SERVICE MANUAL
STIHL 009, 010, 011

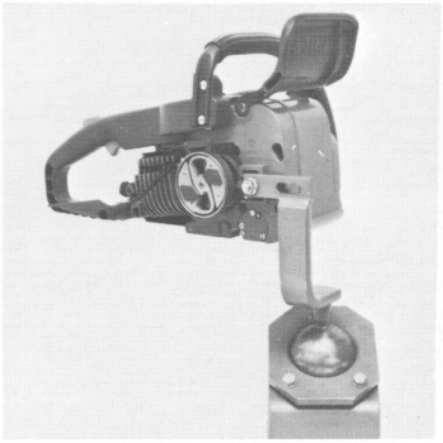
FOREWORD

This Service Manual covers model 010 chain saws up to machine number 7 900 000 as well as later machines unless technical information bulletins have been issued in the meantime with updated repair procedures.

Models 009 and 011 have substantially the same constructional features as model 010 chain saws. This Service Manual can therefore be used for the 009 and 011 chain saws as well.

In the event of faults it is quite possible that a single fault may have several causes. It is therefore advisable to consult the "Troubleshooting Chart" in each chapter when tracing faults. We also recommend that you make use of the exploded views in the illustrated parts lists when carrying out repair work.

This service manual and all technical information bulletins are intended exclusively for the use of STIHL servicing dealers and staff and must not be passed on to third parties.



Repair work is made considerably easier if the chain saw is mounted on assembly stand 5910 850 3100. The saw is easily secured to the stand by means of the bar mounting stud and collar nut.

While on the assembly stand the chain saw can be swivelled into any required position within a certain range to suit the repair in question. This not only has the advantage of keeping the component in the most convenient position for the repair but also leaves both hands free for the work and thus effects a considerable time saving.

SPECIAL TOOL MANUAL

Our special tool manual illustrates and lists the part numbers of ail available machine-related tools as well as general purpose tools for all machines.

The special tool manual is available in several languages and can be ordered by quoting the appropriate part number listed hereunder.

German	0455 901 0023
English	0455 901 0123
French	0455 901 0223
Spanish	0455 901 0323
Yugoslav	0455 901 0423
Swedish	0455 901 0523
Italian	0455 901 0723
Portuguese	0455 901 1223

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CONTENTS

1. SPECIFICATIONS

1.1 Engine

Single cylinder two-stroke engine with specially processed cylinder bore

Displacement 009, 010:	37 cm³ (2.26 cu. in)
Bore 009, 010:	36 mm (1.42 in)
Displacement 011:	41 cm³ (2.50 cu. in)
Bore 011:	38 mm (1.50 in)
Stroke:	36 mm (1.42 in)
Compression ratio:	9.8:1
Max. torque:	1.8 Nm (1.3 lbf. ft) at 4500 r.p.m.
Rated speed, off load with bar and chain:	9500 - 9800 r.p.m.
Mean idle speed:	2200 - 2400 r.p.m.
Crankshaft:	Drop forged
Crankshaft bearings:	2 needle sleeves
Crankpin:	13 mm (0.51 in) dia.
Big-end bearing:	Cylindrical rollers without cage
Piston pin:	9 mm (0.35 in) dia.
Small-end bearing:	Needle sleeve
Rewind starter:	Pawl engagement with automatic starter rope rewind mechanism
Starter rope:	3.5 mm (0.14 in) dia., 960 mm (38 in) long
Clutch:	Centrifugal clutch without linings, 64 mm (2.5 in) dia.
Clutch engages at:	3200 - 3300 r.p.m.
Crankcase leakage test with overpressure:	0.5 bar (7.1 lbf/in²)
with vacuum:	0.5 bar (7.1 lbf/in²)

1.2 Fuel System

Carburetor:	All-position diaphragm carburetor with integral fuel pump
Adjustment:	
High-speed adjustment screw H:	Open 1 turn
Low-speed adjustment screw L:	Open 1 turn (basic setting starting with screws lightly against their seats)
Carburetor leakage test with overpressure:	0.4 bar (5.7 lbf/in²)
Fuel capacity:	0.26 L (0.55 US pt)

	Fuel mixture:	Regular grade gasoline and branded two-cycle engine oil Mix ratio 1:40 with STIHL two-cycle engine oil: 1:25 with other branded two-cycle engine oils
	Air filter:	Large area felt mat

1.3	**Ignition System**	Type:	Breaker-controlled magneto ignition
		Magneto edge gap:	5 mm (0.2 in)
		Ari gap:	0.2 mm (0.008 in)
		Ignition timing:	1.8-2.1 mm before T D.C.
		Ignition advance angle:	23°-24°
		Breaker point gap:	0.3-0.4 mm (0.012-0.016 in)
		Condenser:	Capacitance 0.17 µF
		Ignition armature:	Coil winding resistance Primary Secondary 0.8-1.3 Ω 7.2-8.8 kΩ
		Spark plug (suppressed):	Bosch WSR 6 F or Champion RCJ 6 Y Heat range 200 Electrode gap 0.5 mm (0.02 in)
		Spark plug thread:	M 14x1.25; 9.5 mm (0.37 in) long

1.4	**Tightening Torques**	Crankshaft nut (ignition side) M 8x1:	30 Nm (22.1 lbf. ft)
		Clutch (sprocket side):	30 Nm (22.1 lbf. ft)
		M 6 socket head screws:	10 Nm (74 lbf. ft)
		M 5 pan head screws:	5 Nm (3.7 lbf. ft)
		M 4 pan head screws:	2.5 Nm (1.8 lbf. ft)
		M 5 nuts:	5 Nm (3.7 lbf. ft)
		Spark plug:	25 Nm (18.4 lbf. ft)

1.5 **Cutting Attachment**	Guide bars:	STIHL Standard guide bars without stellite-tipped nose STIHL Duromatic guide bars with stellite-tipped nose STIHL Rollomatic guide bars with sprocket nose All types with corrosion-resistant finish and induction hardened rails	
	Bar lengths:	Duromatic 30 and 35 cm (12 and 14 in) Rollomatic 30, 35 and 40 cm (12, 14 and 16 in)	
	Chain:	9.32 mm (3/8")-Oilomatic-Picco	
	Chain sprocket:	6-tooth for 3/8" Picco pitch	
	Chain speed:	13 m/s (42.6 ft/sec) at 7000 r.p.m.	
	Chain lubrication:	Speed-controlled oil pump with Diaphragm	
	Oil delivery rate:	6-12 cm^3/min (0.37-0.74 cu. in/min) at 7000 r.p.m.	
	Oil tank capacity:	0.28 L (0.59 US pt)	

1.6 **Weights**	Model:	009	010 AV	011 AV
	Dry powerhead with 30 cm bar and chain:	4.3 kg (9.51 b)	4.6 kg (10.1lb)	4.7 kg (10.4lb)

1.7 **Special Accessories**	STIHL repair kit 009, 010, 011	1120 900 5000
	Set of gaskets 009, 010, 011	1120 007 1050

2. CLUTCH, CHAIN DRIVE AND CHAIN BRAKE

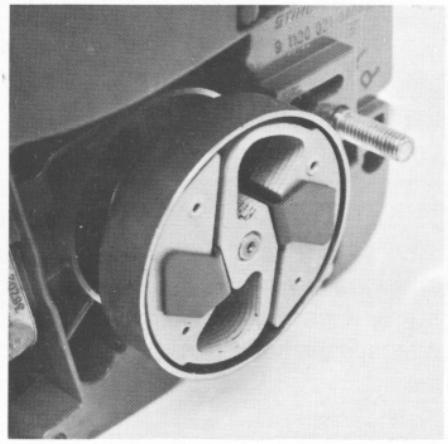
2.1 Construction and Operation

2.1.1 Clutch and Chain Sprocket

The transmission of power from the engine to the saw chain is effected via a centrifugal clutch which has no linings.

The clutch consists of a laminate block made up of seven separate metal sheets which are riveted together. The laminate block is screwed to the crankshaft. A cranked U-plate is fitted between the laminate block and the clutch drum and acts as a guard which prevents parts of the clutch coming adrift in the event of breakage.

Clutch with cranked U-plate in position

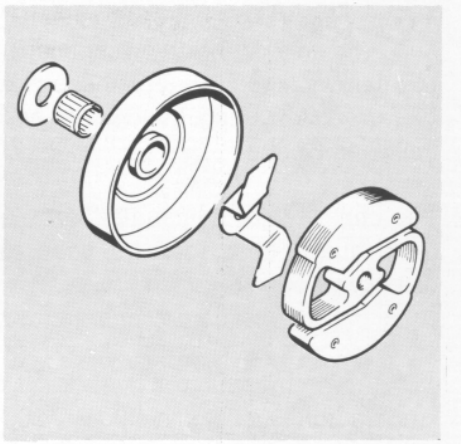


While the engine is running at idle speed there is no change in the shape of the clutch, i.e. its outside diameter remains constant because the rigidity of the laminate block's smallest cross section is greater than the centrifugal force applied. As engine speed increases the outer diameter of the clutch becomes larger when the centrifugal force overcomes the rigidity of the laminate block. This causes the clutch to be pressed against the clutch drum and thus transmit engine torque positively via the clutch drum and the chain sprocket to the saw chain.

The rigidity of the clutch is designed so that the clutch begins to make contact with the clutch drum at an engine speed of approx. 3200 r.p.m.

The clutch engages fully above this speed. It is therefore very important to set the carburetor to the correct idle speed in order to insure that the clutch engagement speed (3200 r.p.m.) is not reached when the engine is idling.

Component parts of clutch



The construction of the clutch is identical on both models of the saw (with and without chain brake).

2.1.2 **Chain Brake**

The chain brake is a spring-loaded band brake without any friction linings. Its main components are the brake band, tension spring, hand guard and the lever system.

The chain brake is actuated via the hand guard which can be used to disengage or engage the brake.

The **chain brake is disengaged** by pulling the hand guard back toward the handlebar. This movement is transmitted via a lever system which preloads the tension spring and releases the brake band.

The actuating lever, which is attached to the hand guard, remains locked in the idle position after the operator releases the hand guard.

The **chain brake is engaged** by moving the hand guard toward the bar nose. This movement unlatches the locked brake lever and causes the brake band to be clamped around the clutch drum by the force of the preloaded tension spring. The cluch drum and saw chain are brought to a standstill in a split second.

2.2 **Troubleshooting Chart**

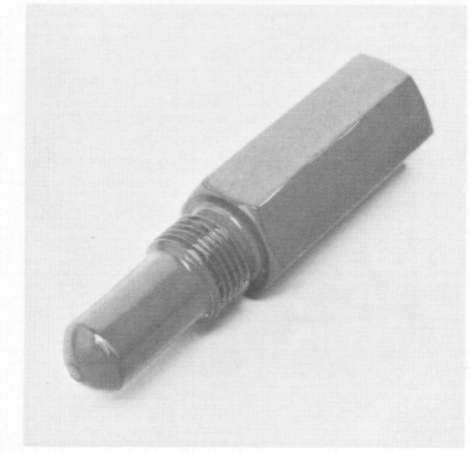
Condition	Cause	Remedy
Saw chain turns at idle speed	Engine idle speed too high	Readjust at idle speed adjusting screw
	Clutch broken	Fit new clutch
Excessive chain sprocket wear	Incorrect chain tension	Tension chain correctly
Saw chain does not stop immediately when chain brake is actuated	Tension spring broken	Fit new tension spring

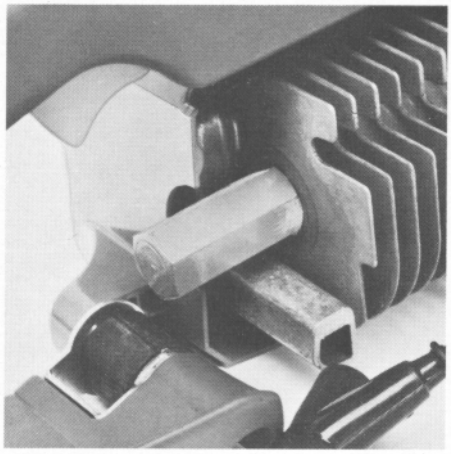
2.3 Repair

2.3.1 Disassembly and Assembly of Clutch

Top:
Locking screw 1107 191 1200

Bottom:
Locking screw in position



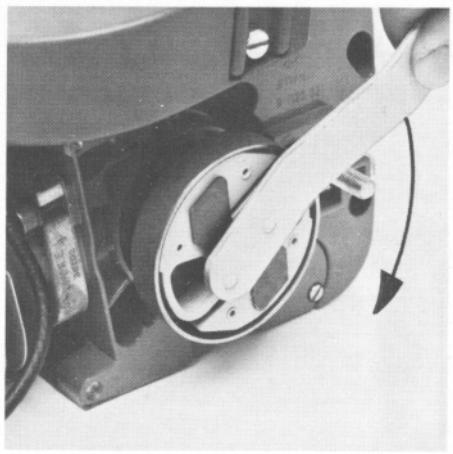


First remove the chain sprocket cover and the cutting attachment. On Quick-stop models it is necessary to disengage the chain brake so that the brake band releases the clutch drum.

Take out the spark plug and fit the locking screw in its place. Use the special wrench to turn the clutch and the crankshaft clockwise until the piston head butts against the locking screw. Now use wrench to unscrew the clutch.

Top:
Wrench 1113 890 3600

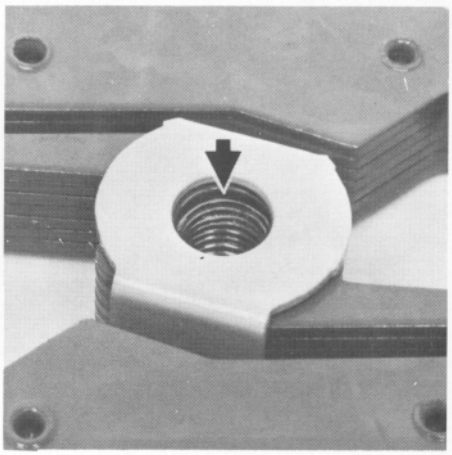
Bottom:
Unscrewing the clutch



Caution: The clutch has a lefthand thread - unscrew it clockwise!

After unscrewing the clutch, remove the chain sprocket, needle cage and thrust washer from the crankshaft. Examine clutch for signs of cracks or breaks. If hairline cracks are found in the sprung part of the clutch, fit a new clutch. The cranked U-plate should also be inspected for hairline cracks. If any are found, fit a new Cranked U-plate. Wash needle cage, thrust

Counterbored side of clutch

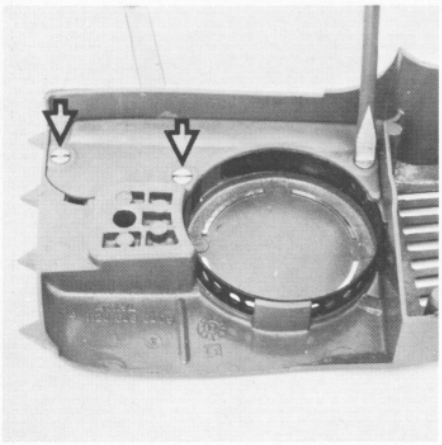


washer and stub of crankshaft with clean gasoline. Replace needle cage if it is faulty.

Lubricate needle cage, thrust washer and stub of crankshaft with antifriction bearing grease before assembly. When refitting the clutch make sure that the side on which the thread is counterbored to a depth of about 2 mm (0.08 in) faces the crankcase. Tighten down clutch with the wrench to a torque load of 30 Nm (3.0 kpm).

2.3.2 Disassembly of Chain Brake

Removing plastic cover



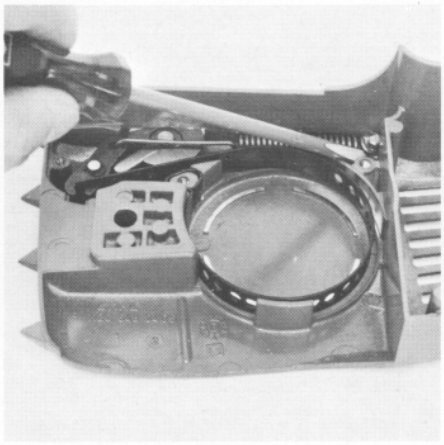
The chain brake components are integrated in the chain sprocket cover. It is therefore necessary to remove the sprocket cover to gain access to the brake components. After removing the sprocket cover, engage the chain brake, unscrew the plastic cover and detach the tension spring from the pin in the housing. Remove retaining washer from brake lever pivot pin and then prise brake lever together with the brake band and the tension spring out of their seats in the cover. The relay lever and actuating lever cannot be disassembled. If either one of these levers is faulty the complete chain sprocket cover (1120 640 1740) must be replaced.

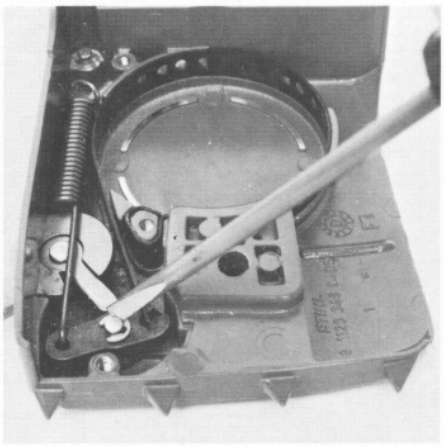
Check levers and brake band for signs of wear. Renew damaged parts and apply a little grease to the pivot points before reassembly.

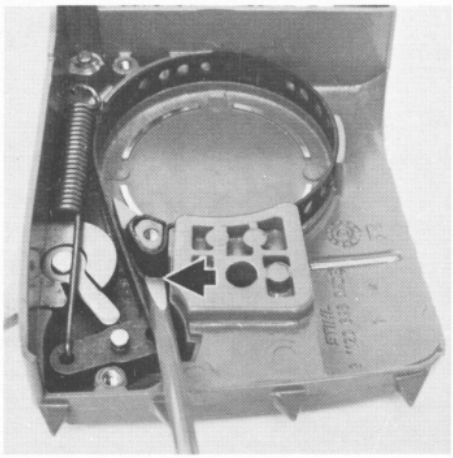
Top:
Detaching tension spring

Center:
Removing retaining washer

Bottom:
Removing brake band



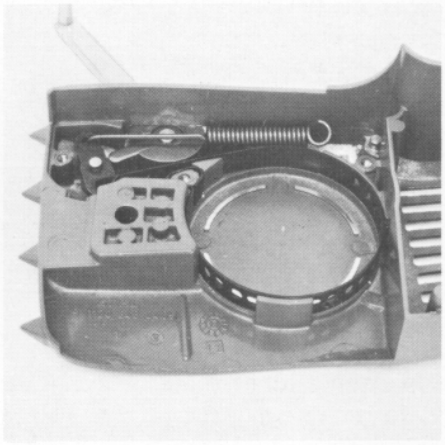


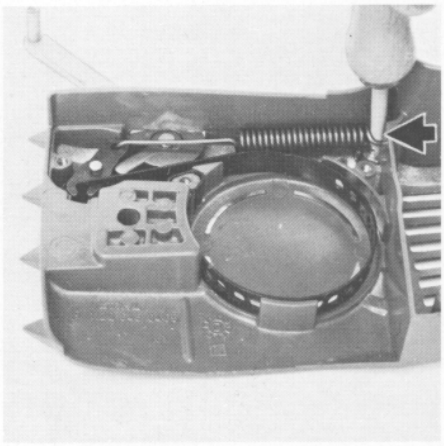


2.3.2.1 Disassembly of Chain Brake

Top:
Brake band, brake lever and tension spring in position

Bottom:
Fitting tension spring with installing tool 1117 890 0900





First engage brake band in the brake lever. Then attach the tension spring to the brake lever and install the pre-assembled parts in the chain sprocket cover.

Fit the retaining washer and use installing tool to attach tension spring to the retaining pin. Finish off by securing the plastic cover.

3. ENGINE

3.1 Construction

Series 010 chain saws are powered by an air-cooled, single cylinder two-stroke engine.

The crankcase is a two-part pressure die casting made of a magnesium alloy. The drop-forged crankshaft is supported in two needle sleeves. Two oil seals, one for each half of the crankcase, hermetically seal the crank chamber.

The connecting rod is supported by cylindrical rollers, i. e. without a bearing cage, on the crankpin and a needle sleeve on the piston pin.

