

Appendix B

Additional Information for Engines with Oil Injection



Attention: The chapter on Oil Injection (Appendix B) is only to be used in connection with the service manual for the corresponding engine type. All sections of the manual, with exception of the chapters concerning lubrication, are from here on still fully valid. Please read all instructions before installing the engine or its operation.

General Directions:

In order to provide for the continuing further development of our products we have to reserve the right to make changes in the size of deliveries, in form, technical execution, and equipment. We also ask for your understanding that no claims can be made based on information contained in this manual.

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1 Description of Oil Injection

1.1 General description of oil injection

An oil pump transports the two stroke oil directly from a container into the intake manifold and in special constructions also directly to hard to reach areas to be lubricated (for example: top bearing when vertically installed [H30; H32]).

The oil pump is fastened to the recoil starter or to a support of the fan housing and is connected by way of the clutch directly to the crankshaft.

With the exception of the H30, H37 and the H32, the oil ratio depends on 2 variables.

1. Number of rotations
2. Throttle position (loaded condition)

The oil ratio of the H30, H37 and the H32 depends **solely** on the engine rpm.

1.2 Names and description of individual parts

- Oil container (**sketch 5.1 pos. 5**)

Function: Reservoir for the two stroke oil for the oil injection

Minimum amount of oil: F30, H30, 3701 und H37 > 2,5 Liter

All others > 1,5 Liter

1. Filling socket with air vent
2. Connection of oil line to oil pump

- Oil level indicator and/or warning light (**sketch 5.1. pos. 4**)

Function: Gives information about present oil level and/or warns when below minimum level.

- Oil filter (**sketch 5.1. pos. 3**)

Function: Cleaning the oil from foreign parts which may damage or congest the oil injection system.

- Oil pump (**sketch 5.1. pos. 2**)

Function: To dispatch and measure out the oil for the suction sockets and the areas to be lubricated.

The oil pump consists of the following main components:

1. Rope disc and Bowden cable holder (**pict. 1**)

Function: Guide for load depending regulator for the amount of oil

Note: With motors of the H-series the amount of oil will only be changed in connection with the rotation number. Therefore, the lever has been adjusted and set at the factory and may not be changed.

2. Oil connections (**pict. 1**)

Function: The connection from oil pump to motor has been factory-installed. The open oil connector is for the connection from the oil reservoir.

2. Installation Instructions

The following instructions have to be adhered to for a safe and trouble free operation

2.1. Mechanical Installation (oil pump control):

- Install a "splitter" into the throttle cable for the carburettor - i.e. throttle valve control.
- Install a Bowden cable between splitter and oil pump.
- Measure and cut the end of Bowden cable and affix lead seal.
- Hang Bowden cable into guide disc.

For 2-cylinder engines:

- Open carburettor i.e. throttle valve completely and adjust the Bowden cable to the required length (**pict. 1a**).

Attention: please note that the respective marks on control dial of oil pump are to be understood only as the minimum settings requiring the final adjustment to the desired mixture ratio.

Remarks: For engines with 2 carburettors or throttle valve sockets, the 2 carburettors, i.e. throttle valves first have to be synchronized to each other, before adjusting the oil pump.

For 3-cylinder engines:

- keep the basic engine setting from factory or adjust the engine without load (e.g. propeller) to idle speed 1400-1500 rpm
Stop the engine and keep position of throttle valve in idle position.
Harmonize mark on oil pump housing and line mark on sheave.

In general:

- Secure the adjusting screw with counter nut.
- Activate throttle control several times, then check the adjustment and if necessary readjust. Repeat until the setting does not change anymore.
- Check that the Bowden cable to the oil pump action is not bent and runs smoothly. Furthermore, assure that the Bowden cable can not be damaged by sharp edges or nearby heat, etc.
- Check that the Bowden cable can not jump from the guide disc.

Note: The amount of oil may not be reduced by changing the setting of the guide disc, because too lean an operation in the partial load may cause serious engine damage. There is no way the operator can adjust the amount of oil.

