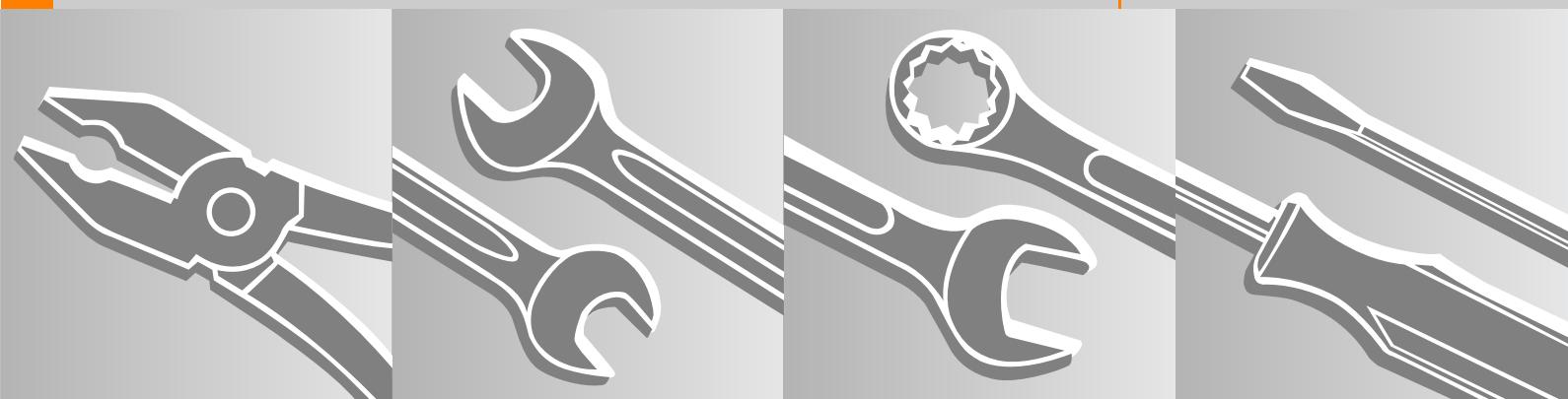


STIHL®

STIHL FS 160, 180, 220, 280

1989-04



FOREWORD

This service manual contains detailed descriptions of all servicing procedures for STIHL model FS 160, FS 180, FS 220 and FS 280 clearing saws and can thus be used as a basis for professional overhauls and repairs on all versions of these machines.

As the engines installed in these units are almost identical, with the exception of the cylinder and piston, and the drive shaft is basically the same on all versions, the repair procedures generally apply to all four models. Differences are described in detail.

We recommend that you make use of the exploded views in the illustrated parts lists while carrying out repair work. Most of the illustrations show the installed positions of the individual components and assemblies.

Refer to the latest edition of the parts list for the part numbers of any spares you may require. Microfilmed parts lists are always more up to date than printed lists.

In the event of faults it is quite possible that a particular condition may have several causes. It is, therefore, advisable to consult the "troubleshooting charts" for all assemblies and systems when tracing faults. You will find these troubleshooting charts immediately after the specifications.

Engineering changes which have introduced since publication of this service manual are announced in "**Technical Information Bulletins**". Such bulletins should be treated as supplements to the service manual.

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

The "STIHL Special Tools" manual illustrates and lists the part numbers of all available model-related servicing tools as well as general purpose tools for all machines.

CONTENTS

1.	Specifications	3	5.2	Repairing Component Parts	33	8.3	Servicing the Carburetor	51
1.1	Engine	3	5.2.1	Spark Plug	33	8.4	Carburetor Adjustment	
1.2	Fuel System	5	5.2.2	Ignition Module (FS 160-220)	34		(FS 160, FS 180, FS 220)	54
1.3	Ignition System	5	5.2.3	Trigger Unit (FS 280)	35	8.5	Air Filter	56
1.4	Gearhead	6	5.2.4	Ignition Coil (FS 280)	36	8.6	Fuel Filter and Fuel Hose	56
1.5	Weights	6	5.2.5	Resistance Test on Primary Winding	37	8.7	Tank Vent	58
1.6	Special Accessories	6	5.2.6	Resistance Test on Secondary Winding	37	8.8	Tank Housing	59
1.7	Tightening Torques	7	5.2.7	Ignition Lead	37			
			5.2.8	Flywheel	39	9.	AV System	61
2.	Troubleshooting Charts	8				9.1	Repair	61
2.1	Clutch	8	6.	Rewind Starter	40			
2.2	Engine	8	6.1	Routine Maintenance	40	10.	Cutting Tool Drive	62
2.3	Ignition System	9	6.2	Rope Rotor	40	10.1	Clutch Drum	62
2.4	Rewind Starter	9	6.3	Replacing Starter Rope	41	10.2	Guard Tube and Drive Shaft	63
2.5	Fuel System	10	6.4	Replacing Rewind Spring	42	10.3	Gearhead	64
3.	Clutch	12	6.5	Tensioning Rewind Spring	42	10.3.1	Disassembly	64
3.1	Disassembly	12	6.6	Replacing Pawl	43	10.3.2	Assembly	66
3.2	Assembly	14	6.7	Replacing Starter Rope Guide Bush	43			
			6.8	Replacing Starter Cup	44	11.	Special Servicing Tools and Aids	68
4.	Engine	16	7.	Throttle Control	45	11.1	Special Servicing Tools	68
4.1	Removing and Refitting Muffler	16	7.1	Replacing Throttle Cable with Stop Switch Wire	45	11.2	Servicing Aids	69
4.2	Exposing the Cylinder	16	7.2	Contact Springs in Control Handle	47			
4.3	Cylinder and Piston	18	7.3	Adjusting Throttle Cable	47			
4.3.1	Removal	18	7.4	Replacing Molded Support on Drive Shaft (FS 220, FS 280)	48			
4.3.2	Installation	19						
4.4	Crankcase	22						
4.4.1	Removing the Crankshaft	22						
4.4.2	Installing the Crankshaft	24						
4.5	Leakage Testing the Crankcase	27						
4.5.1	Pressure Test	27						
4.5.2	Vacuum Test	30						
4.6	Replacing the Oil Seals	31	8.	Fuel System	49			
5.	Ignition System	32	8.1	Leakage Testing the Carburetor	49			
5.1	Troubleshooting Chart	32	8.2	Disassembling the Carburetor	50			

1. SPECIFICATIONS

1.1 Engine	FS 160	FS 180
Single-cylinder two-stroke engine with special impregnated cylinder bore.		
Displacement:	29.8 cm ³ (1.82 cu.in)	35.2 cm ³ (2.11 cu.in)
Bore:	35 mm (1.38 in)	38 mm (1.50 in)
Stroke:	31 mm (1.22 in)	31 mm (1.22 in)
Power output:	1.4 kW (1.9 bhp) at 8,500 rpm	1.7 kW (2.3 bhp) at 9,000 rpm
Max. torque:	1.65 Nm (2.21 lb.ft) at 6,500 rpm	2.0 Nm (2.68 lb.ft) at 6,500 rpm
Max. permissible engine speed:	12,500 rpm	12,500 rpm
Mean idle speed:	2,650 rpm	2,650 rpm
Crankshaft:	Three-part	Three-part
Crankshaft bearings:	2 deep groove ball bearings	2 deep groove ball bearings
Crankpin diameter:	12 mm (0.47 in)	12 mm (0.47 in)
Big-end bearing:	Needle cage	Needle cage
Conrod length:	56 mm (2.2 in)	56 mm (2.2 in)
Piston pin diameter:	10 mm (0.39 in)	10 mm (0.39 in)
Piston pin bearing:	Needle cage	Needle cage
Rewind starter:	Pawl engagement with automatic starter rope rewind mechanism	Pawl engagement with automatic starter rope rewind mechanism
Starter rope:	3.5 mm (0.14 in) dia. x 960 mm (37.8 in)	3.5 mm (0.14 in) dia. x 960 mm (37.8 in)
Clutch:	Centrifugal clutch with bonded, asbestosfree linings, 67 mm (2.64 in) dia. 3,500 rpm	Centrifugal clutch with bonded, asbestosfree linings, 67 mm (2.64 in) dia. 3,500 rpm
Clutch engages at:		
Crankcase leakage test at gauge pressure:	0.6 bar (8.7 psi)	0.6 bar (8.7 psi)
with vacuum:	0.4 bar (5.8 psi)	0.4 bar (5.8 psi)
Silencing:	Intake air silencer and exhaust muffler	Intake air silencer and exhaust muffler

FS 220**FS 280**

Single-cylinder two-stroke engine with special impregnated cylinder bore.

Displacement:	35.2 cm ³ (2.11 cu.in)	38.9 cm ³ (2.38 cu.in)
Bore:	38 mm (1.50 in)	40 mm (1.57 in)
Stroke:	31 mm (1.22 in)	31 mm (1.22 in)
Power output:	1.7 kW (2.3 bhp) at 9,500 rpm	1.9 kW (2.6 bhp) at 9,500 rpm
Max. torque:	2.0 Nm (2.68 lb.ft) at 6,500 rpm	2.2 Nm (1.62 lb.ft) at 6,500 rpm
Max. permissible engine speed:	12,500 rpm	electronic speed limiter abt. 12,600 rpm
Mean idle speed:	2,650 rpm	Speed limited by control valve, cut-off speed 11,500 . . . 13,000 rpm 2,800 rpm resp. 2,550 rpm with control valve
Crankshaft:	Three-part	Three-part
Crankshaft bearings:	2 deep groove ball bearings	2 deep groove ball bearings
Crankpin diameter:	12 mm (0.47 in)	12 mm (0.47 in)
Big-end bearing:	Needle cage	Needle cage
Conrod length:	56 mm (2.2 in)	56 mm (2.2 in)
Piston pin diameter:	Ø 10 mm (0.39 in)	Ø 10 mm (0.39 in)
Piston pin bearing:	Needle cage	Needle cage
Rewind starter:	Pawl engagement with automatic starter rope rewind mechanism	Pawl engagement with automatic starter rope rewind mechanism
Starter rope:	3.5 mm (0.14 in) dia. × 960 mm (37.8 in)	3.5 mm (0.14 in) dia. × 960 mm (37.8 in)
Clutch:	Centrifugal clutch with bonded, asbestosfree linings, 67 mm (2.64 in) dia. 3,500 rpm	Centrifugal clutch with bonded, asbestosfree linings, 67 mm (2.64 in) dia. 3,500 rpm
Clutch engages at:		
Crankcase leakage test at gauge pressure:	0.6 bar (8.7 psi)	0.6 bar (8.7 psi)
with vacuum:	0.4 bar (5.8 psi)	0.4 bar (5.8 psi)
Silencing:	Intake air silencer and exhaust muffler	Intake air silencer and exhaust muffler

1.2 Fuel System

	FS 160, 180, 220	FS 280
Carburetor:	All position diaphragm carburetor with integral fuel and accelerator pump	All position diaphragm carburetor without accelerator pump
Adjustment:		
High speed adjusting screw H:	Approx. 1 turn open	Approx. 1 turn open
Low speed adjusting screw L:	Approx. 1 turn open (Basic setting with screws initially moderately tight against their seats)	Approx. 1 turn open (Basic setting with screws initially moderately tight against their seats)
Carburetor leakage test at gauge pressure:	0.8 bar (11.6 psi)	0.8 bar (11.6 psi)
Fuel tank capacity:	0.58 L (1.0 US pt)	0.58 L (1.0 US pt)
Fuel mixture:	Regular grade gasoline and branded two stroke engine oil. Mix ratio 40:1 with STIHL two-stroke engine oil; 25:1 with other branded two-stroke engine oils.	Regular grade gasoline and branded two stroke engine oil. Mix ratio 40:1 with STIHL two-stroke engine oil; 25:1 with other branded two-stroke engine oils.
Air filter:	Flat element and auxiliary filter (felt mat)	Flat element and auxiliary filter (felt mat)

1.3 Ignition System

Type:	Electronic (breakerless) magneto ignition	
Air gap:	0.15...0.25 mm (0.006-0.010 in)	0.15...0.25 mm (0.006-0.010 in)
Ignition timing:	1.8...2.5 mm (0.07-0.10 in) B.T.D.C. 26...28 B.T.D.C. at 8,000 rpm	1.8...2.5 mm (0.07-0.10 in) B.T.D.C. 26...28 B.T.D.C. at 8,000 rpm
Ignition module:	Coil winding resistances Primary: Secondary: 0.8...1.3 Ω 7.2...8.8 kΩ	
Ignition coil:		Coil winding resistances Primary: Secondary: 0.8...1.3 Ω 7.2...8.8 kΩ
Spark plug (suppressed):	NGK BPMR 7 A or Bosch WSR 6 F Heat range 200 Electrode gap 0.5 mm (0.020 in) Spark plug thread M 14 x 1.25 Length of thread 9.5 mm (0.37 in)	NGK BPMR 7 A or Bosch WSR 6 F Heat range 200 Electrode gap 0.5 mm (0.020 in) Spark plug thread M 14 x 1.25 Length of thread 9.5 mm (0.37 in)

1.4	Gearhead	FS 160	FS 180	FS 220 (FS 220 K)	FS 280 (FS 280 K)
Type:		Spiral-toothed bevel gears	Spiral-toothed bevel gears	Spiral-toothed bevel gears	Spiral-toothed bevel gears
Gear ratio:		1.33	1.33	1.24	1.24
Bearings:		Deep groove ball bearings			
Lubrication:		STIHL gear lubricant 0781 120 1117			

1.5 Weight

less cutting tool and deflector	7.4 kg 16.3 lb	7.4 kg 16.3 lb	7.7 kg (7.5 kg) 17.0 lb (16.5 lb)	7.9 kg (7.7 kg) 17.4 lb (17.0 lb)
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1.6 Special Accessories

Full harness

Tool kit

Safety goggles

Transport guard for steel cutting tools*

Carburetor parts kit**	1120 007 1061	1120 007 1061	1120 007 1061	1120 007 1061
Gasket kit**	4119 007 1050	4119 007 1050	4119 007 1050	4119 007 1050
Gasket panel**	0457 281 1404	0457 281 1404	0457 281 1404	0457 281 1404

* not standard equipment on all markets

** for dealers

1.7 Tightening Torques

Fastener	Threadsize	for	Torque Nm	Remarks (lbf.ft)
Hexagon nut	M8x1	Crankshaft (flywheel)	24.0	(18)
Hexagon nut	M8x1	Starter cup	10.0	(7.5)
Hexagon nut	M8x1	Crankshaft (starter side)	24.0	(18)
Spline screw	IS-M6x25	Clutch shoes	12.0	(9)
Spline screw	IS-M5x65x22	Muffler	7.5	(5.5)
Spline screw	IS-M5x20	Cylinder	8.0*	(6*)
Spline screw	IS-M4x25	Ignition module (FS160,180,220)	3.0	(2.2)
Spline screw	IS-M4x10	Trigger unit (FS280)	1.5	(1.1)
Spline screw	IS-M4x25	Ignition coil (FS280)	3.0	(2.2)
Spline screw	IS-M4x25x10	Shroud	2.0	(1.5)
Spline screw	IS-M5x20	Starter cover	5.5	(4)
Hexagon nut	M5	Carburetor	4.0	(3)
Hexagon nut	M14x1.25	Spark plug	20.0	(15)
Spline screw	IS-M5x20	Gearhead	7.5	(5.5)
Spline screw	IS-M5x20	Handlebar clamp (FS220)	10.0	(7.5)

* Tightening torque must be maintained.

 2. TROUBLESHOOTINGCHARTS

2.1 Clutch

Condition	Cause	Remedy
Insufficient frictional contact - clutch slips	Clutch linings worn	Replace both clutch shoes
Cutting tool rotates while engine is idling	Engine idle speed too high	Correct at idle speed adjusting screw
	Clutch spring stretched or spring hooks broken	Fit new clutch spring

2.2 Engine

Condition	Cause	Remedy
Engine difficult to start, stops at idle speed but runs normally at full throttle	Oil seal(s) in crankcase leaking Manifold leaking Cylinder base gasket leaking Crankcase damaged (cracks)	Replace oil seals Seal or replace manifold Replace gasket Replace crankcase
Engine does not deliver full power or runs erratically	Secondary air see page into engine through poorly mounted or faulty manifold Piston rings worn or broken Muffler coked	Mount manifold correctly or replace Replace piston rings Clean interior of muffler (inlet and exhaust ports). Replace spark arrestor screen.
Engine overheats	Insufficient cylinder cooling due to dirty cooling fins	Thoroughly clean cooling fins

2.3 Ignition System

Condition	Cause	Remedy
Engine difficult to start or will not start or runs erratically	Possibly an ignition system fault	Check/repair ignition system See 5.1 for troubleshooting

2.4 Rewind Starter

Condition	Cause	Remedy
Starter rope broken	Rope pulled out too vigorously as far as stop or over the edge	Replace starter rope
Rewind spring broken	Spring over-tensioned - no reserve when starter rope is fully extended	Replace rewind spring
Starter rope can be pulled out almost without resistance (crankshaft does not turn)	Starter pawl worn Pawl spring fatigued or broken	Replace pawl Fit new pawl spring
Starter rope is difficult to pull and rewinds very slowly	Rewind starter mechanism is very dirty The lubricating oil on the rewind spring becomes viscous at very low outside temperatures (spring windings stick together)	Thoroughly clean complete starter mechanism Apply a little paraffin to the rewind spring, then pull starter rope carefully several times until it operates properly.