The cylinder and piston are made of an aluminium alloy. The cylinder bore is coated in a special process.

3.2 Troubleshooting Chart

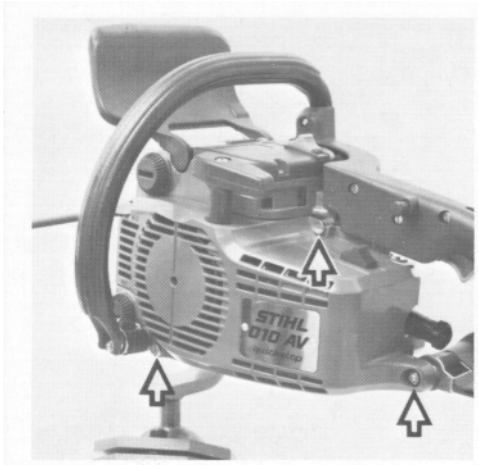
Check fuel system, carburetor, air filter and ignition system before looking for faults in the engine.

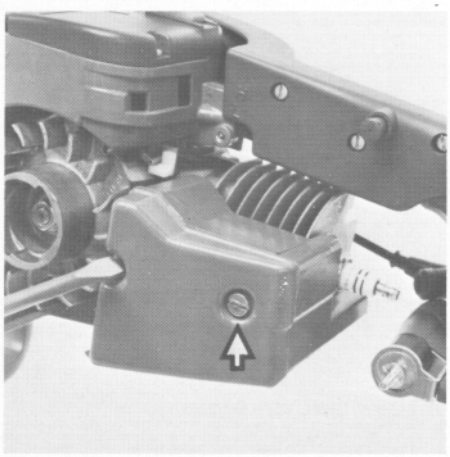
Condition	Cause	Remedy
Engine does not start easily, stalls at idle speed, but runs normally at full throttle	Oil seals in crankcase leaking	Replace oil seals
	Carburetor flange leaking, cracked	Fit new carburetor flange
	Crankcase damaged (cracks)	Replace crankcase
Engine does not deliver full power or runs erratically	Secondary air seepage into engine because of faulty carburetor flange	Fit new carburetor flange
	Piston ring leaking or broken	Replace piston ring
Engine overheats	Insufficient cylinder cooling. Air inlets in fan housing blocked or cylinder cooling fins clogged with dirt	Thoroughly clean all cooling air openings

3.3 Exposing the Cylinder

Top:
Unscrewing the fan housing

Bottom:
Unscrew the muffler screws





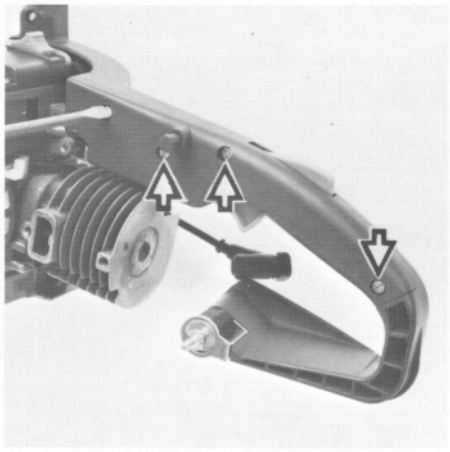
Unscrew the collar nut and take off the chain sprocket cover. Remove flat head screw from rear vibration damper. Unscrew the fan housing and pull off the spark plug terminal.

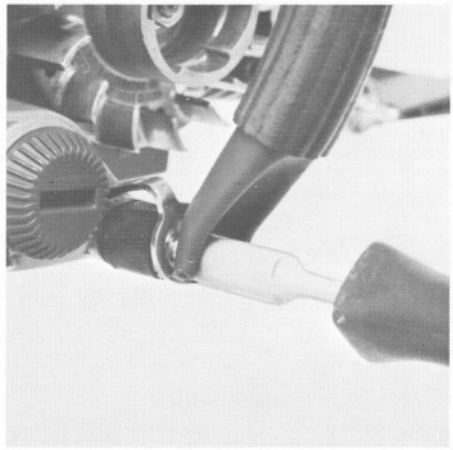
Once the muffler is removed the cooling fins of the cylinder are easily accessible. They should be thoroughly cleaned and examined for signs of damage (cracks, broken cooling fins etc.).

3.4 Disassembly of Cylinder and Piston

Top:
Removing the handle moulding

Bottom:
Removing hexagon nut from handlebar



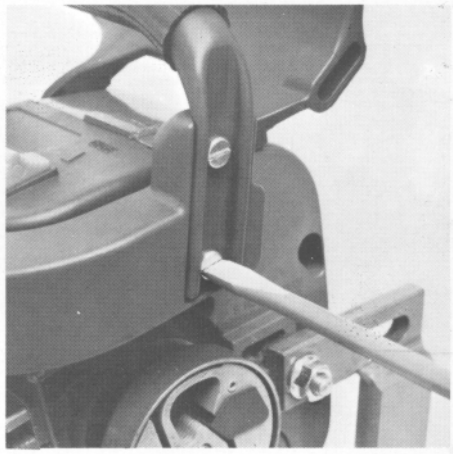


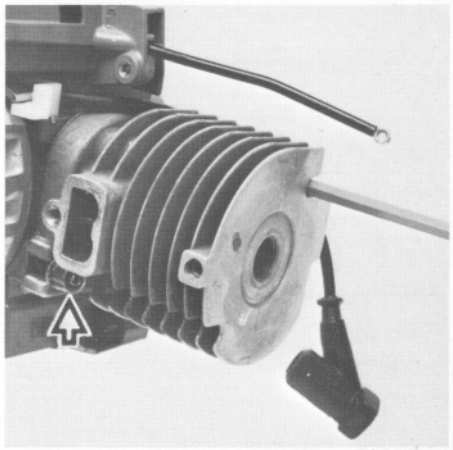
First drain the fuel and oil tanks and remove the spark plug. Unscrew the four self-tapping screws from the handle moulding, take off the moulding and disconnect throttle cable from throttle trigger. Push the handle moulding back into position to prevent the throttle trigger and flat spring dropping out.

Now take off the rear handle together with the handlebar. To do this, unscrew the M 5 hexagon nut and flat

Top:
Removing flat head screw

Bottom:
Removing cylinder base





head screw from the front vibration damper.

Unscrew the two cylinder base screws - which secure the cylinder to the crankcase - and then pull the cylinder off the piston.

Top:
Clamp 1120 893 9100

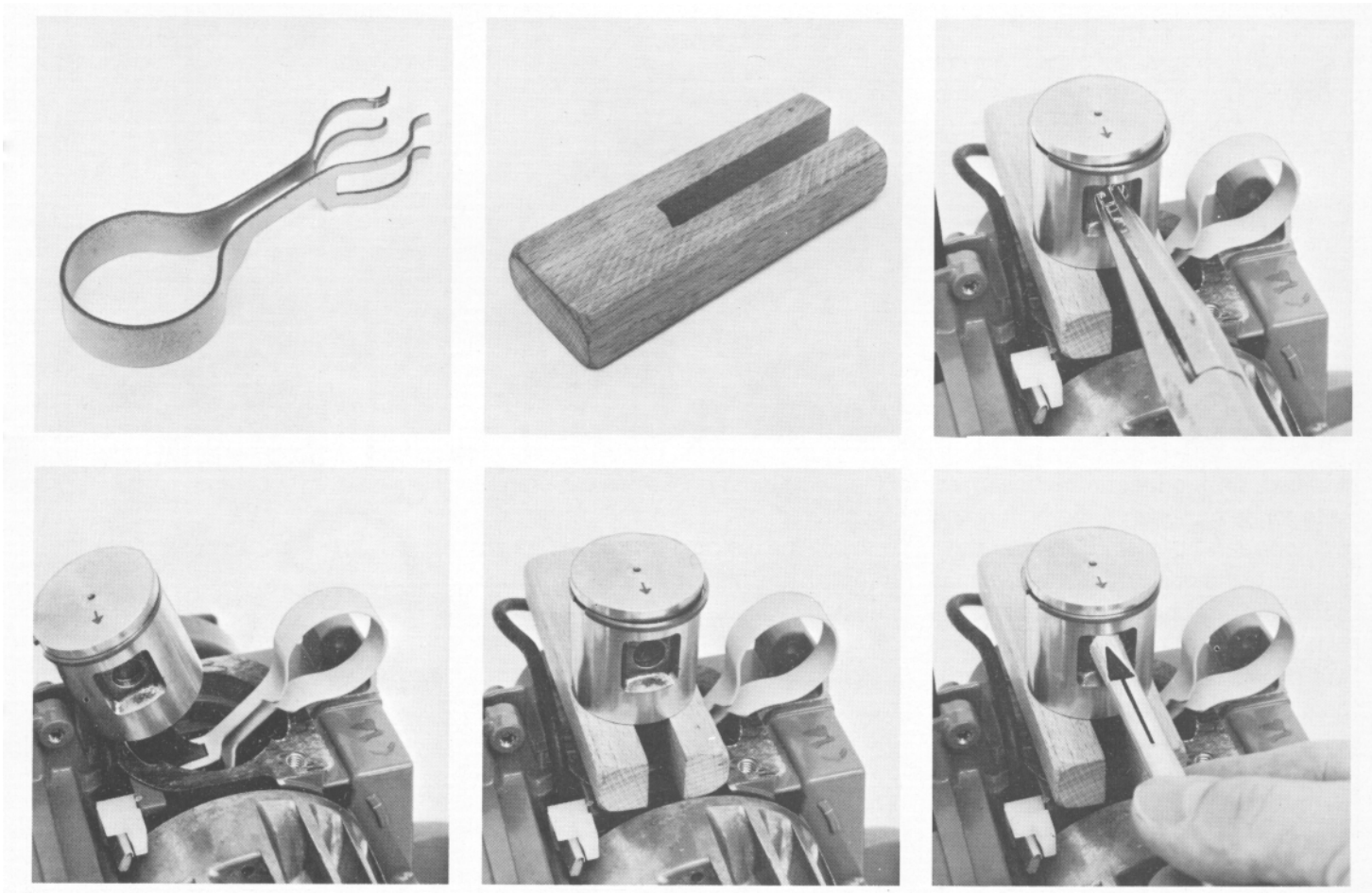
Bottom:
Clamp in position

Top:
Wooden assembly block 1108 893 4800

Bottom:
Assembly block fitted between crankcase and piston

Top:
Removing wire retainer

Bottom:
Pressing out piston pin with drift 1114 893 4700



Caution: The cylindrical rollers in the big end are not held in a bearing cage. The special clamp must therefore be pushed over the big end immediately after taking off the cylinder in order to prevent the cylindrical rollers dropping into the crankcase if the connecting rod shifts sideways.

Before removing the piston it must be decided whether or not the crankshaft is to be removed as well, i. e. the wooden block which is used to lock the crankshaft to facilitate removal of the flywheel and clutch must then be fitted between the crankcase and the piston.

To remove the piston, first take out the two wire retainers which secure the piston pin and use the drift to press the piston pin out of the needle cage.

If the piston pin is stuck as a result of carbonization, tap it out lightly with a hammer and the drift. It is essential to counterhold the piston to insure that no jolts are transmitted to the connecting rod.

3.5 Assembly of Piston and Cylinder

Arrow must point toward flywheel

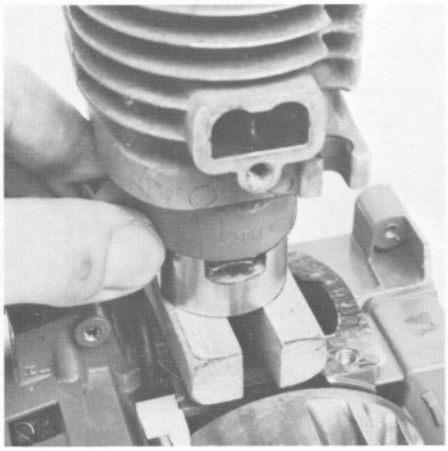
As there are no longer any matching categories to observe the piston and cylinder can be replaced separately. Lubricate the needle cage in the small end with oil before installing the piston. Position piston on connecting rod so that stamped marking (arrow) points toward the flywheel.

Now fit piston pin in piston and connecting rod. To do this, push assembly drift through piston bore and connecting rod (needle cage) to line the bores concentrically. Push piston pin into the piston. Move piston to and from to ease insertion of the piston pin.

The piston pin must move freely in its bore. Never use force during assembly.

Now insert the two wire retainers and make sure they are properly seated. They must fit snugly in the grooves.

Fitting the cylinder



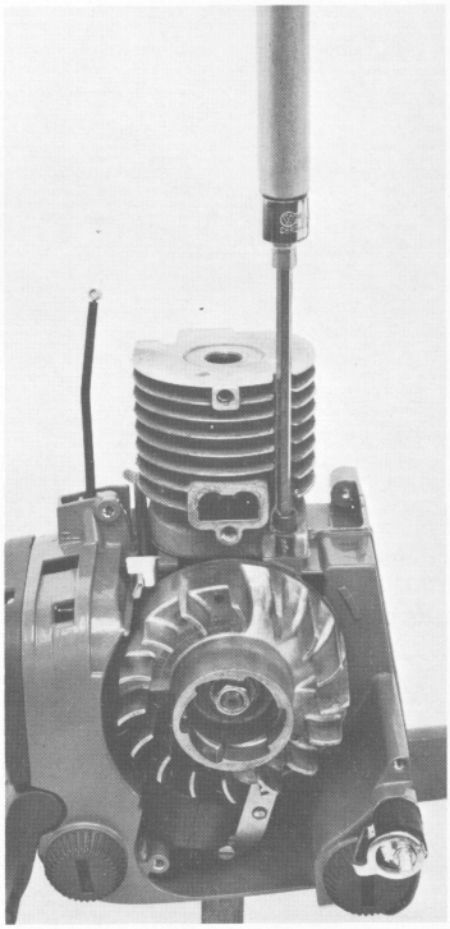
Fit new cylinder gasket on the crankcase. Lubricate piston and piston ring with oil. The piston ring groove has no fixing pin; the piston ring can therefore be fitted in any position.

Use the clamping strap to compress the piston ring around the piston and then push the cylinder over the piston. The cylinder`s exhaust port must face toward the flywheel.

Align cylinder, insert cylinder base screws and preload them initially to a torque of 6-7 Nm (0.6-0.7 kpm). Then finally tighten to a torque of 9.5-12 Nm (1.0-1.2 kpm).

Now reassemble the spark plug, ignition lead terminal, muffler, fan housing, rear handle and handlebar, throttle cable and handle moulding and the chain sprocket cover.

Tightening cylinder base screws with torque wrench



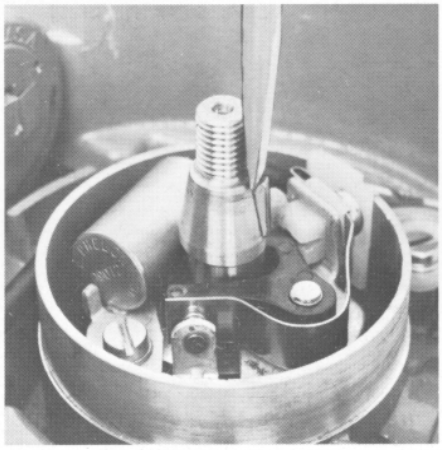
Use a new muffler gasket when refitting the muffler.

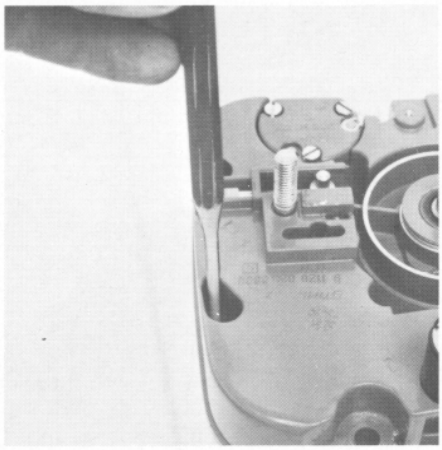
3.6 Disassembly of Crankcase - Removal of Crankshaft

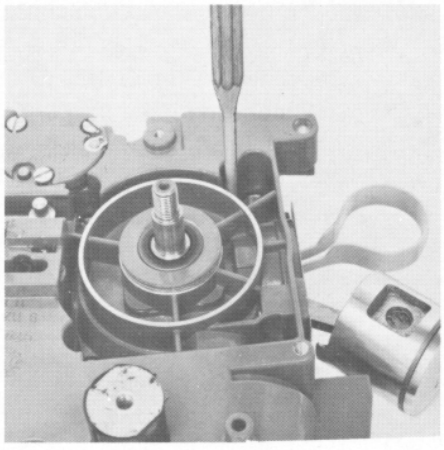
Removing the hand guard

Top:
Removing key

Center and bottom:
Knocking back cylindrical pins

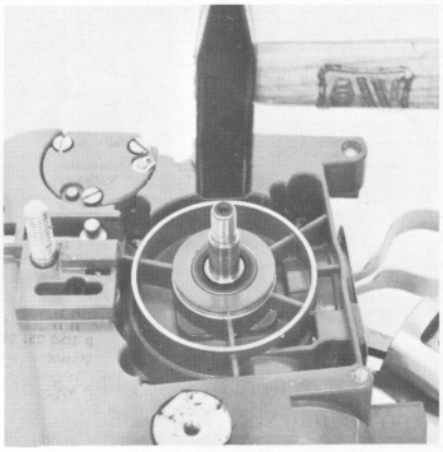


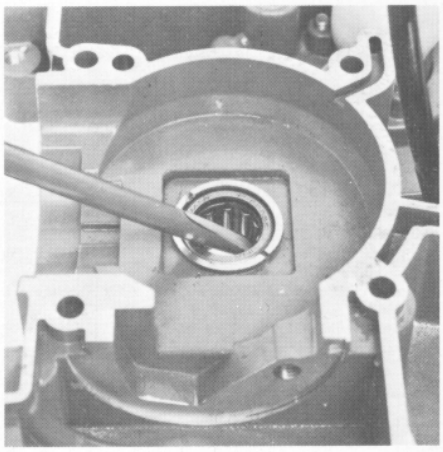




Top:
Driving out the crankshaft

Bottom:
Knocking out oil seal





To remove the crankshaft, first drain the fuel and oil tanks. Then disassemble the rear handle and handlebar, fan housing, muffler (3.4), the clutch (2.3.1), flywheel (4.4.4), carburetor (8.4) and hand guard. Remove cylinder and gasket and fit the special clamp in position (3.4).

Remove key from crankshaft stub at ignition side. Knock the two cylindrical pins back into the ignition side of the crankcase and then unscrew the seven flat head screws at the sprocket side. The two halves of the crankcase can now be split by tapping the sprocket end of the crankshaft with a soft-nosed hammer. The crankshaft should now slide out of the bearing when thumb pressure is applied.

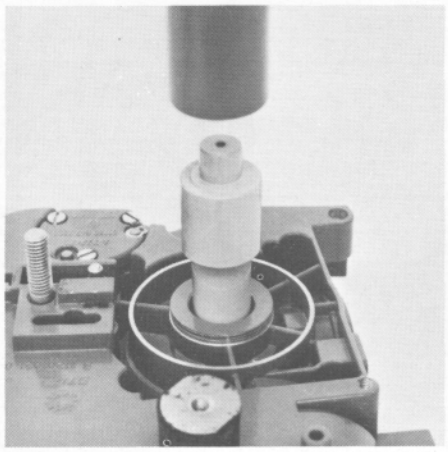
The sprocket side of the crankcase still contains the oil pump (7.4), the chain tensioner, a vibration damper, a needle sleeve and the oil seal.

The ignition side of the crankcase still contains the ignition, a vibration damper, fuel line with pickup body as well as a needle sleeve and the oil seal.

Use a screwdriver to knock the oil seals out of their seats from the inside to the outside, but remove the contact set first.

