Husqvarna

Workshop manual

PP 518

HUSQVARNA CONSTRUCTION PRODUCTS

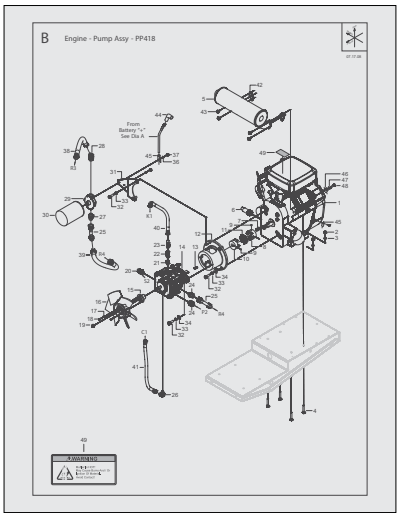
HUSQVARNA PP 518

CONTENTS

Workshop manual

This workshop manual covers all the common servicing actions for the engine and hydraulic system's components. Some very simple and rather obvious repair work has been omitted.

The workshop manual does not cover repairs to the engine and the hydraulic pump. For such actions, please refer to the relevant authorised service workshops with specialised expertise.



Spare parts

The folder includes all the spare parts for Husqvarna PP518. However, parts for the engine and the hydraulic pump must be sourced from the relevant manufacturers.

The folder contains complete exploded drawings for the whole machine where the location, spare part number and appearance of each component is easy to identify.

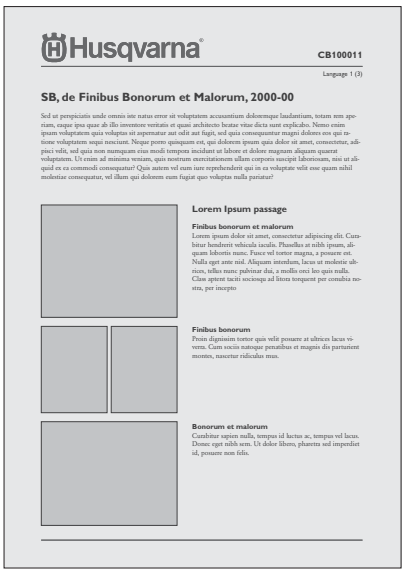
Parts information, called the IPL (Illustrated Parts List), can be downloaded from Husqvarna Construction Products' website or from Husqvarna EPC.

Operators manual

The operators manual describes how the machine is to be used, the functions of the machine, and the maintenance the operator normally carries out.

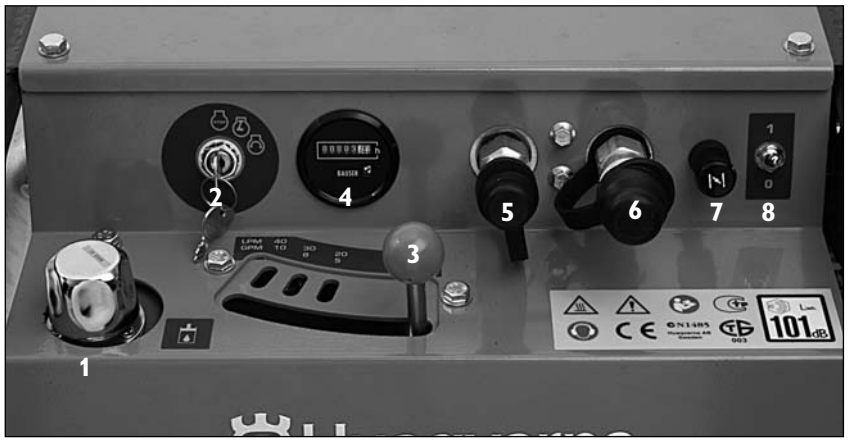
This manual also contains important instructions for the safe handling of the machine.

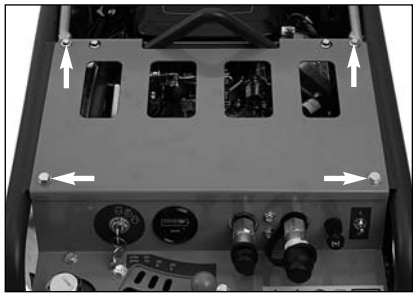
It is extremely important that service personnel are well acquainted with how the machine is used and follow the instructions given in the manual.



Service bulletins

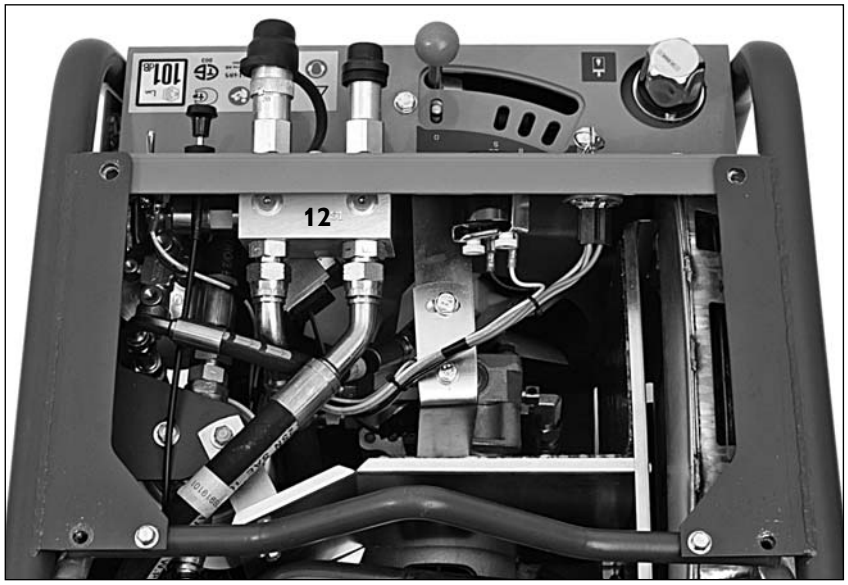
Service bulletins are issued when important design modifications have taken place, for example, or when amended service actions have been introduced. The service bulletins are available to download from the Husqvarna website under “Service bulletins, SB”.





Remove the top panel
You only need to remove the top panel for repair work.

Remove the four screws and lift out the plate.



Panel

1. Hydraulic oil

2. Ignition switch

3. Flow control hydraulics

4. Hour meter

5. Pressure connection

6. Return connection

7. Choke

8. Throttle switch

Short sides

9. Cooler for hydraulic oil

10. Air intake for engine cooling

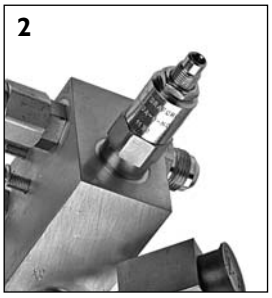
11. Cap for petrol tank

Top panel

12. Valve housing

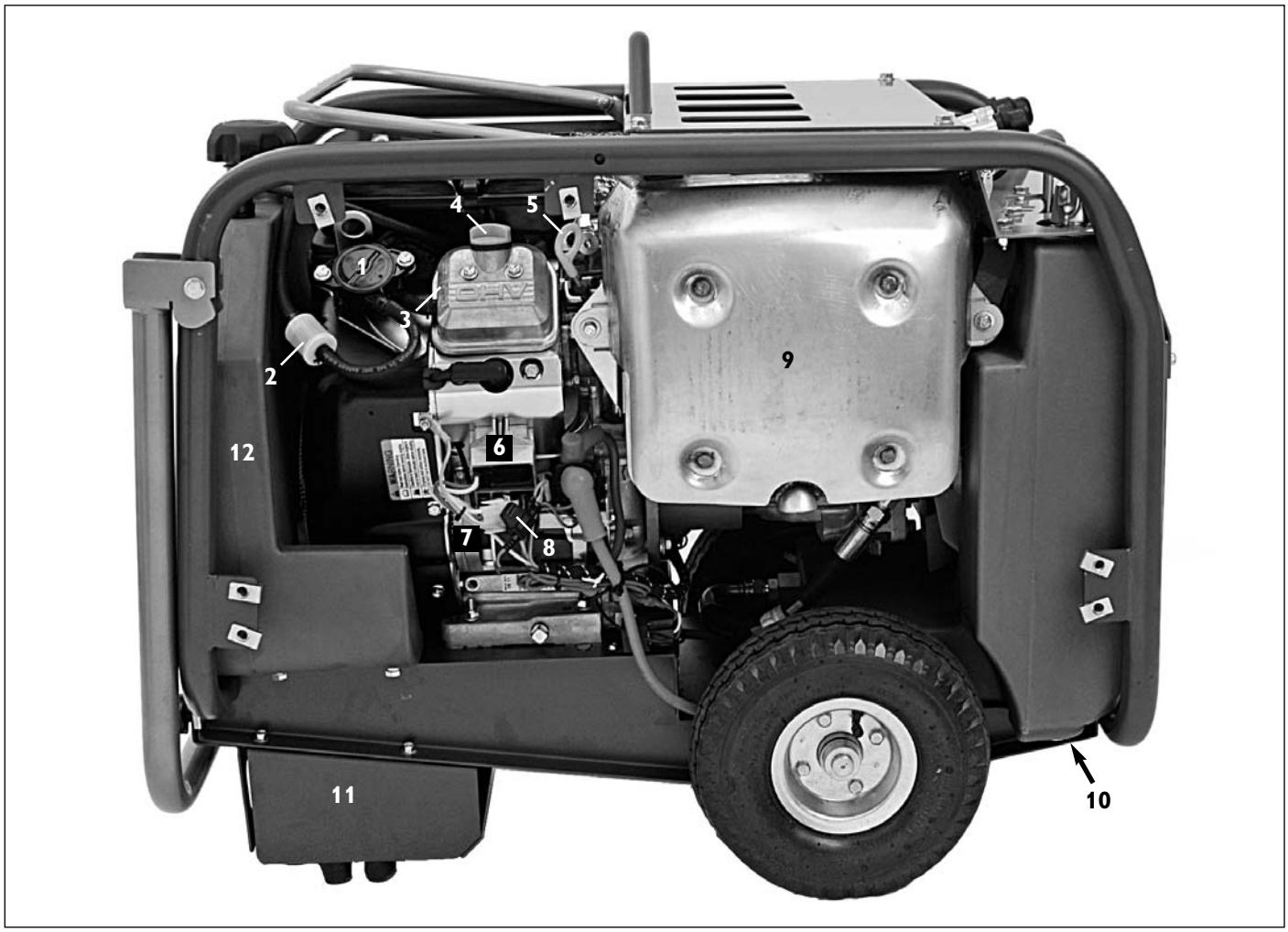
Remove side plate
Remove the left side plate that is required for most service actions.

Remove the six screws and lift out the side plate.



Left side

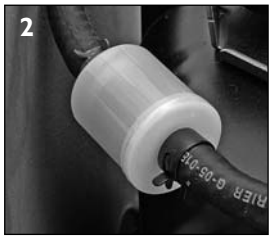
1. Hydraulic oil tank with level gauge, volume 10 litres/2.6 gallons
2. Pressure relief valve
3. Adjustable pressure sensor valves for engine speed control – idle/full throttle (behind the filter)
4. Hydraulic oil filter for oil reserve
5. Oil filter for hydraulic circuit
6. Intake hose from hydraulic tank to pump
7. Pressure hose from hydraulic pump to connection at panel
8. Return flow from panel to oil tank
9. Engine oil filter
10. Machine ID plate
11. Drain valve for engine oil. Opened and closed without tools

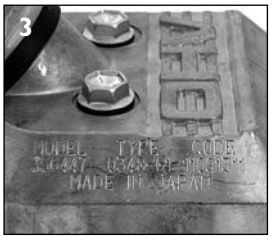


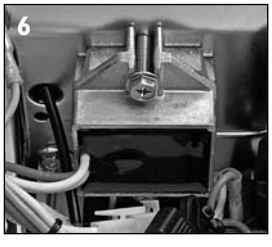
Remove side plate

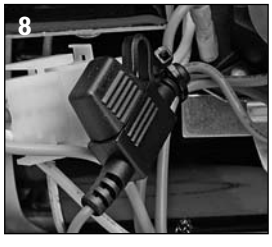
Removing the side plate is required for most less frequent servicing and repair work.