2.5 Fuel System

Condition	Cause	Remedy
Carburetor floods; engine stalls	Inlet needle not sealing. Foreign matter in valve seat or cone damaged. Inlet control lever sticking on spindle	Remove and clean or replace inlet needle, clean fuel tank, pickup body and fuel line if necessary
	Helical spring not located on nipple 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 is too high (relative to design position)	Adjust inlet control lever
Engine does not accelerate smoothly	Inlet control lever is too low (relative to design position)	Adjust inlet control lever
	Inlet needle sticking to valve seat	Remove inlet needle, clean and refit
	Connecting bore to atmosphere blocked	Clean bore
	Diaphragm gasket leaking	Fit new diaphragm gasket
	Metering diaphragm damaged or shrunk	Fit new metering diaphragm
Engine will not idle, idle speed too high	Throttle valve opened too far by idle speed adjusting screw	Reset idle speed adjusting screw correctly

Condition	Cause	Remedy
Engine stalls at idle speed	Idle jet bores or ports blocked	Clean jet bores and ports and blow out with compressed air
	Idle speed adjusting screw incorrectly set - throttle valve completely closed	Set idle speed adjusting screw correctly
Engine speed drops quickly under load - low power	Air filter dirty, tank vent faulty	Clean air filter, tank vent and replace if necessary
	Leak in fuel line between tank and fuel pump	Seal connections and replace fuel line if necessary
	Pump diaphragm damaged or distorted (buckled)	Fit new pump diaphragm
	Main jet bores or blocked	Clean bores and ports
	Fuel pickup body dirty or damaged	Clean fuel pickup body, replace filter

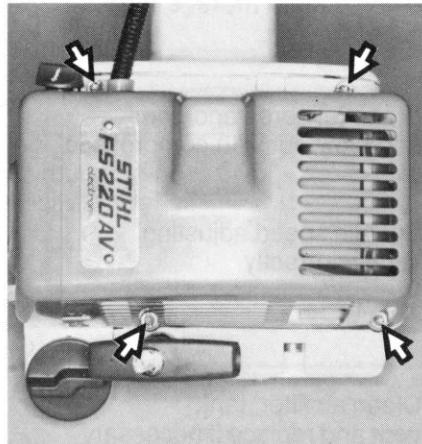
See also 2.2

3. CLUTCH

3.1 Disassembly

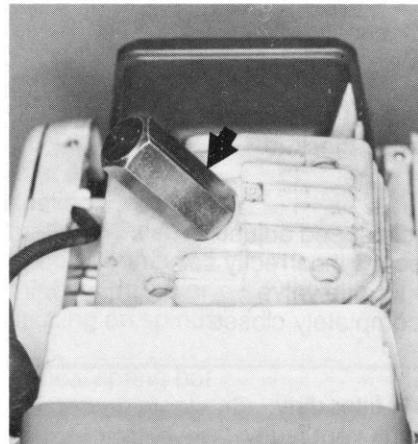
Top:
Shroud mounting screws

Bottom:
Locking screw 1107 191 1200



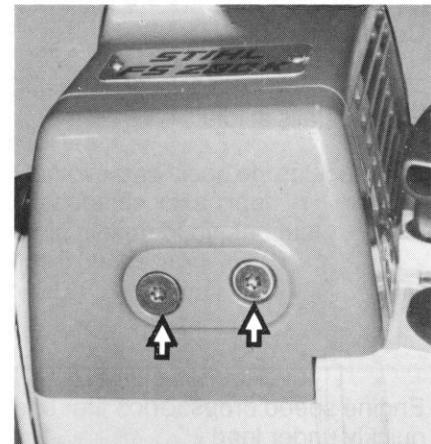
Top:
Locking screw fitted in cylinder

Bottom:
Choke shutter closed



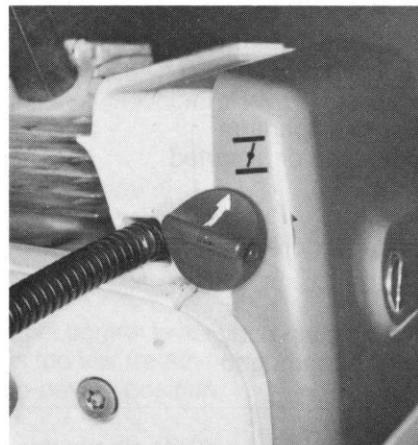
Top:
Carburetor box cover retaining nuts

Bottom:
1 = Air filter element
2 = Filter mat



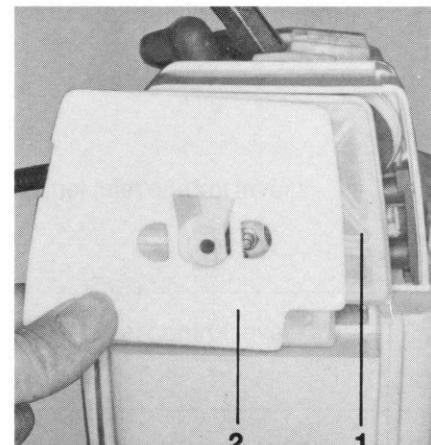
Troubleshooting chart - see 2.1.

Remove shroud mounting screws,
take off the shroud.



Pull off spark plug terminal. Unscrew the spark plug and fit the locking screw in the spark plug hole. Screw down locking screw by hand as far as stop.

Close the choke shutter by turning the choke knob counterclockwise to .

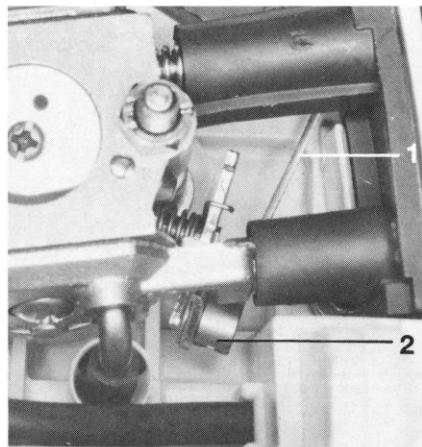


Unscrew the carburetor box cover retaining nuts. Remove carburetor box cover.

Remove the filter mat and air filter element.

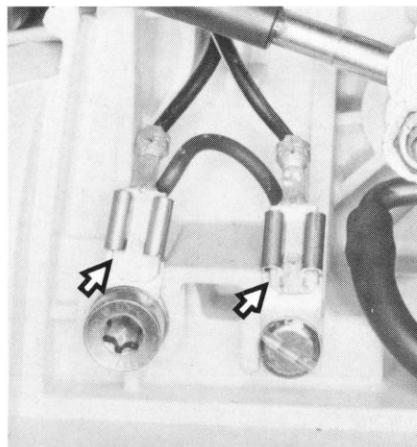
Top:
1 = Throttle cable
2 = Slotted pin

Bottom:
Throttle cable clamp



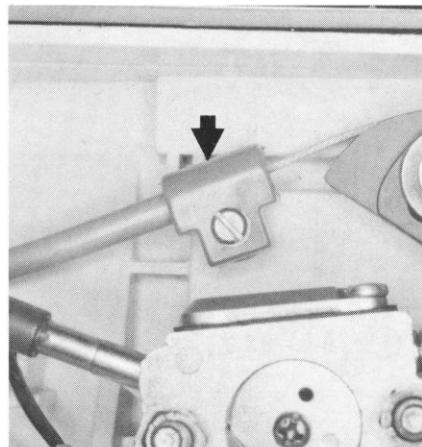
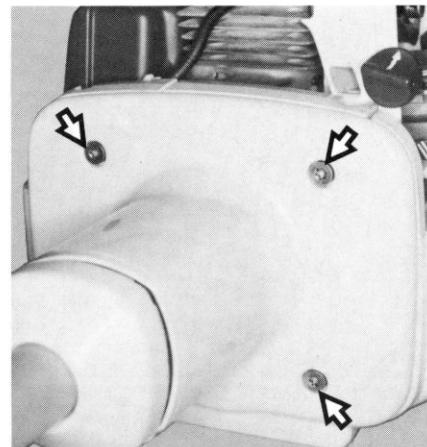
Top:
Short circuit wire spade terminals

Bottom:
Withdrawing throttle cable
from tank housing



Top:
Clutch housing mounting screws (fourth screw hidden in this view)

Bottom:
Clutch drum friction surface



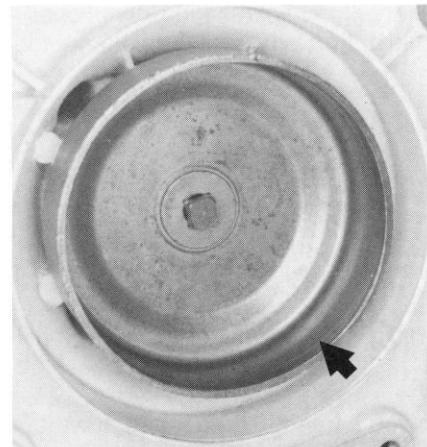
Disconnect throttle cable nipple from slotted pin on throttle lever.

Unscrew and remove clamp from throttle cable.



Pull spade terminals of short circuit wire out of sockets.

Pull throttle cable with short circuit wire out of tank housing.

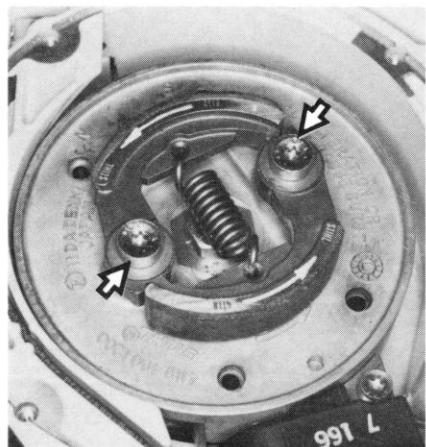


Unscrew the four mounting screws from the clutch housing and then remove it and the drive shaft from the engine.

Examine clutch drum: There should be no scores or signs of excessive wear. Fit a new clutch drum if necessary - see 10.1.

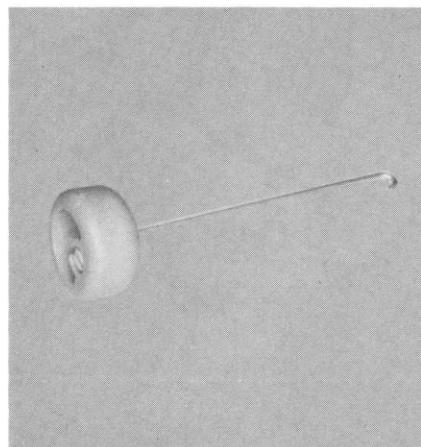
Top:
Clutch shoe screws (pivot mounts)

Bottom:
Clutch shoes bushings



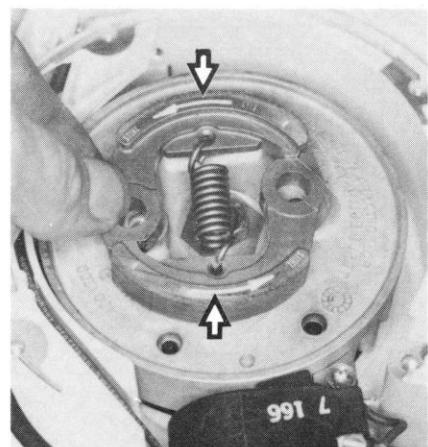
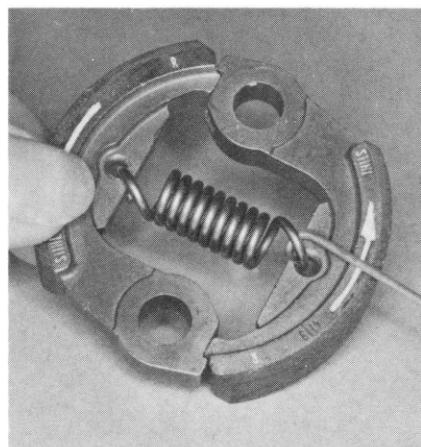
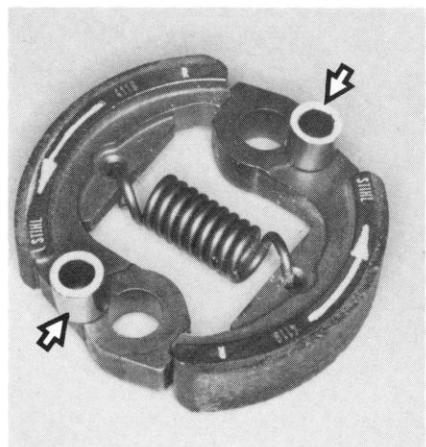
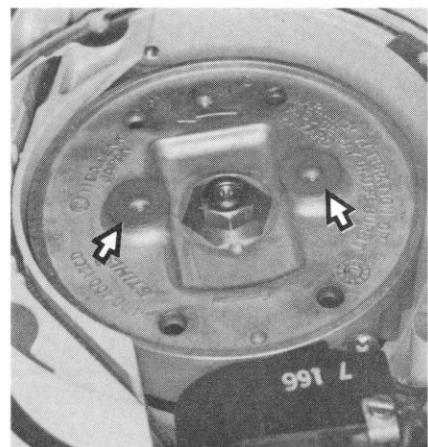
Top:
Assembly hook 5910 890 2800

Bottom:
Detaching clutch spring



Top:
Washers fitted

Bottom:
Fitting clutch shoes



Turn the clutch shoes clockwise until the piston butts against the locking screw.

Release and unscrew the spline screws and take off the clutch shoes together with the washers.

Remove bushings from the clutch shoes.

Replace clutch shoes if their linings are worn or loose. Always fit a new clutch spring.

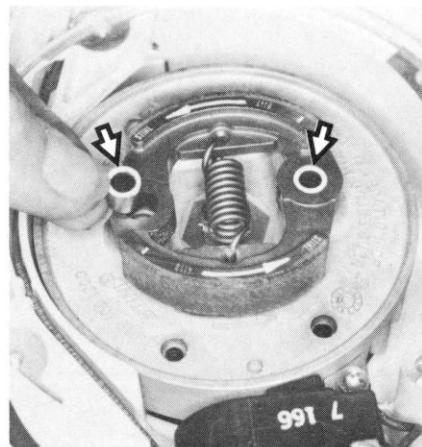
Important: Clutch shoes must always be replaced in pairs. Install the clutch spring so that the open sides of the spring hooks point away from the arrows (direction of rotation).

First place the washers on the flywheel's bosses.

Position the clutch shoes, with the spring fitted, so that the direction of rotation arrows face upward.

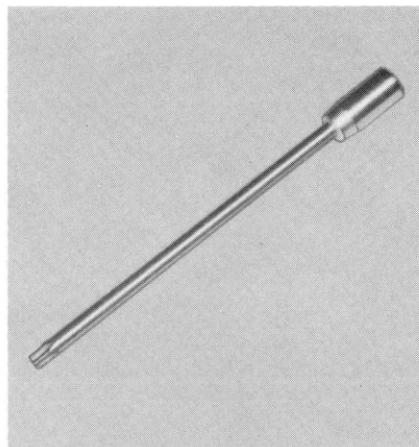
Top:
Inserting bushings in clutch shoes

Bottom:
Inserting spline screws

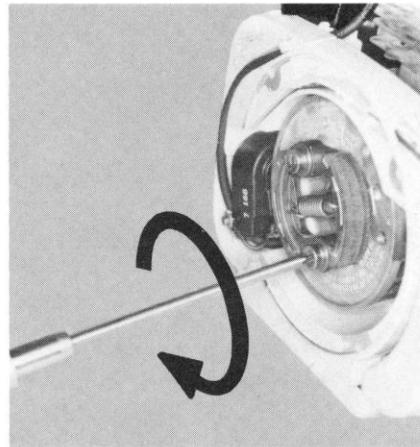
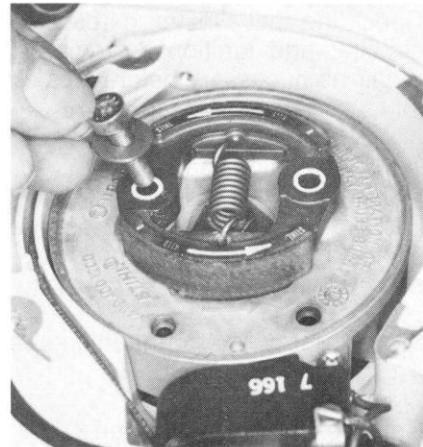
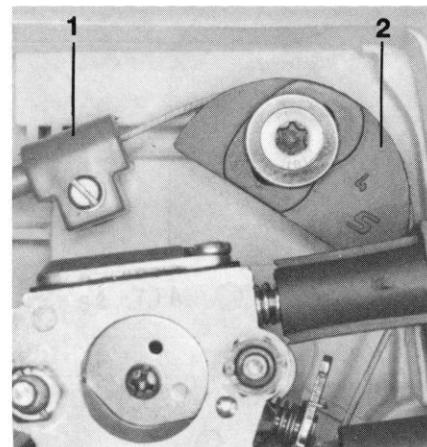


Top:
Spline screw socket 0812 542 2104

Bottom:
Tightening the spline screws



1 = Throttle cable clamp
2 = Tensioner



Insert bushings in the clutch shoes.

Fit spline screws, with washers, in the clutch shoes.

Tighten down the spline screws to a torque of 12 Nm (9 lbf.ft).

Position clutch housing and drive shaft against the engine and secure with the four mounting screws.

Thread the throttle cable into the housing.

Place the throttle cable over the tensioner and attach it to the slotted pin.

Install the throttle cable clamp.

Connect spade terminals of short circuit wire to sockets.

Refit the air filter, filter mat and carburetor box cover.

Remove locking screw from cylinder.

Screw in spark plug, tighten it down to a torque of 20 Nm (15 lbf.ft) and refit spark plug terminal.

Fit the shroud. Insert and tighten down the four mounting screws to a torque of 2 Nm (1.5 lbf.lb).