3.7 Installation of Crankshaft - Assembly of Crankcase

Driving out needle sleeve
with press arbor 1120 893 7200



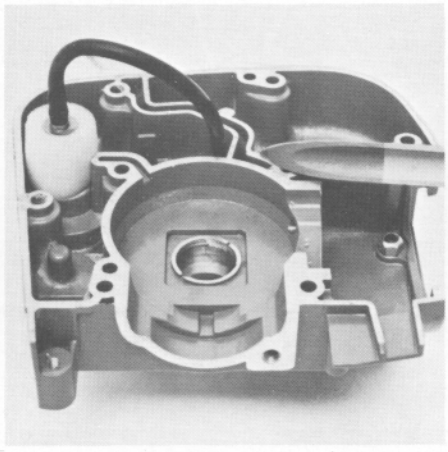
Use the press arbor to drive the needle sleeves out of the crankcase, from the outside to the inside in each case.

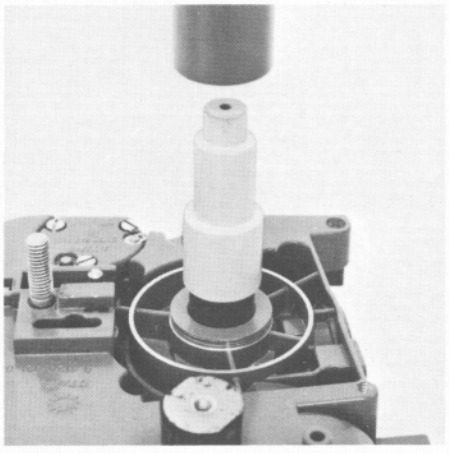
If the crankcase is damaged in any way it must be replaced as a complete unit (both halves). Always install new needle sleeves and oil seals in such a case. All other parts which are still serviceable can then be transferred from the old to the new crankcase.

Top:
Cleaning sealing faces

Center:
Needle sleeve correctly positioned

Bottom:
Pressing in needle sleeve





If the old crankcase is used again, carefully clean the sealing faces. Use a scraper or similar suitable tool to clean off gasket residue before fitting the new gasket.

The crankshaft bearings (needle sleeves) should be pressed into the crankcase halves from the inside to the outside. Do not heat the crankcase for this purpose.

The needle sleeves will only be correctly seated in the crankcase if the press arbor is used.

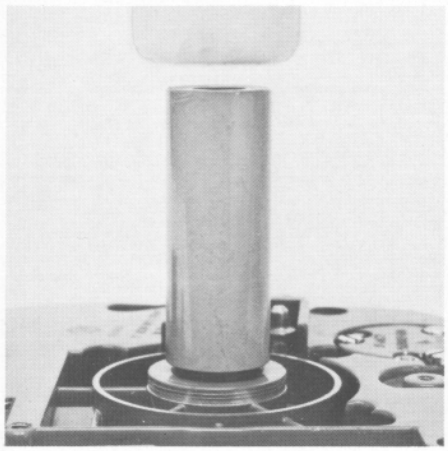
Important: The needle sleeves must be positioned on the press arbor so that the arbor's large diameter butts against the reinforced rim of the needle sleeve.

The needle sleeves are then placed in the crankcase and pressed home until the arbor butts against the crankcase.

Then use press sleeve to press in the oil seals from the outside to the inside.

Top:
Press sleeve 1120 893 2400

Bottom:
Pressing oil seal into position

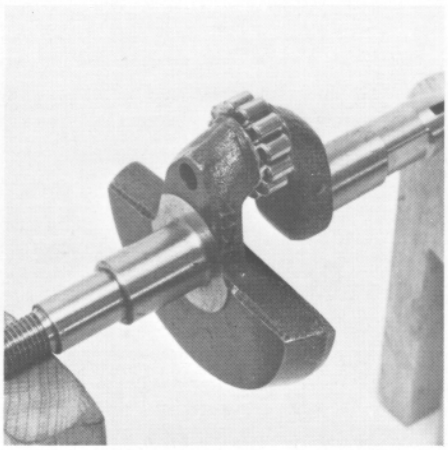


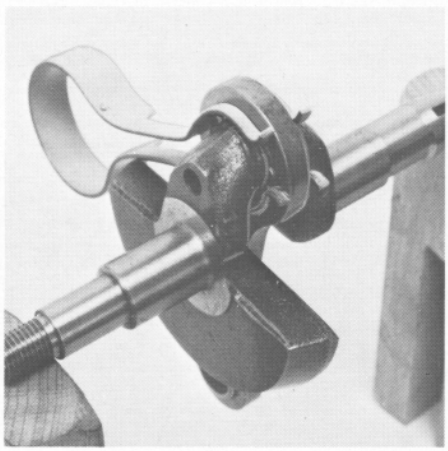
The oil seals should be perfectly flush with the crankcase faces. Lightly grease the sealing lips of the oil seals and the needle sleeves after installation. Use grease 0781 120 1109 for this purpose.

If the oil seals are replaced without removing the crankshaft, use the press sleeve to install them.

Top:
Cylindrical rollers held in position by grease

Bottom:
Clamp 1120 893 9100 in position

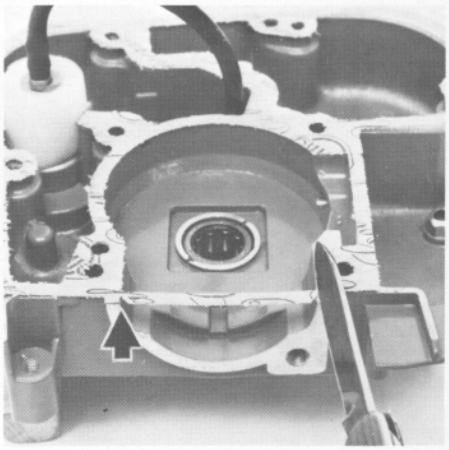




If a new crankshaft is being fitted, first fit 12 new cylindrical rollers in the crankshaft groove by coating the groove with grease (0781 389 3138) and then sticking the cylindrical rollers one by one to the grease. Hold the crankshaft horizontally and carefully fit the connecting rod over the cylindrical rollers.

Now fit the special clamp over the connecting rod to prevent the connecting rod slipping out of position during assembly and the cylindrical rollers dropping out of the crankshaft groove.

Cutting away gasket web at cylinder opening



Coat the mating faces of the two crankcase halves with sealing paste (0783 810 1101) and place the gasket on the clutch half of the crankcase, but first cut away the gasket web across the cylinder opening.

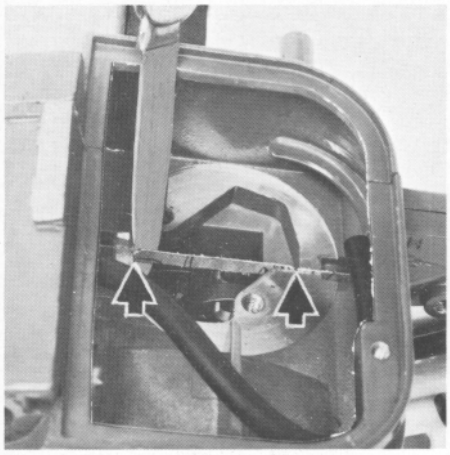
Fit thrust washer in recess on clutch half of crankcase and insert crankshaft, short stub first, into the crankcase until is butts against the thrust washer. Fit the ignition half of crankcase over the other crankshaft stub (do not forget the thrust washer), align the two crankcase halves and then knock in the two cylindrical pins.

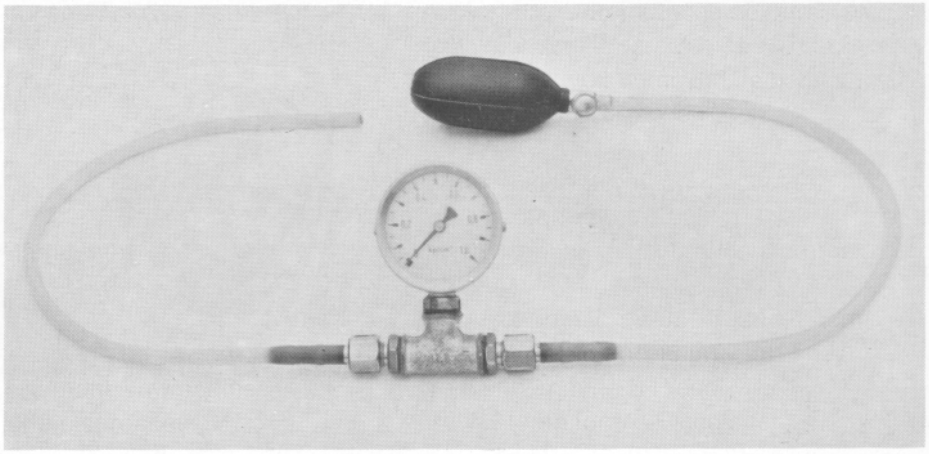
3.8 Leakage Testing the Crankcase

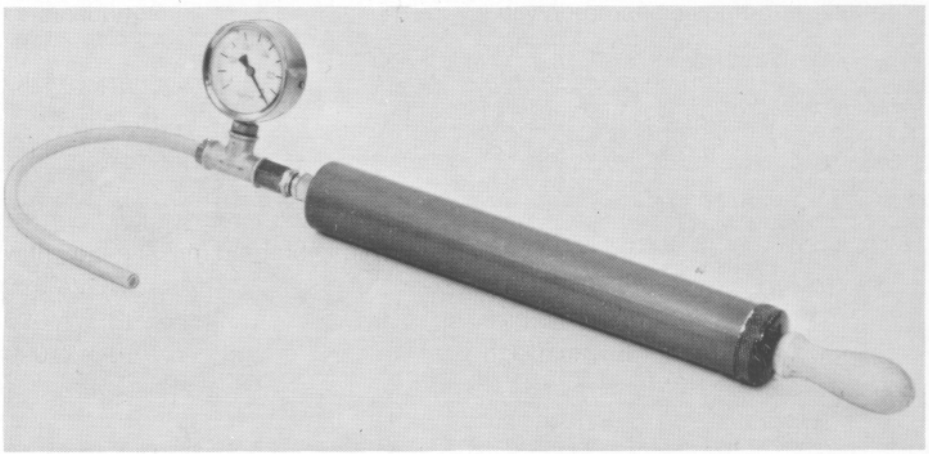
Top:
Carburetor and crankcase tester 1106 850 2900

Bottom:
Vacuum pump 0000 850 3500

Removing gasket web at inlet port







Then insert and tighten down the flat head screws to a torque of 4 - 5 Nm (0.4 - 0.5 kpm).

Reassemble all remaining parts by reversing the disassembly sequence. Carry out crankcase leakage test (3.8) and check ignition timing (4.5.2) before final assembly.

Important: The web of the crankcase gasket across the inlet port must becut away before fitting the diaphragm.

Defective oil seals and gaskets or accucracks in castings are the usual causes of leaks. Such faults allow supplementary air to enter the engine and upset the fuel-air mixture.

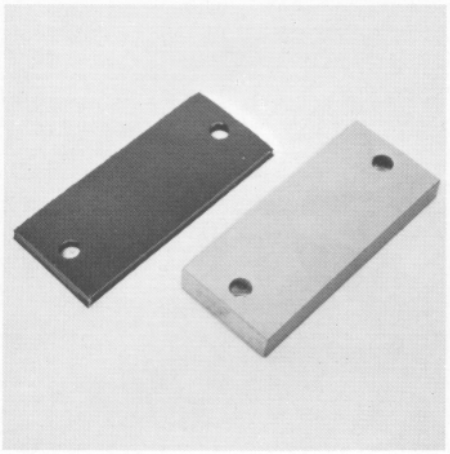
This makes adjustment of the prescribed idle speed difficult or even impossible. Moreover, the transition from idle speed to part or full throttle is not smooth.

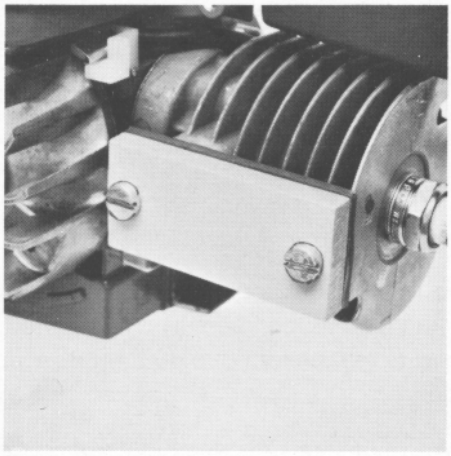
The crankcase can be checked rately for leaks with the carburetor/ crankcase tester and the vacuum pump.

3.8.1 **Pressure Test**

Top:
Sealing plate 1120 855 8100 and test flange 1120 855 4200

Bottom:
Exhaust port sealed





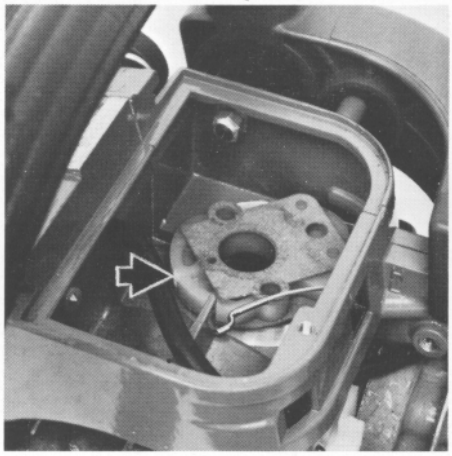
Remove the carburetor and muffler as well as the muffler gasket.

Seal the cylinder exhaust port with the sealing plate and test flange by means of two M 5x18 flat head screws.

Also remove the diaphragm and the two gaskets.

Top:
Test flange 1120 855 4215 in position

Bottom:
Test flange 1118 850 4210 secured in position



Now fit test flange 1120 850 4210 together with two new gaskets (1120 129 0500 and 1120 129 0505) on the crankcase.

Secure test flange 1118 850 4210 by means of two M 5x50 screws in place of carburetor.

Sealing plate 1120 855 8105 installed

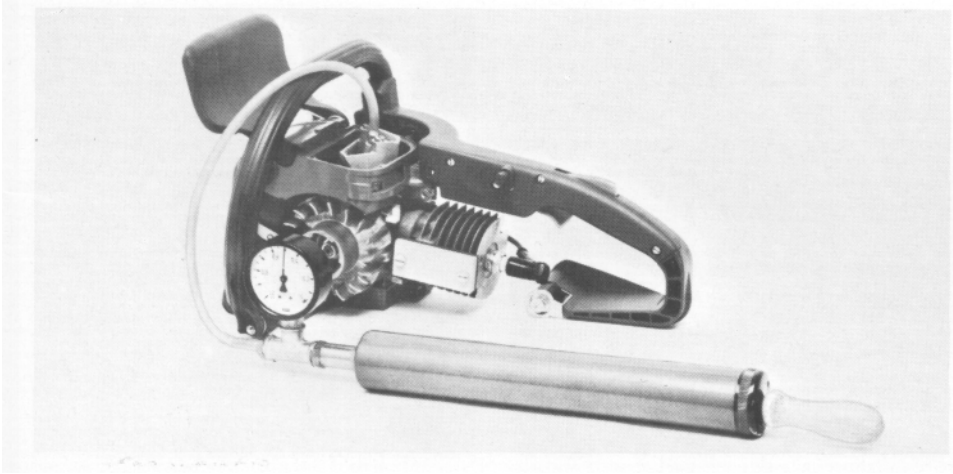
Unscrew the three pan head screws from the oil pump, take complete oil pump out of crankcase and disconnect hose. Use a screwdriver to prise off the circlip and then remove the pump cover. Place sealing plate on flange face - to seal pulse hole - and screw oil pump cover on top of it with the three M 4x16 pan head screws.

Turn piston to top dead center (T D.C.) and check that spark plug is properly tightened down.

Connect tester's pressure hose to the nipple of the test flange. Close bleed screw on rubber bulb and pump air into crankcase until pressure gauge shows a reading of 0.5 bar. If this pressure remains constant, the crankcase is airtight. However, if the pressure reading drops the leak must be found and the faulty part replaced.

3.8.2 Vacuum Test

Leakage test with vacuum pump



Oils seals tend to fail when they are subjected to a vacuum. During the piston's induction stroke the sealing lip lifts off the crankshaft owing to the lack of internal counterpressure.

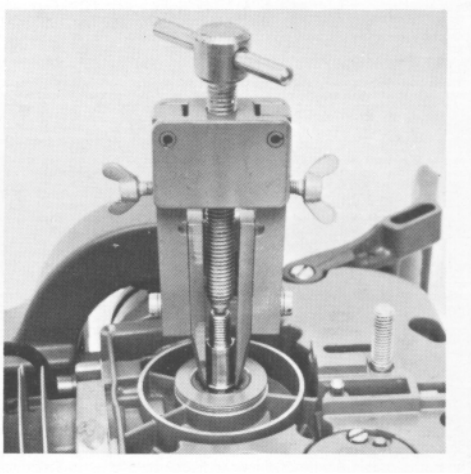
An additional test can be performed with the vacuum pump to detect this fault. The preparations for this test are the same as described for the pressure test (3.8.1).

Connect suction hose of vacuum pump to nipple of test flange. Then pull out pump handle until the pressure gauge indicates a vacuum of 0.5 bar. When you release the pump handle the non-return valve automatically seals the suction hose.

If the vacuum reading remains constant or drops no further than 0.3 bar, the oil seals are in good condition. However, if the vacuum continues to drop (down to 0 bar), the oil seals must be replaced even if no leaks were found in the previous pressure test.

3.8.3 Replacing the Oil Seals

Puller 0000 890 4400 in position



The oil seals can be replaced without disassembling the crankcase. To do this, first remove the clutch (2.3.1), flywheel (4.4.4) and the contact set (4.4.7).The primary lead can be left on the contact set.

Both oil seals, on the ignition and clutch sides, can be pulled out of their seats with puller 0000 890 4400.

Screw the No. 5 jaws to the puller and push the jaws into the oil seal by pressing them down lightly and turning at the same time.

Open up the jaws by turning the wing nuts and then screw down the spindle to pull the oil seal out of its seat.

Installation of the new oil seals is described under 3.7.

4. IGNITION SYSTEM

4.1 Construction

The 010 is equipped with a breaker-controlled magneto ignition system which requires neither a battery nor a generator.

The Phelon ignition system is of component-type construction (ignition armature and control unit are arranged separately) and consists of three main parts - the flywheel (magnet wheel), ignition armature and the control unit.

The flywheel carries the permanent magnet with a north and south pole and is located on the crankshaft stub. The ignition armature is mounted in the crankcase on the periphery of the flywheel and can be adjusted within certain close limits by means of slots in the iron core.

The ignition's control unit, i. e. the contact set with condenser, is screwed to the crankcase behind the flywheel.

4.2 Description of Operation

Every magneto ignition system operates on the principle of magnetic induction. On the breaker-controlled ignition system (and transistorized ignitions) this involves only "dynamic induction".

In **dynamic induction** the electric current is generated in a conductor by moving the conductor through the flux lines of a magnetic field. The magnitude of the induced voltage is basically dependent on the strength of the magnetic field and the speed of the flux change. This in turn is influenced mainly by the intensity of the movement.

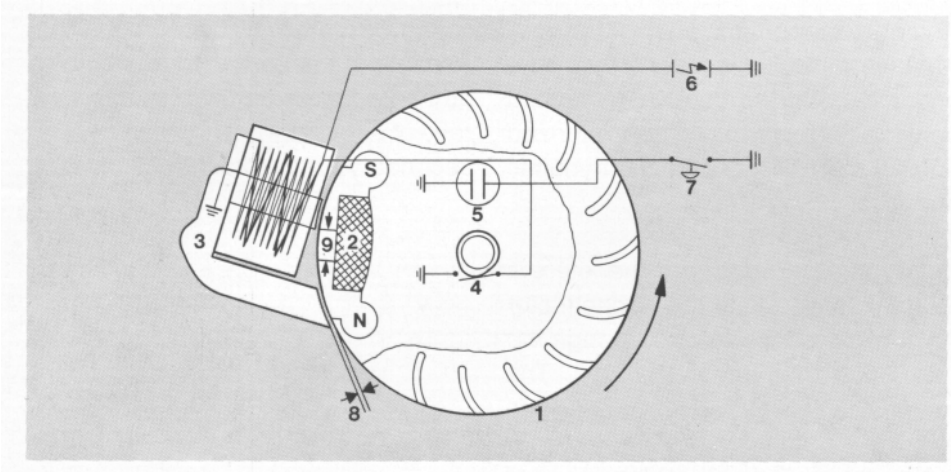
In terms of the magneto ignition system this means: As the flywheel rotates the flux lines flowing between the poles of the permanent magnet, from north pole to south pole, create a magnetic flux in the iron core of the coils. The flux lines of this magnetic field cut through the wire windings of the respective coil and induce a low tension current. The magnitude of the voltage is, therefore, basically depen dent on the rotational speed of the flywheel.

