.
H. Undo the eight 7/16 hex stainless steel bolts holding the thrust shroud. Force the shroud back.

I. Tilt machinery module forward and remove from craft.

J. In operation, check belt adjustment; belt should run very slightly to the rear of the craft. This is achieved with slightly thicker shims under the engine mounts toward the front of the craft.

K. 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.

L. To remove engine drive sprocket, undo sheave bolts, remove belt sheave flange, fit puller and tension, then heat evenly using oxy-acetylene flame until sprocket breaks loose.

M. 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 damages 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 engages while there is a power supply to the system.

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

Reverse thrust system

Description

Microprocessor-based position controller, driving 2 linear actuators based upon two potentiometer inputs, providing diagnostics and field calibration

Hardware specifications

Operating Ambient:	-30F to 120F
Construction:	6.75” x 5.0” circuit board to match – provided enclosure (mounted inside port thrust duct)
Power Terminal Blocks:	Screw-type terminal blocks, 14-22 AWG.
Over-current Adjustment:	3A to 15A amps, on-board potentiometer.
Actuator Outputs:	Two bi-directional, solid-state MOSFET, 15 amp max
Actuator Inputs:	Two 10K potentiometers
Actuator Terminal Blocks:	Screw-type terminal blocks, 14 – 22 AWG
Hand-lever Input:	Two 10K potentiometers
Diagnostic LED Outputs:	Two, rated +12 VDC, 40m A maximum
Calibration Switch Input:	Momentary switch closure, rated +12V, 25mA minimum
Hand-lever Terminal Blocks:	Screw-type terminal blocks, 14 – 22 AWG

Software specifications

Auto-Calibrate Mode:
Both hand levers must be in the released position. The buckets can be in any position.
This mode is entered within 15 seconds of powering up the computer then pressing and releasing the momentary switch on the instrument panel. After 15 seconds, the calibration mode cannot be entered.
During the 15 second period, the hand levers will not directly control the actuators.
Both LED’s on the instrument panel will flash rapidly.
The pilot then fully engages each hand lever and holds for 3 seconds, then fully releases each hand lever. Each actuator will run to the fully retracted and fully extended positions.
The potentiometer values of all four points will be recorded automatically and stored in memory.
When the auto-calibrate mode has been completed, the LED’s will be steady and the pilot will regain control of the actuators.
Typically, the entire period of operation will be completed in less than 30 seconds.

User mode

Based on the stored potentiometer values from the auto-calibrate period, the software will equate a hand lever potentiometer value to an actuator potentiometer value by running the actuator motor. This will be a linear relationship. For example, if the hand levers are retracted 50% of the total distance, the actuator will extend to 50% of the total distance.
The control will shut down if the actuator motor is running and the control senses a current greater than the over-current adjustment (see hardware spec) for a time set by the dip switch (see Option Switches section).
Each time the bucket is fully extended or fully retracted, this position will be compared with the position stored during the auto-calibrate period. If these values are the same, the control continues to operate normally. If the bucket is unable to reach the calibrated position, due to an obstruction, the motor will shut off after 3 or 5 seconds depending on the dip switch setting, and the LED will display an error code (see Diagnostics).

Each time the pilot moves the hand levers, the control will try to move the bucket to the calibrated position.

Diagnostics

The two instrument panel LEDs will be on when there are no faults. When there is a fault, the LED will flash a number of times, corresponding to the following error code. Each LED operates independently.

1 flash = Bucket can’t fully open.
2 flashes = Bucket can’t fully close (reverse).
3 flashes = Actuator potentiometer failure, ohmic value out of range.
4 flashes = Bucket not able to reach correct position per hand lever.
5 flashes = Hand lever potentiometer failure, ohmic value out of range.
6 flashes = Recalibration required.
7 flashes = Cycle power off and on; calibration error.

Option switches

Switch	Switch set to “open” side	Switch set to “number” side
S1	Actuator motors run 100%	Actuator motors run 80% of full speed
S2	Over-current timeout = 3 seconds	Over-current timeout = 5 seconds
S3	Hand-levers dampened 2% of range	Hand-levers dampened 4% of range
S4	Disable ramping actuator speed	Enable ramping when motor at full speed

Electrical actuator specifications

Volts: + / - 12 volts nominal
Load: 30 lbs. @ 3 amp
Peak load, Momentary: 60 lbs.
Motor current (at rated load): 2.25 amps
Motor locked rotor current: 18 amps
Clutch current: 0.6 amps
Stroke (max) 3 inches
Maximum no load speed: 3 inches/second
Weight: 2.4 lbs.
Operating temp Range: -40°F (-40°C) to + 158°F (70°C)
Operating voltage range: +/- 11.5 to 16.0 Vdc

NOTE: If voltage drops below 12 Vdc, actuator will continue to operate at a decreased performance level.