Remove the six screws and lift out the side plate.









Right side

1. Fuel pump

2. Fuel filter

3. Engine ID number

4. Oil top up, engine

5. Dipstick, engine

6. Charge regulator

7. Starter

8. Fuse for starter

9. Muffler

10. Drain plug, hydraulic oil

11. Battery box

12. Fuel tank, volume 7.9 litres/2.1 gallons

Fuel quality

Briggs & Stratton, model 350000, is a four-stroke engine that runs on pure petrol that may contain up to 10 % ethanol. A methanol mixture must not be used. The engine must be switched off when refuelling.

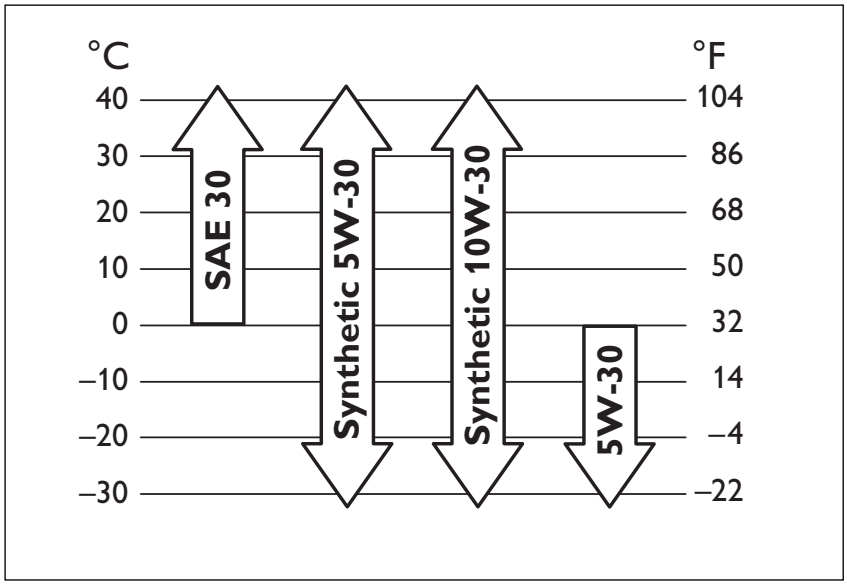
Octane rating

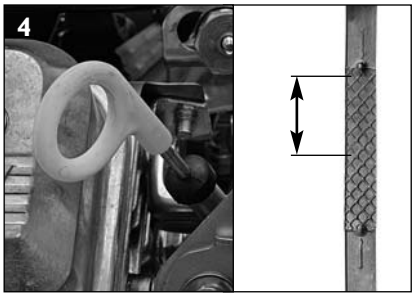
The octane rating is calculated differently around the world.

The RON value is applicable in Europe, and the value must be 91 or higher.

The average value of RON + MON is a different calculation method and is used in the US. The value must be 86 or greater.

Note that the fuel sold as E85 (85 % ethanol) cannot be used.





Oil change, engine

Change the engine oil after 100 hours of operation or once a year. For new machines, the initial oil change must be made after 5 hours of operation. The oil filter must be changed at the same time.

Oil quality

Briggs & Stratton recommends using fully synthetic engine oil in the first instance. Alternatively, mineral oil can also be used according to the adjacent temperature table.

However, semi-synthetic oils must not be used as these rarely withstand the high temperatures that an air-cooled engine emits.

Oil volume

Oil capacity when changing filter 1.42 litres/ 48 fl oz.

Oil capacity without changing filter 1.36 litres/ 46 fl oz.

Oil change

Change the oil when the engine is warm.

1. Drain the oil: Remove the protective plug. Press in the drain valve and turn it to open position.

2. Remove the oil filter. Wipe clean the sealing surface of the filter and use oil to lubricate the rubber gasket on the new filter. Screw the filter in by hand.

3. Top up the oil with the right quality and amount.

4. Start the engine to fill the filter and lubrication system. Turn off the engine and check the oil level with the dipstick after a few minutes. The level must be somewhere in the top half.

The pressure switch means that the starter must be run for an abnormally long period before starting the engine after the oil change.

Starter battery

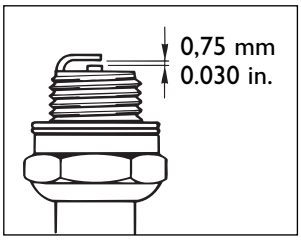
The battery is located in a sliding box. Remove both knobs and pull out the box containing the battery.

The battery has sealed electrolyte and you therefore do not need to check the electrolyte.

Charge

If the power pack has not been used for a long time, the battery may need recharging. Use a normal car charger with a charge voltage of 12 volts.

The safest way to charge the battery is to remove the cables and move the battery from the power pack.



Spark plug

The two spark plugs must be changed following 100 hours of service. Model: Champion RC 12 YC.

Remove the spark plug with the long spark plug socket 16 mm (5/8 in.).

Check and adjust the spark plug gap which should be 0.75 mm (0.030 in.).

Fit the new spark plug and tighten it with a torque wrench to 20 Nm (15 lbf·ft).

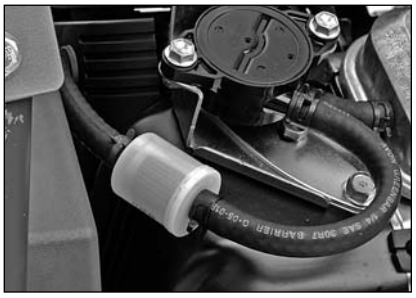
Air filter

The air filter normally needs replacing following 100 hours of service, and more often in dusty conditions.

Open the two locking clamps, remove the centre screw and lift out the filter. The filter unit consists of an outer foam filter and an inner paper filter.

Change filter

The filter unit must be replaced – not cleaned. Blowing with compressed air will damage the paper fibres and will cause dust to penetrate.



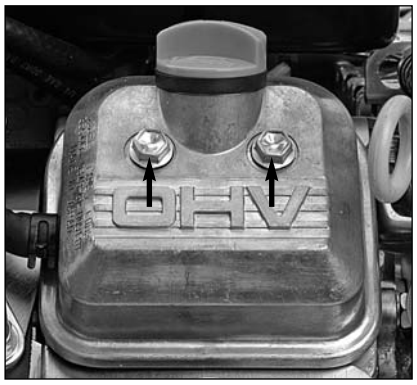
Fuel filter

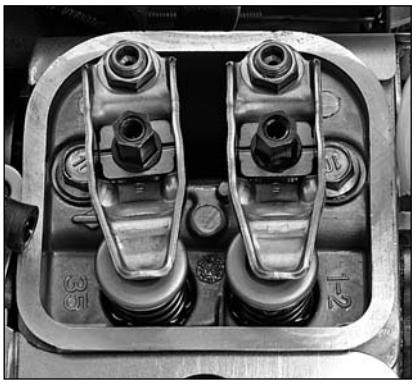
The fuel filter normally needs replacing following 400 hours of service.

Open the hose clamps with pliers and move the hose clamps out a little way along the hose. Change filter.

Checks

Restart the machine after changing the filter and check carefully that there are no leaks.





Valve clearance

Checks
The valve clearance must be checked and adjusted if necessary after 250 hours of operation.

Preparations
Wipe clean the area around the valve covers to prevent dirt from entering the valve housing.

Remove the screws to the valve covers, two per cylinder and lift off the covers.

Make the crankshaft rotatable
For the adjustment of the valve clearance the crankshaft and thereby the camshaft must be rotatable. This is done by turning the cooling fan for the hydraulic oil by hand.

Remove the spark plugs
Remove the spark plugs to eliminate the compression force that prevents the winding of the crankshaft by hand.

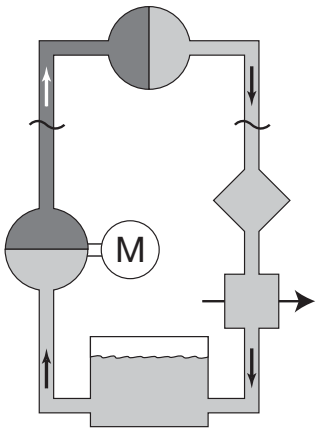
Adjustment

Tools
The following tools are required for the adjustment:
- wrench, 13 mm
- Allen key, 5 mm
- feeler gauge, 0.15 mm (0.006 in.)
- feeler gauge, 0.10 mm (0.004 in.)

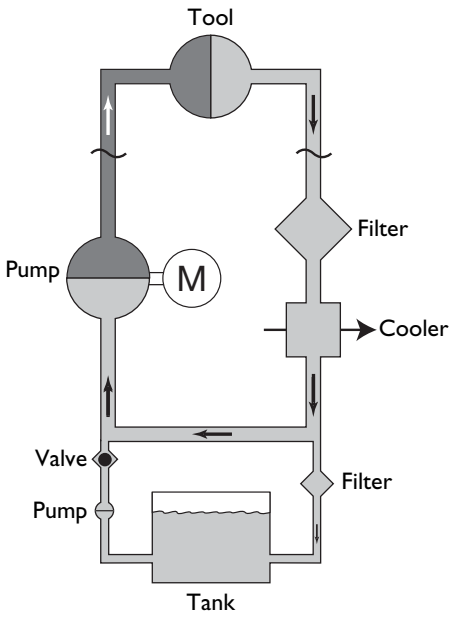
Camshaft position
Start by turning the camshaft into a position where it does not press on the push rod, i.e. the camshaft must be in a position where there is full clearance between the rocker arm and the valve stem. The camshaft is rotated by turning the crankshaft by hand at the cooling fan, as shown in the illustration above.

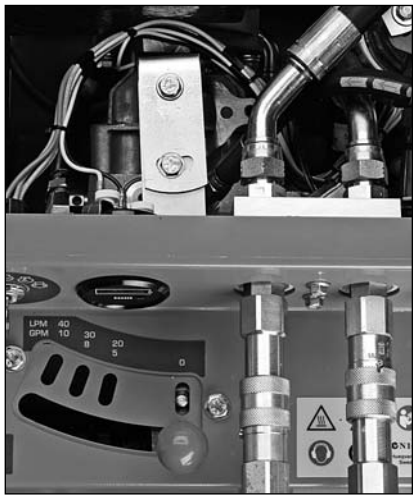
Adjustment
Start by opening the locknut for each valve. Check the gap with the feeler gauge and adjust with the tool to ensure the clearance between the valve and rocker arm is between 0.10 and 0.15 mm (0.04 and 0.006 in.). Now tighten the lock nut. Check that the distance has not changed after tightening.

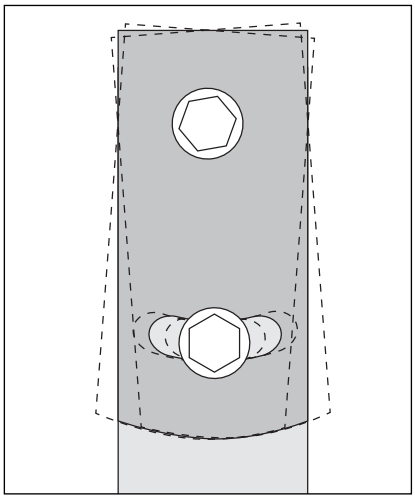
Open-loop system



Closed-loop system







Hydraulpump

Function

The hydraulic pump is a piston pump with variable displacement (flow) that can be set in three fixed positions: 20, 30 and 40 l/min (5, 8, and 10 gal/min).