In the case of **static induction** on the other hand, the voltage is created in a conductor by a magnetic field chang ing its strength or flow direction, the conductor being situated in the mag netic field which is produced by an electric current (transformer prin ciple). The magnitude of the induced voltage is principally depended on the strength of the primary current which generates the magnetic field and the ratio of turns between the primary and secondary coils (transformation ratio).

4.2.1 Breaker-Controlled Magneto Ignition

Diagram of ignition system:

1 Flywheel
2 Permanent magnet with north and south poles and pole shoes
3 Ignition armature with primary and secondary windings
4 Contact breaker
5 Condenser
6 Spark plug
7 Ignition stop switch
8 Air gap
9 Edge gap



A condenser is wired in parallel with the contact breaker in the primary circuit in order to prevent excessive sparking (arcing) between the breaker points while they are opening and insure there is no loss of energy or premature corrosion of the points.

The primary circuit is permanently closed by means of the ignition stop switch. This suppresses the abrupt change in direction of the magnetic flux so that no further high-tension pulse can be induced.

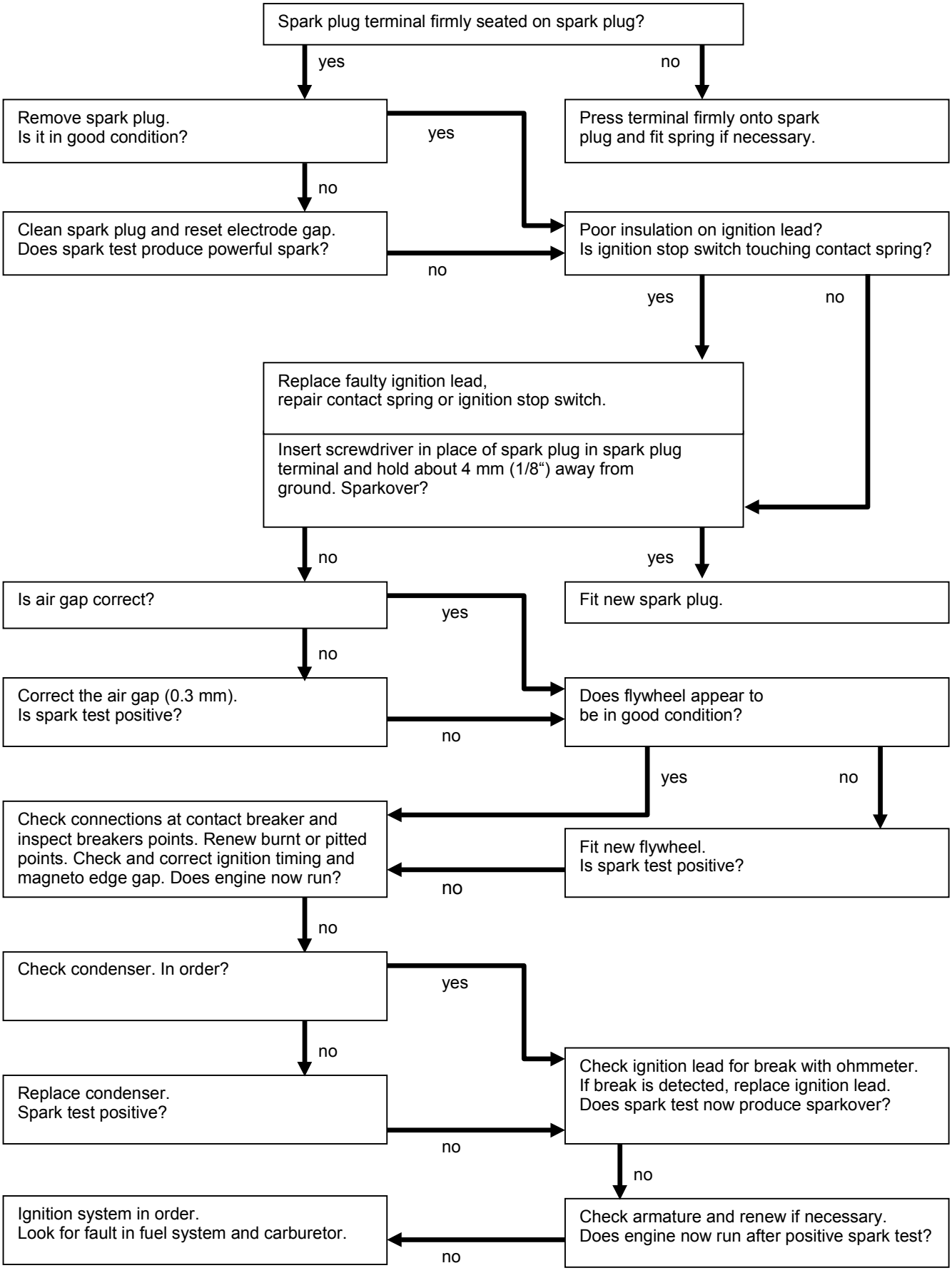
When the magnet poles of the flywheel pass the iron core of the armature coils a low-tension voltage is induced in the coils as a result of the magnetic flux.

Without any form of control the magnetic flux would rise and fall like a sine-wave and finally change direction. The same applies for the electric voltage. However, the magnitude of a voltage pulse generated in this way would not be sufficient to produce a sparkover.

This means that the voltage curve must be controlled. In this ignition system the mechanical contact breaker performs the control function. It is opened by the cam lobe ground on the hub of the flywheel and closed by spring action. At the moment of maximum flux the contact breaker, and also the primary circuit, is closed. The induced voltage thus allows a current to flow in the primary winding which builds up a magnetic field (armature field) around the coil. This is opposed to the inducing magnetic field (exciter field) and counteracts its tendency to change the flux direction. The further the flywheel rotates, the greater the tendency of the exciter field to change the flux direction. The opposing armature field and thus the primary current must also increase accordingly. When the current finally reaches its maximum value the contact breaker opens the primary circuit - this instant is called "magnet breakdown". This causes the magnetic field in the armature core to suddenly change direction and induce a high-tension pulse in the armature's secondary winding which is proportional to the high number of turns in that winding.

This pulse is fed via the hightension ignition lead to the spark plug and is discharged as a sparkover from the center to the ground electrode and thus ignites the fuel-air mixture.

4.3 **Troubleshooting Chart**



4.4 Function and Repair of Components

4.4.1 Spark Plug

The high-tension pulse generated in ignition system is fed to the spark plug and discharge as a sparkover between the center and ground electrodes.

When the spark plug is in good condition and the electrode gap is correct, the spark ignites the fuel-air mixture.

The appearance of the spark plug'sinsulator nose gives valuable information with regard to the effects of various operating conditions:

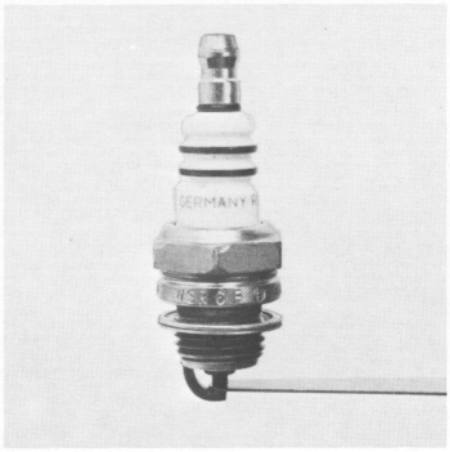
Troubleshooting on the ignition system should always begin at the spark plug.

In the event of starting difficulties, low engine power or misfiring etc., unscrew the spark plug and check whether it is one of the types approved by STIHL.The Champion RCJ 6Y suppressed spark plug is an approved alternative to the standard Bosch the WSR 6 F (formerly WKA 200 TR 6). These spark plugs cover a wide thermal range and have better operating characteristics under severe conditions.

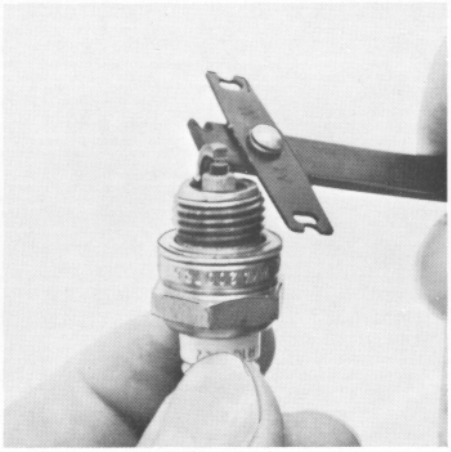
Appearance of insulator nose		Some conditions associated with appearance
Normal:	grey/yellow to brown, dry	Engine in order; spark plug heat range is correct
Sooted:	velvelt-like, dull black coating of soot	Mixture too rich, lack of air (dirty air filter, choke valve partly closed), electrode gap too wide, heat range too high
Smeared with oil:	coating of damp oil carbon and soot	Too much oil in fuel mix
Overheated:	welding beads on insulator nose, eroded electrodes	Mixture too lean, spark plug loose, heat range too low

4.4.2 Ignition Lead

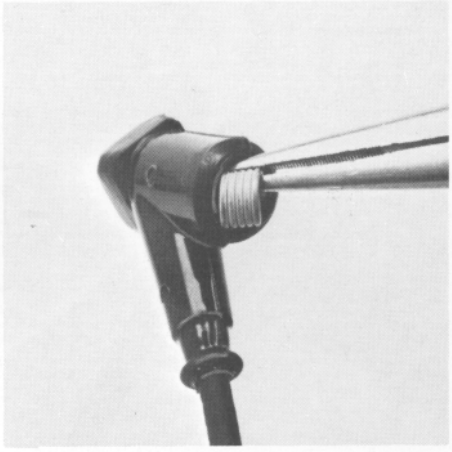
Checking electrode gap with feeler gauge



Resetting electrode gap with Bosch spark plug gauge



Pulling out leg spring



Never use a steel wire brush for cleaning a sooted or carbonized spark plug. Always use a brass wire brush for this purpose and then blow out the plug with compressed air. If the spark plug is smeared with oil, wash the insulator nose with a grease solvent and blow out with compressed air.

As the electrode gap becomes wider as a result of normal erosion the gap must be checked with a feeler gauge at regular intervals and reset as necessary. The specified gap is **0.5 mm** and can be restored by bending the ground electrode. However, always fit a new spark plug if the electrodes are badly eroded.

Accurate checking of the spark plug is possible only with a special spark plug tester. A provisional check can be carried out by fitting the clean spark plug in the ignition lead terminal and holding it against ground. There should be a powerful sparkover at the electrodes when the engine is cranked by pulling the rewind starter.

If there is no sparkover although the spark plug is in good condition, first check the lead connections. Chafed insulation on the ignition or ground leads will cause a short-circuit to ground. If this is the case the engine will either not start or only run erratically.

Before refitting the spark plug in the cylinder, clean the spark plug seat and make sure the sealing ring is in good condition. Tighten down the spark plug to a torque of 25 Nm (2.5 kpm).

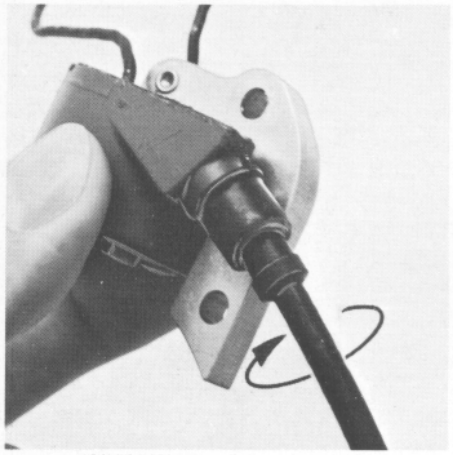
The ignition lead feeds the high-tension pulse generated in the armature to the spark plug. If its insulation is brittle or damaged in any way a sparkover to ground can occur and thus interrupt the ignition process.

The ignition lead must be renewed in such a case.

To remove the ignition lead, disassemble the flywheel (4.4.4) and ignition armature (4.4.5.3). Unscrew the ignition lead from the wood screw on the high-tension output of the armature. Take off the rubber boot and then pull out the ignition lead through the cable clamp and crankcase. Use a suitable pair of pliers to grip and pull the leg spring out of the ignition lead terminal. Then pull ignition lead out of the terminal.

4.4.3 **Ground Lead Contact**

Screwing ignition lead onto armature



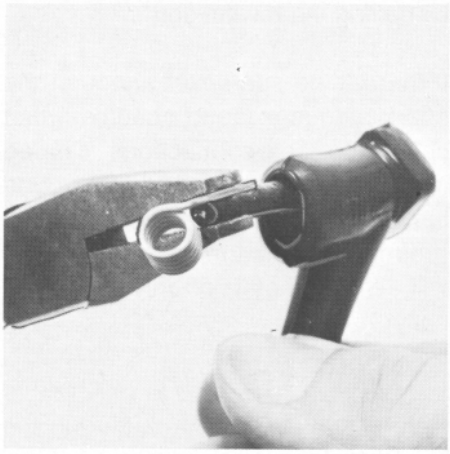
The new ignition lead must have a length of 370 mm.

Slip the rubber boot over one end of the lead and screw the lead firmly onto the wood screw in the armature - this is much easier if a hole is made in the center of the lead with a pointed tool.

Fit the armature and thread the other end of the ignition lead between the crankcase and cable clamp. Coat the free end of the lead with a little oil. Push the terminal over the end of the lead and use a suitable pair of pliers to grip and pull the lead out through the terminal. Pinch the hook of the leg spring into the center of the lead about 15 mm from the end of the lead. Pull lead back so that the leg spring locates in the terminal. Take out locking screw and refit spark plug. Push terminal onto spark plug and reassemble all other parts. Readjust air gap (4.4.5.3).

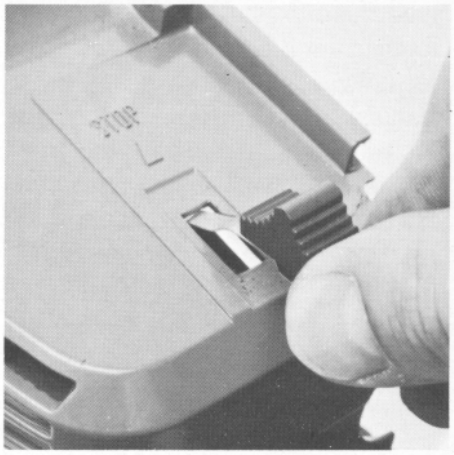
Top:
Ignition lead inserted through terminal

Bottom:
Fitting leg spring



Top:
Spring strip of ignition stop switch pushed out of slot

Bottom:
Removing ignition stop switch

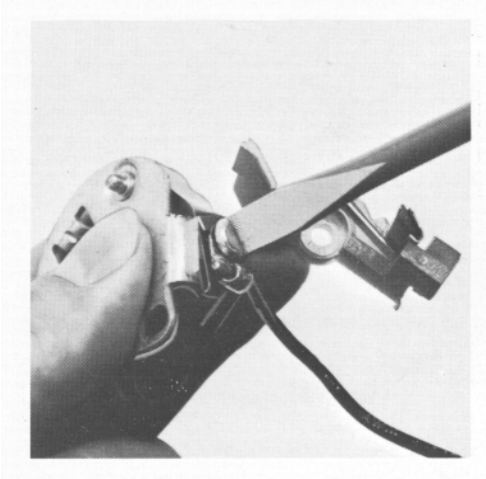


The ignition stop switch short circuits the ignition and thus stops the engine. The switch is installed in the fan housing and makes ground contact when in the "STOP" position.

The ignition stop switch is simply located in the housing slot. To remove it, push the spring strip out of the slot and pull the complete switch upward and out of the housing opening.

4.4.4 **Flywheel**

Removing the contact spring



The contact spring is screwed to the contact set. If the contact spring has to be replaced, first remove the flywheel (4.4.4), then take out the 3 pan head screws and remove the contact set with contact spring and cable clamp from the crankshaft stub. Push the cable clamp to the rear and slacken off screw in contact set a few turns. The contact spring can now be pushed to the rear and taken off.

Reverse the above procedure to install the new contact spring. Reset breaker point gap (4.4.7).

The flywheel has several functions. It accommodates the permanent magnet for the ignition system with a north and south pole (polarized in the engine's normal direction of rotation). The relatively large flywheel mass insures that the engine turns smoothly, i.e. it substantially suppresses the normal irregularities of the engine's combustion process.

The front of the flywheel is designed as a fanwheel to provide the necessary air for engine cooling

Six pawl detents are machined in the hub on the front side of the flywheel in order to transmit the starting torque.

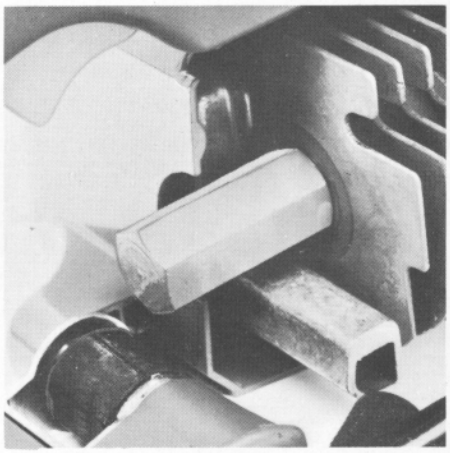
The flywheel is mounted at the ignition end of the crankshaft on a taper seat, located by means of a key and secured with a hexagon nut.

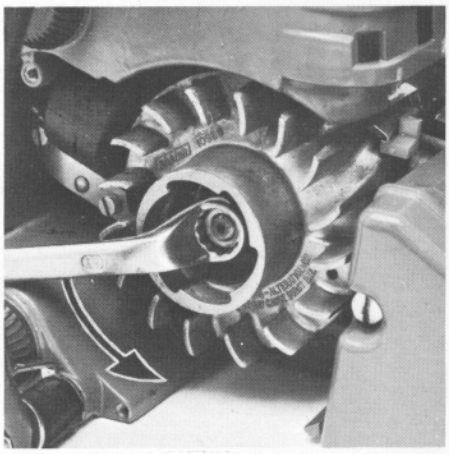
To disassemble the flywheel, first remove the fan housing, unscrew the spark plug and fit the locking screw in the spark plug hole. Tighten it down by hand.

Turn flywheel counterclockwise until the piston head butts against the locking screw. Use a ring or socket wrench to slacken off and remove the hexagon nut counter-clockwise. Screw flywheel puller as far as it will go onto

Top:
Locking screw 1107191 1200 in position

Bottom:
Releasing hexagon nut

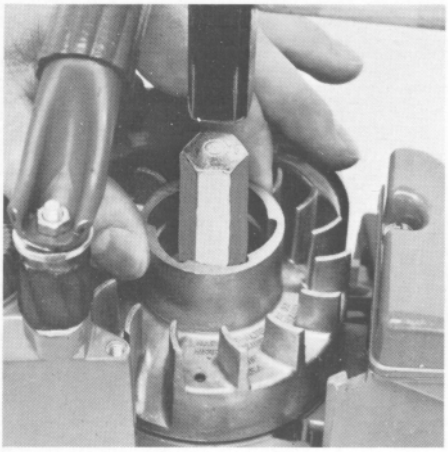




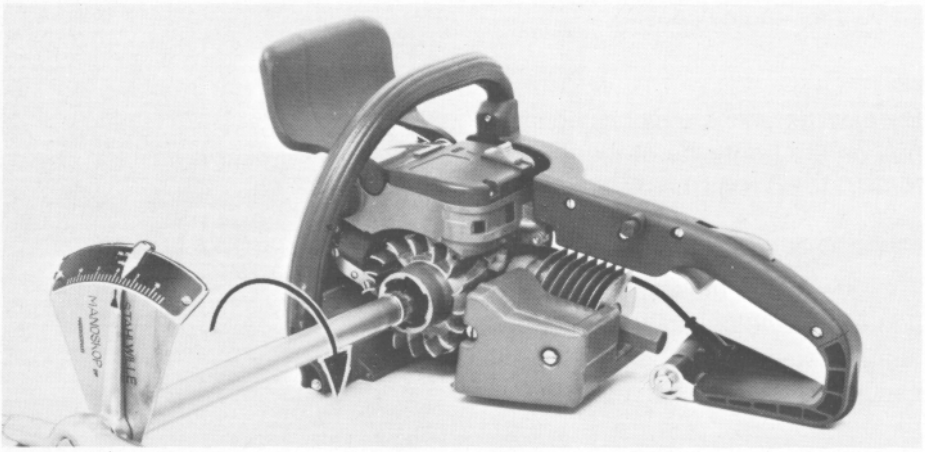
the crankshaft stub an then back it off one full turn. Now hold the flywheel and tap the puller with a small hammer. This releases the flywheel from its taper seat. Unscrew the puller and take off the flywheel.