Construction:
- Aluminum die cast housing
- Powder-coated for corrosion resistance
- Permanently lubricated metal gear drive
- Stainless steel output shaft
- Sealed construction
- Dust proof and splash proof

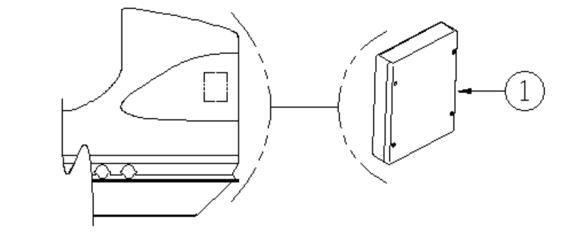
- Polypak rod seal
- 4-start stainless steel Acme screw 7-wire, 20 gauge, shielded cable, 3 feet long

Installing reverse thrust potentiometer controls

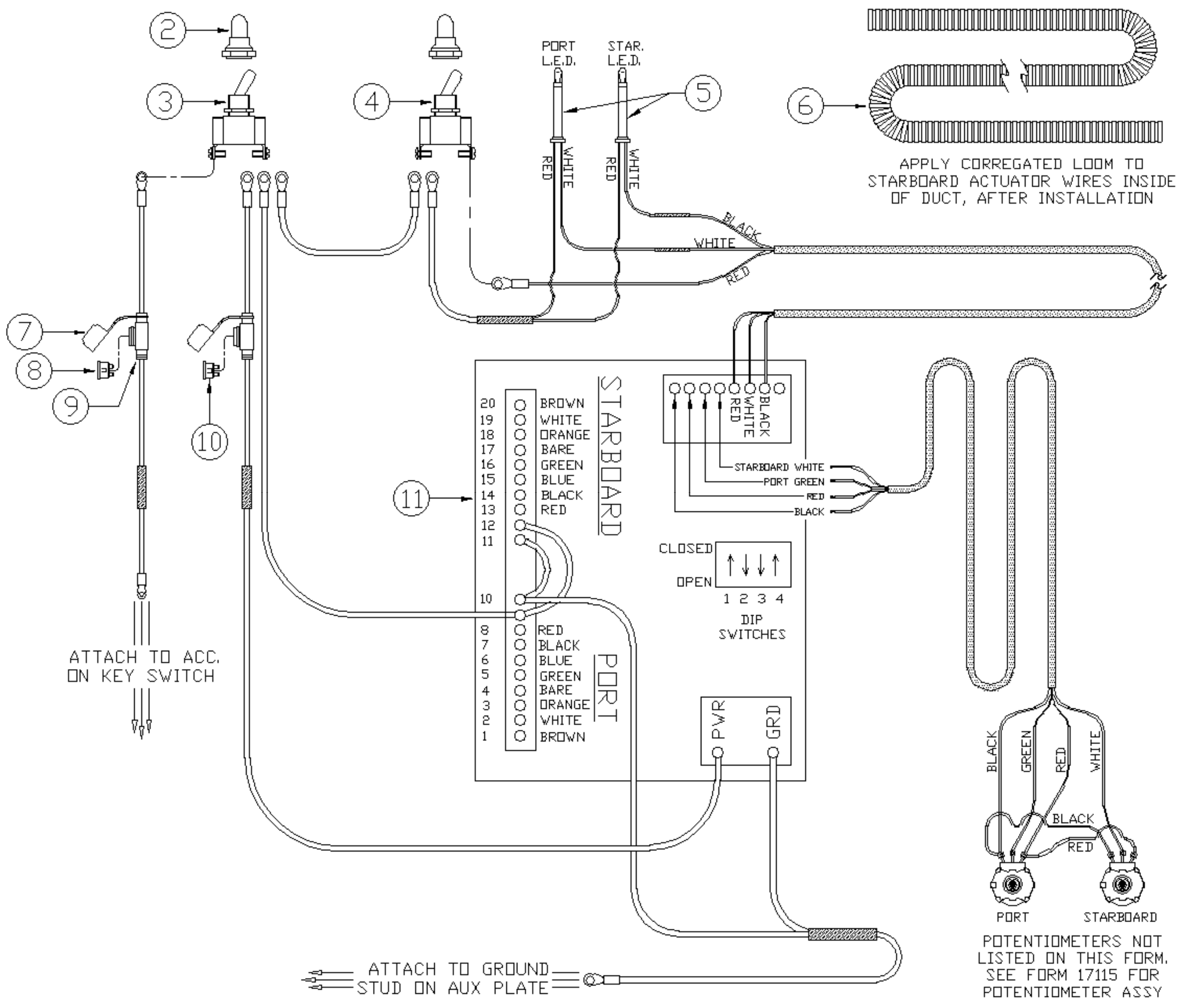
Fit potentiometer (pot.) to bracket with shaft pointing through the bottom of the bracket in the same direction as the welded ends.