There are two basic hydraulic systems: Open-loop and Closed-loop. PP518 works on the principle of a closed-loop system.

In an open-loop system the return oil is returned to the tank and then from there pumped to the pressure side of the tool.

In a closed-loop system the oil circulates between the pump and the tool without being returned to the tank. To equalize the volume changes that may be due to leakage, heating/cooling. etc. the oil volume must be balanced in the closed circuit. At the same time, a certain exchange of hydraulic oil from the tank to the closed-loop system occurs. This is achieved with a feed pump and valve system that senses changes in volume.

The closed-loop system explains why the hydraulic power pack has two filters, a large one for the closed-loop system and a small filter for changing oil in the system.

The adjoining very simplified illustrations describe the working principles.

Calibration – 0 l/min

The only check and basic setting that needs to be made is calibration of the flow setting wherever necessary.

This is done as follows: Set the flow switch to position 0 litres per minute. Connect the test equipment and adjust the linkage to ensure that no flow is achieved.

(The pump is a transmission pump that can provide flows in both directions. For the hydraulic power pack only one direction of flow is used.)

Service work

This workshop manual does not describe any service or repair work on the hydraulic pump. We refer you to an authorised workshop with specialist expertise for this.

Hydraulic oil/filter

The hydraulic oil and filter are changed after 250 hours of operation or once a year. Replace when the oil is hot. The filters are accessible when the right guard plate has been removed.

Hydraulic oil

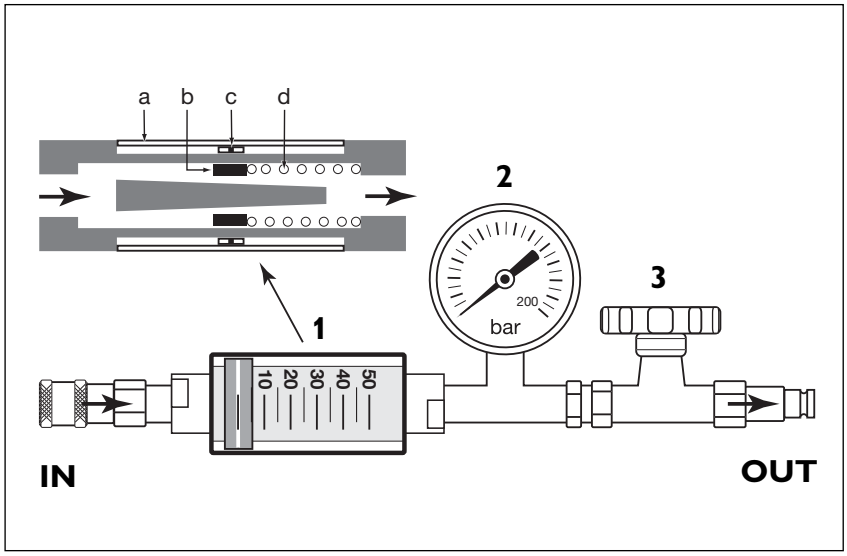
Remove the drain plug at the bottom and drain the tank. Tool: Allen key 5/16 inches.

Hydraulic oil: 46cSt SHS

Vegetable oil or high quality mineral oil. Volume 10 litres (2.6 gallon). Check the oil volume on the measuring glass.

Note
The ignition system supplies power to the spark plug following each revolution of the crankshaft. (Every other spark has no effect on this four-stroke engine.)

The tachometer for two-stroke engines therefore gives the correct value, for example the model sold by Husqvarna, 502 71 14-01.



Test equipment

A number of functions are tested in the following chapters with the engine running. These must be performed outdoors in well-ventilated conditions as the engine emits poisonous carbon monoxide when burned.

Hydraulic function

To test the hydraulic power pack's components, you require testing equipment that consists of the following components:
1. Flow meter
2. Pressure gauge
3. Valve

The valve in the test equipment is used to restrict flow, thereby increasing the pressure in the system. By studying how pressure changes affect the flow and engine speed you can trouble-shoot the power pack's components.

The measuring equipment must be able to withstand a pressure of 200 bar and flows of up to 40 litres/minute.

Tachometer

In order to check the engine speed at different flows and pressures, a basic tachometer is needed that is held adjacent to one of the spark plug wires.

Standard test

A comprehensive review and adjustment of the hydraulic functions comprises two areas that need to be performed in the correct order:

FIRST – Speed control

First you have to check the speed control of the engine and adjust if necessary. This is described on page 14.

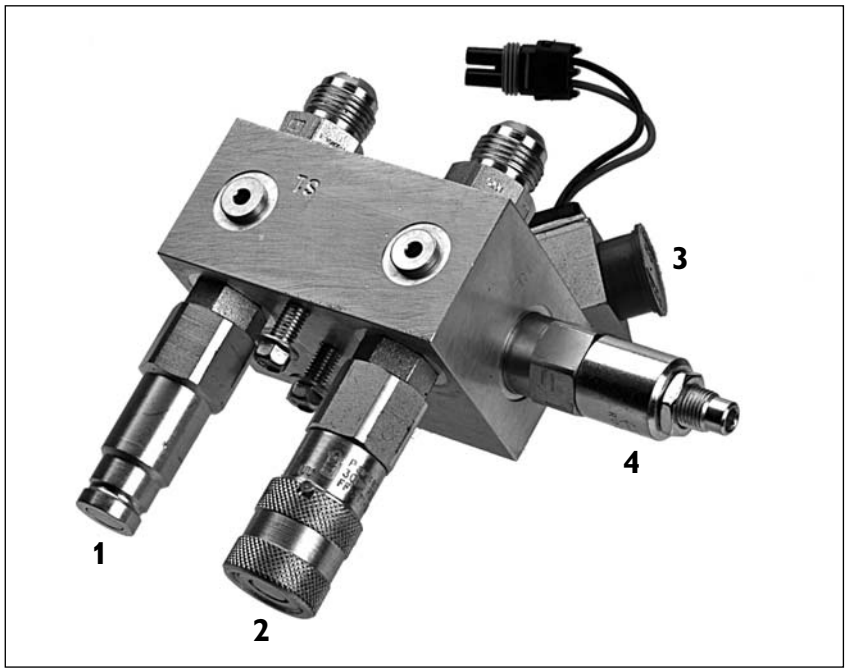
THEN – Test hydraulic units

When the speed control is set correctly, the hydraulic units can be checked. This is described on page 16.

Build own measuring equipment

Measurement equipment is built in principle according to the adjacent illustration. For this you need:
1. Flow meter of the basic cylindrical model where the flow presses a spring loaded (d) hollow piston (b) in different positions depending on the flow rate. The piston is magnetic. A cylindrical ring (c), outside the flow meter's pressure chamber, follows the magnetic piston and displays the flow in the glass (a). The sensor will detect flows of at least 40 l/min.
2. The pressure gauge must show pressures up to 200 bar.
3. The valve should preferably be of the needle valve model, where the flow can be finely adjusted.

All components must be designed to withstand pressures of 200 bar and flows of at least 40 l/min.



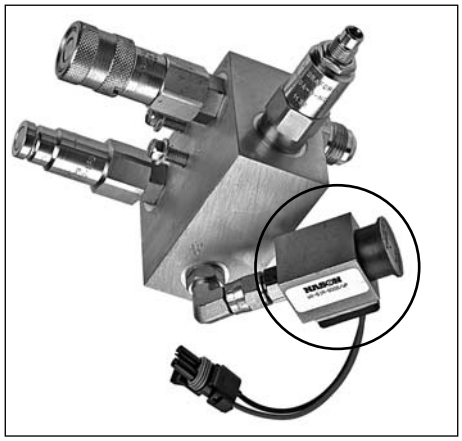
Valve housing components

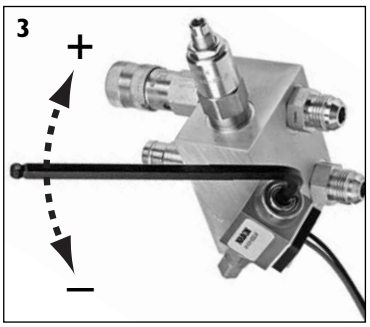
1. Hydraulic coupling, pressure
Pressure line to tool

2. Hydraulic coupling, return
Return line from tool

3. Pressure sensor valve
The pressure sensor valve detects the system pressure and signals to the engine to run at idle or working speed. The electrical connection to the valve is connected to the solenoid which controls the throttle mechanically. The threshold value for idle/working speed can be adjusted.

4. Pressure relief valve
Pressure relief valve is tasked with protecting the power pack and tool from overload. At pressures greater than 150 bar/2100 psi (adjustable), the valve opens and allows the hydraulic oil to pass to the return side.



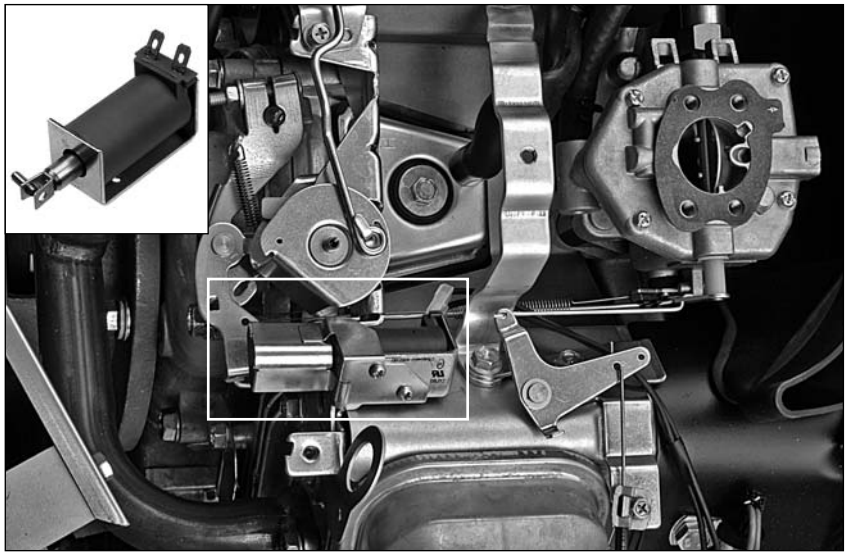


Pressure sensor valve

Fault indication
A defective pressure sensor valve will not regulate the engine speed in line with the back pressure of the tool. Either the engine is idling at high pressures or maintains its working speed at low pressures.

Before removing the valve for replacement, start by checking the electrical connections and the solenoid, illustration 1, that control the throttle valve in that they are free of fault by toggling the throttle switch, illustration 2, between positions 1 and 0.

Adjustment
The threshold value for idle/working speed can be easily adjusted to the required level, illustration 3. The base value set at the factory is about 50 bar/700 psi and suits most tools and conditions.



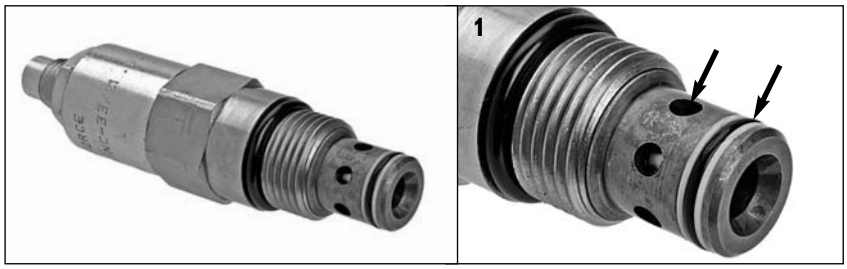
Solenoid

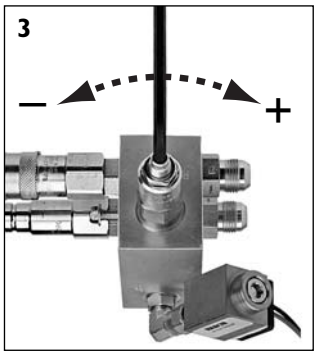
The solenoid has a lever connected to the throttle rod. In idle mode (no power to the solenoid) a spring holds the throttle valve at full throttle. When the solenoid is energised (power to the solenoid) the throttle is pulled down to a mechanically preset idling speed.