4.4.5 Ignition Armature

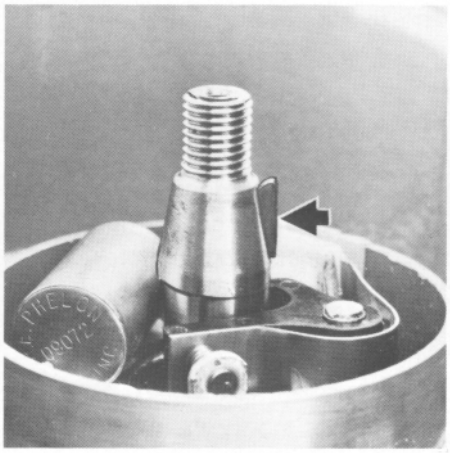
Top:
Releasing flywheel with puller
1116 893 0800



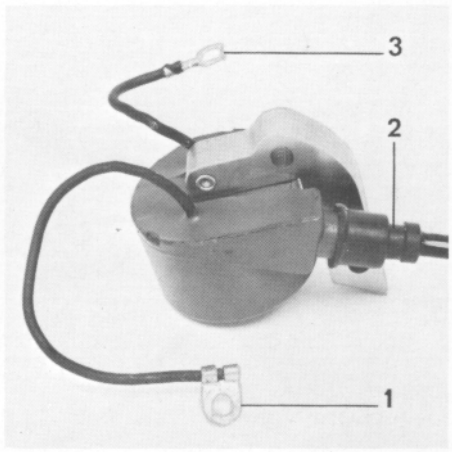
Bottom:
Tightening hexagon nut with
torque wrench



Key correctly positioned



1 = Primary connection
2 = Secondary connection
3 = Ground connection



On the ignition armature the primary and secondary coils are arranged on the center arm of the iron core and encased in a plastic compound to make them moisture-proof. Three electrical connections emerge from the coil body, i.e. the primary and secondary connections and the ground connection.

There are two ways of testing the ignition armature:

The resistance of both coil windings can be checked with the aid of ohm-meter 5910 850 4800.

Accurate testing is performed with an ignition coil tester.

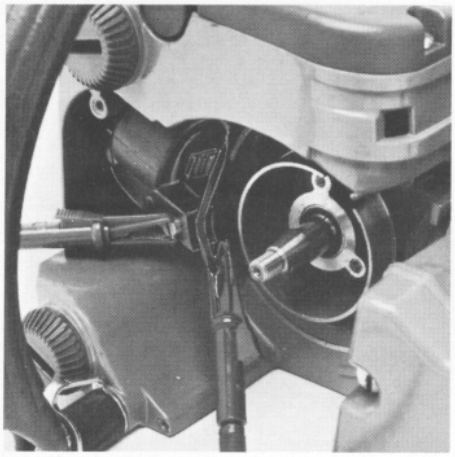
Before re-installing the flywheel, clean the crankshaft stub and the fly-wheel hub bore with a suitable de-greasing agent (e.g. trichlorethlene, diluted nitro). Make sure the key is correctly positioned.

Fit flywheel on the crankshaft so that the key locates in the slot in the fly-wheel hub. The key is provided only to insure that the flywheel is correctly positioned. The driving force between the crankshaft and flywheel must be absorbed entirely by the taper seat. It is therefore absolutely essential to insure that the crankshaft nut is tightened down to the specified torque load of 25 Nm.

Finish off by removing the locking screw, refitting the spark plug and the fan housing.

4.4.5.1 Resistance Test on Primary Winding

Resistance test on primary winding



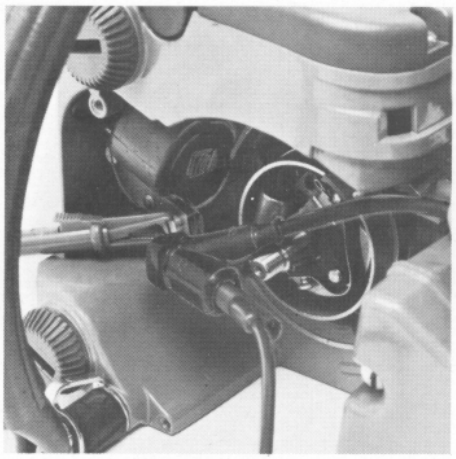
To test the primary winding, first remove the flywheel (4.4.4) and the contact set.

Then disconnect lead from contact set. Clip one of the two test leads to the primary connection and the other to ground of ignition armature. A reading of approx. 0.8 to 1.3 (Ω) should now be obtained in measuring range "Ωx1".

If the reading obtained deviates from this value the ignition armature must be replaced.

4.4.5.2 Resistance Test on Secondary Winding

Resistance test on secondary winding



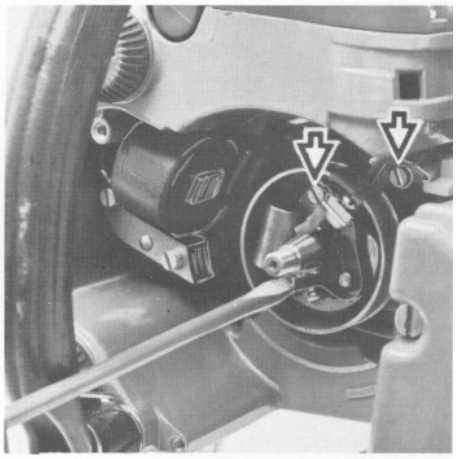
To test the secondary winding, hold banana-pin of one test lead against the leg spring in the spark plug terminal and connect other test lead to ground of ignition armature. A reading of 7.2 to 8.8 (kΩ) should now be obtained in measuring range "Ωx1000" (kΩ).

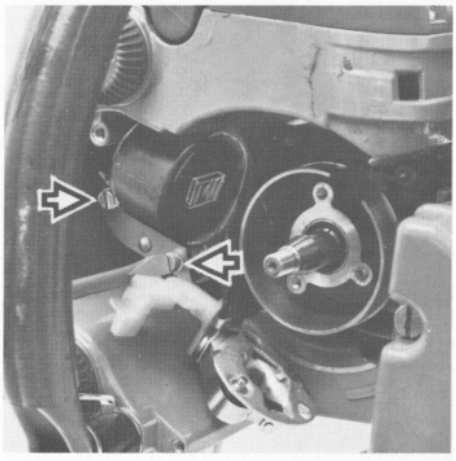
If a different value is obtained, remove the ignition lead and carry out the measurement again, holding one test lead directly against the secondary output of the ignition armature. If the deviation from the specified value persists, the ignition armature must be replaced.

4.4.5.3 Disassembly and Assembly

Top:
Removing the contact set

Bottom:
Unscrewing the ignition armature





First remove the flywheel (4.4.4) and take out the two contact set mounting screws. Unscrew the cable clamp fastening screw and then the two pan head screws on the ignition armature. Remove the ignition armature and contact set. Unscrew the ignition lead from the armature and the primary lead from the contact set.

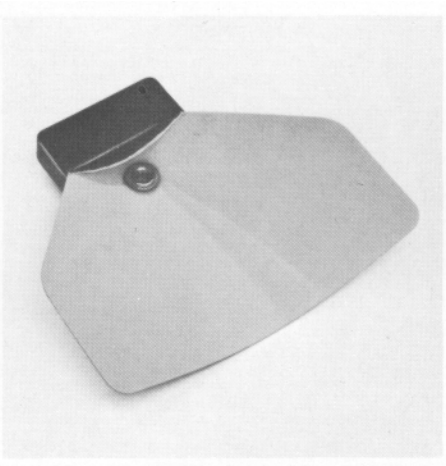
4.4.6 **Condenser**

Top:
Setting gauge 1111 890 6400

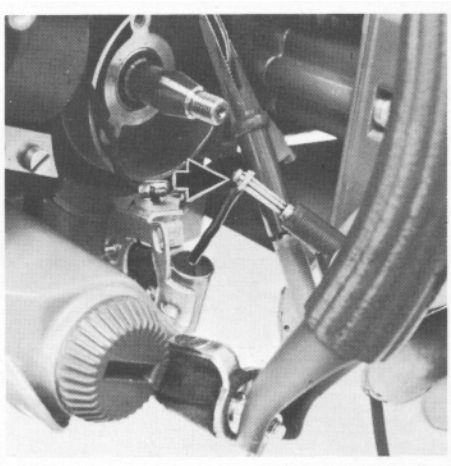
Center:
Securing the armature

Bottom:
Checking air gap with feeler gauge

Pushing armature away from flywheel



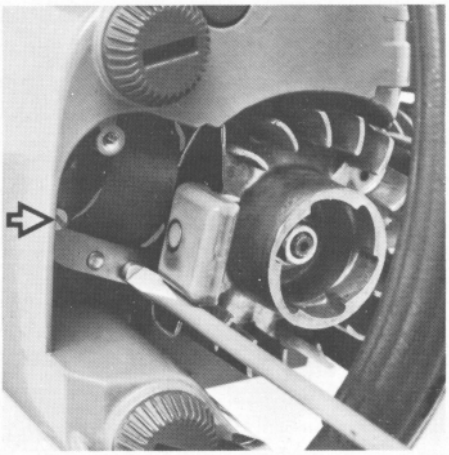
Checking condenser with ohmmeter
5910 850 4800

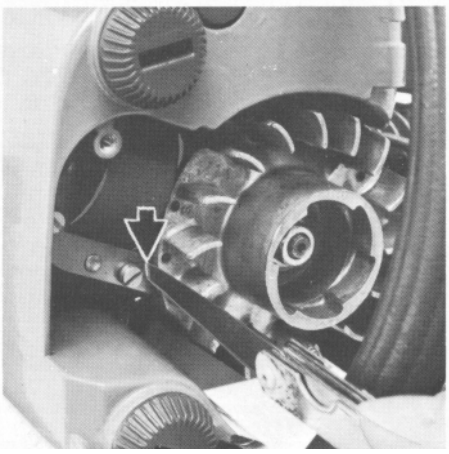


To reassemble, connect up primary and ignition leads. Position ignition lead on crankcase, fit the contact set and flywheel. Push ignition armature away from flywheel and secure in position with pan head screws. Do not forget the ground lead.

Now align flywheel so that the area in which the magnets are embedded covers half of each of the two outer armature arms. Insert setting gauge or 0.2 mm gauge sheet between magnet poles and armature arms, slacken off pan head screws and press armature firmly against the flywheel. Then retighten the pan head screws.

Take away the gauge and check the air gap with a feeler gauge. It should be between 0.2 and 0.3 mm.





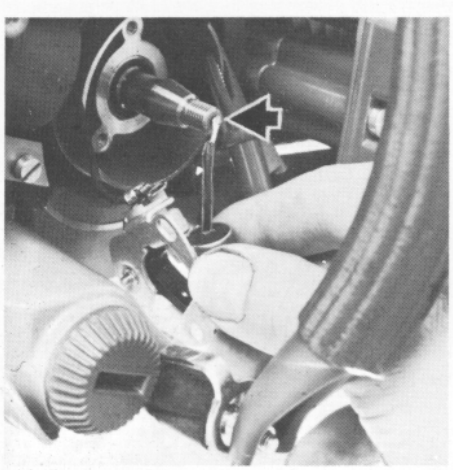
The condenser is wired in parallel with the contact breaker. While the breaker points are opening the primary current is fed briefly to the condenser until it is charged. This insures that the strength of the current flowing via the contact breaker at this point is only minimal and thus suppresses excessive sparking (arcing).

A faulty condenser is often the cause of premature erosion of the contact breaker points and loss of ignition voltage. The condenser's storage capacity is 0.17 µF and can be checked with the ohmmeter or the Bosch ignition coil and condenser tester EFAW 106 A. To do this, remove the fan housing, flywheel, contact set and the condenser lead.

To check with the ohmmeter, connect one of the two leads to ground (e.g. cylinder fin) and hold the other on the condenser connection. If the condenser is in good condition, it will be charged and the ohmmeter's pointer

4.4.7 **Contact Set**

Discharging the condenser



should briefly move to about 0.2 (µF) in measuring range "µFx1" (/-µF = microfarad). If this is not the case the condenser is faulty and a new one must be installed. Always discharge the condenser after each test by shorting it out (connecting lead to ground).

If the Bosch tester EFAW 106 A is used for the test, follow the instructions supplied with the unit.

If the condenser is faulty, the complete contact set must be replaced (4.4.5.3).

Finish off by refitting the contact set, flywheel and fan housing.

The contact breaker set consists of a fixed contact, which is connected to ground, and a moving contact breaker lever which is insulated from ground and connected to the ignition coil's primary connection and the condenser. The contact set functions as a switch which closes the primary circuit and opens it again at the point of ignition.

The service life of the heel on the contact breaker lever is greatly dependent on proper lubrication. It is therefore important to insure that the grease impregnated lubricating felt in the contact plate is always in good condition.

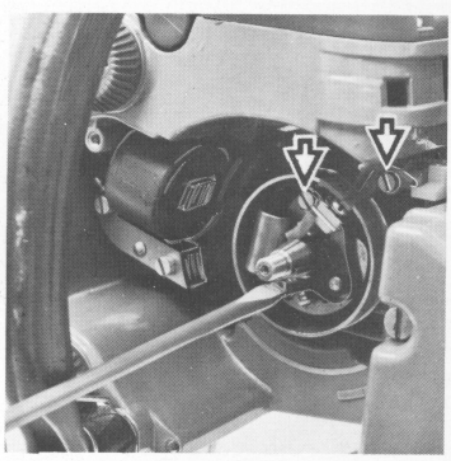
The contact breaker points gradually wear as a result of erosion. Eroded contacts widen the breaker point gap and cause ignition timing to be advanced and the magneto edge gap to be reduced.

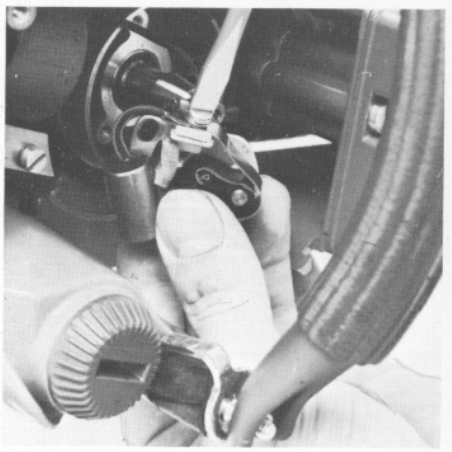
Partly eroded contact breaker points can be reset but badly burnt points necessitate immediate replacement of the complete contact set. To do this, remove fan housing and flywheel, unscrew the two contact set mounting screws and one screw on the cable clamp and then take out the contact set. Push cable clamp out of the way, take out fastening screw and remove contact spring and primary lead.

When installing the new contact set make sure the cable clamp presses

Top:
Removing contact set and cable clamp

Bottom:
Removing mounting screw



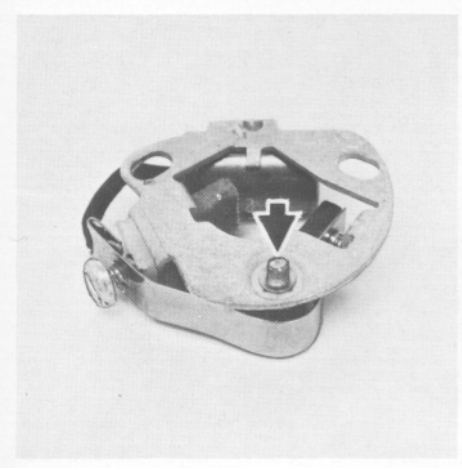


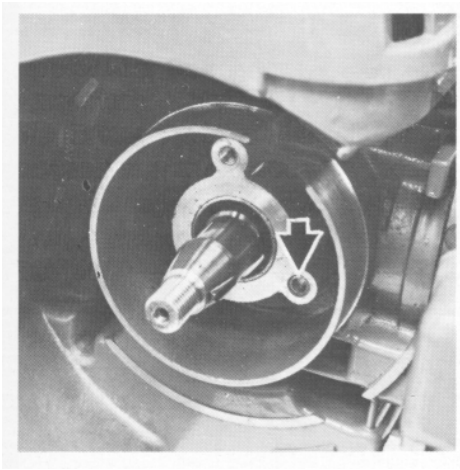
the primary lead firmly into the housing slot. The primary lead must not touch the flywheel. Furthermore, the cylindrical pin on the underside of the contact plate must be properly seated in the locating hole provided in the crankcase.

4.5 Ignition Timing

Top:
Cylindrical pin on contact set

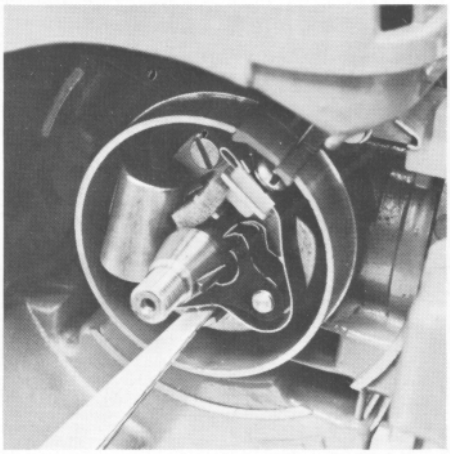
Bottom:
Locating hole in crankcase





To adjust the breaker pointer gap, turn the crankshaft in the engine's normal direction of rotation (counterclockwise) until the piston is at T D.C. The flywheel cam opens the contact breaker lever fully in this position. Now slacken off the contact set and turn it until a breaker point gap of 0.4 mm is obtained with a clean feeler gauge. Then retighten the mounting screws. Check ignition timing and magneto edge gap.

Checking breaker point gap



The breaker point gap, ignition timing and magneto edge gap are interrelated and none of these values can be altered without affecting the others. However, this also means that if one of these values is correct the other two should normally be correct as well. The dominating factor is the magneto edge gap. If variations are experienced in practice, preference should be given to maintaining the correct edge gap.

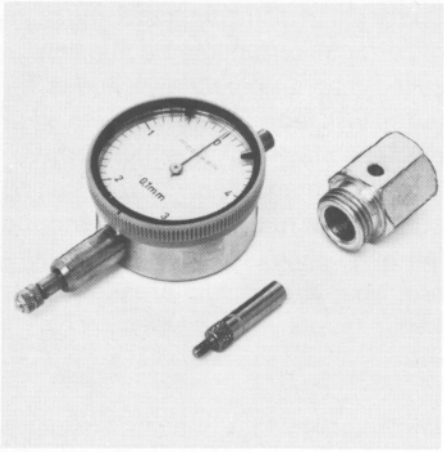
Finish off by checking the lubricating felt. It should be in good condition and soaked with oil.

The ignition timing on the breaker-controlled magneto ignition system must be set to 2.0 mm before T D.C. (top dead center). This means that the moving contact should just begin to lift off the fixed contact when the crankshaft is in this position. The contact breaker points are fully open when the crankshaft is in the T.D.C. position; the breaker point gap must be 0.4 mm.