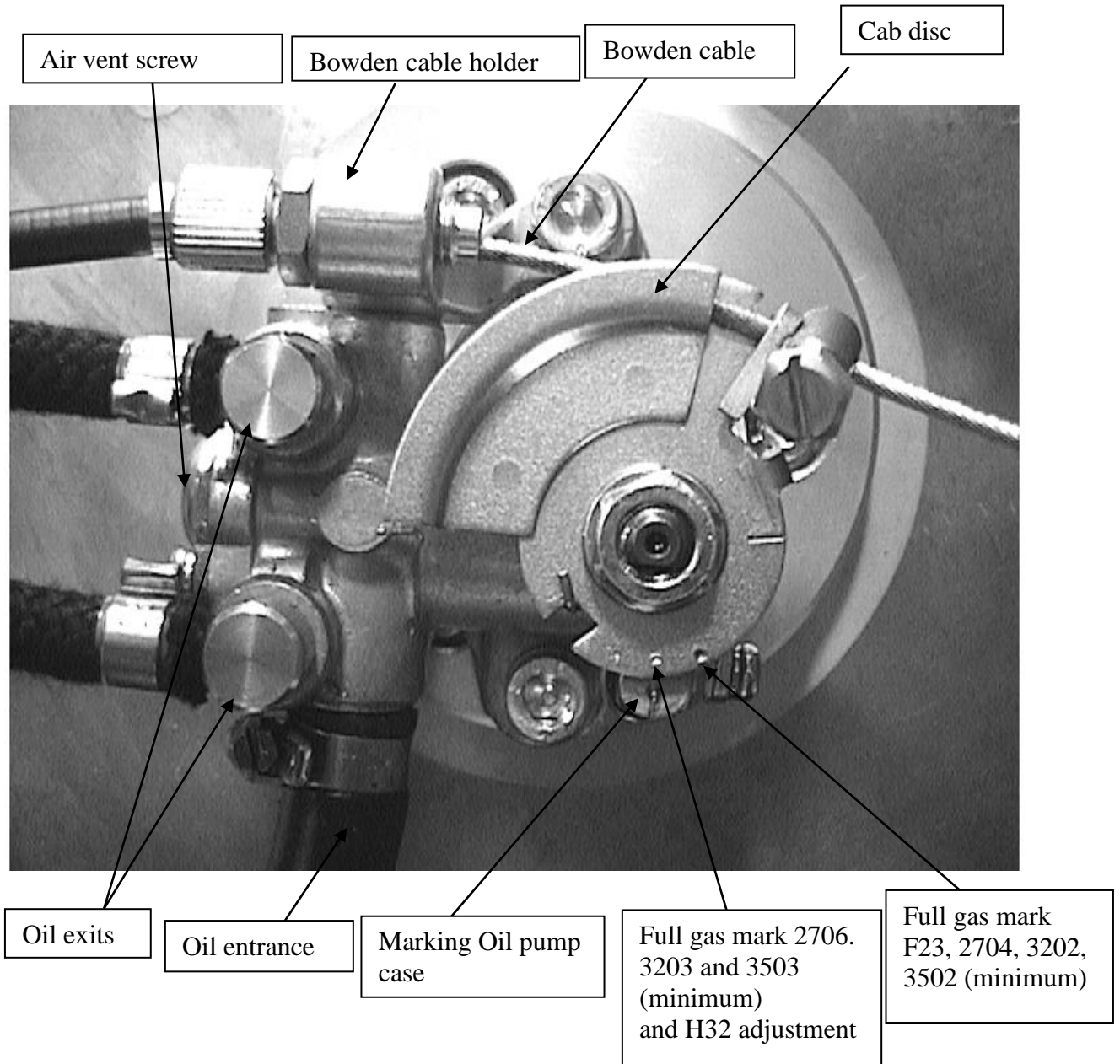
2.2. Hydraulic Installation:

- The oil reservoir must be situated higher than the oil pump, since the oil pump can not begin suction independently.
- An oil filter has to be installed between the oil reservoir and the oil pump in order to avoid damage or clogging of the oil pump.
- All lines have to be attached in sufficient distance to hot parts (i.e. exhaust system).
- The oil lines have to be laid out in such a way, that they may not be damaged by sharp edges.
- The oil lines must not be bent. They have to be secured in such a way that bending can not occur even during operation.
- For safety, hose clamps must be affixed to all connections of the oil lines.