The large illustration shows the solenoid placement. To access this, the air filter housing must be removed.

Fault indication
The engine speed does not change when the throttle switch switches position between 1 and 0.

The solenoid can be checked by connecting current, 12 volts, to this. The rod must move to the coil.





Pressure relief valve

Fault indication

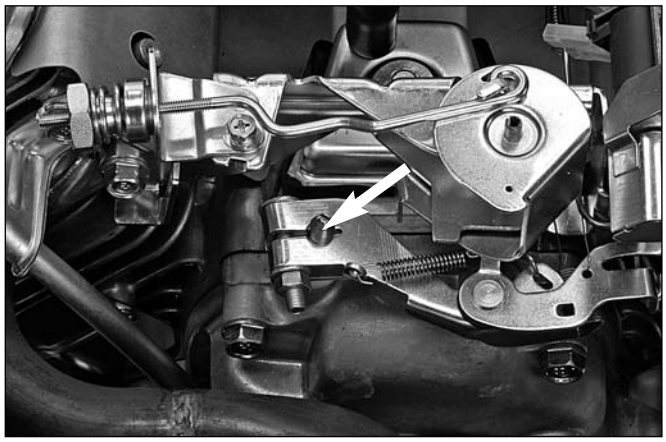
A defective pressure relief valve could result in the power pack exceeding the allowable pressure, i.e. the valve is in a locked position and does not trip. A leaky valve, when open, reduces the pressure.

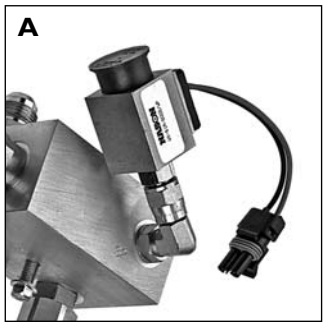
Remove the valve and check that the gaskets, illustration 1, are intact and that the holes are free from contamination.

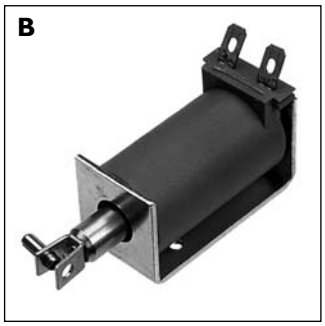
Check that the valve piston is movable by pushing it firmly with a punch, for example, illustration 2. Less force is required if the adjustment is screwed out to the end position. Also check that the valve piston seals tightly against the seat.

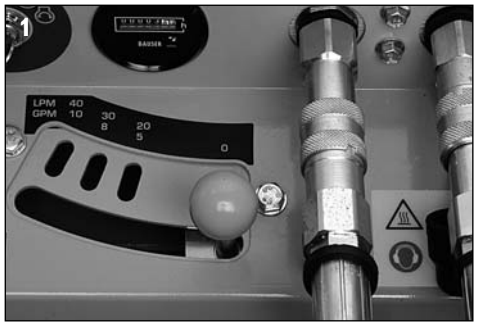
Adjustment

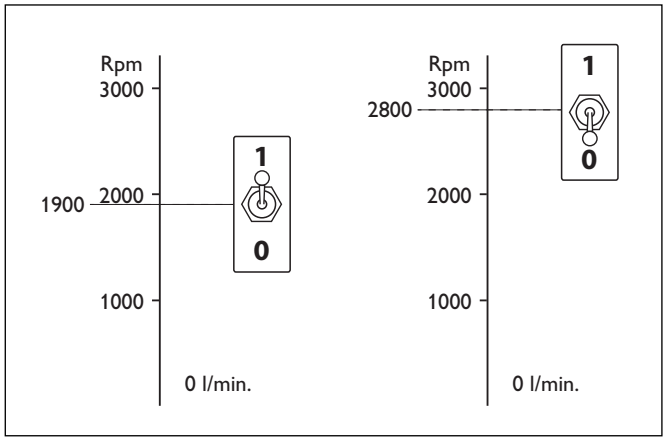
Adjust the valve, mounted on the power pack, with the testing equipment and adjust the opening pressure to a maximum of 150 bar/2100 psi, illustration 3.

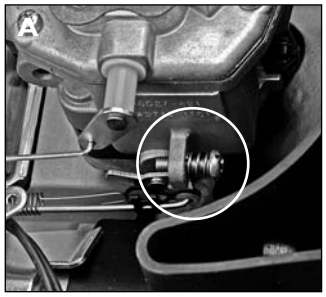


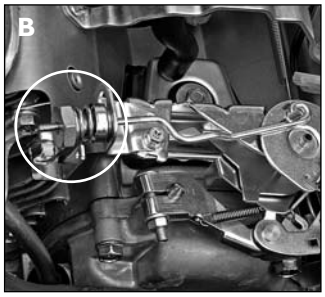












Engine speed control

Centrifugal regulator

A mechanical centrifugal regulator is integrated into the engine's standard equipment which controls the throttle via the linkage's carburettor damper ensuring the working speed (about 2800 rpm) is kept basically stable for various loads. The arrow points to the centrifugal regulator's axis (pivot point). The position is factory set and does not normally need to be readjusted.

Idle/working speed

A pressure sensing system is built into the power pack which automatically gives the machine two speed modes. This is described below.

Pressure sensor valve

The engine has two speed positions, idling and working speed, which can be adjusted as necessary.

A pressure sensor valve with switch **A** controls a solenoid **B** which is connected to the throttle rod. The speed between idle and working speed is controlled by changes in pressure in the hydraulic system, depending on the tool load. At pressures below about 50 bar, the engine must go down to idle speed, and for higher pressures (tool in working mode) increase the engine speed to working speed.

The engine's idling and working speeds

In order to check these speeds, regardless of the impact on the hydraulic system, the checks are best prepared as follows:

1. Set the flow switch on the power pack to 0 l/min.

2. The throttle switch in "0" position eliminates the hydraulic system's speed control and allows the engine to provide working speed in this mode. In "1" position the solenoid is energised and the throttle assumes idle position.

Testing

– Start the engine with the throttle switch set to "1". Measure the speed which should now show about 1900 rpm.

– Set the throttle switch to "0". The speed should now rise to the working speed, about 2800 rpm.

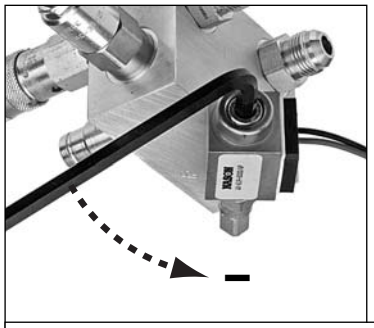
– Switch the throttle switch a few times to check that the speed variations are stable.

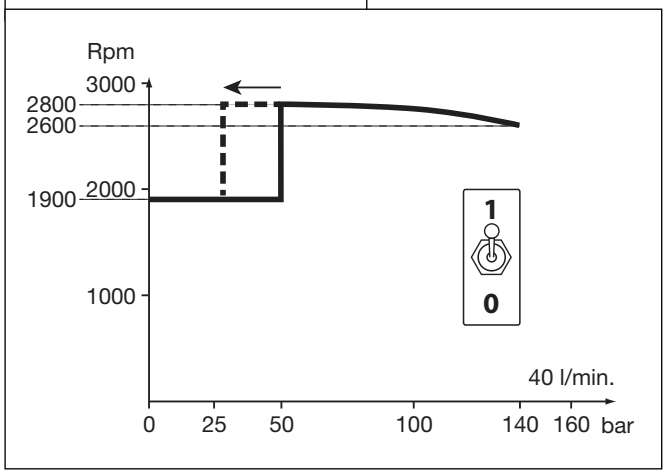
If the engine switches speed during the test, this shows that the solenoid is free of faults, however, this says nothing about the condition of the pressure sensor valve.

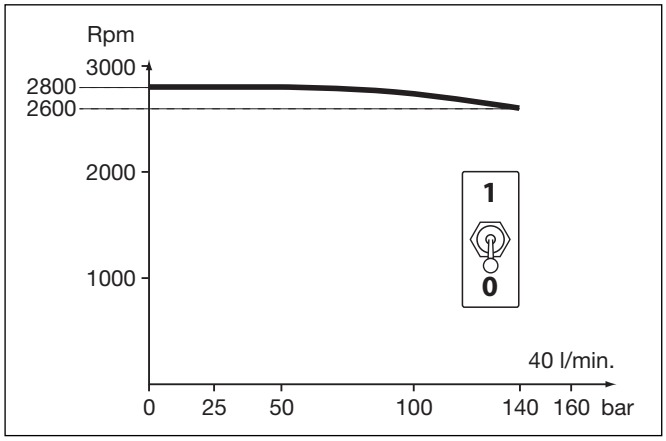
Adjustment

Idling speed (1900 rpm) is adjusted using the screw at the carburettor and provides a stop to the damper shaft **A**.

Working speed (2800 rpm) is adjusted using the screw on the throttle rod which connects to the engine's mechanically controlled centrifugal regulator for maintaining speed **B**.







Threshold value – idling/working speed

Important
Prior to the adjustment of the threshold value, it is necessary to take account of conditions that affect the results:

– Warm run the power pack in order for the hydraulic oil to get the viscosity that it has when working. Cold oil increases the pressure.

– The oil grade, type, and quality, old/new oil.

– The length of the hose affects the back pressure. Long hose lengths and small hose sections raise the pressure.

– High flow rate increases the pressure. Set the flow according to the tool to be used.

Adjustment
The threshold value for switching between idling and working speed is factory set at 50 bar, but can be changed to another value.
Tools that are unloaded provide a very low resistance (pressure rise below 50 bar) does not give the engine a signal to increase the working speed. Hydraulic tool with a high, unloaded flow resistance, longer hose lengths and cooling may require raising the threshold value to ensure the idling speed.

To change the threshold value, the power pack is connected to the test equipment as shown on page 11. Set the flow to the power pack to suit the tool's specification. Restrict the valve on the test equipment until the required threshold (bar) value is reached idling/working speed. Adjust the pressure sensor valve to the level where the engine speed is changed. Suitable steps are an eighth of a revolution at a time.
Note: The pressure sensor valve has an Allen key size of 5/16 inch.

Alternatively, the tool can be connected to the power pack. Set the correct flow adapted to suit the tool. Set the tool in working position (helpers needed) and adjust the pressure sensor valve to a value where the working speed kicks in.

Example
In the adjacent example, the threshold value (idling/working speed) has reduced from 50 bar to 25 bar.
In order to lower the threshold value, adjust the pressure sensor valve counter-clockwise. Clockwise adjustment increases the threshold value.