4. ENGINE

4.1 Removing and Refitting Muffler

4.2 Exposing the Cylinder

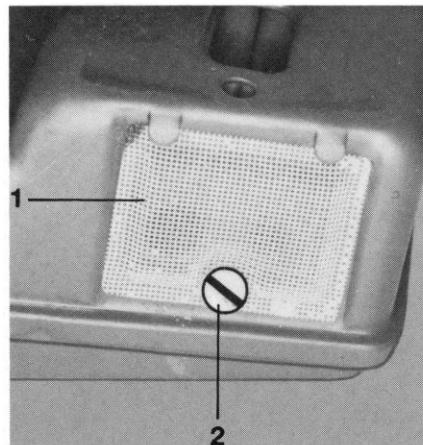
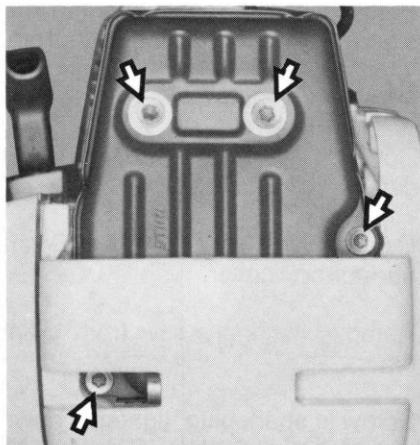
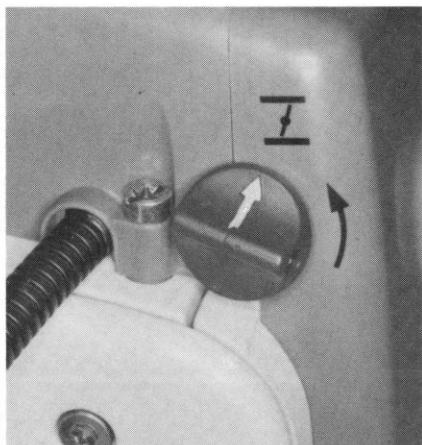
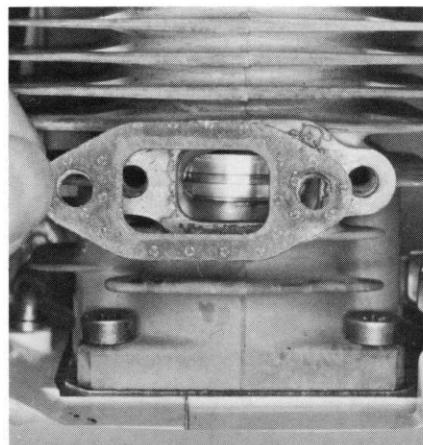
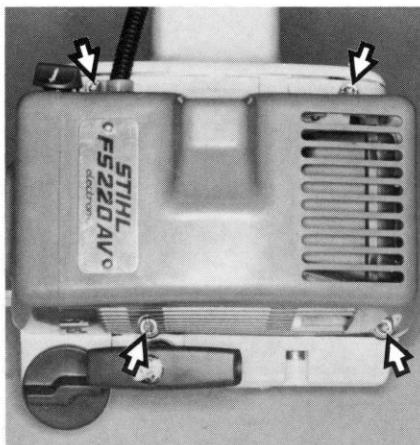
Top:
Shroud mounting screws

Bottom:
Muffler mounting screws

Top:
Removing gasket

Bottom:
1 = Spark arrestor screen (only on versions
with spark-arresting muffler)
2 = Fastening screw

Choke shutter closed



Troubleshooting chart - see 2.2.

Remove shroud mounting screws and lift away the shroud.

Remove the muffler mounting screws and take off the muffler.

Remove muffler gasket.

Inspect the spark arrestor screen. If dirty, take out the fastening screw, remove and clean the spark arrestor screen or fit a new one if necessary.

Install the muffler in the reverse sequence.

Note: The long mounting screws on the muffler must be tightened to a torque of 7.5 Nm (5.5 lbf.ft).

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

Troubleshooting chart - see 2.2

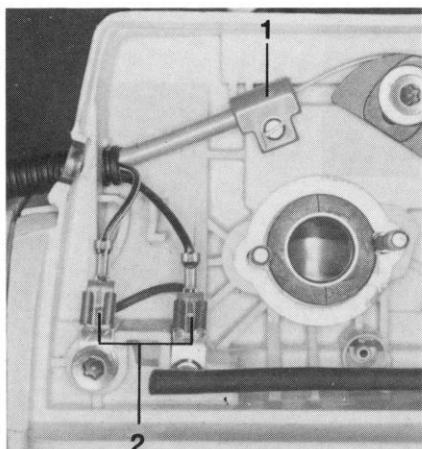
First drain the fuel tank and close the choke shutter (turn counterclockwise to \overline{Z} position).

Remove the shroud and muffler - see 4.1.

Remove the carburetor - see 8.2.

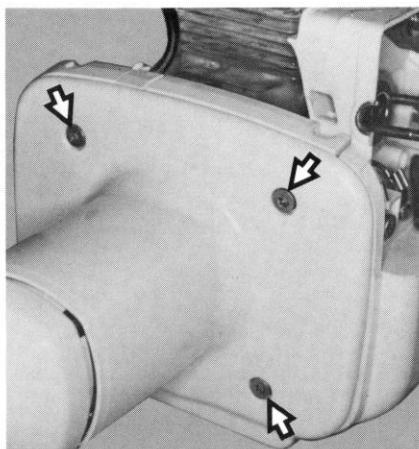
Top:
1 = Throttle cable clamp
2 = Short circuit wire connectors

Bottom:
Withdrawing throttle cable
from tank housing

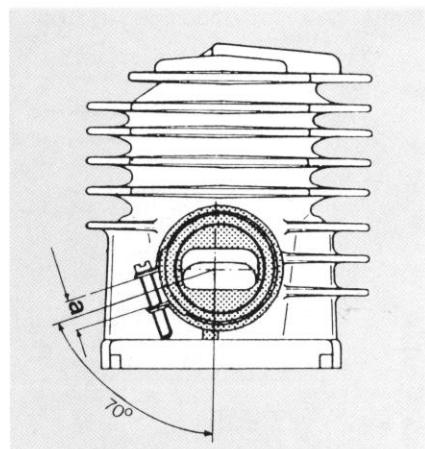


Top:
Clutch housing mounting screws (fourth
screw hidden in this view)

Bottom:
1 = Manifold
2 = Hose clamp



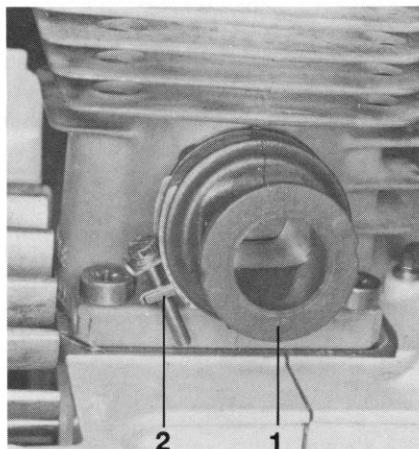
Correct position of hose clamp
 $a = 8.5 \text{ mm (0.33 in)}$



Unscrew and remove clamp from
throttle cable.

Pull spade terminals of short circuit
wire out of sockets.

Pull throttle cable with short circuit
out of tank housing.



Unscrew the four mounting screws
from the clutch housing and then
remove it and the drive shaft from the
engine.

Remove tank housing - see 8.8.

Loosen the manifold hose clamp
and pull the manifold off the intake
stub.

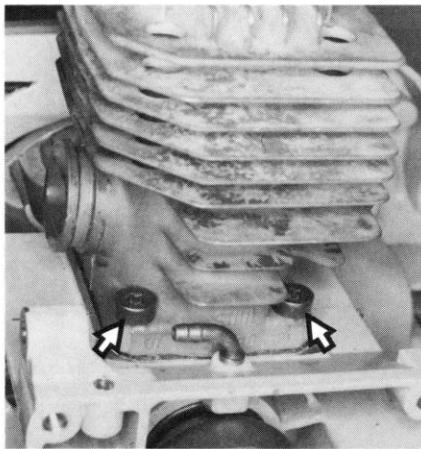
Assembly is a reversal of the disas-
sembly sequence.

Note: Push manifold with hose
clamp onto the intake stub. The
screw is must be at the drive shaft
side. Position the hose clamp so that
its ends point downward to the left at
an angle of 70° (looking at intake
stub). Tighten the screw until the
distance between the two ends is 8.5
mm.

4.3 Cylinder and Piston

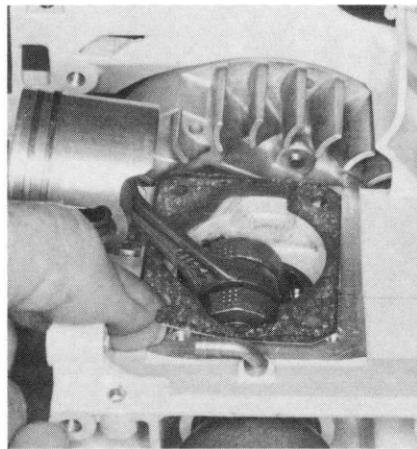
4.3.1 Removal

Cylinder base screws



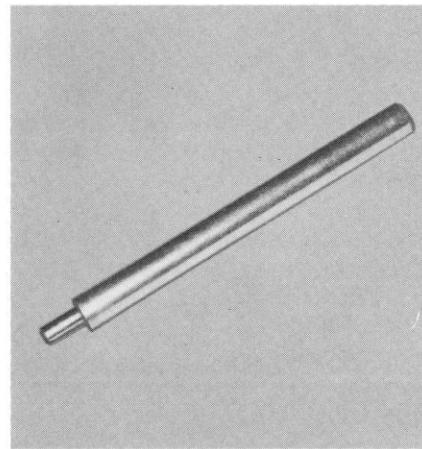
Top:
Removing cylinder gasket

Bottom:
Removing snap ring



Top:
Assembly drift 1110 893 4700

Bottom:
Pushing out the piston pin



See 4.2 for preparatory work.

Pull off the spark plug terminal and take out the spark plug.

Unscrew the cylinder base screws and pull the cylinder off the piston.

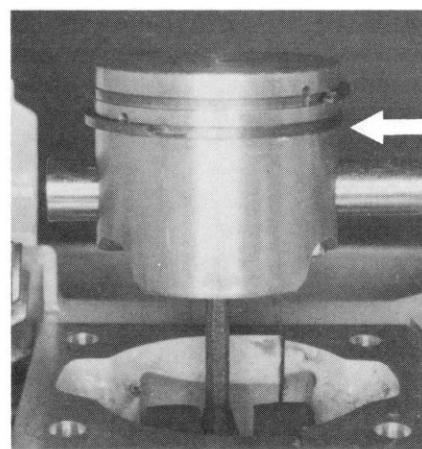
Important: Before removing the piston, decide whether or not the crankshaft has to be removed as well. If this is the case, block the crankshaft by sliding the wooden assembly block between the piston and crankcase. This enables the starter cup and flywheel nuts to be removed.

Inspect the cylinder and replace it if necessary.



Remove the cylinder gasket.

Use a scribe or similar tool to ease the hookless snap rings out of the grooves in the piston boss.



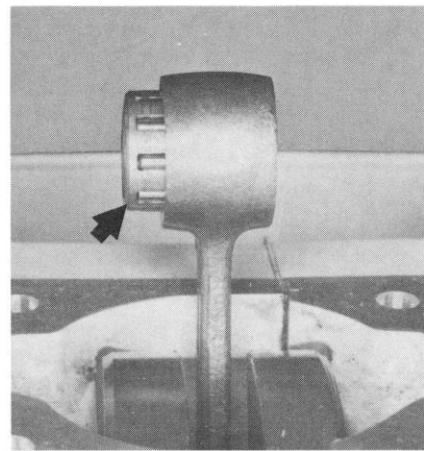
Now press out the piston pin with the drift. If the piston pin is stuck, tap the end of the drift **lightly** with a hammer if necessary. **Important:** Hold the piston steady during this process to ensure that no jolts are transmitted to the connecting rod.

Take the piston and needle cage off the connecting rod.

4.3.2 Installation

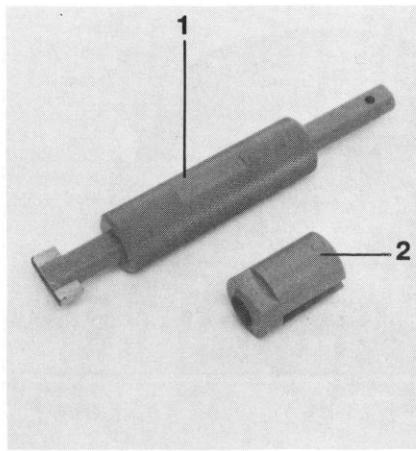
Top:
Needle cage fitted in small end

Bottom:
1 = Arrow on piston crown
2 = Snap ring



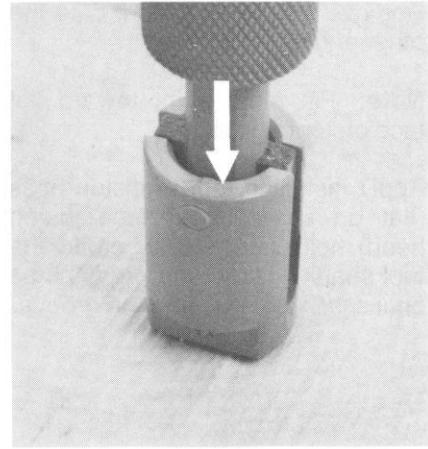
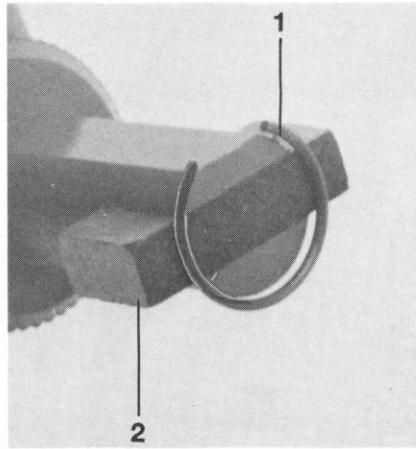
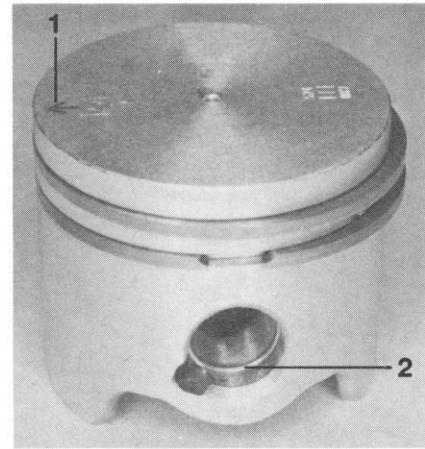
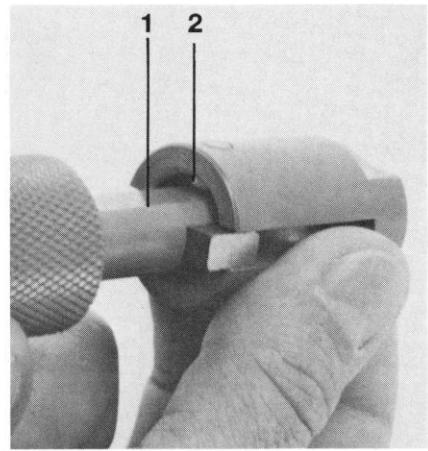
Top:
1 = Installing tool 5910 890 2210
2 = Sleeve

Bottom:
1 = Snap ring (hookless)
2 = Magnet



Top:
1 = Flat on end of shank
2 = Pin

Bottom:
Pushing installing tool into sleeve as far as stop



Thoroughly clean gasket seating face on the cylinder. Lubricate needle bearing with oil and fit it in the small end.
Fit snap ring in the forward-facing piston boss (arrow on piston crown pointing to left).

Note: Fit snap ring with special installing tool 5910 890 2210.

Use installing tool as follows:

Remove sleeve from the tool.

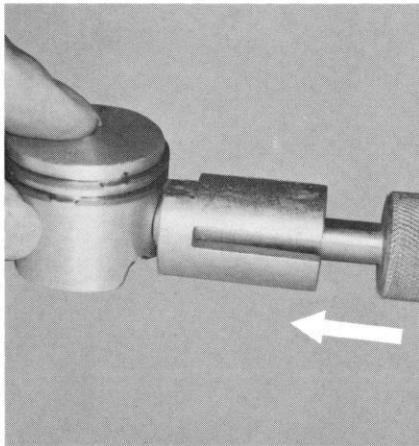
Attach hookless snap ring to magnet so that the ring gap is on the flat side of the tool's shank (see illustration).

Push slotted diameter of sleeve over the magnet and snap ring.

Note: Sleeve must be fitted so that the inner pin slides on the flat face of the tool's shank.

Stand installing tool, sleeve downward, on a flat surface (wooden board) and press vertically downwards until the sleeve butts against the tool's shoulder.

Inserting snap ring



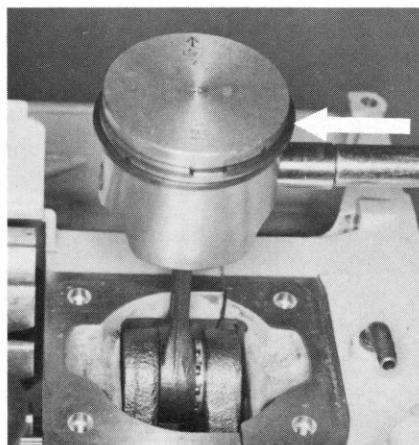
Remove sleeve and slip it onto the other end of the shank.

Note: Pin must point toward flat face of tool's shank.

Apply installing tool to piston boss (flat on shank must face piston head), hold piston steady, center the tool shank exactly and press home until snap ring slips into the groove.

Top:
Arrow on piston crown points toward muffler

Bottom:
Installing the piston pin



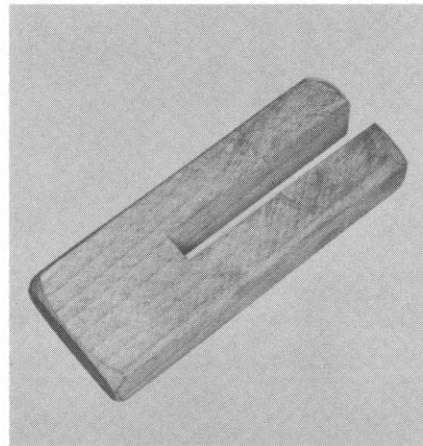
Heat piston on an electric heating plate to about 60°C (140°F) and slip it over the connecting rod so that the arrow on the piston crown points toward the muffler.

Use assembly drift to push the piston pin into the piston and needle bearing (the piston pin slides home easily when the piston is hot) and use the installing tool to fit the second snap ring.

Fit cylinder gasket.

Top:
Wooden assembly block 1108 893 4800

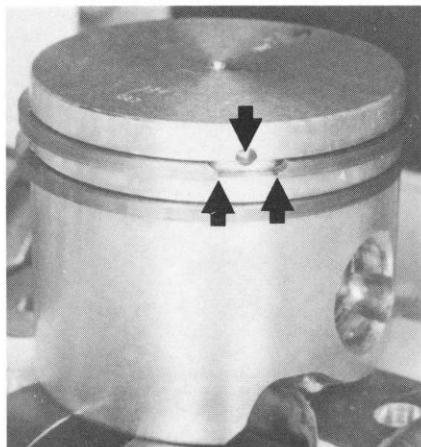
Bottom:
Piston resting on wooden assembly block



Lubricate piston and piston rings with oil and place the piston on the wooden assembly block.