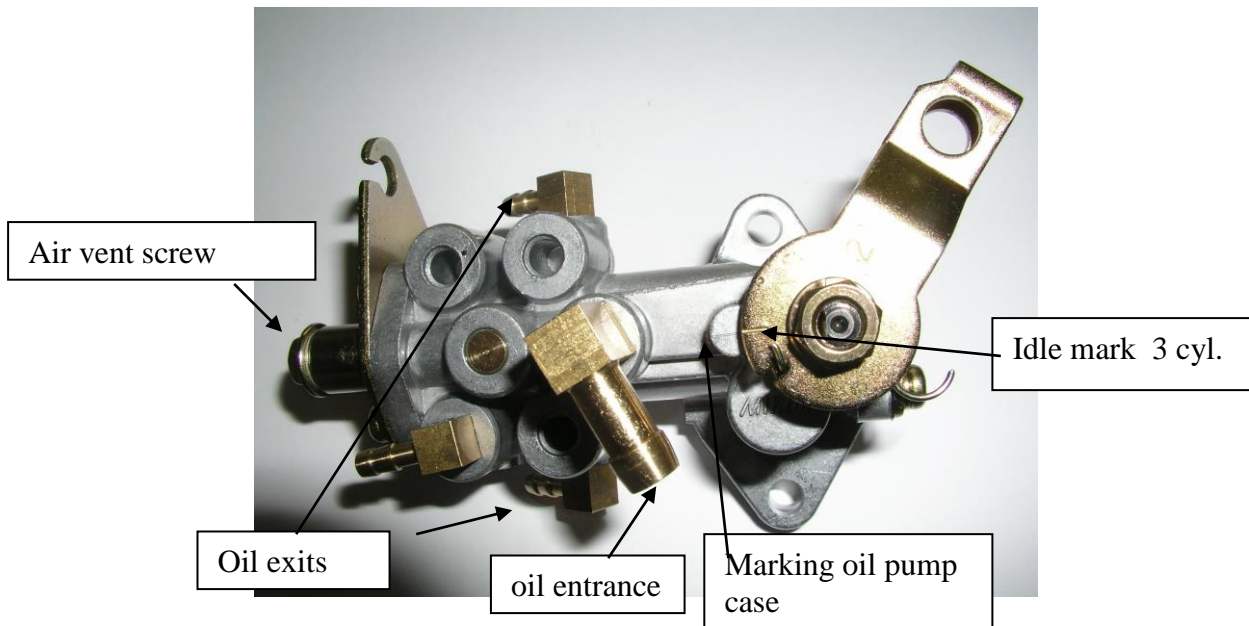
2.3. Installation Instruction

1. Mount the engine as described in the individual service manual.
2. Mount the oil reservoir as described in section 2.2 above.
3. Connect oil reservoir and oil pump, insert an oil filter into the line.
4. Ensure that the necessary amount of oil can flow from the oil reservoir to the oil pump. To do this, hang the oil hose into a measuring cup at the level of the pump, fill 200 ml 2 stroke oil for the oil injection into the oil reservoir. Clock the time between the beginning and the end of the oil flow.
5. For engines H30, F30, 3701, the 200ml must have run through a maximum of 20 min. For engines 2702-2706 and H32 E, 30 min maximum. When measuring, the oil- and surrounding temperature should be between 10-20°C. Should the passage take longer than stated, the position of the oil reservoir has to be changed accordingly until the flow condition described is reached.
6. Connect the oil hose to the entrance of the oil pump and secure with a hose clamp.
7. Fill oil reservoir with 2 stroke oil for the oil injection.
8. Vent the oil pump by opening the air vent screw (**pictures 1a and 1b**). Wait until the oil exits the bore hole without bubbles. Then the vent bore hole must be closed again.

Picture 1a: Front view of Oil pump all engines except 3 cylinder models.



Picture 1b: Front view of oil pump (3-cylinder engines)



2.4 Additional Measures to Ensure Safety of the Construction:

The following measures are not necessary for a secure operation of the installation.

1. Install a fill level indicator into the oil reservoir to control the oil level.
2. Install a warning light when going under the minimum amount of oil.
Recommendation: The setting for the minimum amount of oil should be chosen so as to ensure that the remaining amount of oil is sufficient for the entire fuel tank capacity.
3. Check the used amount of oil in relationship to the used amount of fuel in order to be able to react in time to a blocked or worn out oil pump.
Note: The consumption of oil is strongly influenced by the fuel setting. If the engine is operated with various loads the oil consumption may vary also.

3. Operation of the System

3.1. Operational means

Only brand name 2 stroke oils may be used. They have to be suitable for oil injection and must be labeled accordingly.

For safe engine operation and least wear Göbler-Hirth Engines recommends

BlueMax AL 2-stroke oil.

3.2. First Time Operation:

1. Fill fuel tank with at least 10 liters of pre mixed fuel (1:50).
2. Start engine and let idle.
3. Manually completely open guide disc of the oil pump (see **picture 1**).
4. Check that oil lines fill evenly with oil.
5. After all oil lines have filled with oil, reposition guide disc to the idle position.
6. Let engine run for another 5-10 minutes and turn off.
7. Check all oil lines for leaks and whether the oil pump setting is still correctly adjusted.
8. Operate engine with the rest of the mixture, before refuelling.

3.3. Operation of the Oil Injection System:

See chapter 4 about maintenance and service intervals.

Before each operation it is necessary to ensure, that the oil reservoir contains a sufficient amount of oil for the planned time of operation, since an interruption of the oil supply may lead to serious engine damage.

4. Maintenance-/Service Intervals

Oil injection needs no service with the exception of the components described on the chart.