Engine power

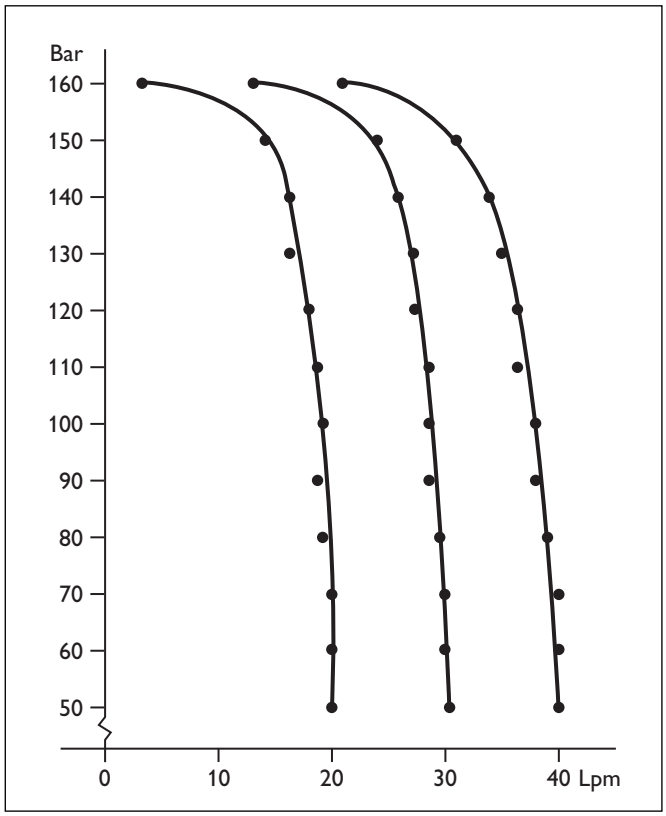
A check that the engine power and the engine's mechanical centrifugal regulator are working is performed as follows:

– Connect the test equipment as described on page 11.

– Set the flow selector to 40 l/min.

– Start the engine. Slowly throttle the flow to the test equipment's valve and note the speed change in the engine following increasing pressure. When the engine is operating unloaded, the speed should be about 2800 rpm. At full load, the speed drops to about 2600 rpm if the engine is producing the right power.

Test the hydraulic components
The hydraulic system functions and condition are tested on the following pages. Always start by testing the engine function as shown in the following description in order to exclude this as a source of fault.



Flow 40 Lpm

Bar	Lpm
50	40
60	40
70	40
80	39
90	38
100	38
110	36
120	36
130	35
140	34
150	32
160	21
170	11

Normal values

Standard test

The method used to check the condition of the hydraulic power pack with respect to the hydraulic components are described here. Before this test is performed, the functions for speed control must be accurate. A check that the engine power and the engine's mechanical centrifugal regulator are working is also made according to the previous page.

Connect the power pack as per page. 11. Warm up the hydraulic oil by running the power pack with flow and pressure through the test instrument for a few minutes.

Check pressure/flow

The test is to show how the flow changes when the pressure rises. Internal leaks are found to be most pronounced when the pressure is high.

Test the power pack by checking how the flow changes following a rise in pressure. Pressure changes are made to the valve on the test unit.

Test protocol

An example of a test protocol for flow setting 40 litres per minute is displayed at the bottom of this page. The flow was read for each pressure rise of ten units. The readings are then marked in the diagram above. Note that some spread of values is due to the measurement equipment not being perfect but that gives fully adequate precision to assess the condition of the power pack.

Diagram

The diagram shows the sequence of events at the flow settings 20, 30 and 40 l/min.

At the initial position when the pressure is in principle 0 bar, the engine runs at idle speed. The flow is below the value set on the flow selector.

When the pressure reaches above about 50 bar the pressure sensor valve is activated and the engine increases to a working speed that gives the selected pump volume.

When the pressure exceeds about 150 bar, the pressure relief valve trips and the flow reduces.

Normal values

The diagram to right shows the typical curves for a power pack with no faults. Typically, it is the slowly decreasing flow curve following an increase in pressure which then drops rapidly when the pressure exceeds 150 bar and the pressure relief valve opens.

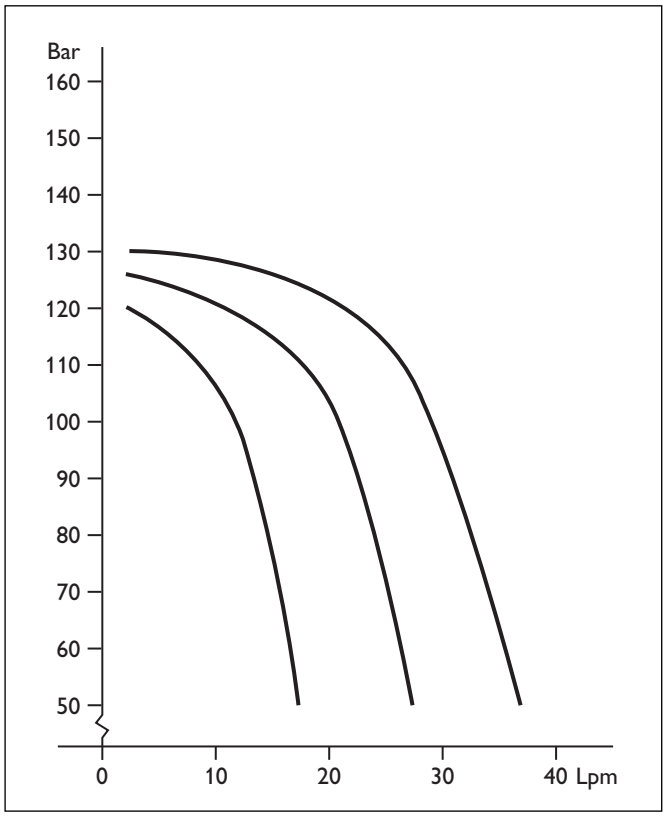
If a measurement is made with standard length hydraulic hoses connected (7.5 m/25 ft) the flow values will drop by about 10 %.

Tolerances

The test values are highly dependent on the type of oil and oil temperature at which the tests are performed. Normal measuring instruments for measuring pressure and flow also usually have large deviations in measurement accuracy.

As several factors affect the test results, it is far more important to study the relative values during the test and pay less heed to the absolute values.

A relatively flat curve between 50–140 bar testifies that the power pack is in satisfactory condition.



Troubleshooting

Potential faults

Faults in the hydraulic system can essentially be looked for in three units: the hydraulic pump, the pressure sensor valve or the pressure relief valve.

The diagram to the left shows typical curves for these units if leaks are present. A defective hydraulic pump or leaky valves often cause pressure drops that are so large that maximum pressure is not reached.

Hydraulic pump

A worn hydraulic pump exhibits its deficiencies particularly in the higher pressure ranges. As long as the pump is operated at low pressure, it will retain its capacity for the most part. When the pressure increases, larger amounts leak beyond the pump pistons and the flow drops in line with the increasing pressure.

Pressure sensor valve

A defective pressure sensor valve will not allow the engine to reach operating speed when the pressure exceeds 50 bar. The flow does not reach the set value. The function of the pressure sensor valve can be easily tested by excluding this with the throttle switch set to full throttle.

Pressure relief valve

A leaking pressure relief valve provides pressure and flow falls. If the pressure relief valve is locked in the closed position, it will not trip at 150 bar.

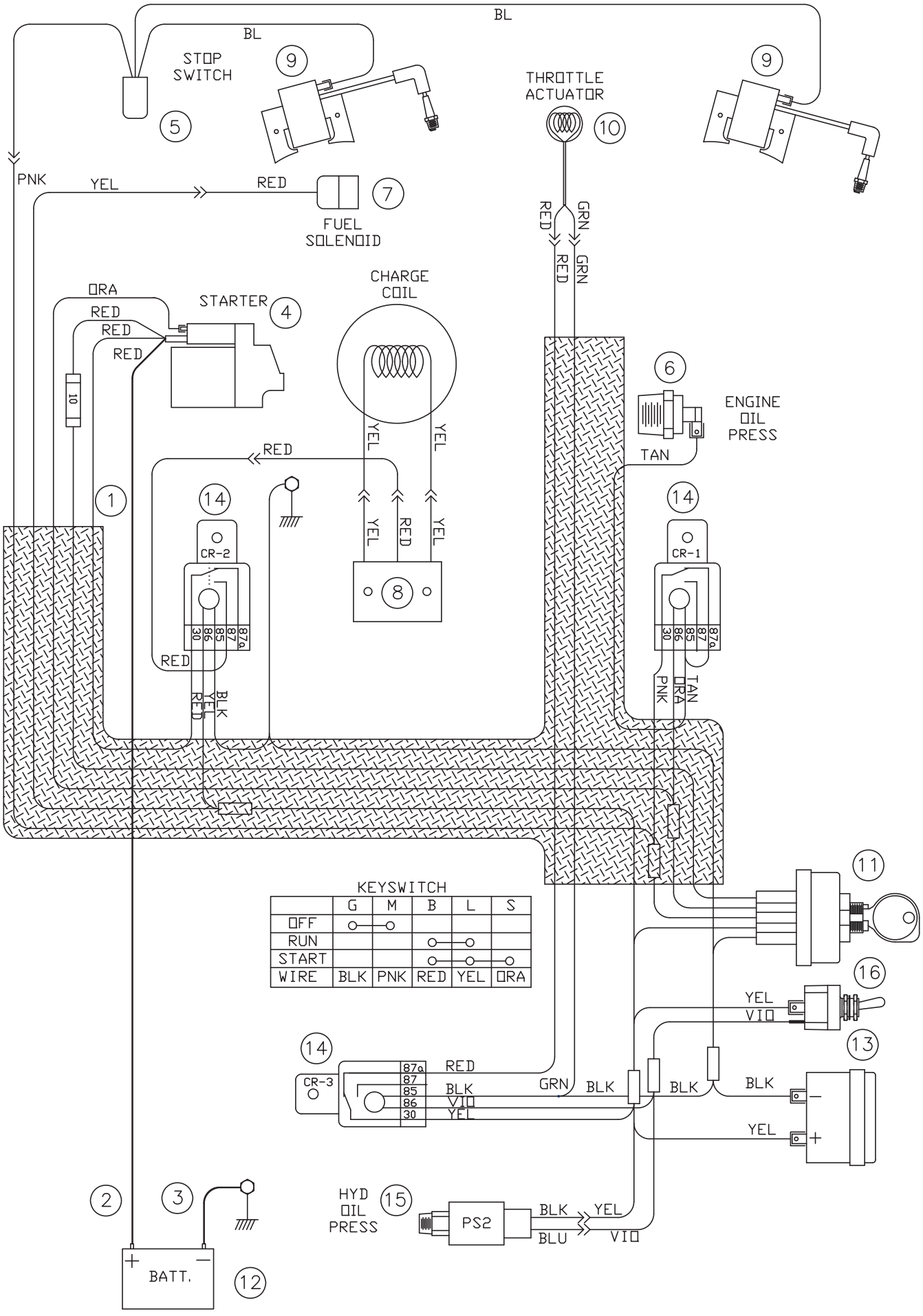
Hint

As all the described internal leaks give roughly the same symptoms when measuring, you need to assess the potential faults.

If the fault occurred suddenly or after the power pack has been unused for a long time, the fault is likely to be connected to the valves.

An older power pack that is frequently used, perhaps even without the prescribed oil changes and where the fault has been compounded over time, probably has a worn hydraulic pump.

Start by checking the hydraulic oil! Worn oil is the most common cause of poor hydraulic power.