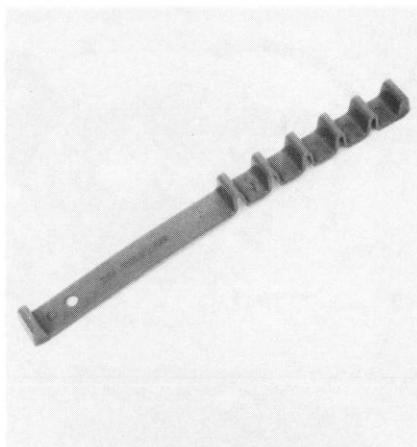
Top:
Upper piston ring correctly positioned

Bottom:
1 = Original cylinder
2 = New cylinder

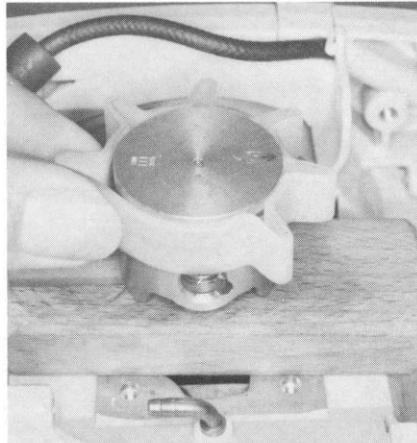
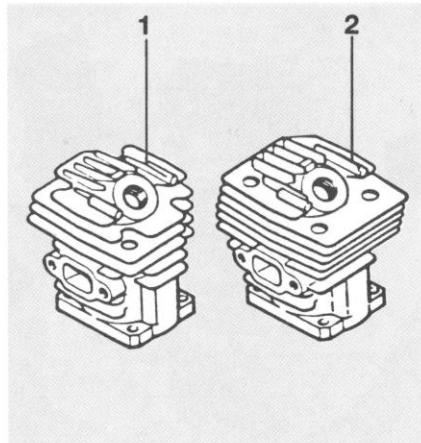
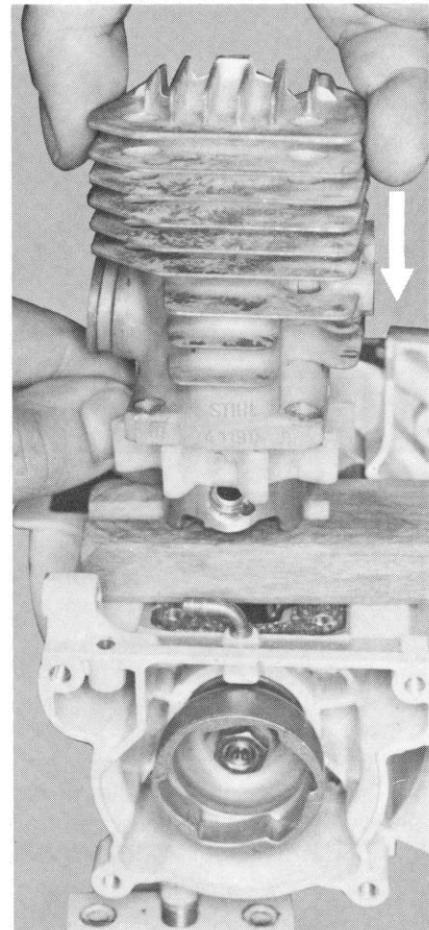


Top:
Clamping strap 0000 893 2600

Bottom:
Compressing piston rings with clamping strap



Fitting aligned cylinder over piston



Position the piston rings so that the radii at the ring gap meet at the fixing pin in the piston groove when the rings are compressed.

If a new cylinder is installed, the original 265 mm (10 7/16") ignition lead must be replaced by one which is 290 mm (11 7/16") long. Similarly, a 90° spark plug terminal must also be fitted.

Use the clamping strap to compress the piston rings around the piston (check again to see that they are correctly positioned).

Lubricate inside of cylinder with oil and line it up so that it is positioned exactly as it will be in the installed condition (see illustration). If this point is not observed, there is a risk of the piston rings breaking.

Now slide the cylinder over the piston - the clamping strap is pushed downward as the piston rings move into the cylinder.

Remove the clamping strap and wooden assembly block and line up gasket and cylinder. Fit cylinder base screws and tighten them down to a torque load of 8 Nm (6 lbf.ft).

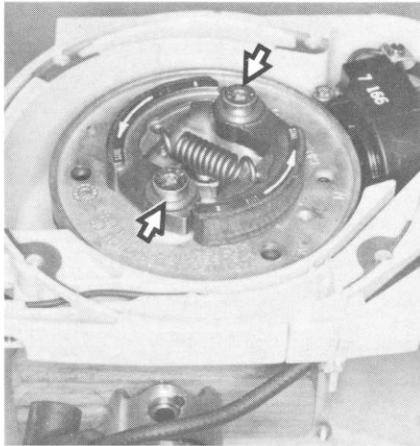
Assembly is now a reversal of the disassembly sequence. Always fit new gaskets as a matter of routine.

4.4 Crankcase

4.4.1 Removing the Crankshaft

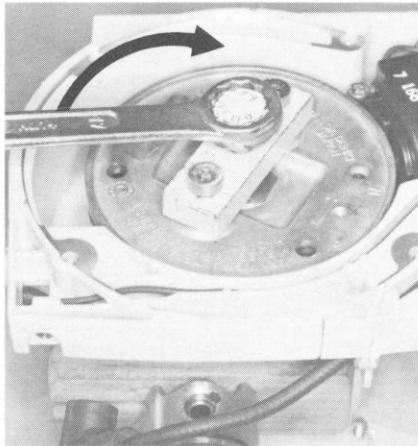
Top:
Spline screws (clutch shoe pivot mounts)

Bottom:
Flywheel mounting nut



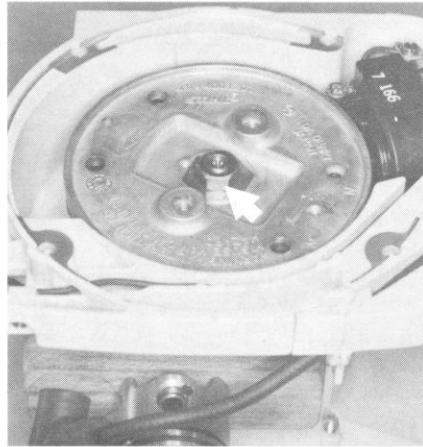
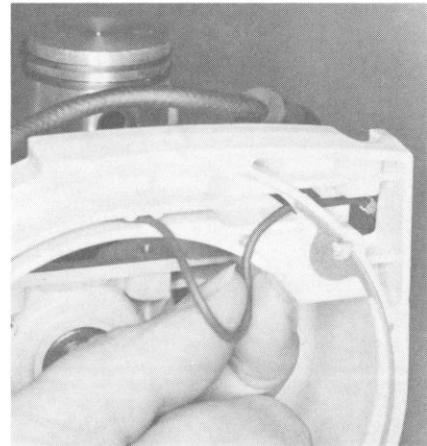
Top:
Removing flywheel with puller 4119 890 4590

Bottom:
Ignition lead retainer



Top:
Withdrawing short circuit wire

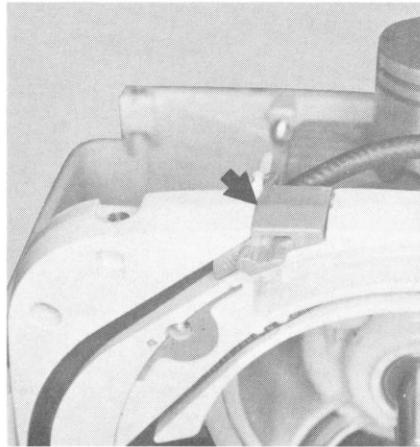
Bottom:
Ignition module mounting screws (FS 160 - FS 220)



Remove the cylinder (see 4.3.1) and support piston on wooden assembly block.

Take out the spline screws. Remove clutch shoes and washers.

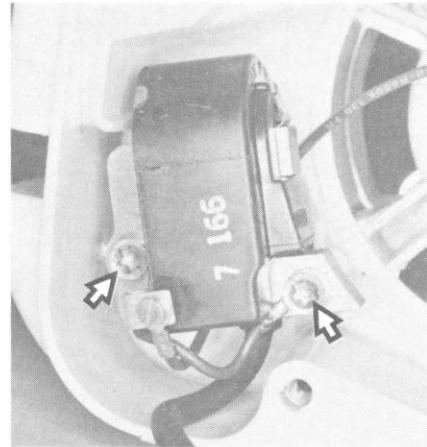
Unscrew flywheel mounting nut from the crankshaft.



Pull the flywheel off the crankshaft.

Remove ignition lead retainer from the crankcase.

Pull the ignition lead out of the retainer in the crankcase.



Pull short circuit wire through the opening in the crankcase and out of the guide slot.

Remove the ignition module mounting screws and lift away the module.

Note: Remove trigger unit and ignition coil on FS 280 - see 5.2.3.

Top:
1 = Starter cup
2 = Locknut

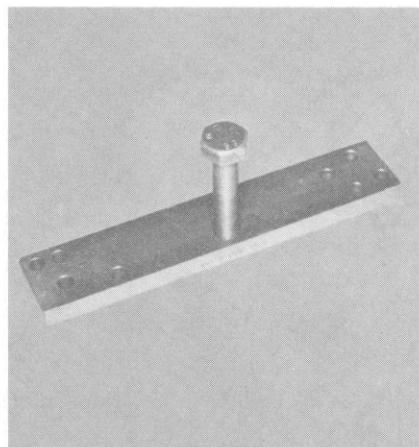
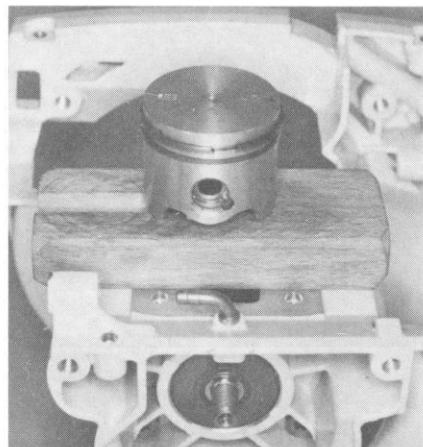
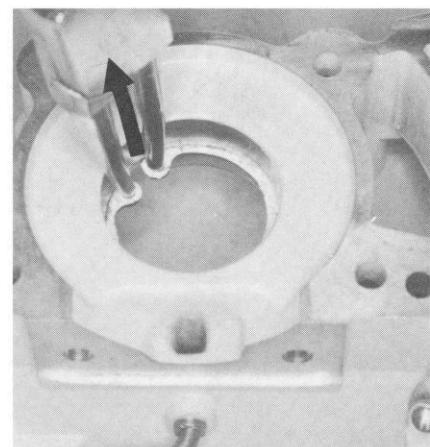
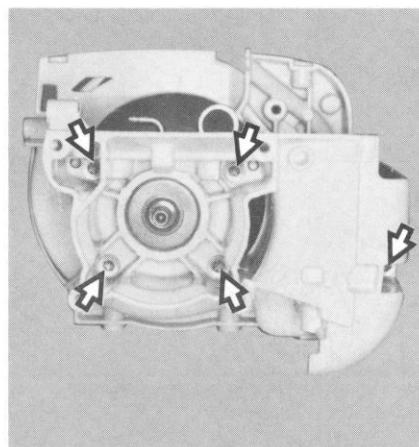
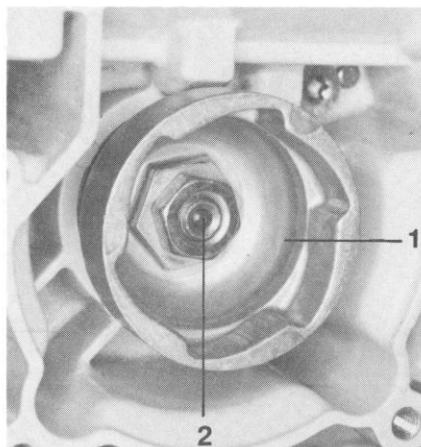
Bottom:
Piston supported on wooden assembly block

Top:
Crankcase connecting screws

Center:
Removing tool 4119 890 4600

Bottom:
Pressing off one half of crankcase

Removing circlip

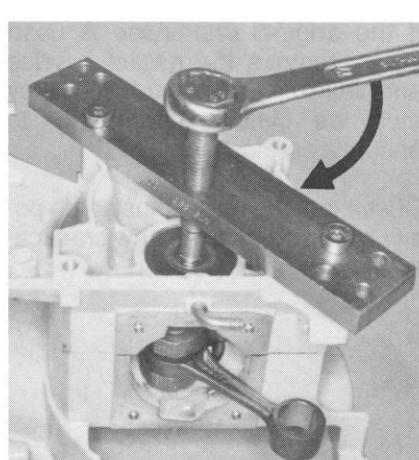


Unscrew locknut from starter cup and then unscrew starter cup from the crankshaft.

Remove the piston - see 4.3.1.

Take out the screws which secure the two halves of the crankcase.

Fit the removing tool and center the tip of its thrust bolt on the end of the crankshaft.



Rotate the removing tool's thrust bar until two of its holes line up with two holes in the crankcase. Insert and firmly tighten down the mounting screws.

Press starter side of the crankcase off the crankshaft journal.

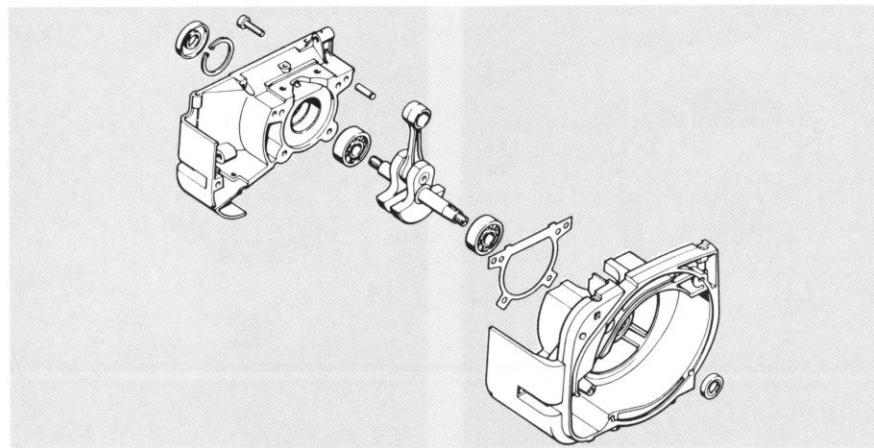
Use a plastic-faced hammer to tap the crankshaft carefully out of the bearing while holding the flywheel side of the crankcase steady.

Pry out the oil seals. Remove the internal circuit from the crankcase. Heat the two halves of the crankcase to approx. 110-140°C (230-280°F) and knock them carefully on a wooden base to remove the ball bearings.

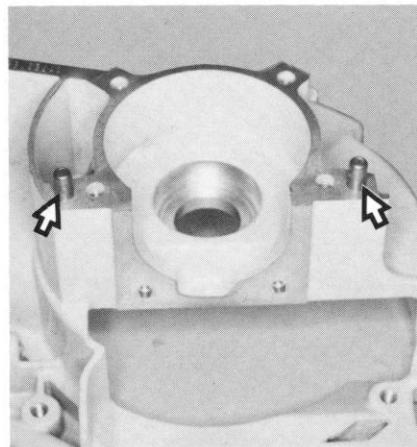
Visual inspection: Check the big-end bearing. If the bearing is damaged (worn), replace the complete crankshaft. Inspect the two halves of the crankcase for cracks.

4.4.2 Installing the Crankshaft

Top:
Crankcase in correct assembly sequence



Bottom:
Dowel pins in crankcase

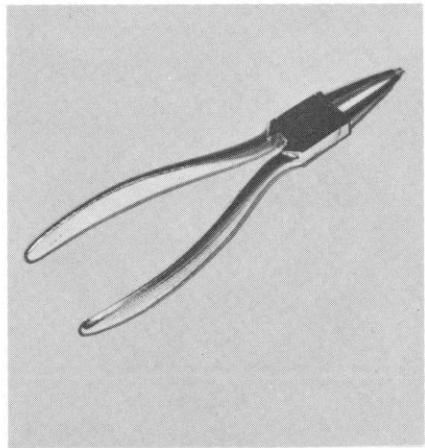


The crankshaft, connecting rod and needle bearing are inseparable. This means that the crankshaft must always be replaced as a complete unit in the event of damage to any one of these parts. When fitting a replacement always install new ball bearings and oil seals. The complete crankcase must be replaced if either half is damaged.

Note: Only replacement crankcase 4119 020 2106 may be used for the FS 280. All crankcase versions may be used as replacements for models FS 160 - FS 220.

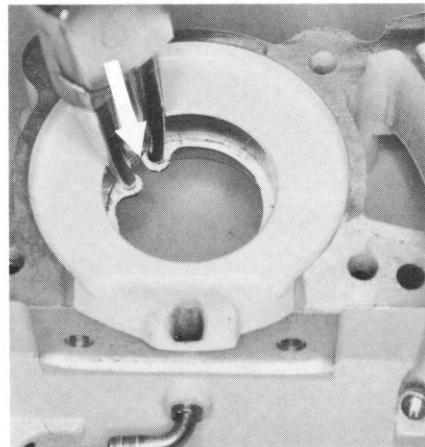
Top:
Circlip pliers 0811 641 8380

Bottom:
Installing circlip in crankcase



If the original crankcase is used again, remove the gasket residue and clean the sealing surfaces - they must be cleaned thoroughly to ensure a perfect seal.

Check that the dowel pins are in position or fit them in the new crankcase.



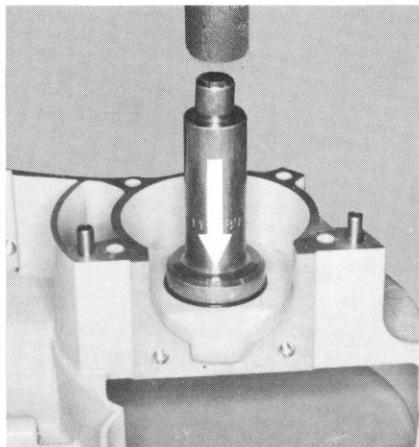
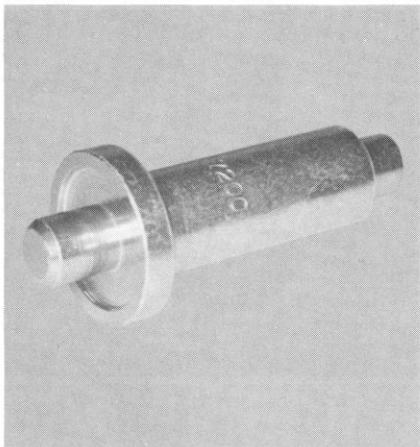
Insert the circlip in the groove in the starter half of the crankcase.