Turn the pot. fully clockwise then back 10º and place the cable drum on the pot. shaft so that the slot is parallel with the edges of the bracket and the rounded sides of the slot are facing away from the side of the bracket through which the cable passes. The small set screw is now on the left side with the cable just passing over the top edge of the set screw. The top of the pot. shaft should line up with the bottom of the drum cable slot. Tighten 3/16 set screw.

Fit the brass end of the cable to the BMW control lever (take note of the arrangement of parts if you start this procedure by dismantling these controls). Fit the cable-housing end into the cable receptor on the bracket. Turn drum and pot. 10º or so counterclockwise. Wrap cable with loop end about 260º clockwise around drum; feed through slot so that the cable bend takes place in the carved out slot. Wrap remainder of cable, tighten about 280º clockwise around drum and fit spring through loop in cable. Stretch spring and hook its other end through the hole provided in the bracket. Fit 5/16 set screw and tighten down on cable with a pinching force. Operate BMW bucket levers while checking for proper rotation of pot. drum. If cable rubs against itself, rotate spring until rubbing stops. Drum must rotate a total of about 100º. Lubricate cable with SAE 30 oil.



REF.	PART NO.	DESCRIPTION
1	5704	MICROPROCESSOR ENCLOSURE, MODIFIED
2	1653	TOGGLE SWITCH BOOT
3	1652	TOGGLE SWITCH, ON/OFF
4	2431	TOGGLE SWITCH, MOMENTARY
5	5633	12V LED, GREEN
6	2422	7/16 CORRUGATED LOOM, BLACK
7	2683	MINI AUTOMOTIVE FUSE COVER
8	2685	MINI AUTOMOTIVE FUSE, 15A
9	2682	MINI AUTOMOTIVE FUSE HOLDER
10	2684	MINI AUTOMOTIVE FUSE, 5A
11	5622	HT REVERSE MICROPROCESSOR



Neoteric Hovercraft Inc.
1649 TIPPECANOE STREET
TERRE HAUTE,INDIANA,U.S.A. 47807-2394
TELEPHONE(812) 234-1120 FAX:(812) 234-3217

DRAWN: C. STEIMEL	NAME: REVERSE MICROPROCESSOR ASSY
DATE: 20 JAN, 2009	FORM: 17103

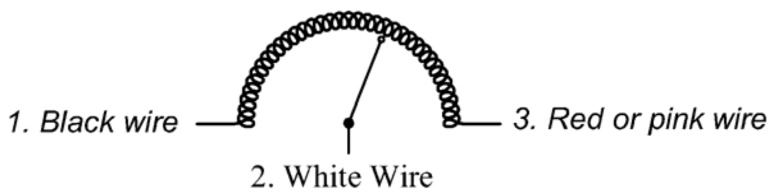
Testing actuator
First, disconnect actuator cable from computer.

Connect 12 Vdc to the red and black actuator wires. Measure the current; this should be 0.6 amps. If not 0.6, actuator is faulty. Reverse the 12 Vdc to black and red wires and check for 0.6 amps.

Connect 12 Vdc positive to blue and negative (ground) to green actuator wires. Clutch should engage and hold actuator rod from moving. If rod can be moved clutch is damaged.