BL
BL
STOP SWITCH
9
9
5
THROTTLE ACTUATOR
10
PNK
YEL
RED
7
FUEL SOLENOID
RED
GRN
RED
GRN
CHARGE COIL
ORA
STARTER
4
RED
RED
RED
10
6
ENGINE OIL PRESS
TAN
YEL
YEL
RED
1
14
14
CR-2
CR-1
YEL
RED
YEL
8
87a
87
85
86
30
RED
BLK
YEL
RED
TAN
ORA
PNK
KEYSWITCH
G M B L S
OFF
RUN
START
WIRE BLK PNK RED YEL ORA
11
16
YEL
VIO
14
13
CR-3
87a
87
85
86
30
RED
BLK
VIO
YEL
GRN
BLK
BLK
BLK
YEL
2
3
HYD OIL PRESS
15
PS2
BLK
BLU
YEL
VIO
BATT.
12

Component	Quantity	Description
1	1	Cable trunk
2	1	Battery cable, positive
3	1	Battery cable, negative (earth)
4	1	Starter
5	1	Stop switch
6	1	Oil pressure sensor
7	1	Fuel valve
8	1	Charging relay
9	2	Ignition coil
10	1	Solenoid for throttle valve
11	1	Ignition switch
12	1	Battery 12 volt
13	1	Hour counter
14	3	Relay NO/NC
15	1	Pressure sensor valve
16	1	Throttle switch

Colour codes

BLK	Black
BLU	Blue
GRN	Green
RED	Red
YEL	Yellow
PNK	Pink
ORA	Orange
TAN	Tan
VIO	Violet

9 SERVICE SCHEDULE

	Daily	50 hrs	100 hrs	250 hrs	400 hrs	As needed
General						
Check the safety equipment	●					
Check for leaks or damage to the hoses/couplings	●					
Motor						
Check oil level	●					
Check and clean the area around the muffler (fire hazard)	●					
Oil change*		●				
Replace oil filter			●			
Fuel filter				●		
Replace air filter**		●				
Replace spark plug			●			
Check valve clearance				●		
Clean engine air cooling system**					●	
Clean the oil cooler's airways**					●	
Hydraulics						
Oil level	●					
Oil change				●		
Replacing the filter, 2 filter				●		
Other						
Charge battery, 12 V, 2-10 A						●
Tyres, pressure 2 bar/30 psi						●
Engine speed control						●
Calibrate the flow setting						●

* The initial oil change on the new machine should be made after 5 hours of work. Volume 1.4 litres/48 fl oz.
Briggs & Stratton recommends fully synthetic oil 5W-30 or 10W-30.
Never use a semi-synthetic engine oil!

** Under dusty conditions, the actions must be carried out more often.

www.briggsandstratton.com

www.hydro-gear.com

Basic units

Previous chapters have described how the machine's control functions are checked and adjusted. These components have been developed by Husqvarna and together with the other components developed by Husqvarna, they are included in the parts list IPL (Illustrated Parts List).

The hydraulic power pack's main components are the engine and the hydraulic pump. These are original units that come from other manufacturers. Repair instructions and spare parts are not included in the workshop manual and parts list. For work on the engine and hydraulic pump, we refer you to the relevant company's organisation.

Engine – Briggs & Stratton 350000

Basic engine 350000 is available in a large number of versions with various add-ons. PP518 has a version with type number 356447.

Frequent replacement parts, such as air filters, oil filters, etc. are included with the article number in the operator's manual included. For spares and repairs of the engine, we refer you to Briggs & Stratton's authorised representatives.

Hydraulic Pump – Hydro Gear, Type PR

The hydraulic pump is a transmission piston pump of the PR model with a displacement of 16 cubic centimetres (0.97 cubic inches). The hydraulic pump normally requires no spares other than the replacement of filters, which are listed in the parts list from Husqvarna.

For repairs of the hydraulic pump, we refer you to representatives for Hydro-Gear or another company with specialist expertise in hydraulic pumps.

Dismantling in basic units

The following pages describe how the machine is best disassembled into basic units. Dismantling at a detailed component level has been omitted as the structure of the machine is quite simple. The purpose of this chapter is to provide guidance on the best method to dismantle and assemble the basic units of the power pack.

Tools

For the dismantling/assembly of the power pack into the basic units, the most commonly available tools are needed.

The hydraulic power pack has a screw standard mostly in millimetres. The main exception are the hydraulic system's pipe fittings that have inch dimensions and require the appropriate tools.

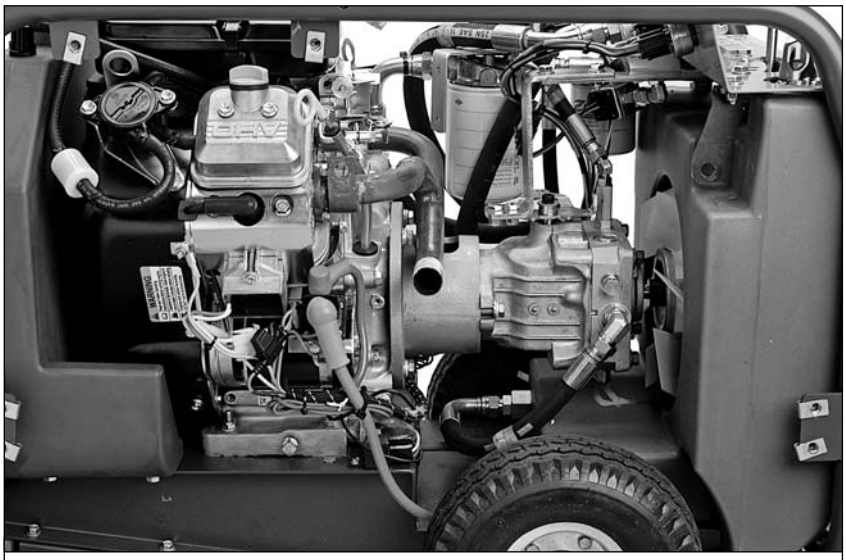
Preparations

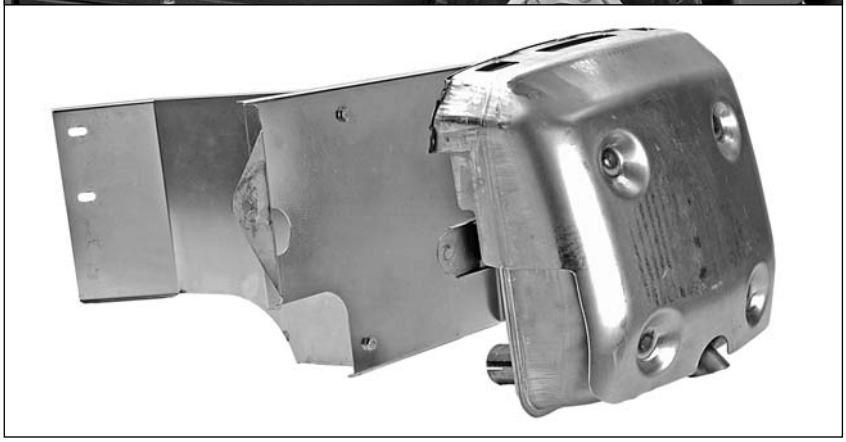
Before work begins, it is important to do the following:
- Disconnect the connections to the battery
- Drain the hydraulic tank
- Empty the fuel tank or plug fuel lines (fire hazard) if the work includes the engine
- Remove the front and side panels

Work procedure

Generally, a division must be made between the engine and hydraulic pump. The latter is removed first. Work on the hydraulic pump can only be carried out when it has been removed from the power pack.

Actions on the engine can be carried out in many cases without dismantling it from its position. If the engine has to be lifted from the chassis, this requires that the hydraulic pump is first disassembled.





Engine/hydraulic pump

The hydraulic power pack's main components are of course the engine and the hydraulic pump. These are connected with an intermediate piece that holds the hydraulic pump in place as the sole anchoring point.

The engine is fixed to the chassis using four screws.

Muffler, heat shield

The muffler and heat shield are components that are installed last in the manufacture and are attached to the chassis. Accessibility is impeded if these are installed, and we recommend that these are first removed for more extensive work such as if the hydraulic pump needs to be removed. Note that the heat shield cannot be removed alone, but only together with muffler.

Dismantling – hydraulic pump

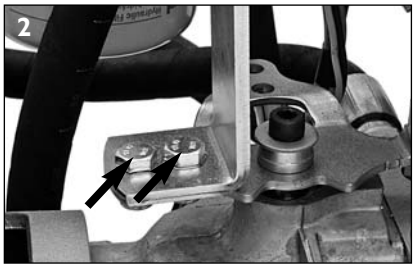
Preparations

For the work, a vessel is needed that can hold at least 10 litres and a few smaller cans to collect oil from the hoses as they are being dismantled.

For removal of hydraulic components, an tool with imperial dimensions is needed.

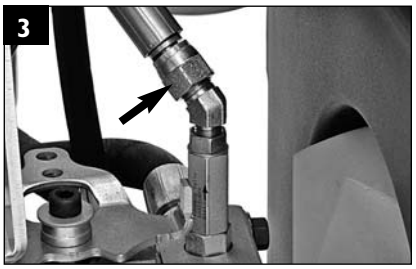
1. Drain the hydraulic tank

Start by emptying the hydraulic tank by removing the drain plug. The tank volume is about 10 litres/2.6 gal. Tool: Allen key 5/16 inches.



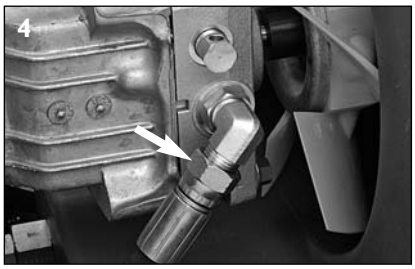
2. Linkage

Remove the two screws to the link.



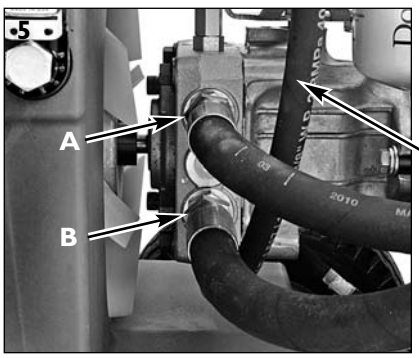
3. Connection of top side

Remove the hose connection at the pump's top side.



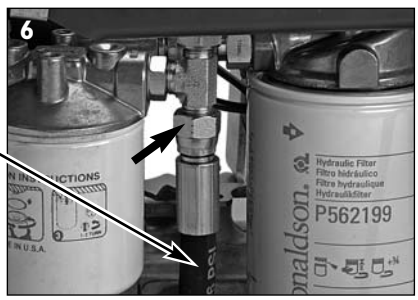
4. Connection of right side

Remove the hose connection. (Connects to the bottom of the hydraulic tank.)



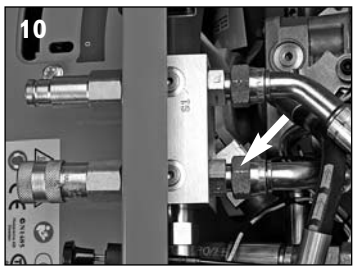
5. Connection of left side

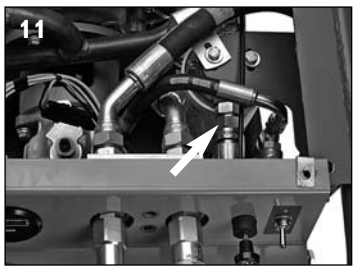
Remove the two hose connections.
(A: Return line to filter.)
(B: Pressure line to valve housing.)