Note: The whole circumference of the circlip must be properly located in the groove.

Top:
Press arbor 4119 893 7200

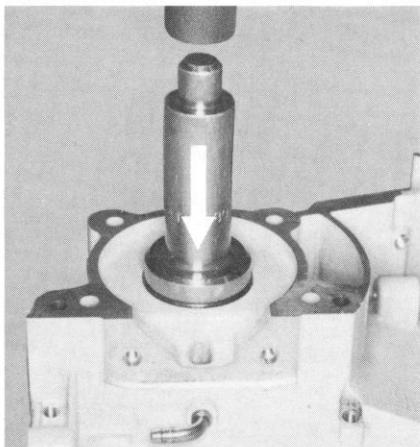
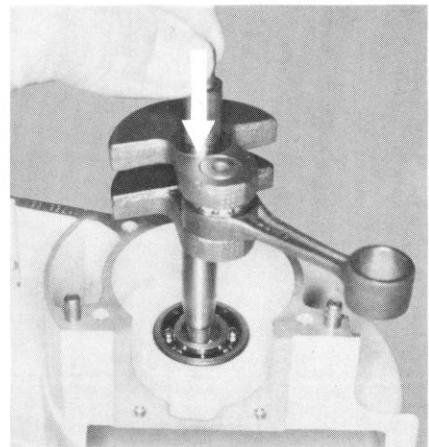
Bottom:
Installing ball bearing in starter half of crankcase

Installing ball bearing in flywheel half of crankcase



Top:
Fitting crankshaft

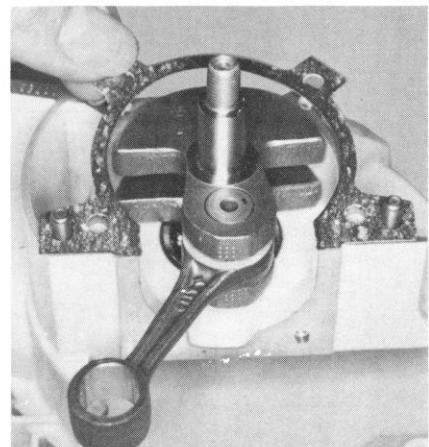
Bottom:
Fitting gasket



Heat the flywheel half of the crankcase to approx. 150°C (300°F) and press home the ball bearing until the press arbor butts against the crankcase.

Before fitting the crankshaft, use a soldering iron with a suitable copper attachment to heat the inner races of the ball bearings to approx. 150°C (300°F). This enables the crankshaft to be fitted in the bearings without the need for special tools, even if the tolerances are unfavorable.

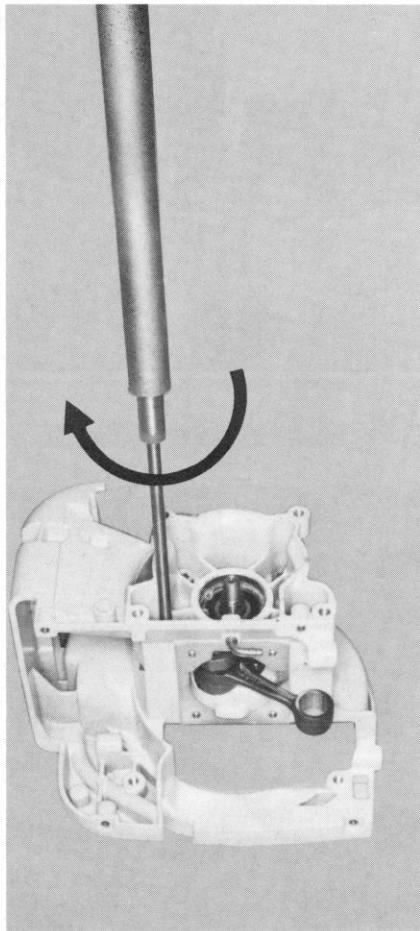
Heat the starter half of the crankcase to approx. 150°C (300°F) and press home ball bearing so that it butts against the circlip.



Now slide the tapered stub of the crankshaft quickly into the bearing in the flywheel half of the crankcase.

Fit a new gasket on the crankcase sealing face.

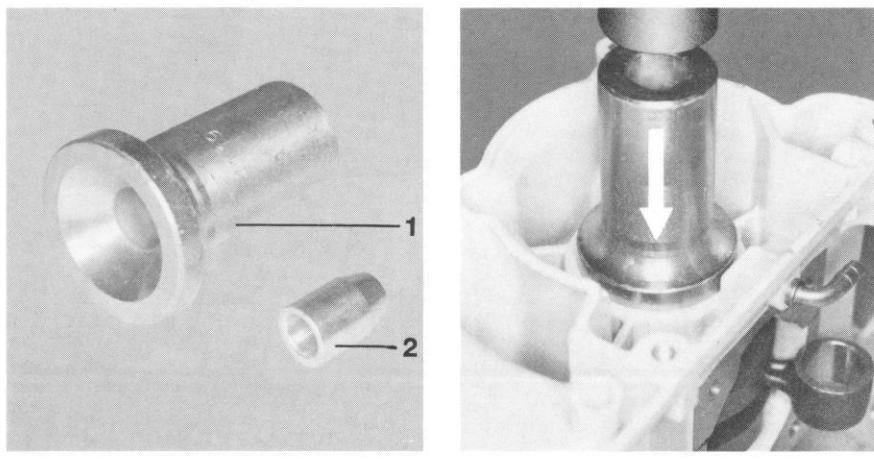
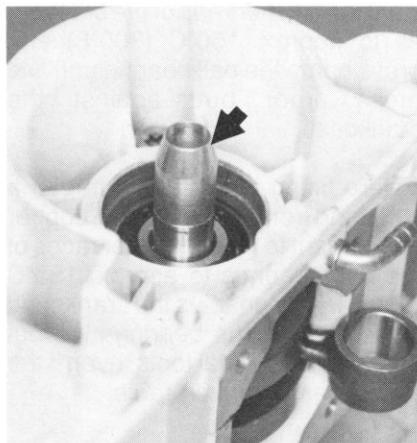
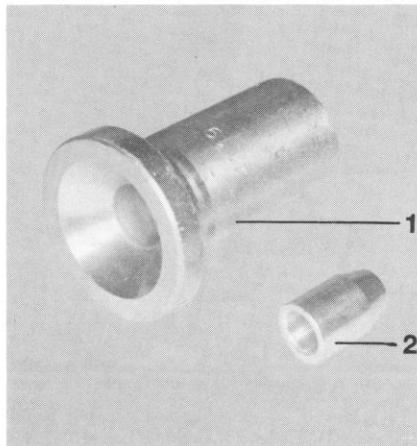
Tightening crankcase connecting screws



Heat the ball bearing inner race to approx. 150°C (300°F) and then slip the starter half of the crankcase quickly over the straight stub of the crankshaft. Insert crankcase connecting screws and tighten them down in a diagonal pattern to a torque of 8.5 Nm (6.3 lbf.ft).

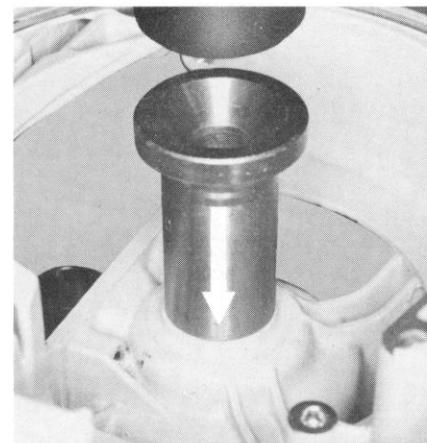
Top:
1 = Press sleeve 4119 893 2400
2 = Installing sleeve 4119 893 4600

Bottom:
Installing sleeve fitted over crankshaft stub



Top:
Pressing in oil seal at starter side

Bottom:
Pressing in oil seal at flywheel side



Slip oil seal installing sleeve over the straight stub of the crankshaft at the starter side. Coat sealing lips of oil seals with grease. Push the oil seal over the installing sleeve, open side of seal must face crankcase. Take away the installing sleeve and use the press sleeve to press the oil seal fully home until it is flush with the crankcase.

Note: The installing sleeve is not required for the oil seal at the flywheel side.

Place the oil seal (flywheel side) in position with its sealing lip facing down and then use the press sleeve to press it home until it is flush with the crankcase.

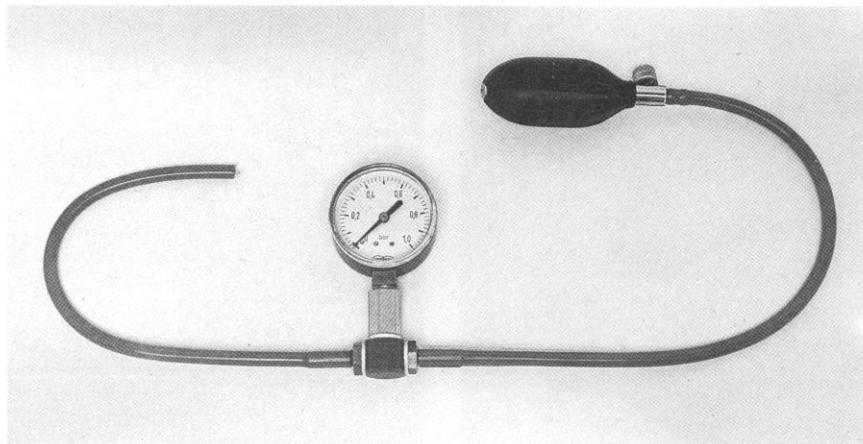
Assembly of the remaining parts is a reversal of the disassembly sequence.

4.5 Leakage Testing the Crankcase

4.5.1 Pressure Test

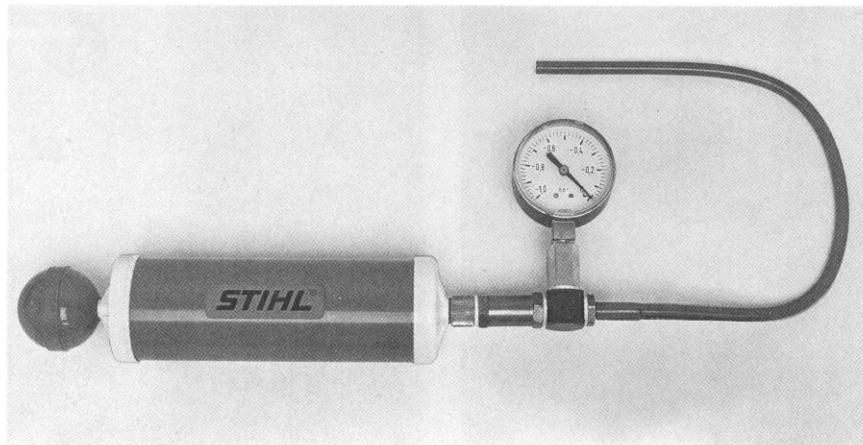
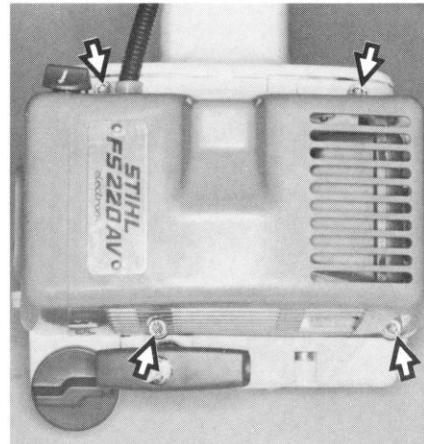
Top:
Carburetor and crankcase tester
1106 850 2905

Bottom:
Vacuum pump 0000 850 3500



Top:
Shroud mounting screws

Bottom:
Muffler mounting screws



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

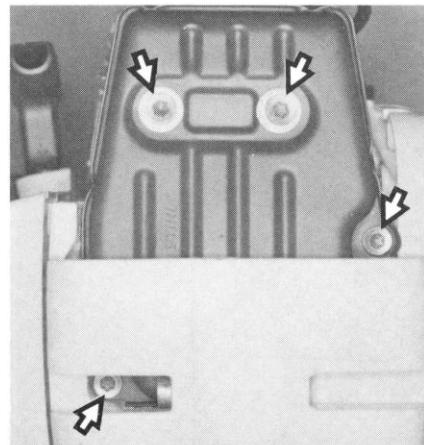
This makes adjustment of the prescribed idle speed difficult if not impossible.

Moreover, the transition from idle speed to part or full throttle is not smooth.

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

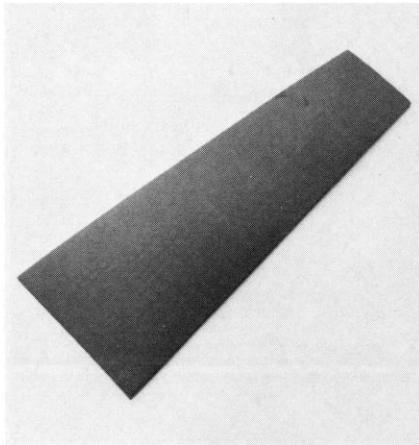
Take out shroud mounting screws and lift shroud away.

Slacken the muffler mounting screws about half way.



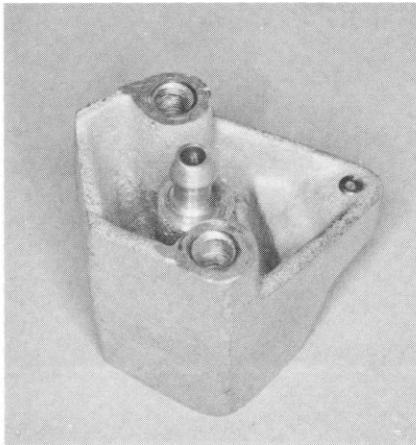
Top:
Sealing plate 0000 855 8105

Bottom:
Sealing plate in position



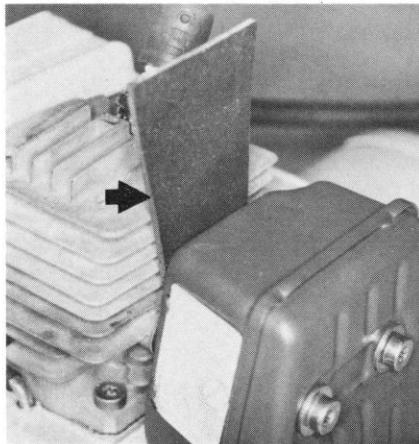
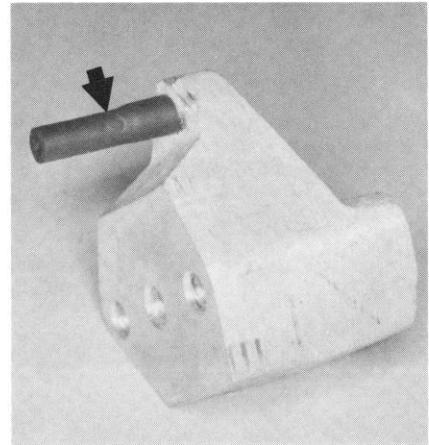
Top:
Test flange 1118 850 4200

Bottom:
Impulse hose on carb's connector



Top:
Impulse hose on test flange

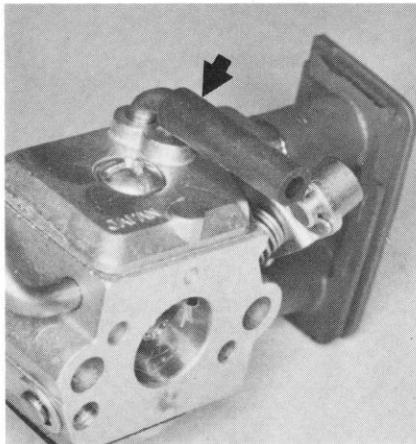
Bottom:
Test flange fitted



Slide the sealing plate between the muffler and cylinder exhaust port. Retighten the mounting screws moderately.

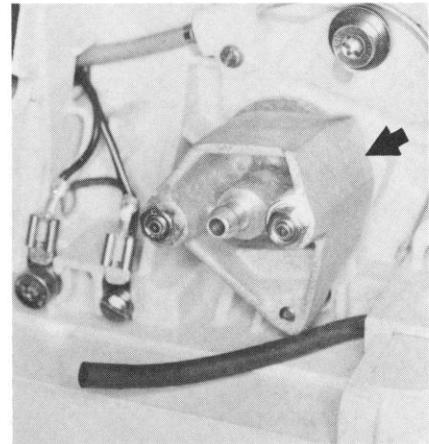
Remove carburetor - see 8.2.

Set piston to top dead center (T.D.C.) (this can be checked through inlet port).



Pull the impulse hose off the carburetor's elbow connector.

Push the impulse hose onto the pin on the test flange.