4.5.1 Checking Breaker Controlled Ignition

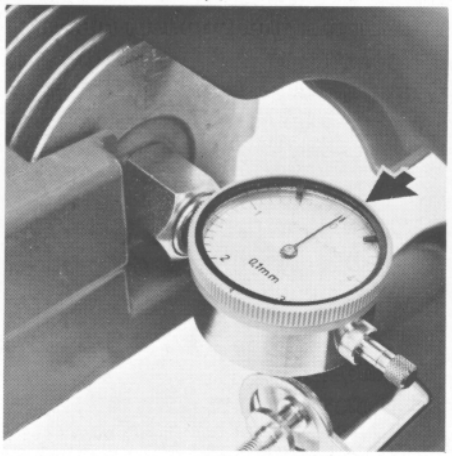
Top:
Dial gauge with holder 1110 890 8600 and tracer pin 1107 894 3000

Bottom:
Holder in position

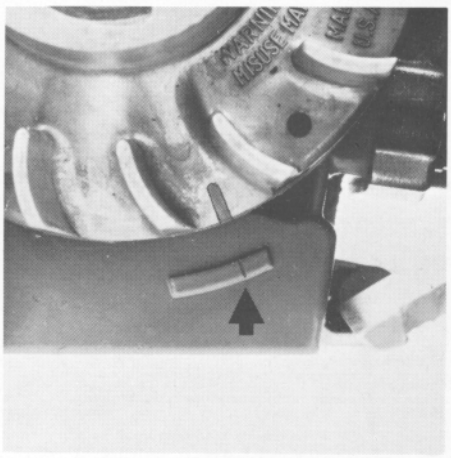


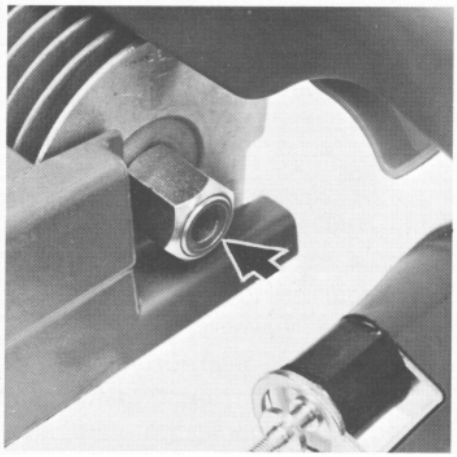
Top:
Dial gauge set to "O"

Bottom:
Ignition timing unit ready for test



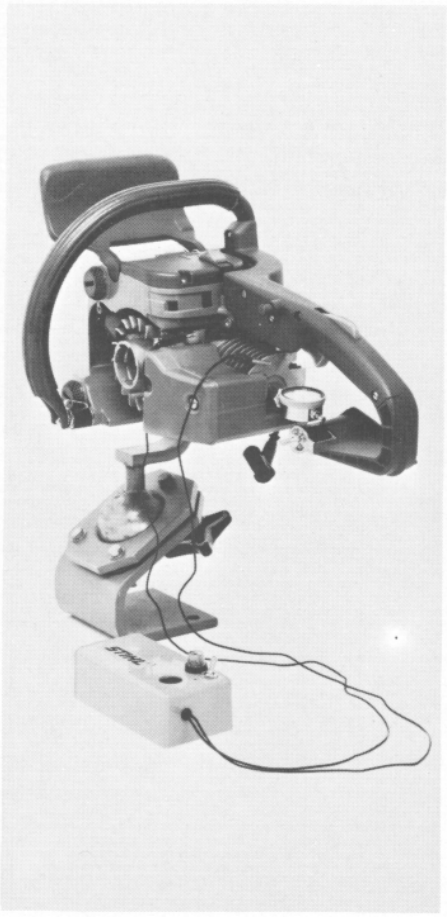
Timing marks on flywheel and crankcase





To check ignition timing, remove the fan housing and spark plug. Screw the holder into the spark plug hole and then insert the dial gauge, with tracer pin extension, in the holder.

Turn the flywheel to bring the piston to T D.C. and then set the dial gauge pointer to "0" in this position. Attach terminal clips of ignition timing unit securely to cylinder fin and contact spring. Now turn flywheel backward about a quarter of a revolution.Switch



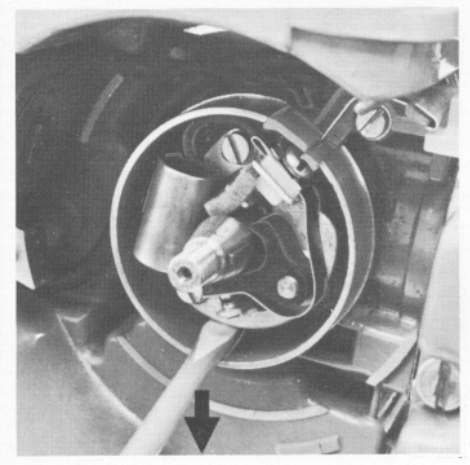
on ignition timing unit and turn flywheel slowly in the engine's normal direction of rotation until the indicator lamp on the timing unit lights up, or the buzzer sounds.

The contact breaker opens in this position. The dial gauge should now show a reading of 2.0 mm. If this is not the case, the ignition must be retimed.

On machines with a timing mark on the flywheel, ignition timing is checked by bringing the flywheel and crankcase timing marks into alignment. The indicator lamp on the timing unit should just begin to glow in this position.

4.5.2 Adjusting Breaker-Controlled Ignition

Resetting breaker point gap



In addition to the preparations described under 4.5.1 (inserting the dial gauge) it is necessary to remove the flywheel in order to adjust ignition timing.

Turn clutch in engine's normal direction of rotation (clockwise) until the dial gauge pointer remains stationary (T D.C. position). Now set dial gauge pointer to zero. Turn clutch about a quarter of a revolution clockwise and then backward again until the dial gauge shows a reading of 2.0 mm. Switch on the ignition timing unit, slacken the contact set and turn it until the indicator lamp on the timing unit just lights up.

Then retighten the contact set mounting screws and recheck ignition timing. If it is now between 1.9 and 2.1 mm before T D.C., the breaker point gap will be between 0.3 and 0.4 mm.

The breaker point gap, ignition timing and magneto edge gap are interrelated. None of these values can be altered without affecting the others. However, this also means that if one of these values is correctly set the other two will normally be correct as well. The dominating factor is the magneto edge gap. If any variations are experienced in practice, preference should be given to maintaining the correct edge gap.

Finish off by removing the test equipment and reassembling the saw.

4.6 Magneto Edge Gap on Breaker-Controlled Ignition

The position of the magnet at the point of current interruption, i.e. ignition, is called magnet breakdown and is referred to in terms of the magneto edge gap. The magneto edge gap is, therefore, the distance between the trailing edge of the north pole shoe and the left-hand edge of the center armature arm when the contact breaker points begin to open. This distance is 5 mm.

The magneto edge gap has a decisive influence on the performance of the ignition system. If it is too large, the ignition voltage during starting will be too low; however, if it is too small, the engine will misfire at high speed.

If the ignition is properly timed the magneto edge gap will automatically be correct as the two factors are interrelated. However, variations may occur as a result of an accumulation of maximum manufacturing tolerances. The edge gap should, therefore, also be checked whenever the ignition timing is adjusted. Preference should always be given to maintaining the correct edge gap even if this means that there are minor discrepancies in ignition timing and the breaker point gap.

To check the edge gap, first follow procedure for checking ignition timing. The magneto edge gap should then be measured at the moment the timing unit's indicator lamp lights up (ignition point).

5. REWIND STARTER

5.1 Construction and Operation

The rewind starter mechanism is mounted on the starter post in the fan housing, directly in front of the flywheel. Its main components are the starter rope with grip, rope rotor with rewind spring and pawl. A spring clip holds these components in position on the post. The starter rope, which is wound onto the rope rotor by the pre-loaded rewind spring, rotates the rotor when the starter grip is pulled. This causes the pawl to be moved outward by the spring clip and engage the flywheelhub.

The torque produced by the starter rope is thus transmitted positively via the flywheel and turns the crankshaft.

The withdrawn starter rope is automatically rewound onto the rope rotor by the preloaded rewind spring.

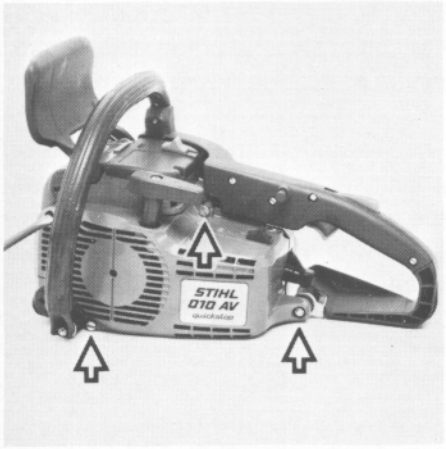
The rewind starter mechanism is practically maintenance-free. Only the rope rotor post needs to be lubricated with non-resinous oil at regular intervals.

5.2 Troubleshooting Chart

Fault	Cause	Remedy
Starter rope broken	Rope pulled out too vigorously as far as stop or not pulled vertically	Replace starter rope
Rewind spring broken	Spring overtensioned - no reserve when starter rope is fully extended	Replace rewind spring
Starter rope difficult to pull and rewinds very slowly	Rewind starter mechanism very dirty (dusty conditions)	Thoroughly clean rewind starter
	The lubricating oil on the rewind spring becomes viscous at very low outside temperatures (spring windings stick together)	Apply a little paraffin to the rewind spring, then pull starter rope carefully several times until normal action is restored

5.3 Disassembly

Unscrewing the fan housing



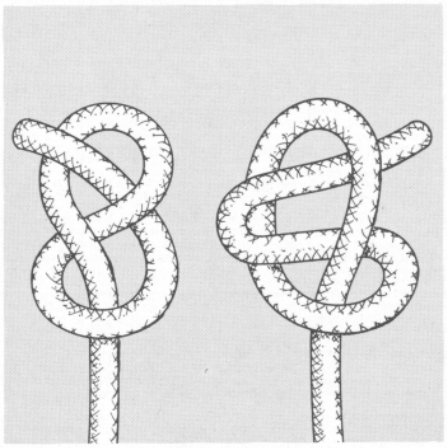
First unscrew the fan housing together with the rewind starter. Then release tension on rewind spring. To do this, pull starter rope partly out of the housing, hold the rope rotor firmly and takeoff two or three turns of the starter rope. Let go of rope rotor- it will turn back and the rewind spring is then relieved of preload.

There will, of course, be no preload on the rewind spring if the starter rope is broken. Now remove the deflector and use a screwdriver or pliers to prise the spring clip off the starter post. Then take the washer, rope rotor and pawl off the starter post.

5.4 Replacing the Starter Rope

Top:
Starter rope secured in rope rotor

Bottom:
Special knots

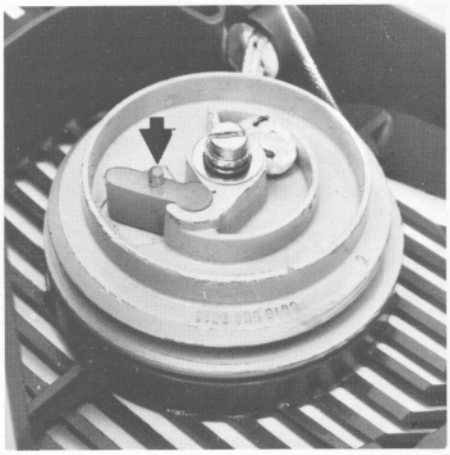


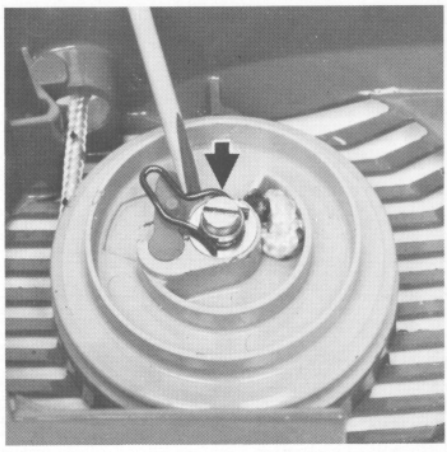
Remove rope residue from rope rotor, thread a new 3.5 mm dia. and 960 mm long starter rope through the rope rotor are secure it with an overhand knot. Push the other end of the rope through the hole in the fan housing and through the underside of the starter grip and secure it with a special knot.

Lubricate the starter post with nonresinous oil. Slip rotor onto starter post and turn it to and fro to engage

Top:
Pawl in position

Bottom:
Fitting the spring clip

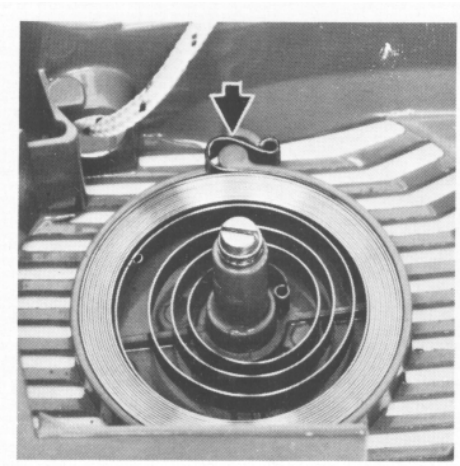




loop of rewind spring in recess of annular rib. Now fit washer on starter post and pawl in the rotor. Use a screwdriver or suitable pair of pliers to fit spring clip on the starter post, making sure that its loop faces clockwise and engages on the pawl's guide pin. Finish off by tensioning the rewind spring (5.6).

5.5 Replacing the Rewind Spring

Rewind spring in position



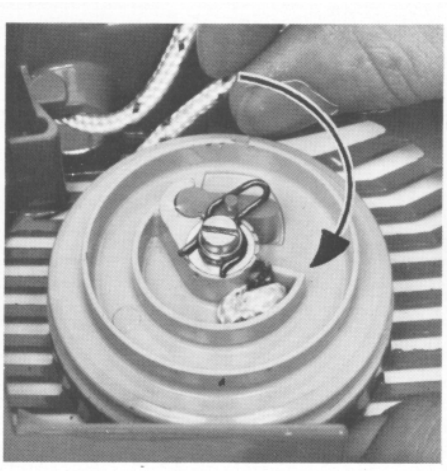
First remove the rope rotor and take out any spring particles which are still in the fan housing. The replacement spring is supplied ready for assembly and is held together by a wire strap. It should be lubricated with a few drops of non-resinous oil before installation.

Position the rewind spring in the rope rotor so that the outer spring loop engages on the lug in the fan housing. The wire strap is pushed off the spring during this operation.

If the spring comes out and uncoils during installation, refit it in the fan housing in the clockwise direction, starting with the outer end and working inward. Then refit the rope rotor.

5.6 Tensioning the Rewind Spring

Tensioning the rewind spring



Wind the starter rope clockwise onto the rope rotor until the starter grip is about 20 cm (8") away from the fan housing. Grip rope next to rotor and use it to rotate rotor two full turns clockwise. This tensions the rewind spring. Now hold rope rotor firmly in position, straighten out twisted rope and pull it out of fan housing. Let go of rope rotor and slowly release rope so that it winds onto the rotor.

The rewind spring is correctly tensioned when the starter grip sits firmly in the fan housing without hanging to one side. If this is not the case, tension rewind spring a further turn. When the rope is fully extended it must still be possible to rotate the rope rotor at least another half turn before maximum spring tension is reached. If this is not so, take off one turn of the rope.

5.7 General Maintenance

If the starter rope action becomes very stiff and it rewinds very slowly or not completely, it can be assumed that the rewind starter is mechanically in order but plugged with dirt.

At very low temperatures the oil on the rewind spring may thicken and cause the spring windings to stick together. This has a detrimental effect on the operation of the rewind starter. In such a case it is sufficient to apply a little paraffin to the rewind spring.

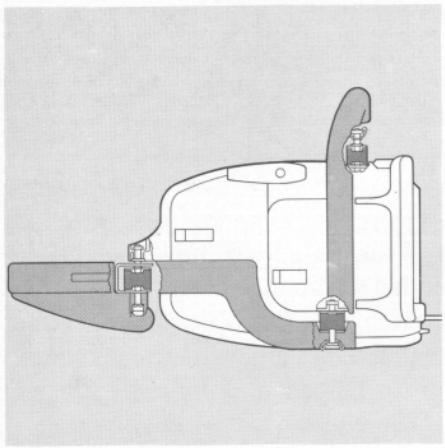
Then pull out starter rope carefully several times until its normal smooth action is restored. If clogged with dirt or resin, the entire rewind starter mechanism, including rewind spring, must be removed from the machine. Take special care when removing the spring! Wash all parts in paraffin or clean gasoline.

Lubricate the rewind spring and starter post with oil when reassembling the mechanism.

6. AV HANDLE SYSTEM

6.1 Construction and Operation

Position of vibration dampers

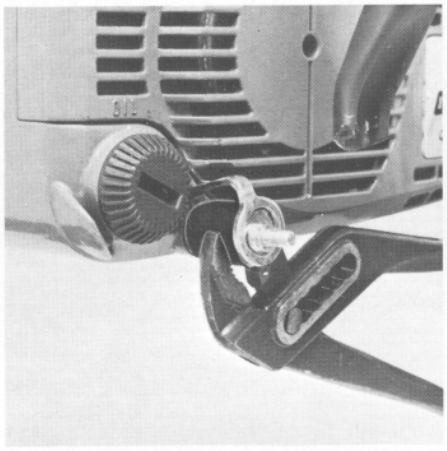


The anti-vibration handle system reduces engine and cutting attachment vibrations to a minimum before they reach the operator. This vibration insulation is achieved by means of resilient anti-vibration mounts between the chain saw housing and the front and rear handles.

To insure that the full benefit of the AV handle system is maintained it is essential that the saw be operated only with completely intact vibration dampers. Moreover, it is extremely important to insure that the brackets (anti-shear elements) are always fitted at the front left on the handlebar and on the rear handle. The risk of accidents will be increased if the anti-shear elements are forgotten during a repair.

6.2 Repair

Unscrewing vibration damper with bracket



On handlebar

Unscrew the hexagon nut. Pull handlebar off the collar stud and unscrew the annular buffer (vibration damper) and bracket from the saw housing.

Do not forget the bracket (anti-shear element) when installing the new vibration damper.

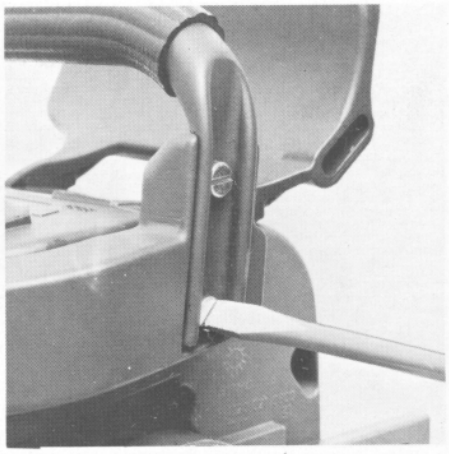
On rear handle

Unscrew M 5x18 flat head screw from annular buffer (vibration damper). Swing handle upward and unscrew the annular buffer and bracket from the saw housing.

Do not forget the bracket (anti-shear element) when installing the new vibration damper.

Top: Removing flat head screw

Bottom: Unscrewing the hexagon nut



On filter cover

Unscrew flat head screw from annular buffer (virbration damper). Remove filter cover and plate and then unscrew hexagon nut and take out annular buffer.

Note on repairs: If only one annular buffer is faulty, always replace all three annular buffers for safety reasons.