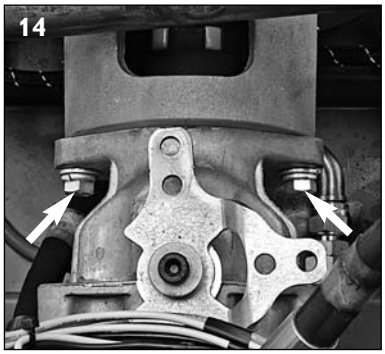


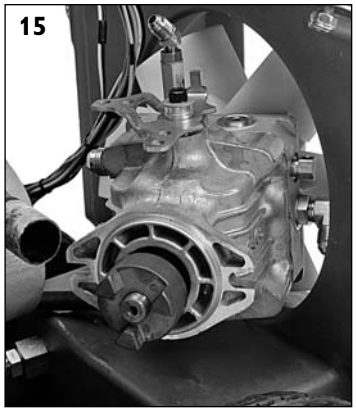
6. Connection underneath

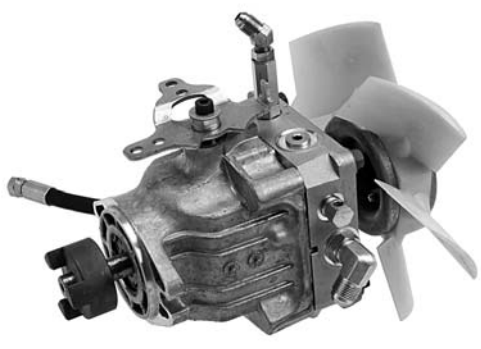
The connection under the pump is difficult to access with the pump in place. Loosen the hose connection between the filters instead.











The next step is to release the pump from the unit that is installed between the pump and engine, here called the clutch housing.

The engine crankshaft and the pump shaft are connected by means of a jaw clutch in the clutch housing. To release the pump it must be moved out of the clutch housing, towards the cooler. In order to make room, the cooler must therefore be removed first.

7. Remove the panel
Remove the six screws.

8. Valve housing
Remove the two screws to the valve housing and push this backwards. Alternatively, remove the hoses behind the valve housing.

9. Lift the instrument panel
Press the tubular frame to the sides and lift up the instrument panel.

10. Remove the lower connection
The cooler is filled with oil. The connection to the cooler bottom goes to the return line on the valve housing. It is practical to loosen the line here and plug the connection to avoid oil spills.

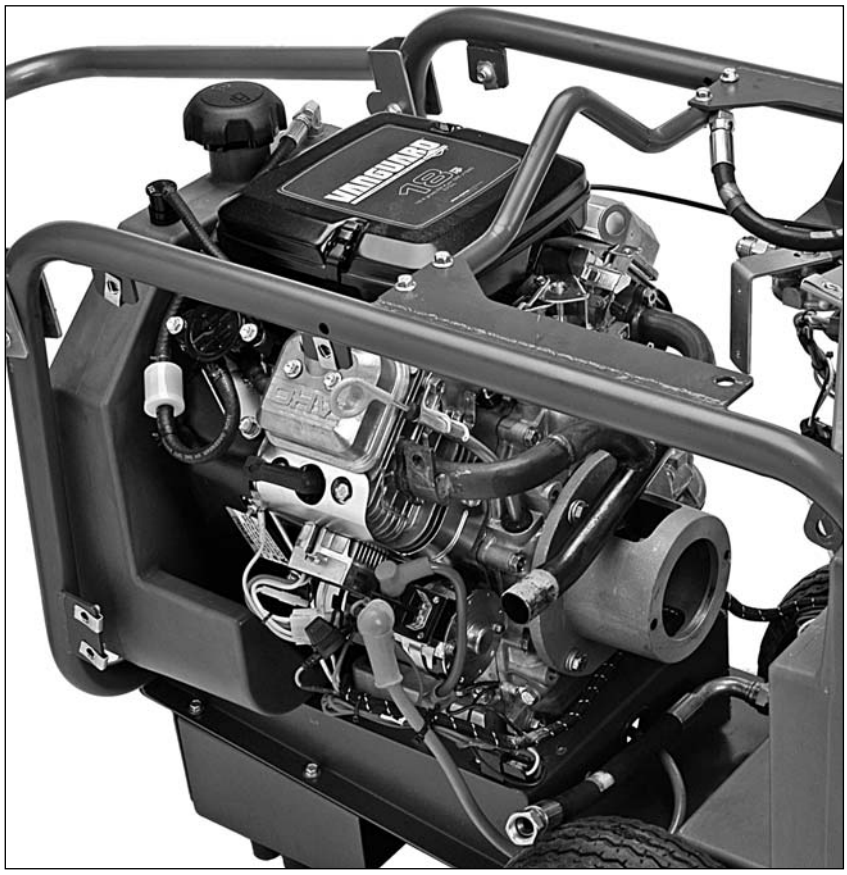
11. Remove the top connection
The top cooler connection is most easily removed at the main filter.

12. Remove cooler
The cooler is attached with four screws to the hydraulic tank. Remove the screws and lift out the cooler.

13. Dismounted cooler

14. Dismantle the pump
Remove the two screws that hold the pump to the clutch housing.

15. Lift out the pump
Pull out the pump a little towards the tank ensuring the pump's jaw clutch can be moved out of the clutch housing. Now lift out the pump to the side of the power pack.



Engine repairs

Most servicing and engine repairs can be done on site without dismantling either the hydraulic pump or the actual engine. Examples of components that can be easily fixed without specialised expertise are:
- carburettor
- starter/generator
- charging regulator
- electrical components/cabling
- fuel pump
- exhaust system

Centrifugal regulator

The mechanical speed control is accessible when the hydraulic pump and clutch housing have been removed, as previously described. The manifold on the exhaust side must also be dismantled.

Repair of the centrifugal regulator is best done by an authorised Briggs & Stratton workshop.

The engine cooler

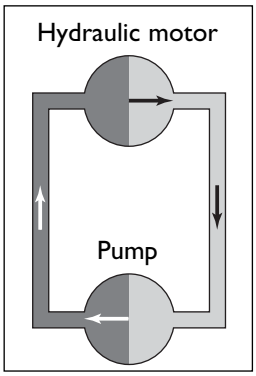
This is accessible when the fuel tank has first been removed. Now remove the air line cover.

Remove the engine

The probability that the engine needs to be removed during the lifetime of the power pack is extremely small. If this is still necessary, the work is performed as follows:
- Remove the hydraulic pump
- Remove the electrical cables
- Remove the fuel lines
- Remove the choke cable
- The engine is secured with four screws to the chassis to be removed
- The engine can then be lifted in by the two eye bolts located next to the air filter housing.

The target group for this chapter is mechanics who have no prior knowledge of hydraulic machines. An understanding of the basic principles of hydraulics will help resolve many of the problems and issues encountered during troubleshooting.

Hydraulic system

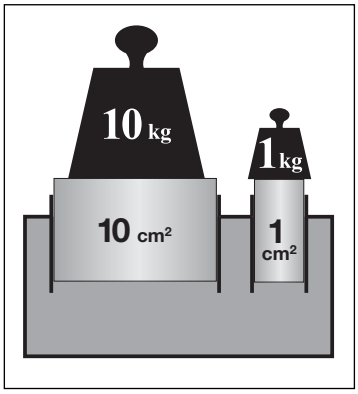


The term "hydraulic" refers to the transfer of power using some form of fluid. The fluid that is used in this context is oil, which apart from serving as the medium for transferring power, also lubricates and cools the system's components. Hydraulic power transfer normally operates in a sealed system, that is to say the fluid medium that is used is returned to a container from where it is reused. A hydraulic system consists of a power source, a pump of some sort and a recipient that performs some kind of work, for example a hydraulic motor. Often, transmission links of some kind are also required, for example hoses or pipes. A comparison with a mechanical system helps clarify this set-up, for example with a motor or engine, a chain and a wheel.

PRESSURE AND FLOW

Two terms are fundamental when it comes to hydraulics, namely pressure and flow. Proper understanding of how these work and interact will help solve most problems and answer most questions that may arise.

Pressure



In order to describe pressure, we use the example of a static hydraulic system. This example also shows how hydraulics can be used for motion and power gearing. The figure here shows a sealed container containing water. The container has two movable pistons, one with an area of 10 cm^2 and the other just 1 cm^2. We place a weight of 1 kg on the smaller piston and 10 kg on the large piston. The following will apply:

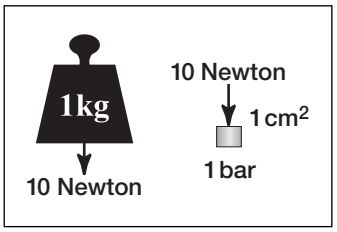
Weight balance. Since the weights are proportional to the areas on which they are placed (1 kg/cm^2), the system remains in balance, and the pistons will not move.

Movement gearing. The piston areas in contact with the fluid have a ratio of 1 to 10. If we press down the small piston 10 mm into the fluid, the large piston will rise 1 mm. The same fluid volume will now have exchanged places between the two pistons, and we have used hydraulics to create movements of different magnitudes.

Power gearing. Gearing of movement also promotes gearing of power – that which is lost in terms of movement is gained in terms of power. The load of the small piston gives a lifting power on the large piston that is 10 times greater.

These basic physical properties are used for functions in hydraulic and pneumatic systems and in such applications, very complex functions can often be carried out using surprisingly simple mechanical designs.

Dimensions for pressure



Pressure must always be measured over a given area in order for it to be meaningful as a dimension, usually per square centimetre. Pressure was previously often measured as kg/cm^2 (actually kp/cm^2), a method that is still widely used because it is so easy to grasp since we have a clearer understanding of weight as a dimension. Since engineers and physicists prefer the dimension of Newton for weight and power (10 N corresponds to 1 kp), the "bar" is often nowadays used as the unit for expressing pressure, for instance in hydraulic systems (1 bar corresponds to 1 kp/cm^2). A power of 10 Newton/cm^2 gives a pressure of 1 bar. Note that each square centimetre-sized surface unit of the container we described earlier is subjected to a pressure of 1 bar. We can thus measure pressure anywhere we like in the container.

Flow

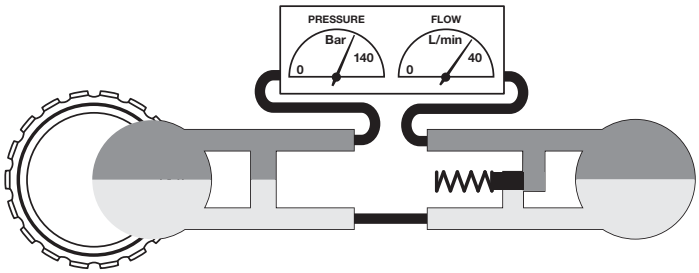
Flow in a hydraulic system is the fluid's speed of movement, often measured in litres per minute (l/min). In more or less static systems, such as a hydraulic jack, flow is unimportant. However, if we want to drive various devices hydraulically at set speeds, such as cranes, vehicles, power cutters and so on, flow is a vital parameter.

The hydraulic unit pumps a predetermined volume at a given rotational speed or pump stroke. If the pump's speed is altered, then flow too is changed. If we know the pump's capacity, we can calculate the movement at the other (receiving) end. If we know the hydraulic
piston's area, we can calculate the rotational speed, and if we know the hydraulic motor's flow-through volume per revolution, then we can calculate the speed.

Measurement of pressure and flow

In order to be able to check the function of hydraulic cutting machines, you must be able to measure pressure and flow. Of course, to do this you need a hydraulic unit with a capacity equivalent to that required for the cutting machine in question. In the case of Husqvarna hydraulic cutters, the hydraulic unit must provide a flow of 40 l/min (10 gpm) and a pressure of up to 150 bar (2000 psi), at which point an overpressure valve in the unit must trip.

As shown in the diagram below, the measurement equipment must be connected to the pressure side, which is represented by the upper half.



Measurement equipment

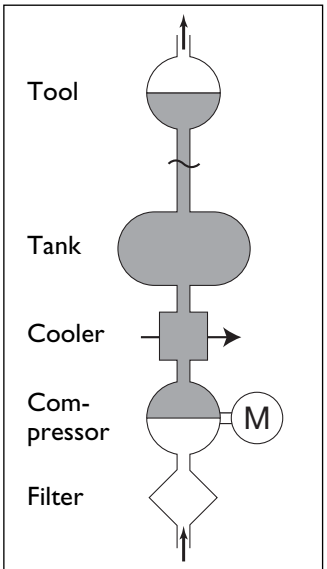
Measurement equipment for hydraulic applications is available in a number of configurations from specialist retailers. It is relatively easy to build a suitable measurement device, the procedure for which is described on page 11.