The following service and checks must be executed:

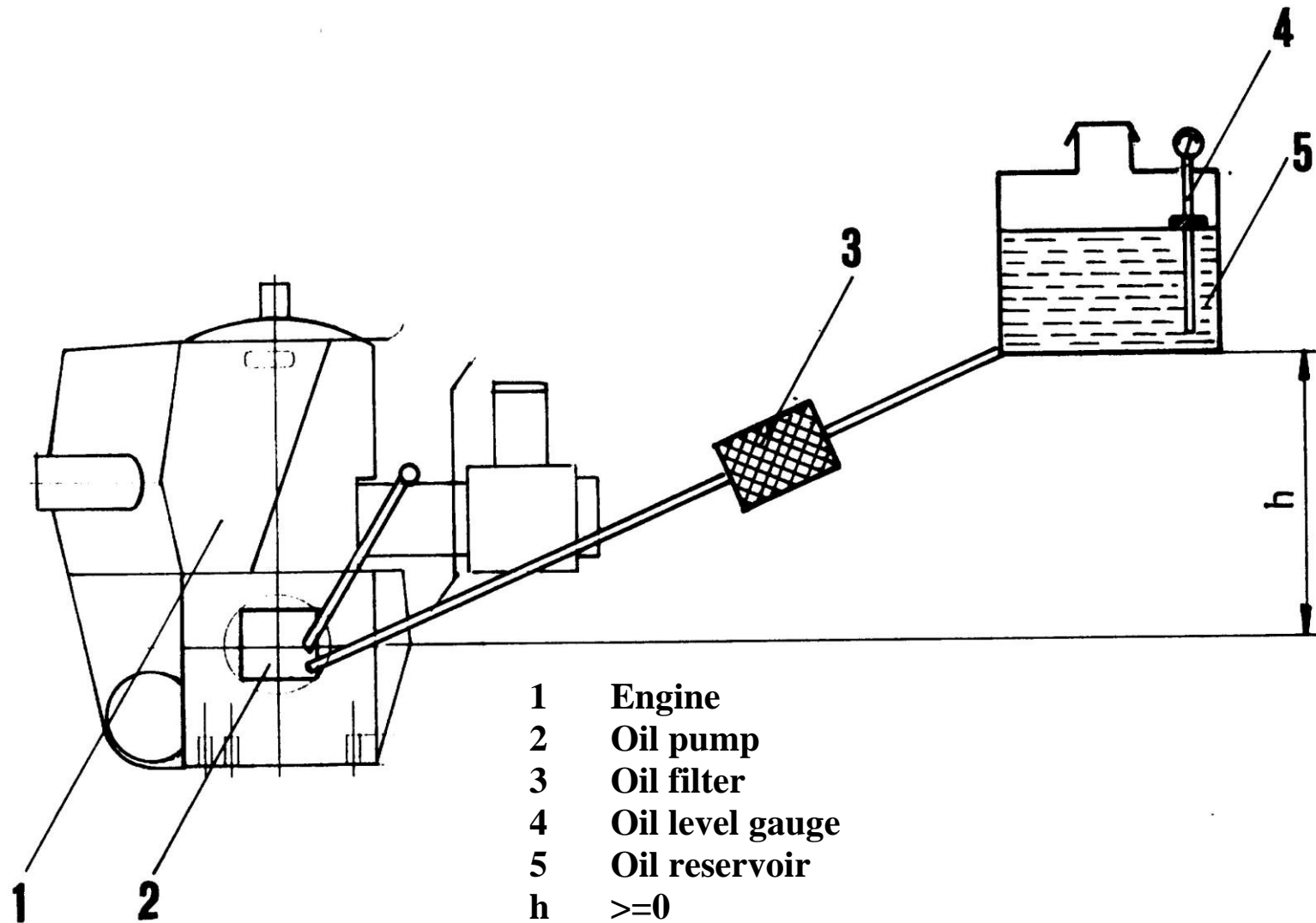
Nr.	Description	Timeinterval				
		In beginning After (hours)				Then every (hours)
		1	5	10	25	
1.	Check setting of oil pump	X				50h
2.	Check whether oil filter is clean		X			25h
3.	Check whether oil pump setting is functioning	Before each operation				
4.	Check oil level in the reservoir	Before each operation				
5.	Check the hydraulic system for leaks	Before each operation				

The following parts have to be replaced:

Nr.	Name	Exchange intervall
1.	Oil filter	Each 200h
2.	Oil pump	Each 1000h

5. Diagram

5.1. Hydraulic Diagram



6. Trouble Shooting

Attention, should it become clear that no or too little oil is being moved, the engine must immediately be changed to a lubrication mixture of 1:50 until the problem is solved, otherwise serious damage to the engine may occur.