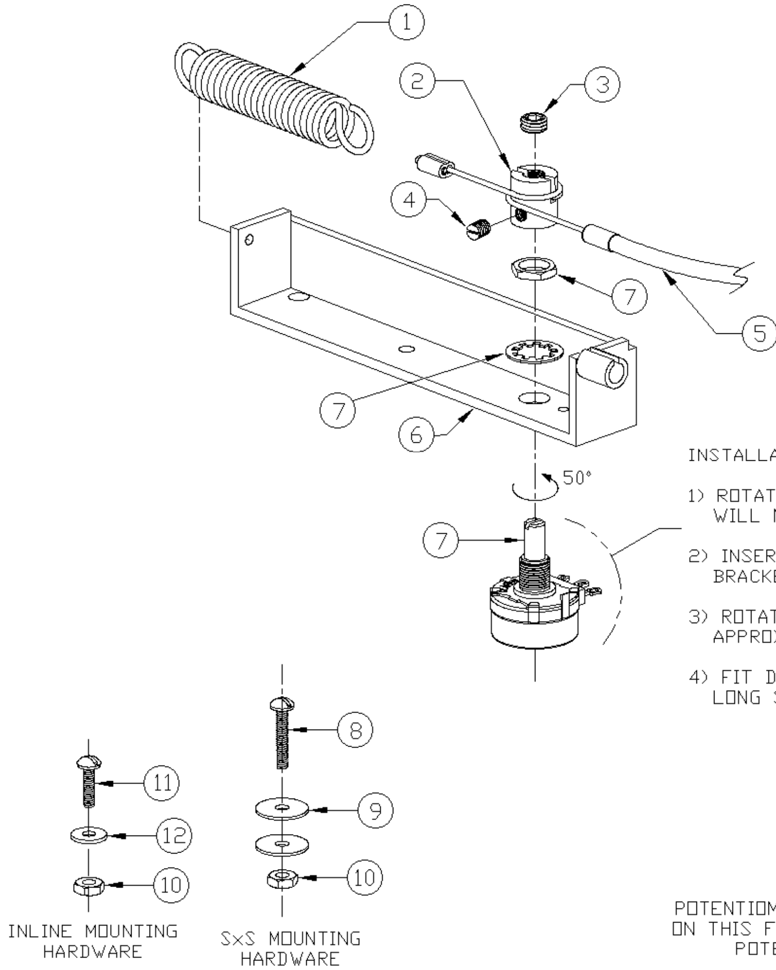
Attach an ohmmeter to the brown and orange wires, which are connected to the potentiometer inside the actuator. A reading of 8 – 12 K ohms should be obtained otherwise internal potentiometer is defective.

Attach ohmmeter to brown and white wires. Move the actuator full stroke. The ohmmeter should read 0 –10 K ohms. If the ohmmeter shows any discontinuity, peeks or 0 ohms during the stroke, the potentiometer is faulty.



Hand control potentiometer: This should read 0 – 10 K ohms when tested.

BILL OF MATERIAL		
REF.	PART NO.	DESCRIPTION
1	2419	POTENTIOMETER CONTROL SPRING
2	3772	POTENTIOMETER CABLE DRUM
3	2464	ø5/16-24 X 5/32 HOLLOW SET SCREW, HEX SOCKET SS
4	2465	#10-32 X 1/4 CUP POINT SET SCREW, SS
5	3954	POTENTIOMETER CONTOL CABLE, SXS
5	3520	POTENTIOMETER CONTOL CABLE, INLINE
6	3703	POTENTIOMETER CONTROL BRACKET ASSY
7	2970	POTENTIOMETER, 312 DEG
8	2397	#10-24 X 1-1/2 MACH SCREW, PHILLIPS ROUND HD SS
9	2070	1/4 X 5/8 X 1/16 WASHER, SS
10	2333	#10-24 HEX NUT, SS
11	2265	10-24 x 3/4 RD MACHINE Z SLT
12	2353	10 x 0.50 x 0.050 Z WASHER



INSTALLATION NOTE:

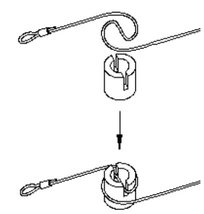
1) ROTATE CLOCKWISE UNTIL DIAL WILL NO LONGER TURN

2) INSERT POTENTIOMETER INTO BRACKET AS SHOWN

3) ROTATE DIAL COUNTER-CLOCKWISE APPROX 50°

4) FIT DRUM WITH SLOT PARALLEL TO LONG SIDES OF BRACKET

CABLE / DRUM INSTALLATION



THE CONTROL CABLE SHOULD BE INSTALLED ONTO THE DRUM AS SHOWN ABOVE

POTENTIOMETER WIRING NOT SHOWN ON THIS FORM. SEE FORM 17103 FOR POTENTIOMETER WIRING.

Neoteric Hovercraft Inc.
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TELEPHONE: (812) 234-1120 FAX: (812) 234-3217

DRAWN: C. STEIMEL	NAME: POTENTIOMETER CONTROL ASSY
DATE: 15 JULY, 2009	FORM: 17115