Comparison of hydraulics and pneumatics

For people used to compressed-air applications but not familiar with hydraulics, a comparison between the two is valuable since the operational principles are entirely different. One basic difference is the following: **A gas can be compressed whereas a fluid cannot.**

A compressed air system utilises this to build up the energy that is subsequently used: the compressor builds up pressure that is collected in a tank. When no air is being consumed, there is no flow. The pressure in the system is constant.

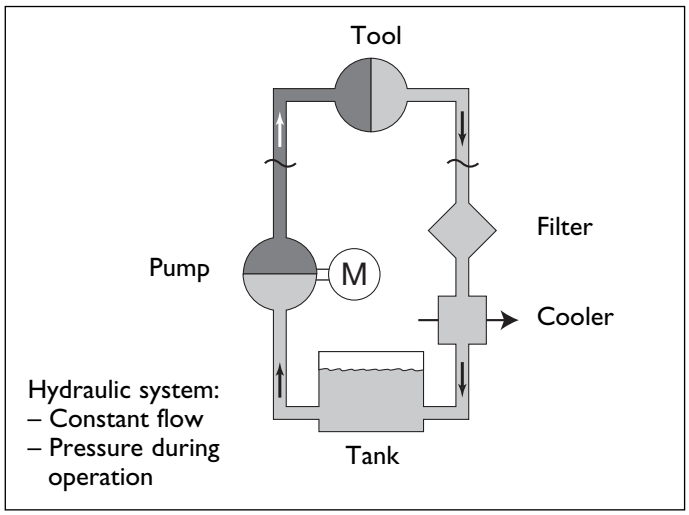
In practice, there is normally a slight variation in pressure. The compressor has an activation and deactivation pressure within a given interval, which however does not play any role in the operational principle.



Compressed air system:
– Constant pressure
– Flow during operation

Hydraulics – rigid power transmission

For practical reasons, hydraulic systems are always built in a closed loop. Hydraulic fluid is pumped in a circuit where in each cycle it passes through an operational phase and a return phase before being collected in a tank for reuse.



Hydraulic system:
– Constant flow
– Pressure during operation

As we said earlier, a fluid cannot be compressed, which means that as long as the pump runs at a constant speed, the flow in the system is also constant, which is exactly the opposite of the compressed-air system.

At what pressure does the hydraulic system operate? If we imagine for a moment that no resistance is offered by any part of the system, the fluid will be pumped without any pressure. If we connect a tool that performs heavy work (high resistance), pressure will naturally increase between the pump and the tool. Pressure is thus dependent on the work that is being carried out.

Practical differences - pneumatics/hydraulics

One important difference between pneumatics and hydraulics is that several tools can be connected to the same compressor in a pneumatic system since the pressure is constant and there is a state of flow during the work. Since the hydraulic system provides varying pressure during operation, it is impossible to add more power cutters to a single hydraulic unit.

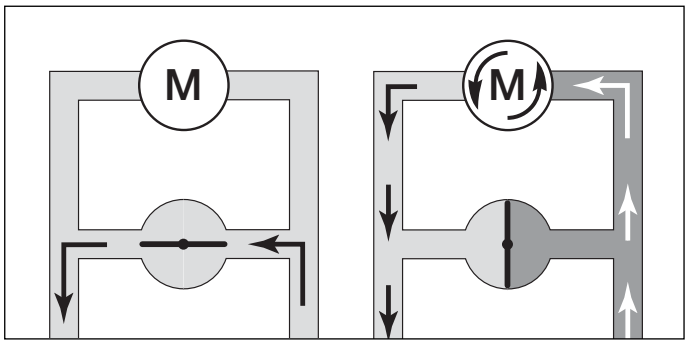
The benefit of the hydraulic system in driving a power cutter – and for many other applications – is the fact that a fluid cannot be compressed. Therefore, power transmission remains exactly the same as if there was a mechanical link. As a result, the cutting blade rotates at the same speed irrespective of load – as long as the power source maintains a steady pump capacity.

If instead we imagine a pneumatic system, the cutting blade's speed would vary with load. We have admittedly said that a pneumatic system operates with steady pressure, but as soon as the air has the opportunity to expand, it will do so. If we inject compressed air into a pneumatic motor that does not have any resistance, the volume of that air will expand upon entry and thus boost speed; under load, the air would once again shrink in volume. The disadvantage of compressed air for equipment that needs to operate at a steady speed under varying load conditions is thus obvious.

The hydraulic system's constant flow, which cannot be varied at will, naturally requires constructive solutions so as to be able to vary the tool's rotating speed. We will now see a few common solutions that are applied in hydraulic systems and for Husqvarna hydraulic power cutters.

Bypass

Since we cannot vary flow in a hydraulic system, an alternative solution must be employed. We must instead lead some or part of the fluid via a different path. This so-called bypass solution is used for many functions in various hydraulic tools. This basic principle is also termed "open centre". (A hydraulic jack operates according to the "closed centre" principle.)



Regulating flow

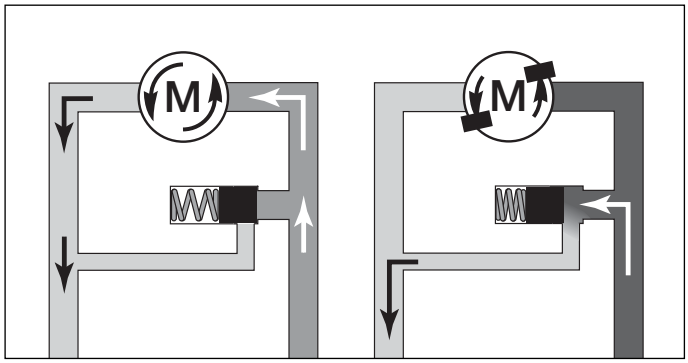
Assume that we want to vary flow to the tool (M) but that we cannot change either the pump's speed or displacement (volume).

By leading some of the fluid directly to the return side, the flow to the tool can be varied. This principle is used for throttle control in Husqvarna hydraulic cutters. When the machine is not operating, the entire flow passes virtually without pressure through the bypass valve. When the throttle control is pressed in, the bypass valve is closed and the hydraulic fluid is forced to pass through the motor.

Overload protector

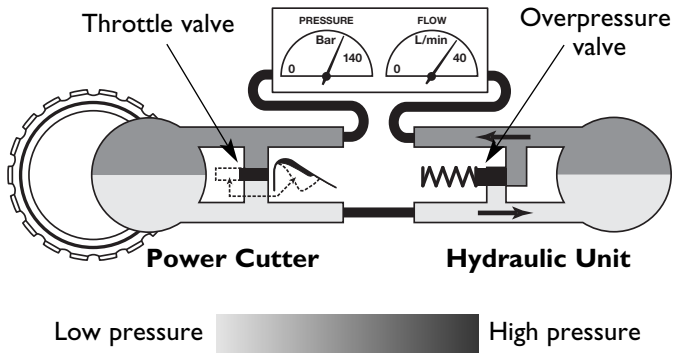
A bypass valve is also used in hydraulic systems to protect the equipment from overpressure. A spring-loaded valve keeps the duct closed up to the maximum permitted pressure. If the hydraulic motor is suddenly blocked during operation (the cutter blade gets stuck while spinning) the pressure rises abruptly to the level at which the pressure pushes the piston towards the return side and permits the fluid to pass through.

An overload protector of this type is normally found in all hydraulic units. Husqvarna hydraulic cutters therefore do not have this feature duplicated in the machines themselves.

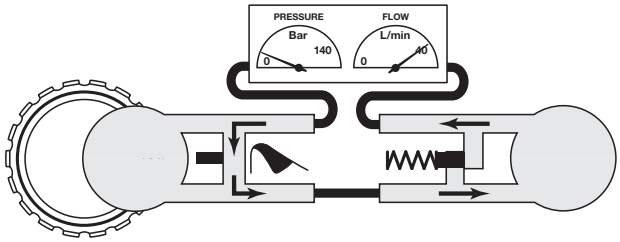


Power cutter and hydraulic unit

We will now see how pressure and flow interact in principle in a variety of situations with the Husqvarna K3600 MkII/ K2500 and the Husqvarna hydraulic unit. Measuring equipment for pressure and flow are connected to the pressure side. The cutter has a bypass valve that is regulated by throttle action and the hydraulic unit has an overpressure valve that activates if pressure exceeds the maximum permitted.

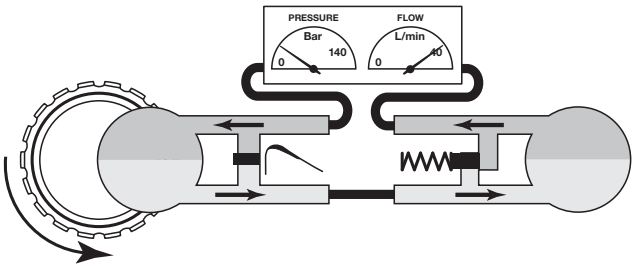


The pressure side of the hydraulic system is described by the upper half and the return by the lower half. As we shall see, there will be no change of pressure on the return side, only the flow path is changed under certain circumstances. That is why we only need to measure what happens on the pressure side, that is to say the side to which the hydraulic unit provides flow and pressure, and which drives the power cutter.



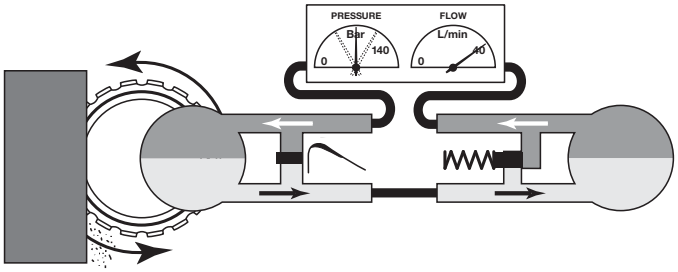
Idling

The hydraulic unit is operational and provides its preset 40 l/min (10 gpm). The throttle on the cutter is at the stop setting, so the throttle valve is open and allows all the fluid to pass freely through the bypass valve. The pressure and return sides are practically without pressure, and the blade is at a standstill.



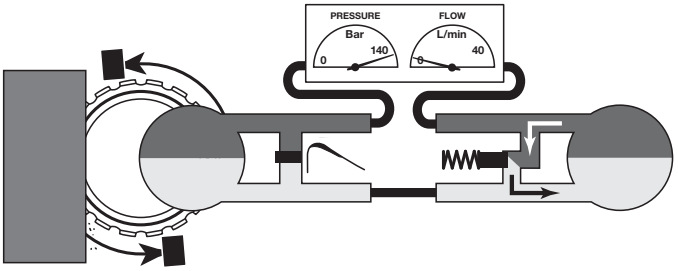
Start

Work is about to begin, the throttle is pressed in so the throttle valve closes. The fluid is now forced to pass through the hydraulic motor and the blade rotates. The pressure is somewhat higher now since some power is required to rotate the blade.



Cutting

When the blade rotates in the material to be cut, resistance naturally increases and pressure rises on the pressure side. Depending on how heavily the machine has to work, the pressure gauge will show readings close to the normal rating.



Blade gets stuck

The blade gets stuck. Flow to the power cutter is cut off and pressure rises to the level at which the overload protector valve in the unit opens and allows the fluid to enter the bypass duct. As soon as the operator releases the throttle, the overpressure valve will close and the fluid will pass through the power cutter's bypass valve, as in the picture entitled "Idling".

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