Problem	Cause	Control	Elimination
Insufficient oil flow	Oil pump setting not properly adjusted	See Chapter 2.1.	Readjust oil pump setting
	Oil filter blocked	Check amount of flow (see Chapter 2.3. Pos.5)	Exchange filter
Too much oil flow	Oil pump setting not properly adjusted	See Chapter 2.1	Read just pump setting
	Defektive injection valve	Exchange injection valves and check whether or not the defect changes too.	Replace injection valve
No or too small amount of oil in one channel	Oil line blocked or pinched	Check oil lines visually	Exchange oil line
	Oil pump defective	Measure amount of oil flow of all channels without injection valve and with new lines	Exchane oil pump
No amount of oil flow	Inflow stopped up, Oil filter blocked	Check amount of flow (see Chapter 2.3. Pos.5)	Exchange filter
	Oil pump defective	Measure amount of oil flow of all channels without injection valve	Exchange oil pump

Oil injection tips

The oil injection pump pushes oil to the injectors but does not draw oil from the reservoir tank. The pump is gravity feed so your choice for mounting the reservoir tank must be high enough that the outlet on bottom of tank is at least 1" higher than the supply inlet hose barb on the pump. In the case of a tractor prop installation the tank will be lower during climb than in level flight so it may be necessary to mount the tank 2 or 3 inches higher than the pump. Use ¼" hose with the supplied oil filter in between pump and tank. Make sure the oil filter is installed with the oil flow arrow toward the pump.

This is a variable rate oil injection system meaning the RPM of the engine combined with the position of the cable disk on the front of the pump will determine the ratio. The cable disk must be connected to your throttle cable system so that as you increase throttle the disk moves as well which increases the oil flow. On a tractor prop application this can simply be a 3rd cable run all the way to your quadrant. On pusher applications the quadrant will be much farther away from the engine and the small spring on the pump cable disk may not be strong enough to pull the cable back when you go to idle. This is where a 3 way throttle cable splitter can come in handy. You can purchase a cable splitter from Aircraft Spruce. The oil injection manual shows how to initially adjust the cable. On 2 cylinder engines after cable is installed bend the retaining tab over to keep it in place.

Once installed and reservoir tank filled you need to bleed the air out of the pump. There is a small bleed screw on the side of the pump that you turn out a few turns to bleed the air. Once the air is gone and oil begins to come out tighten the bleed screw. There is still air in the injection lines that can not be bled out until engine is started and until it is there will be no lubrication. For your first run you need to premix your first tank of fuel at 50:1 ratio. This will keep engine lubricated until the oil injection system is functioning. Pull the black plastic protective sheath that is around the oil lines back at each injector far enough that you can see the white oil line on each. After engine is started monitor the line. When the air is gone and oil is all the way to the injector you will be able to see it in the line. You can shove the sheath back into place. Once the oil is flowing make a mark on the tank that reflects the oil level. Also record how much fuel is in the fuel tank. Start the break in procedure. Before you refill fuel tank record how much fuel you used for break in. Refill oil tank until you are back at your mark measuring exactly how much oil is required to refill it. Now do the math to determine what ratio of oil you are getting. As an example if you used 8 gallons total for the break in and 14.5 ounces of oil your ratio is 70:1. - $8 \times 128 \text{ ounces in a gallon} = 1024 \text{ ounces of fuel divided by } 14.5 = 70:1 \text{ oil ratio.}$ 70: to 1 is the correct ratio. If the ratio found on the survey is substantially less than 70:1 increase the amount the cable disk on the pump is actuated by adjusting the cable adjuster on the oil pump to increase it. If you are using too much oil adjust the cable adjuster so that the cable disk is opened less. Keep doing short surveys (1 gallon of fuel at 5000Rpm per survey) making adjustments until the required ratio is achieved. When you are confident engine is receiving sufficient oil from the oil injection system (70:1) to operate safely you can stop premixing oil with the fuel and begin running straight gas.

Size of reservoir tank: You want to choose an oil reservoir tank that will not run empty before the fuel tank does. If your oil ratio is 70:1 a 1 gallon oil reservoir tank would

provide enough oil for 70 gallons of fuel. A 3 quart tank would cover 52 gallons, a 2 quart tank is good for 35 gallons and a 1 quart tank would be good for 17.5 gallons of fuel. If you had a 10 gallon fuel tank a 1 quart oil tank would be more than enough oil for each tank full but would have to be refilled each time the fuel tank is refilled. With 2 quarts of oil you could run 3 full tanks of fuel before refilling the oil tank. There are various reasons for oil injection failures but by far the largest percentage of failure is forgetting to refill the oil tank. For this reason some users will choose the 1 quart tank and just get into the habit of refilling it at the same time they add fuel. Also it takes up less room. You want to use a translucent oil tank that allows you to see the oil level at a glance to insure you always have enough before you leave.

Recommended oil ratios: Blue Max 2 cycle injection oil – 70:1

Off the shelf mineral based 2 cycle injection oils – 60:1

Synthetic 2 cycle oils: 45:1 for pure synthetic - 50:1 for synthetic/mineral blends

Note: Hirth does not recommend the use of any type or blend of synthetic oil.

Do not use Blue Max pre mix oil in an oil injected engine.