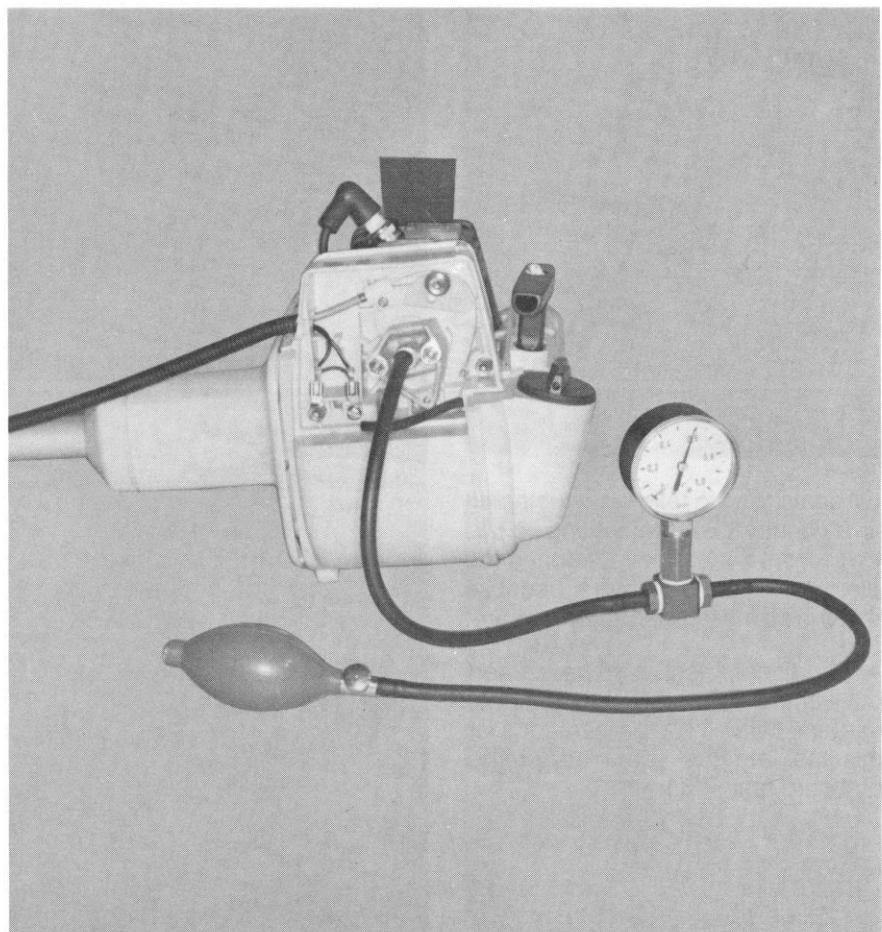
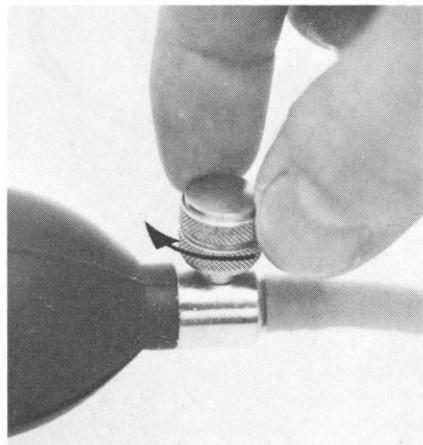
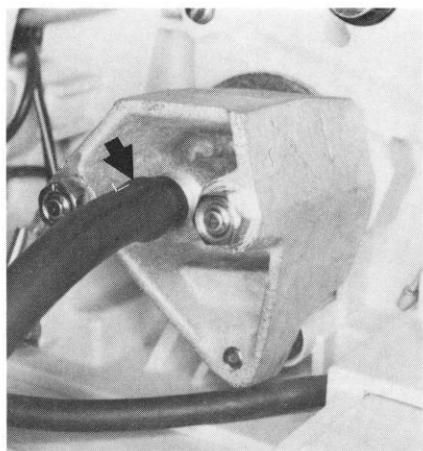
Fit the test flange in place of the carburetor.

Make sure the spark plug is properly tightened down before starting the test.

Top:
Tester's pressure hose fitted to nipple of test flange

Bottom:
Closing the vent screw

Pressure-testing the crankcase



Connect pressure hose of tester to nipple of test flange and close the vent screw on the rubber bulb. Pump air into the crankcase until the gauge indicates a pressure of 0.6 bar (8.7 psi). If this pressure remains constant for at least 20 seconds, the crankcase is airtight.

However, if the pressure drops, the leak must be located and the faulty part replaced.

Carry out the vacuum test - see 4.5.2.

After finishing the test, open the vent screw and disconnect the hose.

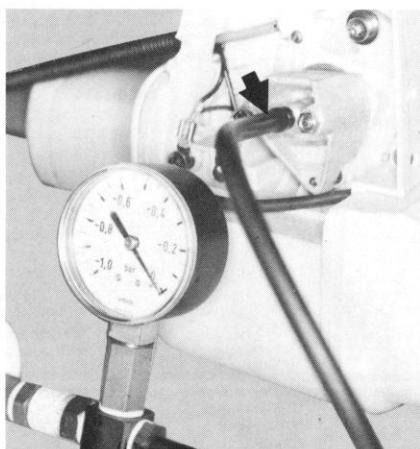
Remove the test flange and refit the carburetor - see 8.2.

Withdraw the sealing plate from between the muffler and cylinder.

Tighten down the muffler and refit the shroud.

4.5.2 Vacuum Test

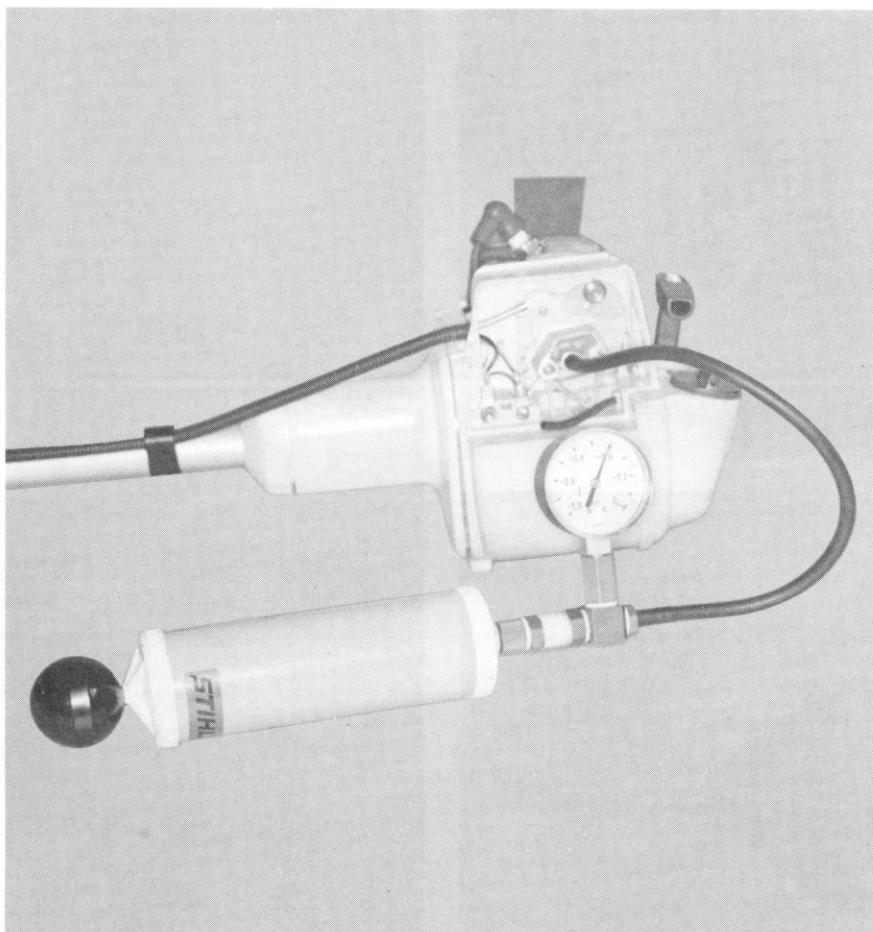
Testers suction hose fitted to nipple of test flange



Oil seals tend to fail when subjected to a vacuum, i.e. the sealing lip lifts away from the crankshaft during the piston's induction stroke because there is no internal counterpressure.

An additional test can be carried out with the vacuum pump to detect this kind of fault. The preparations for this test are the same as for the pressure test (4.5.1).

Leakage test with vacuum pump



Connect the suction hose of the vacuum pump to the nipple of the test flange. Pull out the pump piston until the gauges indicates a vacuum of 0.4 bar (5.8 psi).

Note: When you release the pump piston the non-return valve automatically seals the suction hose.

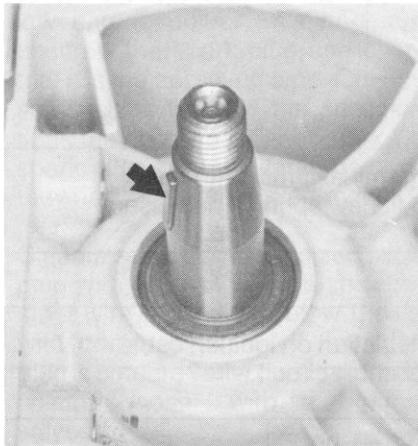
If the vacuum reading remains constant, or rises no more than 0.2 bar (3 psi) within 20 seconds, it can be assumed that the oil seals are in good condition.

However, if the pressure continues to rise (reduced vacuum in crankcase), the oil seals must be replaced, even if no leaks were detected in the pressure test.

4.6 Replacing the Oil Seals

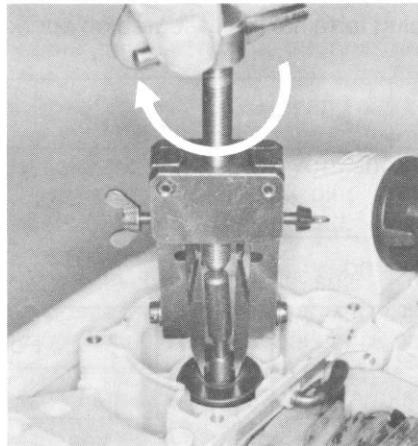
Top:
Woodruff key for flywheel location

Bottom:
Puller 0000 890 4400
with jaws 0000 893 3706



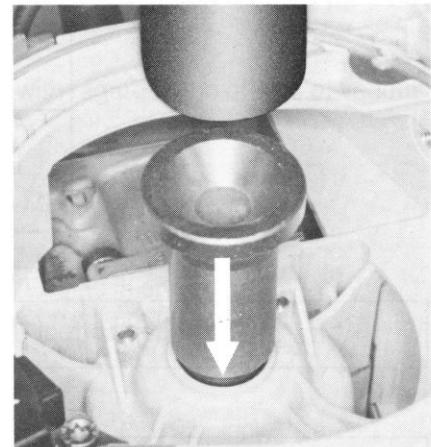
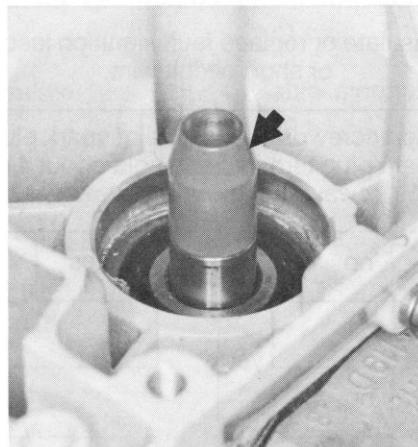
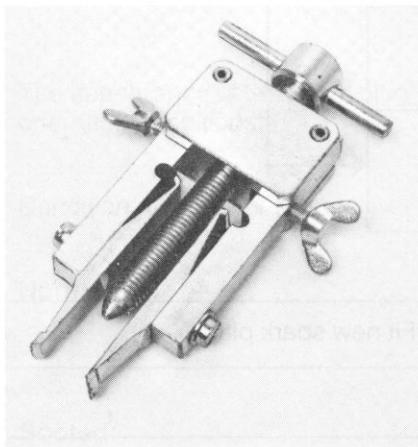
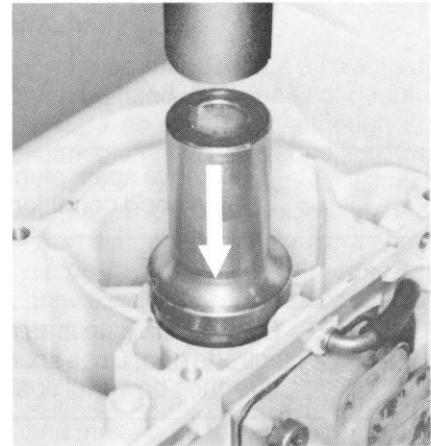
Top:
Pulling out oil seal using assembly drift 4116 893 4700 as extension

Bottom:
Installing sleeve 4119 893 4600 fitted over crankshaft stub



Top:
Pressing in oil seal at starter side with press sleeve 4119 893 2400

Bottom:
Pressing in oil seal at flywheel side with press sleeve 4119 893 2400



It is not necessary to disassemble the complete crankcase if only the oil seals have to be replaced.

Remove the starter cup - see 6.5.
Remove flywheel - see 5.2.8.

Remove the Woodruff key for the flywheel.

Fit the puller and withdraw both the oil seals from their seats.

Note: The puller's spindle must be extended approx. 10 mm (3/8") at the starter side (e.g. with the assembly drift). When using the puller make sure that it does not damage the crankshaft surface in the area of the oil seals.

Coat sealing lips of oil seals with grease. Slip oil seal installing sleeve over the straight stub of the crankshaft at the starter side.

Push the oil seal over the installing sleeve, open side of seal must face crankcase. Take away the installing sleeve and use the press sleeve to press the oil seal fully home until it is flush with the crankcase.

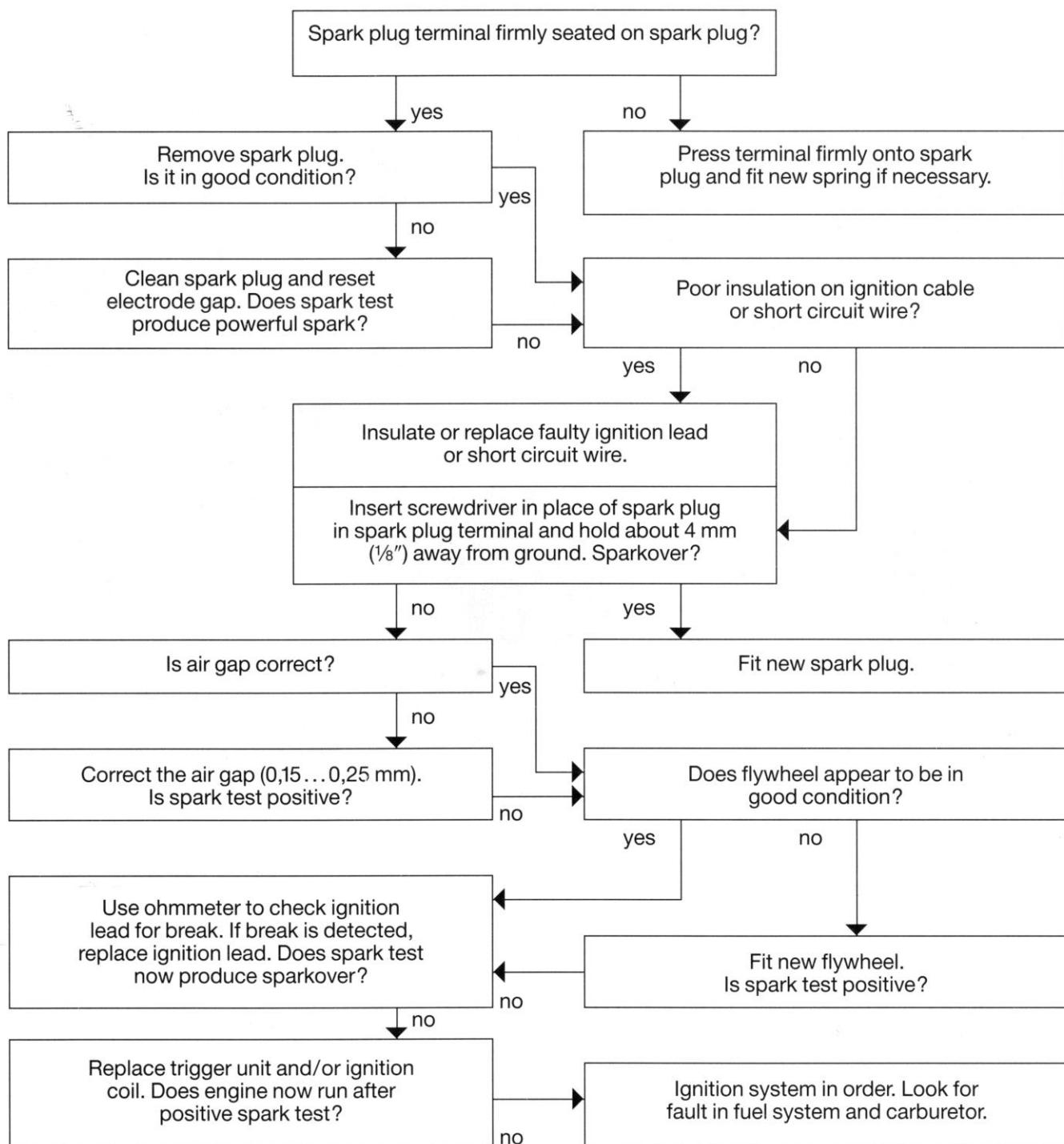
Only the press sleeve is required for installing the oil seal at the flywheel side.

Install flywheel - see 5.2.8.
Install starter cup - see 6.5.
Install clutch - see 3.2.

5. IGNITION SYSTEM

5.1 Troubleshooting Chart

Warning: Exercise extreme caution while carrying out maintenance and repair work on the ignition system. The high voltages which occur can cause serious or fatal accidents!



5.2 Repairing Component Parts

5.2.1 Spark Plug

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

In the event of starting difficulties, low engine power, misfiring etc., unscrew the spark plug and check that it is the approved type. Only the spark plugs listed in the specifications may be used. Other makes of spark plug are unsuitable because they have long-reach electrodes.

Clean a sooted or carbonized spark plug with a brass wire brush (not a steel wire brush) and blow it clear with compressed air. If the spark plug is smeared with oil, wash the insulator nose with a grease solvent

and blow clear with compressed air.

Since 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 (0.020 in) and can be restored by bending the ground electrode. However, you should 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 a clean spark plug in the spark plug 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.

It is recommended that a new spark plug be fitted in all cases of doubt. If there no sparkover although the spark plug is in good condition, first check the lead connections. Chafed insulation on the ignition lead or short circuit wire will cause a short-circuit to ground. In this 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.