7. CHAIN LUBRICATION

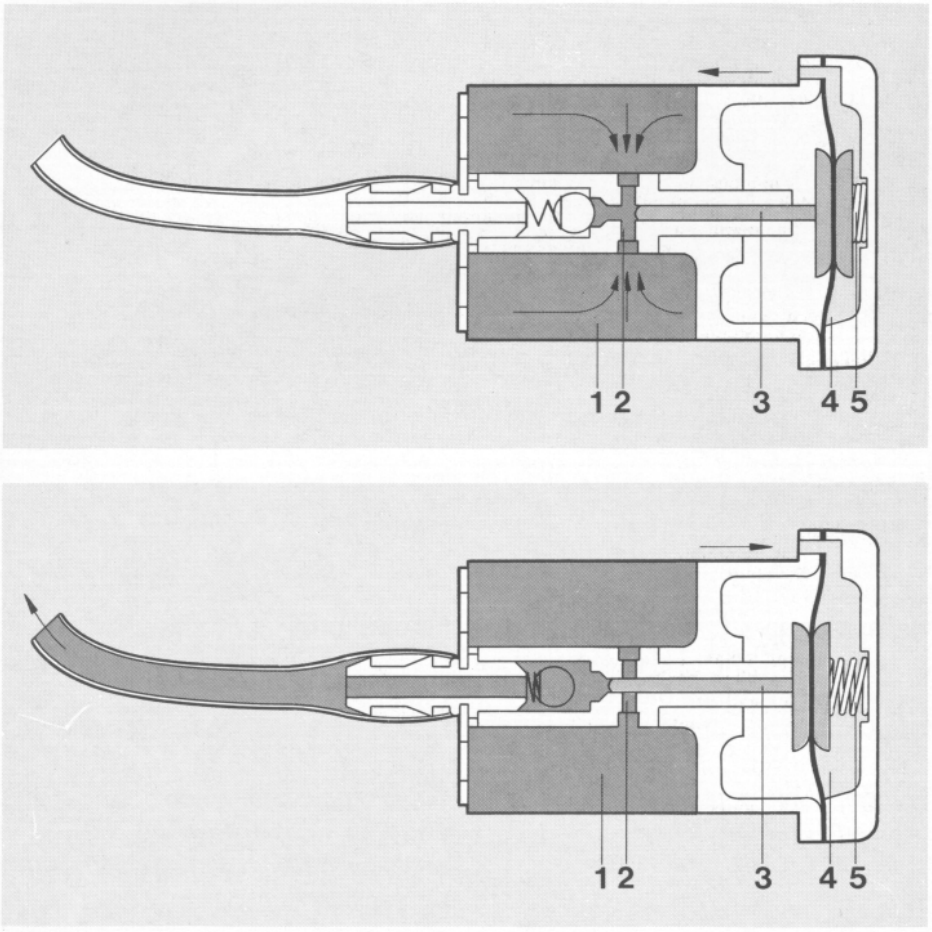
7.1 Construction and Operation of Oil Pump

Schematic of oil pump

Top:
Intake stroke

Bottom:
Delivery stroke

1 = Filter
2 = Feed bore
3 = Plunger with diaphragm
4 = Pulse chamber
5 = Compression spring



The oil pump is located on the clutch side of the crankcase. It supplies lubricating oil to the guide bar and chain while the engine is running.

The pump consists of the pump housing, end cover, the diaphragm with plunger, compression spring, check valve and oil filter.

The oil pump is not driven mechanically. It is operated by the alternating pressure in the crankcase. The oil pump's pulse chamber is connected to the crank chamber by a bore.

The upward stroke of the piston creates a depression in the crankcase which is transferred via the housing bore to the pulse chamber. This causes the diaphragm to move back. The plunger is attached to the diaphragm and opens the oil feed bore. The ball check valve closes the oil delivery bore at the same time and the space between the check valve and plunger fills with chain oil. The oil must pass through a filter before it enters the pressure chamber.

The pressure in the pulse chamber is changed by the downward stroke of the piston. This causes the diaphragm to be moved in the opposite direction and the plunger forces the chain oil out of the pressure chamber into a rubber hose and from there to the cutting attachment. A compression spring between the diaphragm and the pump cover assists the action of the pressure against the diaphragm.

The oil delivery rate rises in an almost linear ratio to engine speed and, therefore, the chain speed. This means there is always a sufficient supply of lubricating oil to match chain speed.

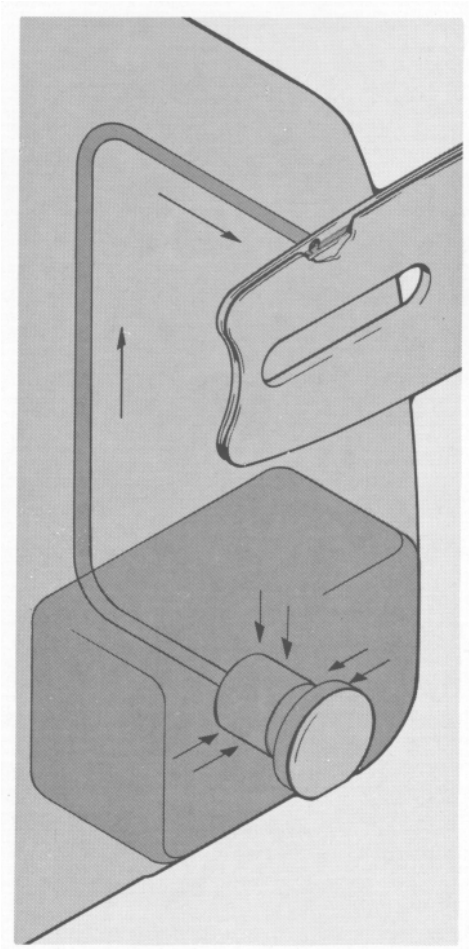
7.2 **Troubleshooting Chart**

In the event of difficulties with the chain oil supply, always investigate and rectify the other possible sources of faults before disassembling the oil pump.

Fault	Cause	Remedy
No oil supply to chain	Oil tank empty	Fill up with oil
	Oil inlet hole in guide bar is blocked	Clean oil inlet hole
	Plunger guide bore or filter blocked or delivery hose cracked	Wash out plunger guide bore and filter in clean gasoline and blow out with compressed air; replace if necessary
	New filter installed	Wait approx. 5 minutes until filter is saturated
Machine loses chain oil	Cracks in crankcase	Fit new crankcase
	Seals on pump housing faulty	Replace seals
Oil pump delivers too little oil	Diaphragm faulty	Replace diaphragm with plunger
	Plunger guide in pump housing worn or dirty	Replace pump housing together with diaphragm and plunger

7.3 Oil Tank/Tank Vent

Chain oil supply system



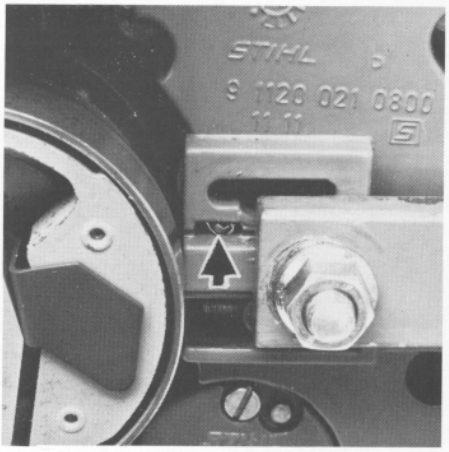
The chain oil tank is an integral part of the crankcase. The oil pump - which is operated by the alternating pressures in the crankcase - draws chain oil through a filter and into the pump housing. It then feeds it through a rubber hose to the oil inlet hole in the guide bar.

A precondition for correct operation of the oil pump is that the pressure in the pump housing during the intake stroke must be lower than the pressure in the oil tank. This is necessary because the pump would not otherwise operate, i. e. the airtight seal provided by the oil filler cap would cause a vacuum to be created in the oil tank as the oil level drops and thus negate the suction of the oil pump.

There is a vent hole in the crankcase below the chain oil outlet to insure that equal pressures are maintained inside and outside the oil tank. A split pin is fitted in the vent hole which allows air to enter but also prevents the ingress of dirt and the loss of chain oil from the tank.

7.4 Notes on Repair

Split pin in vent hole



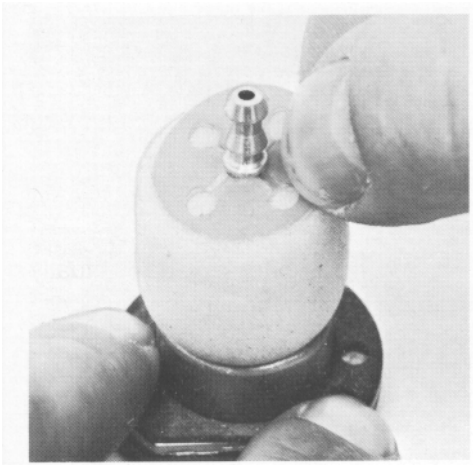
If the vent hole is caked with dirt, it can blown be out with compressed air. Stubborn particles of dirt can be loosened by turning the split pin carefully to and fro and then blown out with compressed air.

If the two halves of the crankcase are separated during a repair, the pulse hole in the sprocket side of the crankcase should be examined for deposits of foreign matter. If any are found, they should be cleaned away with the pump housing removed.

If the machine has not been in use for an extended period, the pump plunger may be stuck in the pump housing owing to resin in the oil. In such a case the pump must be disassembled and washed in clean gasoline.

7.5 Disassembly and Repair of Pump Housing

Removing plastic washer



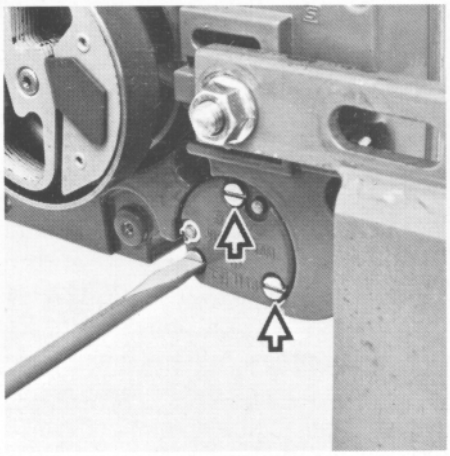
The filter can also be washed in clean gasoline. However, if it is saturated with resin it is best to fit a new filter.

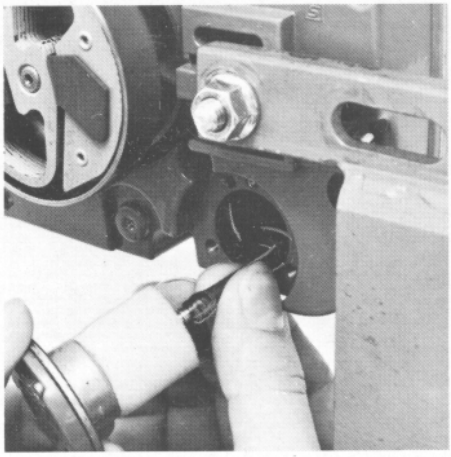
The filter can be removed after taking off the plastic washer which sits in the groove of the hose nipple. The plastic washer is used to locate the filter element and must not be forgotten during reassembly.

Important: After installing a new filter wait at least 5 minutes between filling up with chain oil and starting. This period allows the filter to fill with chain oil, i.e. the lubrication system is then primed and the saw is ready for operation.

Top:
Removing the oil pump

Bottom:
Disconnecting delivery hose



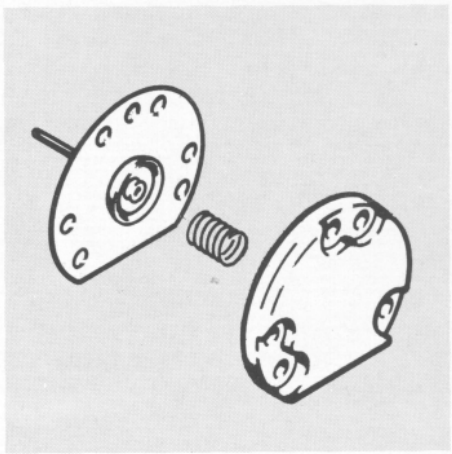


To remove the pump housing, first unscrew the three pan head screws. Pull the pump housing out of the chain oil tank and disconnect the delivery hose.

Prise the retaining ring off the pump housing cover in order to disassemble the pump. The retaining ring is only fitted for shipment and need not be refitted when the pump is assembled.

Top:
Removing retaining ring

Bottom:
Assembly sequence-diaphragm, compression spring and pump cover



Clean the pump housing by blowing out the oil hole with compressed air. Resinous deposits can be cleaned away with gasoline. Always replace the diaphragm if it is faulty. When reassembling the pump make sure that the compression spring is fitted between the diaphragm and pump cover, and not between the diaphragm and the housing as this would cause the pump to malfunction.

8. FUEL SYSTEM

8.1 Construction and Operation of Carburetor

The all-position diaphragm carburetor consists of the fuel pump and the carburetor body. The fuel pump operates as a completely separate and independent unit although it shares a common housing with the carburetor.

8.1.1 Operation of Fuel Pump

The pressure in the crankcase varies with each stroke of the piston. The piston creates a depression in the crankcase on its upward stroke and overpressure on its downward stroke. This is utilized for actuation of the fuel pump. The chamber in front of the pump diaphragm (pulse chamber) is connected to the crank chamber by a pulse line. The changes in pressure act directly on the pump diaphragm and cause it to move in time with the piston. Control is effected by means of two flap valves stamped in the pump diaphragm.

The depression created by the upward stroke of the piston draws the pump diaphragm into the diaphragm chamber. This enlarges the pump chamber and produces a vacuum. The inlet valve then opens and the higher atmospheric pressure forces fuel from the tank into the pump chamber and presses the outlet valve against its seat.

The downward stroke of the piston changes the relative pressures. An overpressure is built up in the crank and pump chambers which presses the diaphragm against the pump chamber and exerts pressure on the fuel. The overpressure forces the inlet valve to close, while the outlet valve opens and allows fuel to flow to the carburetor's needle valve.

8.1.2 Operation of Carburetor

The opening and closing action of the needle valve and, therefore, the supply of fuel to the carburetor is controlled by the metering diaphragm. The metering diaphragm is in a position of rest when atmospheric and diaphragm chamber pressures are equal (the chamber above the diaphragm is connected to atmosphere).

The cone of the inlet needle is held against its seat by spring pressure.

The metering diaphragm chamber is filled with fuel when the engine is running. A depression is created in the choke tube (venturi) during the induction stroke. Fuel is drawn into the choke tube through the jet bores between the choke tube and diaphragm chamber. This is turn produces a depression in the diaphragm chamber and atmospheric pressure presses the metering diaphragm toward the carburetor body. The force generated by the pressure difference x diaphragm area acts on the inlet control lever via the perforated disc on the diaphragm, overcomes the spring force and lifts the inlet needle off its seat. This allows fresh fuel to flow from the pump chamber into the diaphragm chamber. The needle valve closes again as soon as atmospheric pressure is reached in the metering chamber. Under normal operating conditions the needle valve does not open and close constantly. The metering diaphragm actually settles down to a mean level, depending on engine speed, and the needle valve remains open relative to the diaphragm's position.

The quantity of fuel drawn into the choke tube depends on the amount of depression, and this in turn is influenced by the position of the choke and throttle valves. The volume of fuel can be altered to suit different operating conditions by means of the adjustment screws in the idle and main jets.

Top:
Starting position

Bottom:
Idle position

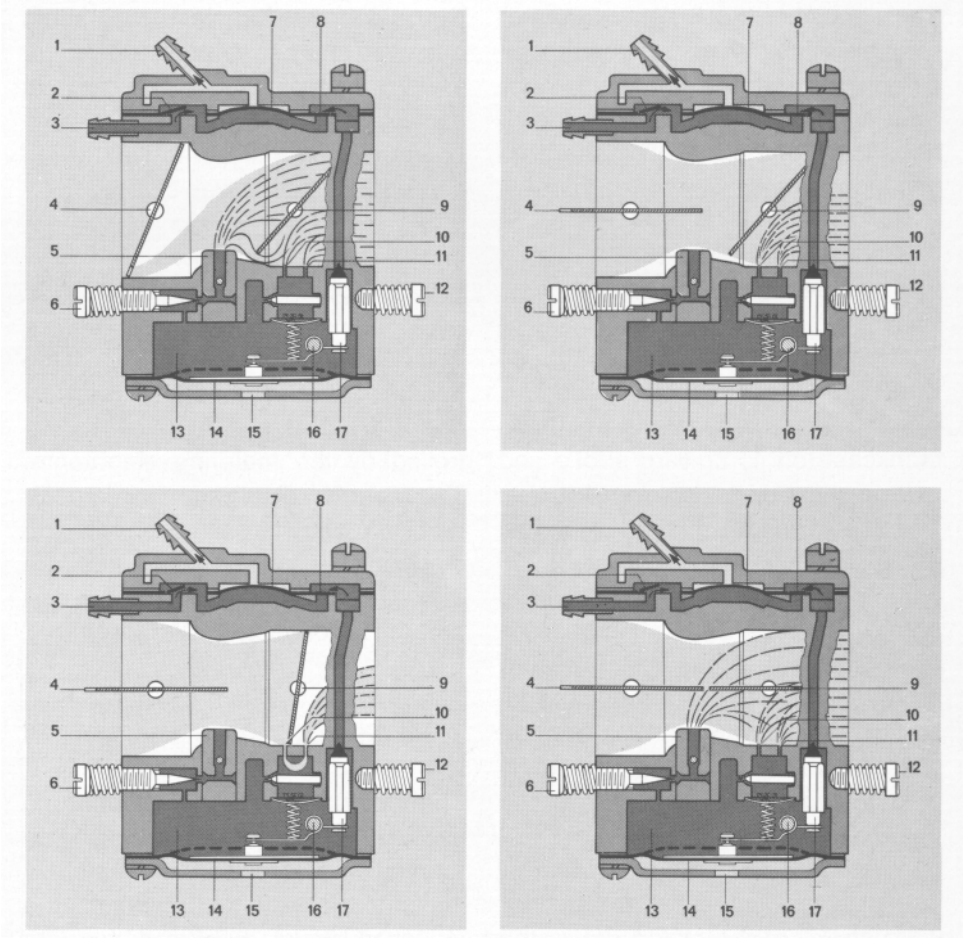
1 - Pulse nipple
2 - Inlet valve open
3 - Fuel intake
4 - Choke valve
5 - Valve jet
6 - High-speed adjustment screw
7 - Pump diaphragm (intake position)
8 - Outlet valve closed

Top:
Changing from idle to part or full-throttle position

Bottom:
Full-throttle position

9 - Throttle valve
10 - Secondary idle jet
11 - Primary idle jet
12 - Low-speed adjustment screw
13 - Metering chamber diaphragm
14 - Metering diaphragm
15 - Connection to atmosphere
16 - Inlet control lever
17 - Inlet needle

(both adjustment screws are drawn offset by 90°; choke valve is shown integrated in carburetor only for this description)



Four basic operating conditions are described below to explain the function of the carburetor:

1. The choke valve is closed and the throttle valve partly open during the **starting process.** A powerfull vacuum is created in the choke tube during the induction stroke because the entry of outside air is almost completely restricted by the closed choke valve. This means that the engine draws in a large amount of fuel through all the jets and relatively little air. A rich starting mixture is obtained in this way. The choke valve must be opened as soon as the engine fires - the mixture would otherwise be too rich and stall the engine.

2. Very little fuel is required for **idling.** The choke valve is fully open and the throttle valve almost completely closed. The vacuum only acts on the **primary idle jet** so that fuel is only drawn off through this jet. Owing to the pressure difference between the choke tube (venturi) and the intake pipe behind the throttle valve, air flows through the secondary idle jet and the **air correction jet** into the idle chamber and prevents the mixture becoming too rich. However, because of this pressure difference it is necessary to prevent supplementary air getting into the diaphragm chamber, making the mixture too lean and causing the engine to stall. This problem is eliminated by a small plate in the valve jet which closes against the inlet when there is insufficient depression in the choke tube.

3. During the **changeover** from idle to part or full-throttle sufficient fuel must be drawn in with the suddenly increased flow of air when the throttle is opened. This is effected by means of the **secondary idle jet** which is exposed to the effects of vacuum at this point, thus producing the richer, igniteable mixture required.