Engines with recoil starter: On 2 cylinder in line engines the oil pump is installed on the recoil starter. To avoid shipping damage to the pump we sometimes remove the pump and the oil line clamp and store it alongside the engine in a small plastic bag. Also inside the bag are the two 5mm pump mounting bolts. Simply line up the pump driving slot with the pump shaft, push the pump into place and install the two 5mm bolts with blue locktight on the threads. (25 inch pounds) Note that one of the 5mm bolts is longer than the other so be sure to install them in the correct mounting foot on the pump. Install the oil line clamp to the recoil starter case with the spacer between the clamp and the recoil case. Use Blue locktight on the threads and torque to 86 inch pounds.

Re positioning the recoil handle: If you decide you want the recoil handle to exit the engine in a different direction it is possible to pull the 3 mounting bolts out and turn the recoil. You will first have to remove the oil pump. When re installing the recoil it is imperative that it is centered with the crankshaft. To center the recoil install all 3 screws (with blue locktight) until they are just snug and you can still move the recoil slightly. Snap the recoil handle out hard until it catches but do not pull the engine over. Hold the tension on the handle with one hand and tighten the 3 recoil mounting bolts with the other. Now pull the handle out about a foot and let go. If the handle recoils back easily you have the starter centered and you can go ahead and torque the 3 mounting bolts to 86 inch pounds. If the handle has drag when you let go loosen the 3 bolts and repeat the centering procedure until the recoil is centered. If you pulled the recoil off the engine make sure the rubber insert that goes between the pump shaft and the crankshaft is still in the coupling and that the coupling is lined up before you push the recoil in place. If you let the rubber insert fall out the coupling will shear off in a short time and you will have a total failure of the lubrication system. Now that the recoil is in a new position you will find the pump mounting holes no longer line up. Remove the pump mount plate from the front of the recoil, turn it until the pump mount holes are again in correct position then re install the plate mounting bolts with blue locktight (925 inch pounds) and then re mount the pump as per pump mounting instructions previously mentioned above.