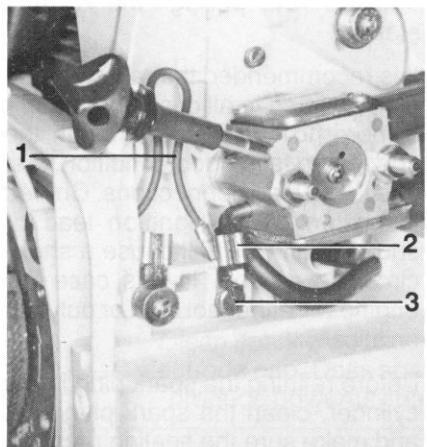
The appearance of the spark plug's insulator nose gives valuable information with regard to the effects of various operating conditions:

Condition of Insulator Nose	Appearance	Meaning
Normal:	Greyish yellow-to-brown, dry	Engine in order, correct spark plug (heat range as specified)
Sooted:	Velvet-like, dull black coating of soot	Mixture too rich, lack of air (dirty air filter, choke shutter partly closed), electrode gap too wide, wrong spark plug (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, pitted electrodes (heat range too low)	Mixture too lean, spark plug loose, wrong spark plug (heat range too low)

5.2.2 Ignition Module

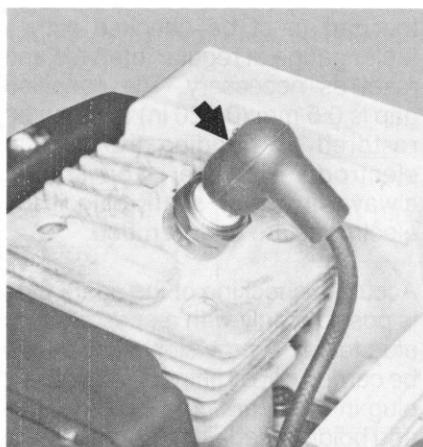
Top:
 1 = Short circuit wire
 2 = Connector
 3 = Short circuit wire fastening screw

Bottom:
 Withdrawing short circuit wire



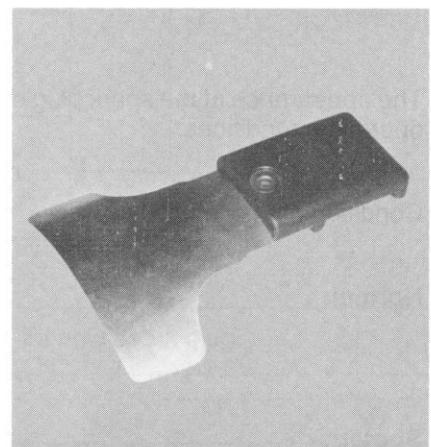
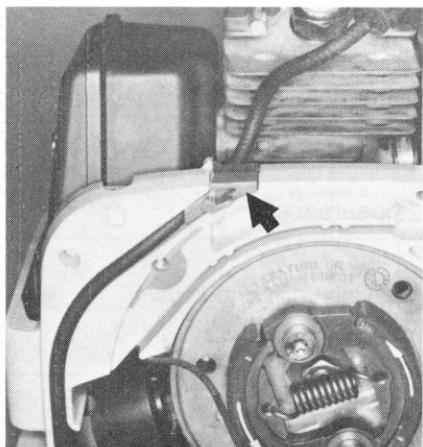
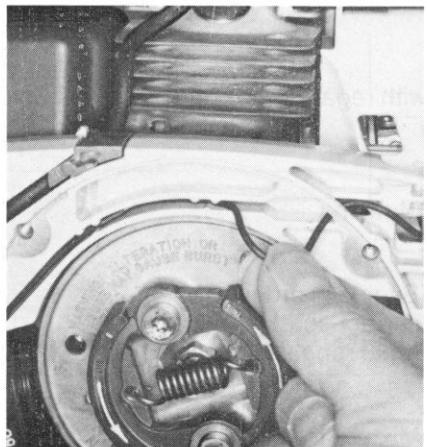
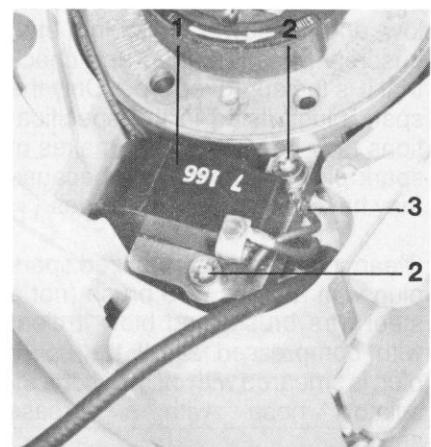
Top:
 Spark plug terminal

Bottom:
 Ignition lead retainer



Top:
 1 = Ignition module
 2 = Mounting screws
 3 = Ground wire

Bottom:
 Setting gauge 4118 890 6401



Model FS 160, 180 and FS 220 clearing saws are equipped with an electronic (breakerless) magneto ignition system which basically consists of the ignition module (with integral trigger unit) and the flywheel.

Remove the clutch housing and drive shaft - see 3.1.

Remove the fastening screw from the short circuit wire.

Pull the short circuit wire out through the hole and away from its guide in the crankcase.

Pull off the spark plug terminal.

Remove ignition lead retainer from the crankcase and withdraw ignition lead from its guide.

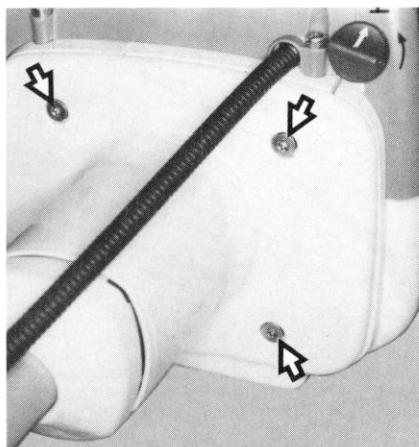
Remove the ignition module mounting screws. Take out the ignition module.

5.2.3 Trigger Unit (FS 280)

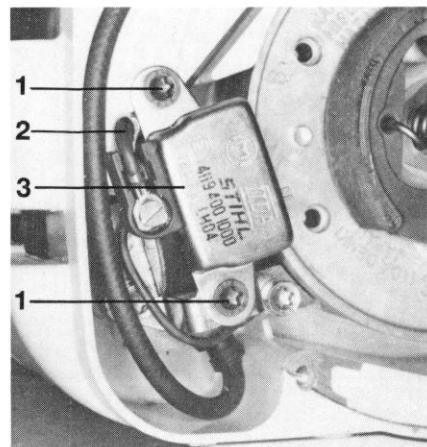
Setting gauge between flywheel and ignition module



Clutch housing mounting screws (fourth screw hidden in this view)



1 = Mounting screws
2 = Electric wire
3 = Trigger unit



To install the ignition module, place it in position and fit the mounting screws but do not tighten them down yet. Slide the setting gauge between the arms of the ignition module and the flywheel magnets.

Press the module against the setting gauge, tighten down the mounting screws securely to a torque of 3 Nm (2.2 lbf.ft) and withdraw the setting gauge.

Assembly is then a reversal of the disassembly sequence.

Note: Secure connector under screw for short circuit wire and secure ground wire with screw at flywheel side.

In the trigger unit the electronic switching elements and other components of the electronic control are accommodated on a common printed circuit board and completely sealed in a plastic compound. The electronic control system is, therefore, impervious to moisture and contamination.

The trigger unit is not subject to any mechanical wear and is therefore practically trouble-free. Ignition timing does not change as long as the trigger unit is intact, i.e. timing does not require routine checking.

However, if the spark test on the ignition system is negative and the other components are in order, it can be assumed that the trigger unit is faulty and needs to be replaced.

To replace the trigger unit, remove the clutch housing and drive shaft from the engine - see 3.1.

Remove the screw holding the electric wire.

Remove the trigger unit mounting screws. Lift away the trigger unit.

Reverse the above sequence to install the new trigger unit.

5.2.4 Ignition Coil (FS 280)

Top:
Removing

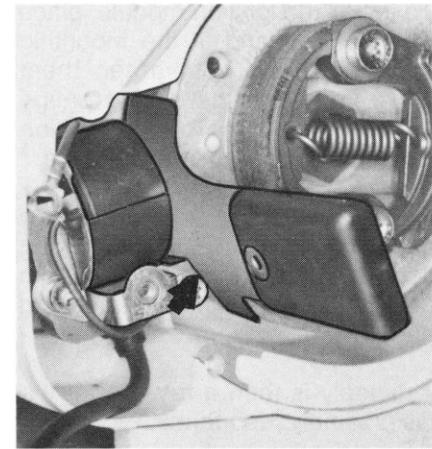
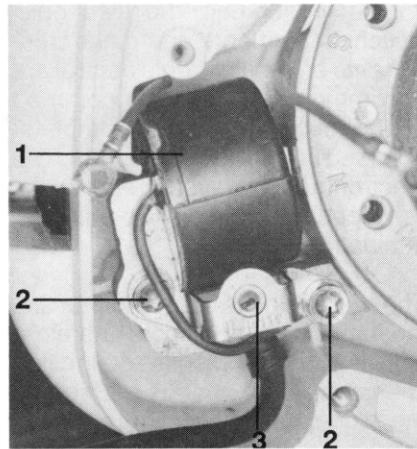
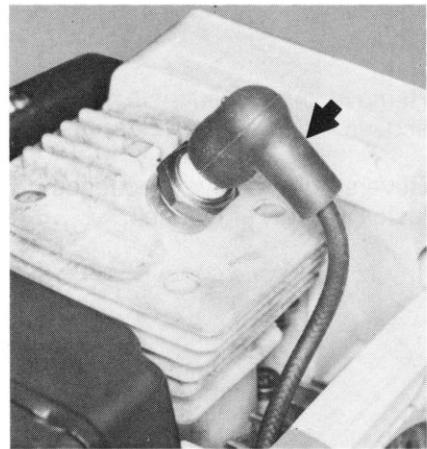
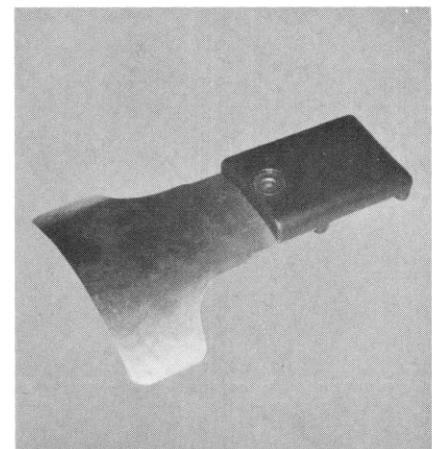
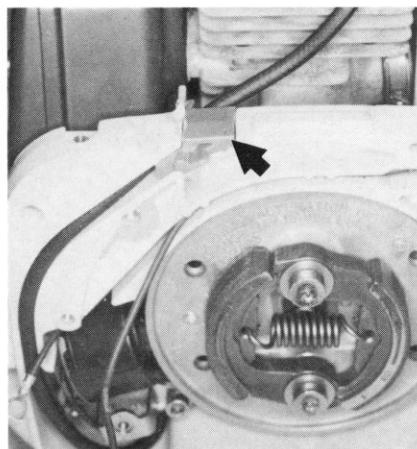
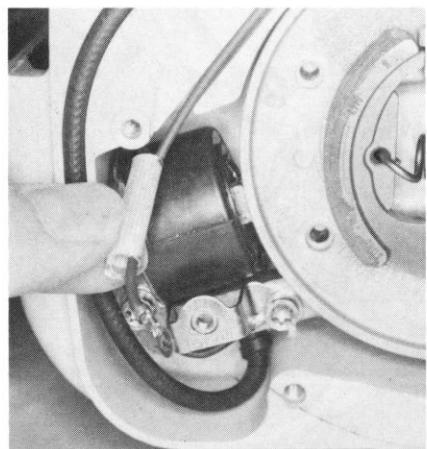
Bottom:
Spark plug terminal

Top:
Ignition lead retainer

Bottom:
1 = Ignition coil
2 = Mounting screws
3 = Trigger unit retainer

Top:
Setting gauge 4118 890 6401

Bottom:
Setting gauge fitted between flywheel and ignition coil



The electronic (breakerless) ignition system on the FS 280 basically consists of the ignition coil, trigger unit and flywheel.

To remove the ignition coil, first remove the trigger unit - see 5.2.3.

Pull the protective sleeve off the short circuit wire.

Pull off the spark plug terminal.

Remove ignition lead retainer from crankcase and pull the ignition lead out of its guide.

Take out the mounting screws and lift away the ignition coil.

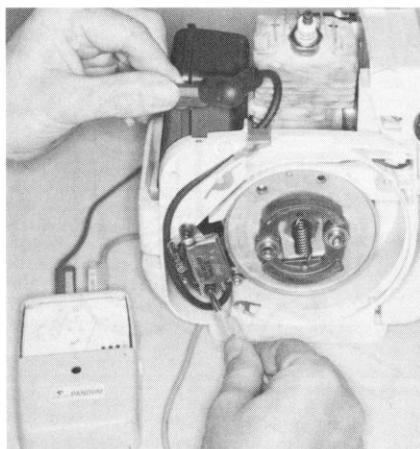
To install the ignition coil, place it in position and fit the mounting screws but do not tighten them down yet. Slide the setting gauge between the arms of the ignition coil and the flywheel magnets.

Press the coil against the setting gauge, tighten down the mounting screws securely and withdraw the setting gauge.

Refit the trigger unit - see 5.2.3.

5.2.5 Resistance Test on Primary Winding

Resistance test on primary winding



An ohmmeter can be used to check the resistance of the ignition coil's primary and secondary windings. However, accurate testing is only possible with an ignition coil tester.

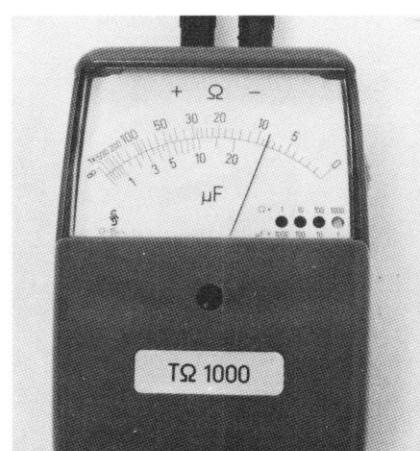
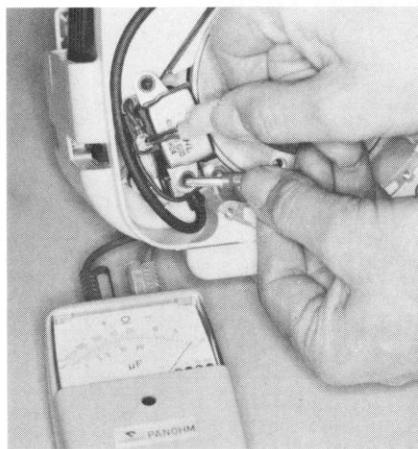
To test the primary winding, remove the clutch housing and drive shaft, see 3.1, and connect one of the two test leads to the primary terminal (if ignition coil is fitted) or the short circuit wire (if module is fitted) and the other to ground on the ignition coil/module. In measuring range " $\Omega \times 1$ " the ohmmeter must show a reading of 0.8 to 1.3 (Ω).

If this value is not obtained, fit a new ignition coil.

5.2.6 Resistance Test on Secondary Winding

Top:
Resistance test on secondary winding

Bottom:
Ohmmeter (reading $8\text{k}\Omega$)



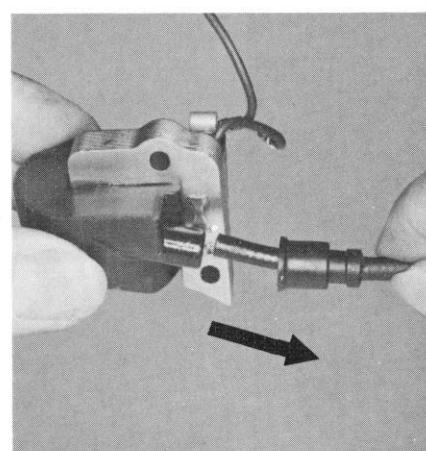
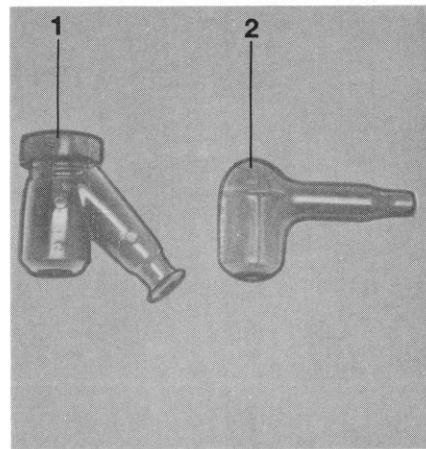
To test the secondary winding, connect one test lead to leg spring in the spark plug terminal and the other to ground on the ignition coil/module. In measuring range " $\Omega \times 1000$ " ($\text{k}\Omega$), the ohmmeter must show a reading of 7.2 to 11.0 ($\text{k}\Omega$).

If this value is not obtained, fit a new ignition coil.

5.2.7 Ignition Lead

Top:
1 Spark plug terminal 1113 405 1000 (45°)
2 Spark plug terminal 1106 405 1000 (90°)

Bottom:
Pulling unscrewed ignition lead out of ignition module



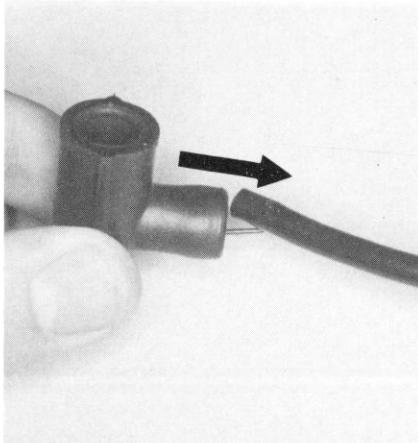
Note: If a new cylinder (with long cooling fins) has been installed, the original 45° spark plug terminal must be exchanged for a 90° terminal and the 265 mm (10 7/16") ignition lead replaced by a 290 mm (11 7/16") ignition lead.

Remove the ignition module or coil - see 5.2.2 or 5.2.4.

Unscrew lead from the contact pin and pull it out of the ignition module.

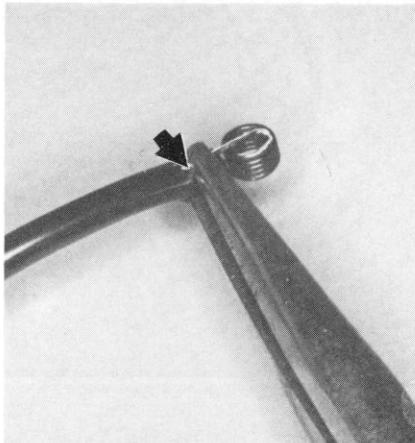
Top:
Pulling ignition lead out of spark plug terminal

Bottom:
Grommet on igniton lead



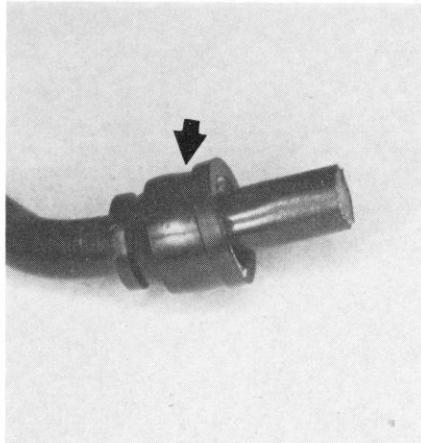
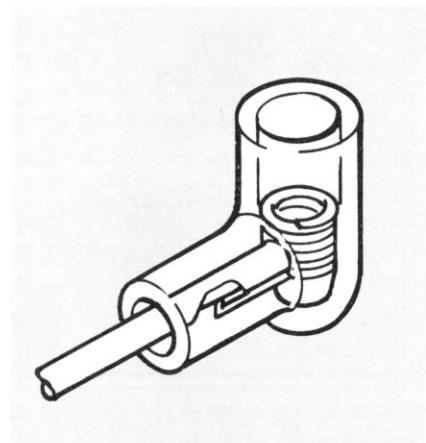
Top:
Attaching the leg spring

Bottom:
Threading ignition lead with leg spring through the spark plug terminal



Top:
Leg spring correctly seated in spark plug terminal

Bottom:
Grommet fitted over ignition module's high voltage terminal

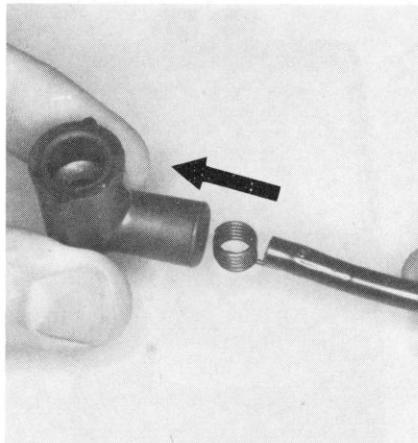


Pull the ignition lead with leg spring out through the terminal.