4. Opening the throttle valve further brings the **main jet (valve jet),** located at the narrowest point of the choke tube, into operation and provides the fuel required for **full-throttle operation.**

8.2 Troubleshooting Chart

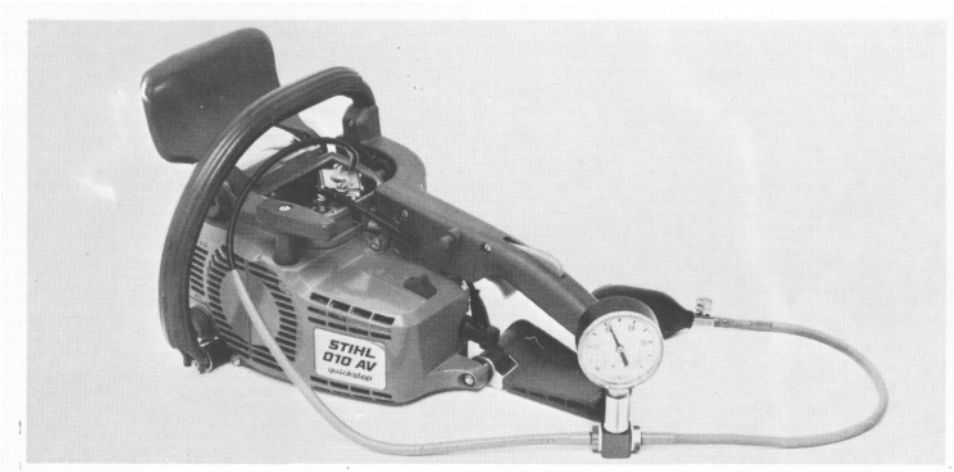
Fault	Cause	Remedy
Carburetor floods – engine stalls	Inlet valve not sealing. Foreign matter in valve seat or cone damaged	Remove and clean or replace inlet needle
	Helical spring not located on dimple of inlet control lever	Remove inlet control lever and refit correctly
	Perforated disc on diaphragm is deformed and presses constantly against inlet control lever	Fit new metering diaphragm
	Inlet control lever too high (relative to design position)	Set inlet control lever flush with top edge of plate
Engine does not respond properly to throttle	Idle jet "too lean"	Back off low-speed adjustment screw slightly (see Carburetor Adjustment)
	Inlet control lever too low (relative to design position)	Set inlet control lever flush with top edge of plate
	Vent bore to atmosphere blocked	Clean bore
	Diaphragm gasket leaking	Fit new diaphragm gasket
	Metering diaphragm damaged	Fit new metering diaphragm
Engine will not idle	Throttle valve opened too far by idle speed adjustment screw	Reset idle speed adjustment screw

Fault	Cause	Remedy
Engine stalls at idle speed	Idle jet bores or ports clogged	Clean jet bores and blow out with compressed air
	Idle jet too "rich"	Turn low-speed adjustment screw slightly clockwise (see Carburetor Adjustment)
	Idle speed screw incorrectly set – throttle valve completely closed	Set idle speed screw correctly
Engine speed drops quickly under load - low power	Air filter plugged	Clean air filter
	Tank vent faulty	Clean tank vent or replace if necessary
	Leak in fuel line between tank and fuel pump	Seal connections and replace fuel line if necessary
	Pump diaphragm damaged	Fit new pump diaphragm
	Main jet bores or ports blocked	Clean bores and ports
	Fuel strainer dirty	Clean fuel strainer

See also 3.2

8.3 Leakage Test (Pressure Test) on Carburetor

Tester connected



The carburetor can be tested for leaks with the carburetor and crankcase tester 1106 850 2900.

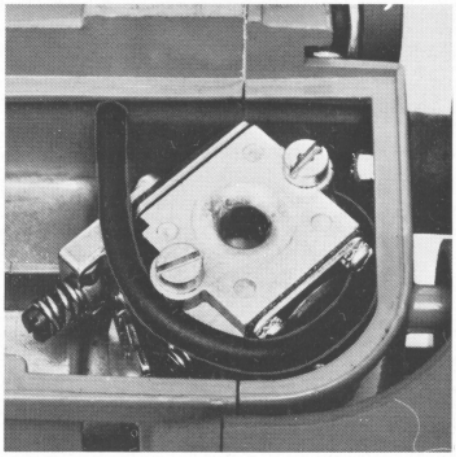
First remove the filter cover and filter plate and disconnect the fuel line from the elbow connector. As the inside diameter of the test hose is larger than the outside diameter of the elbow connector, a fuel line (1120 358 0700) must be used as an adapter to make the connection.

Push one end of the fuel line onto the elbow connector and the other end into the test hose.

Now close the vent screw on the rubber bulb and pump air into the carburetor until the pressure gauge indicates a pressure of 0.4 to 0.5 bar.

If this pressure remains constant, the carburetor is airtight. However, if it drops, there are two possible causes:

Bottom:
Correct position of fuel line

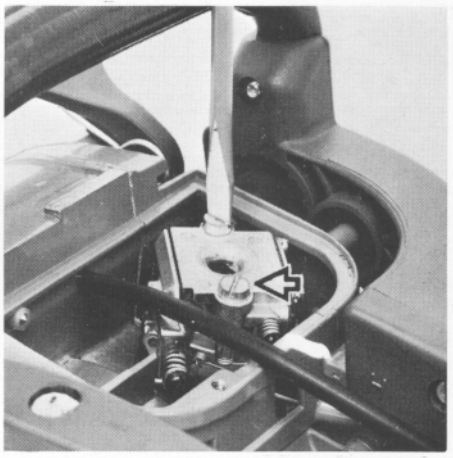


1. The inlet needle is not sealing (foreign matter in valve seat or cone of inlet needle is damaged).

2. The metering diaphragm is damaged.

In either of these cases the carburetor must be removed and repaired. It is necessary to unscrew the carburetor mounting screws and raise the carburetor in order to refit the fuel line.

Removing the carburetor



First remove the filter cover and filter plate and pull the fuel line off the carburetor. Take out the two pan head screws. Lift out the carburetor and disconnect the throttle cable from the lever on the throttle shaft - this is best done with the throttle shaft in the full-throttle position; the same applies for reassembly.

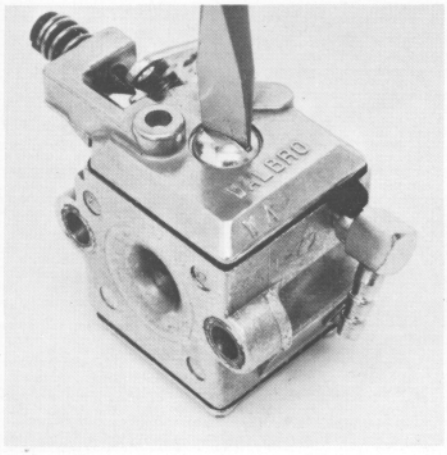
There is a gasket at both sides of the diaphragm, between the carburetor and crankcase flange. Replace these gaskets when installing the carburetor. Coat the sealing faces with a little jointing paste, taking care not to cover the pulse bore.

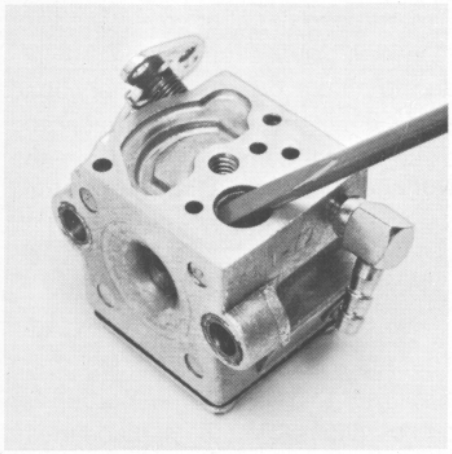
It is still necessary to unscrew and lift the carburetor even if only the throttle cable is faulty.

8.5 **Repair of Carburetor**

Top:
Removing fuel pump end cover

Bottom:
Taking out the fuel strainer

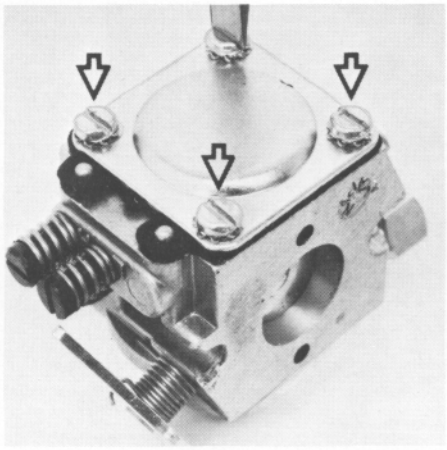




It is advisable to check the serviceability of the fuel pump whenever the carburetor is removed for repair.

Unscrew the fuel pump end cover and remove the gasket and pump diaphragm. The end cover, gasket and diaphragm are frequently stuck together. If this is the case, take particular care when separating them. If the fuel strainer in the pump side of the carburetor body is dirty, it should

Removing metering chamber cover



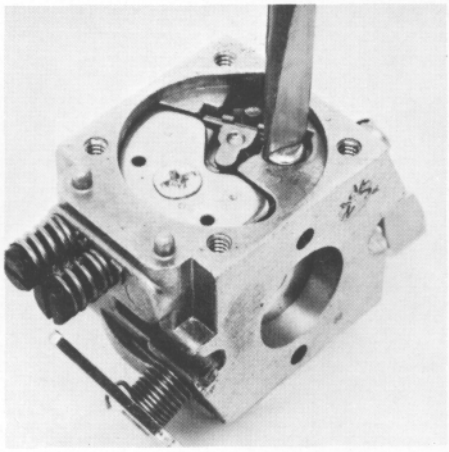
be lifted out with a screwdriver and washed in clean gasoline. Always replace the fuel strainer if it shows any signs of damage.

To disassemble the carburetor body, unscrew the metering chamber cover and remove the metering diaphragm and gasket. This diaphragm and gasket may also be stuck together and must be separated carefully.

The diaphragms are the most delicate parts of the carburetor. Due to the continuous alternating stress to which the diaphragms are subjected, the material eventually shows signs of fatigue - the diaphragms distort and swell. When this stage is reached the carburetor can no longer function correctly and the diaphragms must be replaced.

The inlet needle valve is located in a

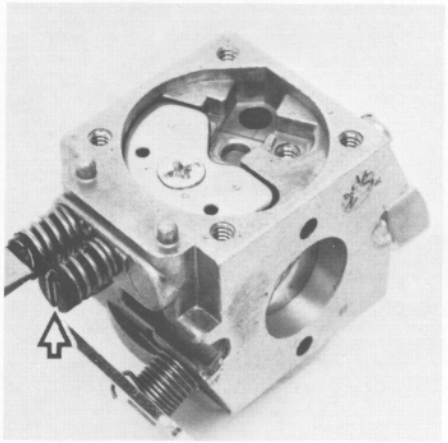
Removing inlet needle

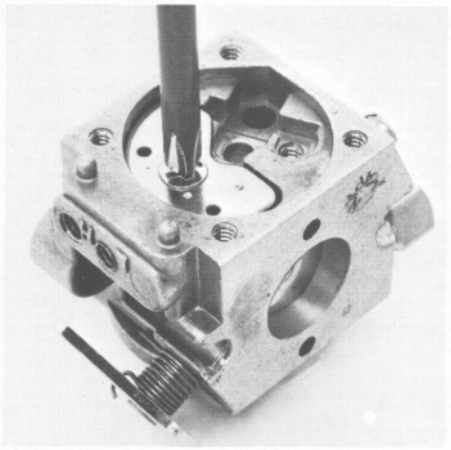


recess in the metering diaphragm chamber. The inlet control lever with spindle, helical spring and inlet needle can be removed after unscrewing the round head screw. If an annular indentation is visible on the cone of the inlet needle, it should be replaced as it will no longer seal properly. This is indicated by constant flooding of the carburetor although the needle is clean.

Top:
Removing adjustment screws

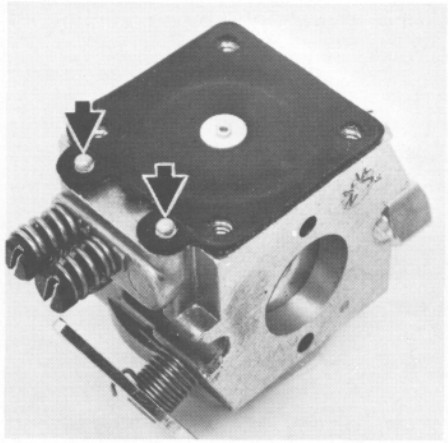
Bottom:
Removing the plate

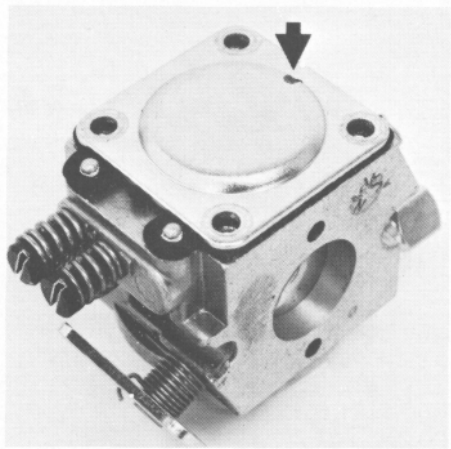




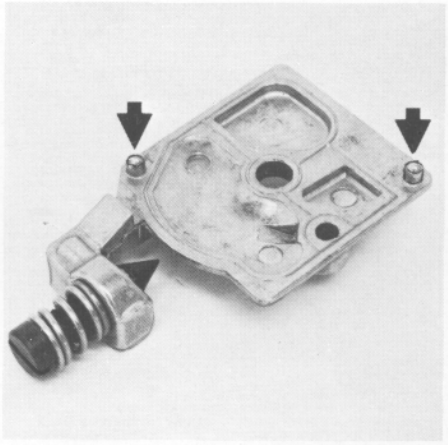
Top:
Locating studs on carburetor body

Bottom:
Hole in metering chamber cover





Locating studs on end cover



Wash all parts of the carburetor in clean gasoline (never use high octane gasoline) and blow out with compressed air, paying particular attention to the bores and ports. Remove the two adjustment screws as well as the plate and gasket (countersunk screw) for this purpose.

After cleaning the carburetor, insert the inlet needle and fit the helical spring in its bore. Position spindle in inlet control lever, engage clevis in annular groove on head of inlet needle and secure it with the countersunk screw, making sure the helical spring locates on the control lever's dimple. Check freedom of movement of inlet control lever.

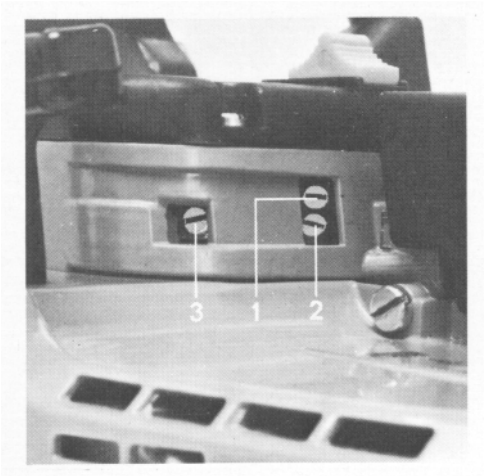
Now screw the two adjustment screws and plate into position.

Then fit and secure the gasket, metering diaphragm and the end cover on the carburetor body. The hole in the end cover must face away from the adjustment screws.

Refit the fuel strainer, pump diaphragm, gasket and fuel pump end cover and screw down firmly. The two integrally cast studs on the end cover locate the pump diaphragm and gasket.

8.6.1 Notes for Fine Adjustment of Carburetor

1 = High-speed adjustment screw
2 = Low-speed adjustment screw
3 = Idle speed screw



Do not interchange these adjustment screws!

Always carry out carburetor adjustments with the engine warm and the air filter clean.

The carburetor is adjusted at the factory to provide optimum engine power and low fuel consumption under local atmospheric conditions.

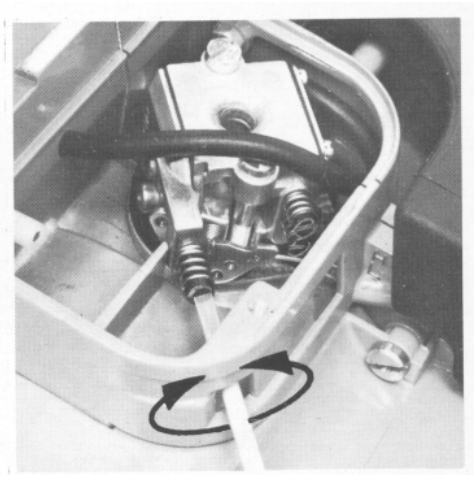
If the chain saw is operated at high altitudes (mountains) or near sea level, the carburetor setting must be altered. This correction is made at the two adjustments screws and the idle speed screw.

Both adjustment screws must be very carefully screwed down onto their seats in order to obtain the basic setting which is only intended as a guide for fine adjustment. Then adjust as follows:

High-speed adjustment screw H:
Long, open 1 turn

Low-speed adjustment screw L:
Short, open 1 turn

Adjusting idle speed screw
(Filter cover must be removed for this adjustment)



Engine stops while idling:

Turn idle speed screw slightly clockwise (to the right) while the engine is running (chain must not rotate).

Chain rotates at idle speed:

Turn idle speed screw slightly counterclockwise (to the left).

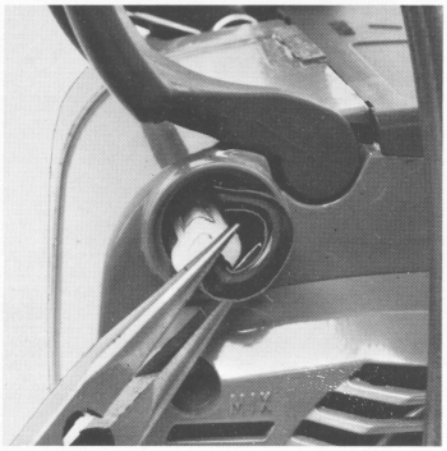
Engine runs erratically at idle speed:

Regulate at low-speed adjustment screw. Turn clockwise for leaner mixture or counterclockwise for richer mixture.

Important: Even very slight alteration of the adjustment screw settings has a marked effect on engine running characteristics.

8.7 Fuel Line

Withdrawing the pickup body



The diaphragm pump draws fuel out of the fuel tank and into the carburetor via the fuel line. Any impurities mixed with the fuel in the tank are filtered out by the pickup body (filter and felt bar). The fine pores of the felt bar eventually become blocked with minute particles of dirt. This restricts the passage of fuel and the result is fuel starvation.

In the event of trouble with the fuel supply system, always clean the filter in the pickup body first. To do this, pull the pickup body out through the tank filler.

The felt bar can now be taken out of the pickup body and replaced. When reinstalling the pickup body, make sure it is positioned at the lowest point in the tank.

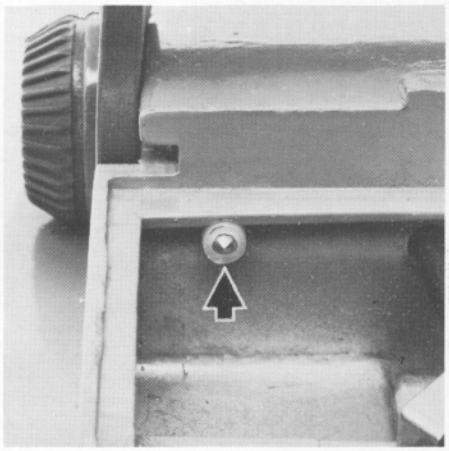
It is not advisable to clean the felt bar - always fit a new one.

Removing the felt bar

Trouble-free operation of the carburetor depends on the fuel tank and atmospheric pressures always being equal. This is assured by the

8.8 Tank Vent

Tank vent in position



The tank vent consists of a tube and a grub screw. When replacing the tank vent, push grub screw into the tube, slotted end first, until its tip is flush with the end of the tube.

Then insert tube about 8 mm in its housing bore with the tip of the grub screw facing the carburetor chamber.

In the event of difficulties with the carburetor or fuel supply system, always check and clean the tank vent. If the thread of the grub screw has cut deeply into the tube, replace the vent tube.

8.9 **Air Filter and Choke Valve**

Removing filter cover

Top:
Choke slide in "CHOKE" position

Bottom:
Pressing down the valve plate

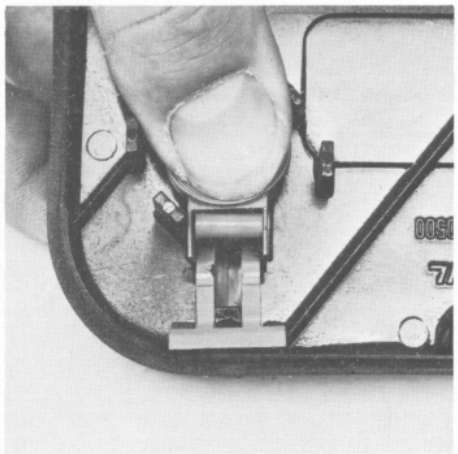
The air filter's function is to intercept and retain dust and dirt in the intake air and thus reduce wear on engine components.

Clogged air filters have a detrimental effect on engine performance, they increase fuel consumption and make starting more difficult.

Clean loose dirt off the filter cover and the surrounding area before removing the filter to insure that no foreign matter can get into the carburetor or engine when the filter cover is lifted off.

The filter can then be knocked out and cleaned with gasoline. It may also be blown out with compressed air. In the case of a repair it is always best to fit a new filter.

Use this opportunity to check the condition and operation of the choke valve.



A faulty choke valve can be removed without tools. To do this, move choke slide to **"CHOKE".** Then press valve plate down against the spring with your thumb and pull slide downward and turn it through 90° at same time.

Installation is a reversal of the above sequence.