Oil injection system / 2 cylinder engine

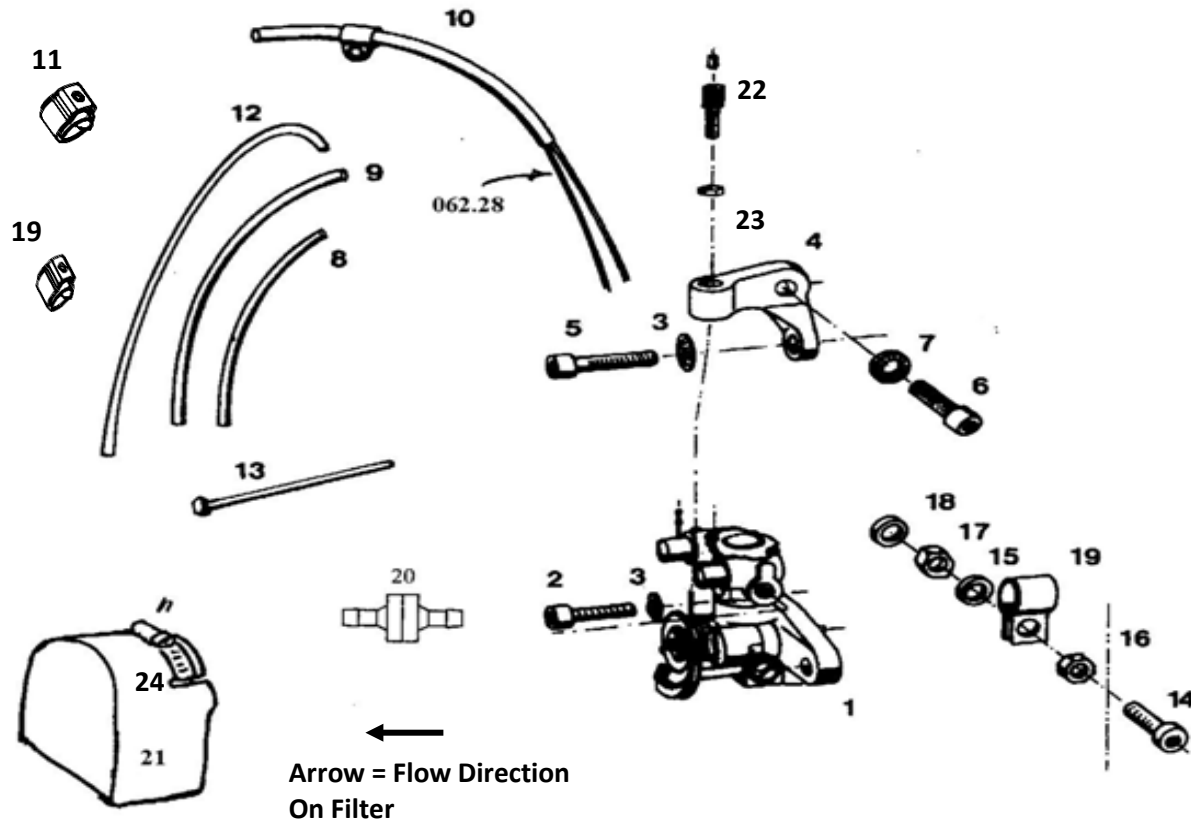


Fig. No	No.	Designation	Hirth Ref. No	Neoteric No.	Notes
1	1	Oil pump	045.9	5426	
2	1	Cylinder screw	D912M5x16		Shorter (port side) oil pump schs .Loctite 243
3	2	Locking washer	053.8/5		Belleville washer under pump mount schs
4	1	Cable adjuster holder	3211 A3		Aluminum bracket to attach cable
5	1	Cylinder screw (Timing Adj. Hardware)	D912 M5X20		Longer (starboard side) oil pump schs.Loctite 243
6	1	Cylinder screw	D912 M6X12	2469	Holds cable adjuster in place.Loctite 243
7	1	Serrated Locking washer	053.8/6	6902	Belleville washer under DIN912M6X12
8	1	Isolating hose	D40621 B5X0,6/140	7128	Short single oil line cover (black)
9	1	Isolating hose	D40621 B8x0,7/330	7129	Long single oil line cover (black)
10	1	Hose	062.28/380	3425	Supply hose front 13" long
11	4	Hose Clamp (small)		5646	Clamp hose to tank & Filter
12	1	Hose	063.28/500	3425	Supply hose rear 16 1/4" long
13	1	Cable tie rap	026.40	2372	Zip tie, do not use
14	1	Cylinder Screw	Din 912 M6x25		Do not use
15	2	Washer	DIN 125 B6,4	6916	Do not use
16	1	Hexagon head screw	DIN 985 M6	5572	Do not use
17	1	Hexagon head screw	DIN 934 M6		Do not use
18	1	Washer	DIN 433 6,4		Do not use
19	4	Hose clamp (smaller)		5489	Clamp hose to pump & carbs
20	1	Oil Filter		5505	Inline oil filter Arrow = Flow Direction
21	1	Splash Cover		6246	Fiberglass part, Neoteric manufactures
22	1	Adjusting Screw		6105	Oil Injection Cable Adjuster Screw
23	1	Adjusting Screw Nut		6106	Nut to lock adjuster screw
24	1	3" Hose Clamp, SS		2734	Hose clamp for splash cover

Oil injection mounting assembly 3203/3202

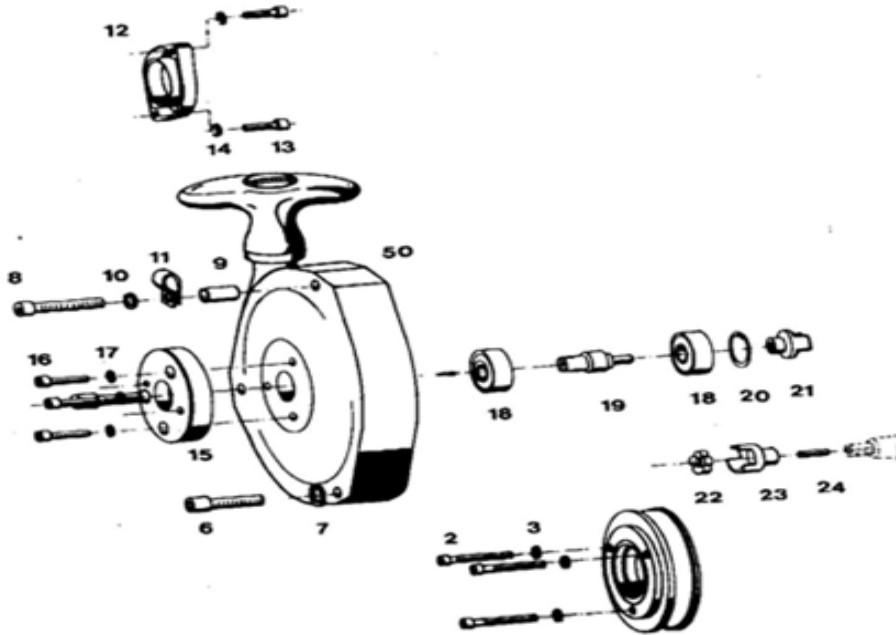
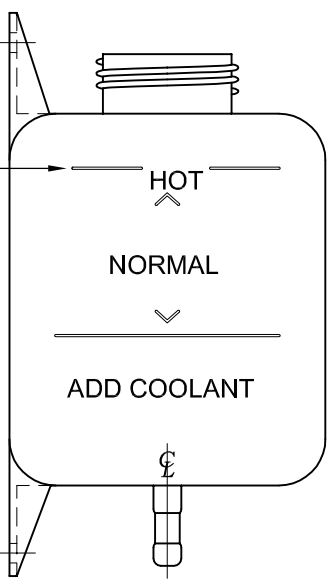


Fig. No	Qty	Designation	Hirth Part No.	Neoteric Part No.	Notes
1	1	Driving Dog with starter	275Y3U	6189	Dog Pulley
2	3	Cylinder Screw	DIN 6912M8X35		Dog Pulley hardware, SCHS Md=23-28Nm
3	3	Tab washer	053.8/8		Belleville washer under DIN6912M8X35
50	1	Recoil	275AF1U	5471	Pull Start
6	2	Cylinder screw	DIN 912 M6X35	6911	Pull Start Hardware SCHS Md=9,6...11 Nm
7	2	Spring Ring	DIN7980 6	6940	Pull Start Hardware, Belleville washer under DIN912M6X35
8	1	Cylinder screw	DIN 912 M6X50	2479	Pull Start Hardware SCHS (Only applies to 5471 pull start long screw)Md=9,6...11 Nm
9	1	Spacer pipe	264 H4	6935	Pull Start Hardware
10	1	Washer	DIN 125 B6,4	6916	
11	1	Pipe clamp with rubber	063.24	6697	Small #8 clamp
12	1	Solenoid starter	195 A1		
13	2	Cylinder screw	DIN 912 M8X30	2348	Starter SCHS bolt
14	2	Spring ring	DIN 127 B8		Belleville washer under DIN912M8X30
15	1	Mounting Plate	3211 A4		Round plate on front 5471
16	3	Cylinder screw	DIN 912 M5X16		SCHS holds on round plate 3211A4
17	3	Serrated tab washer	053.8/5		Belleville washer under DIN912M5X16
18	2	Deep groove ball bearing	DIN 625 6200 2RS/C3	6887	Located inside 5471
19	1	Shaft	3211 A5		Located inside 5471
20	1	Locking ring	DIN 472 30X1,2		Located inside 5471
21	1	Coupling right	3211 A8		Located inside 5471
22	1	Coupling element	040.4/2		Rubber coupling element. Loctite 243
23	1	Coupling left	3211 A7		Aluminum coupler engine side. Loctite 243 –reverse threaded
24	1	Threaded pin	DIN 913 M6X20 LH		Reverse thread set screw that attaches 3122A7 to the crankshaft. Loctite 243-reverse threaded

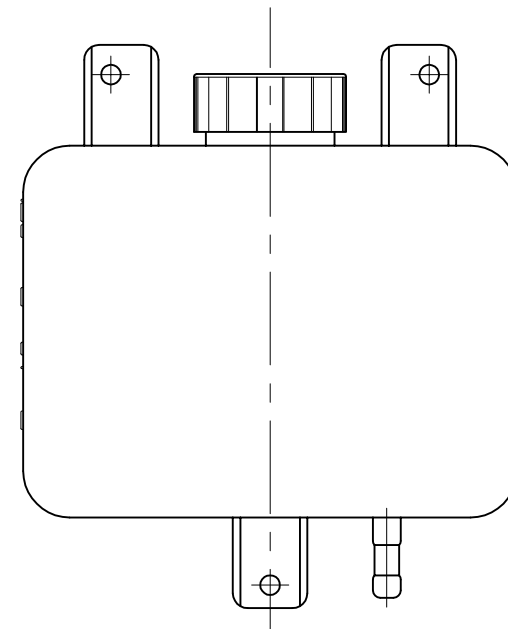
BILL OF MATERIAL	
PART #	DESCRIPTION
5911	OIL RESERVOIR TANK



UPPER OIL LEVEL = 54 FL-OZ
= 3.38 PINTS = [1597ml]




*NOTE:
DISREGARD TANK MARKINGS
EXCEPT FOR UPPER LEVEL



NOTES:

1. TANK CAPACITY: 64 FL-OZ = 4 PINTS = [1893ml] AT TOP OF CAP.
2. 1.00 [25.4] DROP IN OIL LEVEL = 12.8 FL-OZ = 0.8 PINTS = [379ml]
3. CONSUMING 5 GALLONS OF FUEL @40:1 FUEL/OIL RATIO WILL PRODUCE 1.25 [31.75] DROP IN OIL LEVEL

ALL DIMENSIONS IN In AND [mm] TOLERANCE UNLESS OTHERWISE SPECIFIED:				
		SIG. NO.	REVISION	DATE
		 Neoteric Hovercraft Inc. 1649 TIPPECANOE STREET TERRE HAUTE, INDIANA, U.S.A. 47807-2394 TELEPHONE (812) 234-1120 FAX (812) 234-3217		
# REQUIRED:	CHECKED:	DRAWN:	NAME:	
SCALE:		CJ POEHLIN	OIL RESERVOIR TANK	
PAGE:	WEIGHT:	DATE:	NUMBER:	REV.
1 OF 1	7.2 oz	11 NOV, 2015	16646	2