Detach the leg spring from the ignition lead.

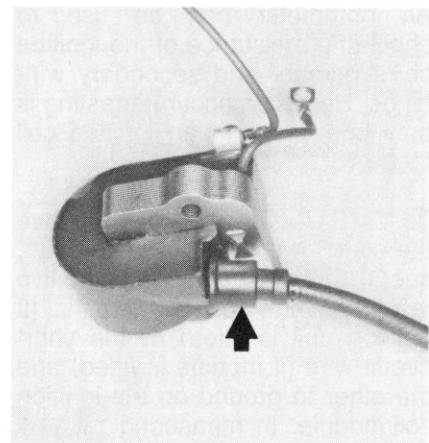
Pull the grommet off the ignition lead.

Pinch the hook of the leg spring into the center of the new lead's cross section, about 7 mm (5/16") from the end of the lead.



Coat the leg spring and end of the new ignition lead (approx. 265 mm or 290 mm/10 7/16" or 11 7/16" long) with oil.

Push the ignition lead through the terminal so that the open side of the leg spring points toward the opening in the spark plug terminal.



Use a pointed tool to pierce the center of the other end of the ignition lead.

Slip the grommet over the ignition lead and then screw the lead into the ignition module.

Push the grommet over the ignition module's high voltage terminal.

Install the ignition module or coil - see 5.2.2 or 5.2.4.

5.2.8 Flywheel

Top:
Flywheel (FS 280)

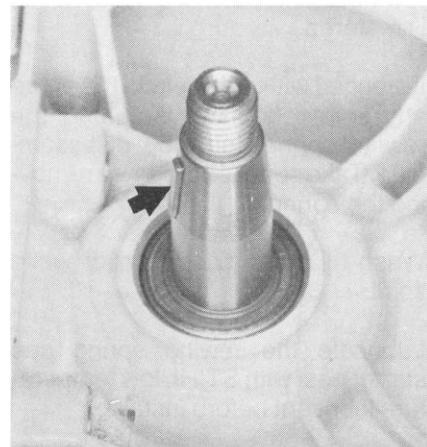
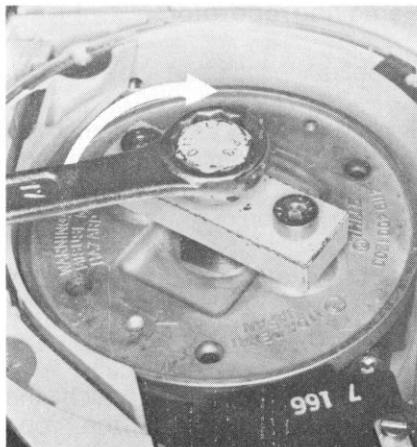
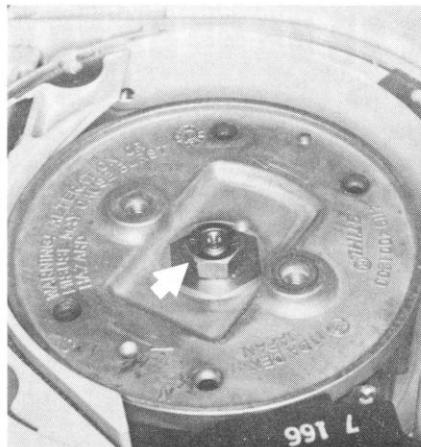
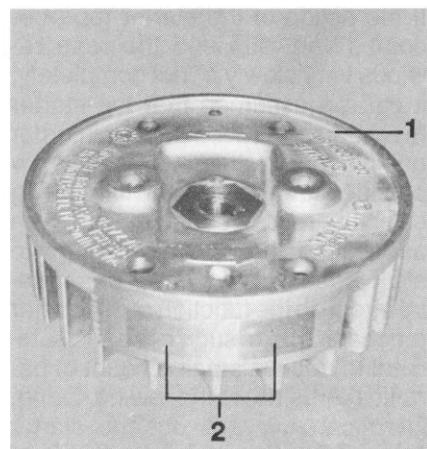
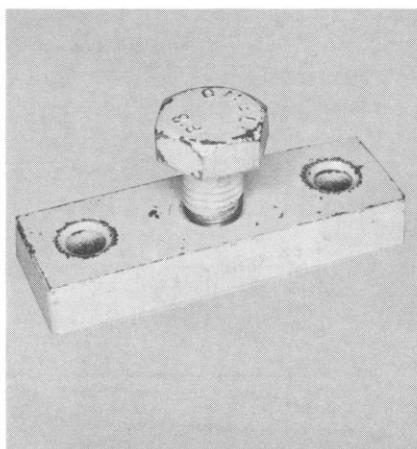
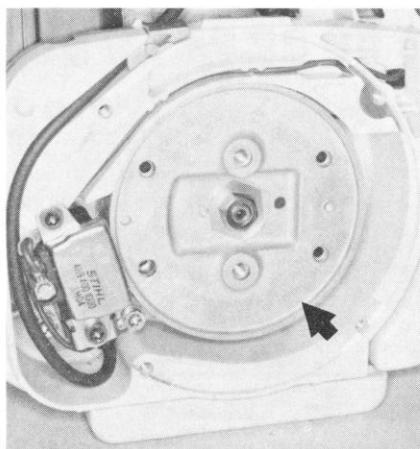
Bottom:
Flywheel mounting nut

Top:
Puller 4119 890 4590

Bottom:
Removing the flywheel

Top:
1 = Flywheel
2 = Magnet poles

Bottom:
Key for flywheel



To remove the flywheel:

Disassemble the clutch - see 3.1.

Rotate the flywheel so that the magnet poles are opposite the ignition module.

Unscrew flywheel mounting nut from the crankshaft.

Use spline screws from clutch shoes to attach puller to flywheel. Pull flywheel off the crankshaft.

Inspect the flywheel and magnets for any signs of cracks or other damage. Fit a new flywheel if you find any damage.

To install the flywheel:

Important: Clean the stub of the crankshaft and flywheel hub bore with a suitable standard commercial, solvent-based degreasant. Check that the Woodruff key is correctly positioned. Fit the flywheel in position and tighten down mounting nut to a torque of 24 Nm (18 lbf.ft).

Reassemble the clutch - see 3.2.

6. REWINDSTARTER

6.1 Routine Maintenance

6.2 Rope Rotor

If the action of the starter rope becomes very stiff and the rope re-winds very slowly or not completely, it can be assumed that the starter mechanism is mechanically in order but plugged with dirt. At very low outside temperatures the lubricating oil on the rewind spring may thicken and cause the spring windings to stick together. This has a detrimental effect on the function of the starter mechanism. In such case it is sufficient to apply a small amount of paraffin (kerosine) to the rewind spring. Then carefully pull out the starter rope several times and allow it to rewind until its normal smooth action is restored.

If clogged with dirt or pitch, the entire starter mechanism, including the rewind spring, must be disassembled. Take special care when removing the spring.

Wash all parts in paraffin or white spirit.

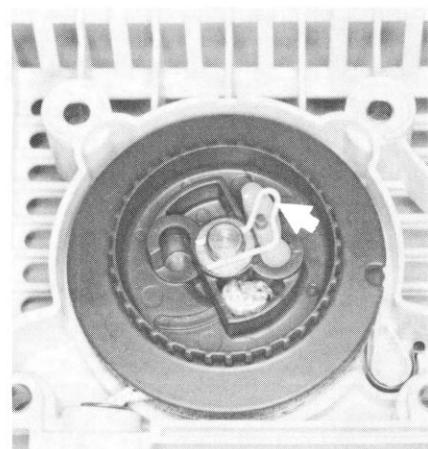
Lubricate the rewind spring and starter post with STIHL low temperature lubricant before installing.

Starter cover mounting screws



Top:
Spring clip

Bottom:
Pulling rope rotor off starter post



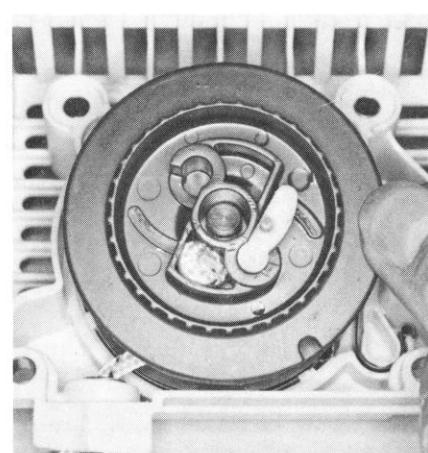
Removing rope rotor:

Troubleshooting chart - see 2.4.

The starter cover has to be removed for access to the starter mechanism.

Relieve tension of rewind spring:

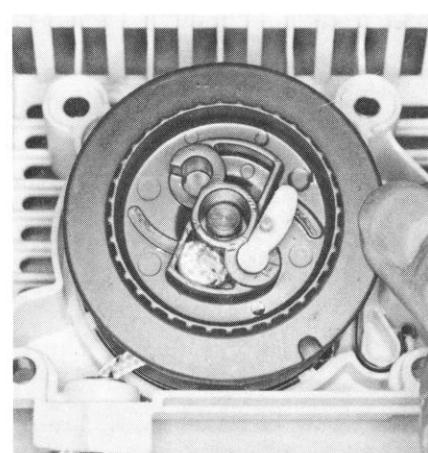
Pull out starter rope to a length of approx. 30 cm (1 ft) and hold the rope rotor steady.



Use a screwdriver to catch the starter rope between the rope guide bush and the rope rotor.

While still holding the rope rotor steady, take three turns off the rope rotor.

Pull out the rope with the starter grip and then let go of the rope rotor.



Use a screwdriver or suitable pliers to carefully remove the spring clip from the starter post.

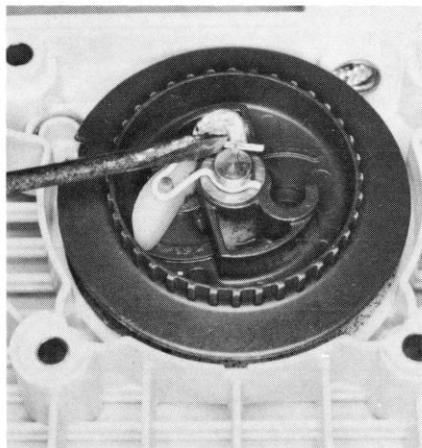
Take the washer, rope rotor and pawl off the starter post.

Replace the broken or worn starter rope.

Note: The rope rotor will spin back and thus relieve the tension on the rewind spring. The rewind spring will not be under tension if the starter rope is broken.

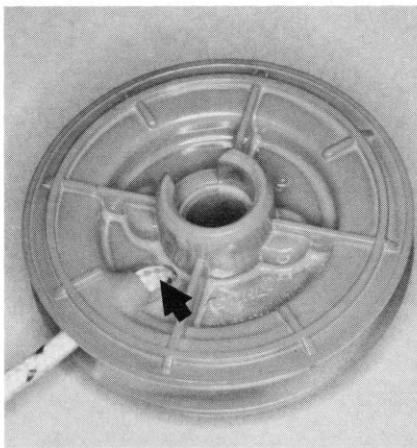
6.3 Replacing Starter Rope

Fitting spring clip on starter post



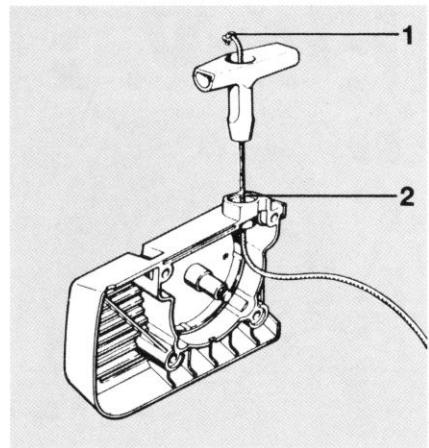
Top:
Correct position of starter rope in rope rotor

Bottom:
Starter rope secured in rope rotor with knot



Top:
1 = Special knots
2 = Rope guide bush

Bottom:
Special knots used



Installing the rope rotor

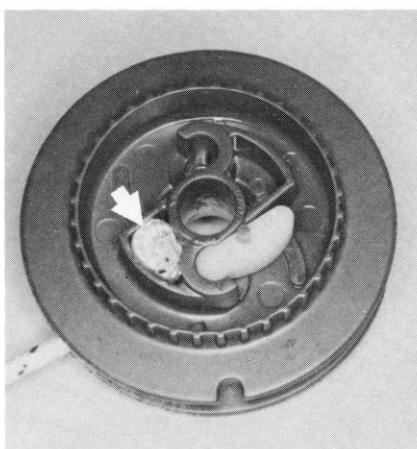
Coat bore in rope rotor with STIHL low temperature lubricant. Fit the rotor on the starter post so that the inner spring loop slides into the lug on the rotor. Fit starter rope in notch on periphery of rotor at the same time.

Note: Check that spring loop has engaged by turning the rope rotor counterclockwise and letting it go - it must spring back.

Slip the washer onto the starter post and install the spring clip in the starter post groove.

Note: Make sure the spring clip engages on the pawl's guide peg and points it in the counterclockwise direction. The spring clip must be treated very carefully. If it is bent during disassembly or assembly, the rewind starter might malfunction.

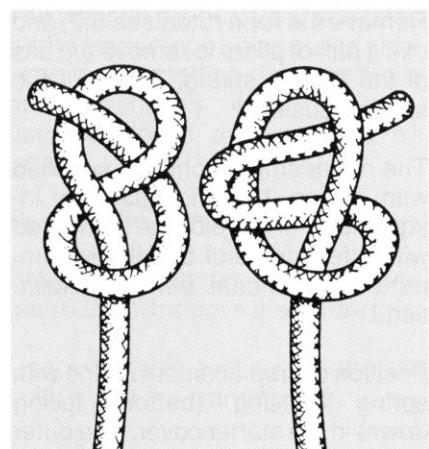
Tension the rewind spring - see 6.5.



Remove the rope rotor – see 6.2.

Remove the remaining rope from the rope rotor. Thread one end of a new 3.5 mm (9/64") dia. and 960 mm (37 3/4") long rope through the side of the rope rotor and then, from the underside, into the inner hole and pull it up to the top side. Secure rope with a simple overhand knot.

Pull the rope back so that the knot locates in the recess in the rope rotor.

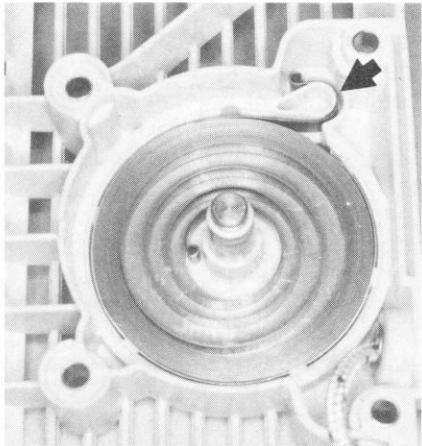


Thread the other end of the rope through the guide bush from inside the starter cover and through the starter grip. Secure with one of the special knots shown.

Install the rope rotor – see 6.2.

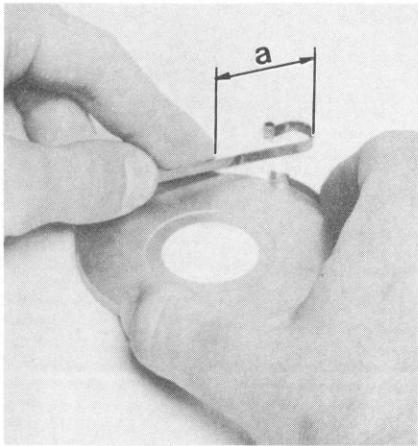
6.4 Replacing Rewind Spring

Rewind spring fitted in position



Top:
Position of outer spring loop
 $a = 20 \text{ mm (3/4")}$

Bottom:
Fitting rewind spring in spring housing with
aid of wooden assembly
block 1108 893 4800

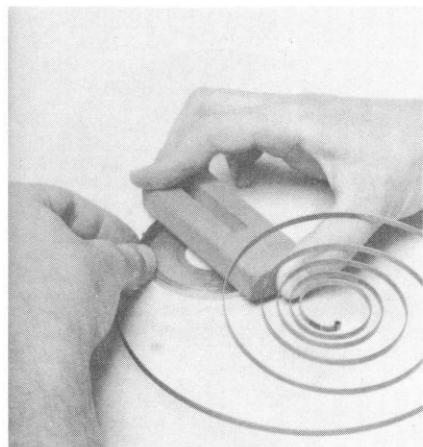


Remove the rope rotor, see 6.2, and use a pair of pliers to remove the bits of the broken spring. Take out the spring housing.

The replacement spring is supplied with spring housing ready for installation. It should be lubricated with a few drops of STIHL low temperature lubricant before installation.

Position the replacement spring with spring housing (bottom facing down) in the starter cover. The outer spring loop must be engaged on the anchor lug in the starter cover.

Important: If the rewind spring pops out and uncoils during installation, it must be refitted in the spring housing as follows:



Position the outer spring loop about 20 mm (3/4") from the edge of the spring housing.

Refit the rewind spring in the spring housing in the counterclockwise direction, starting from the outside and working inwards.

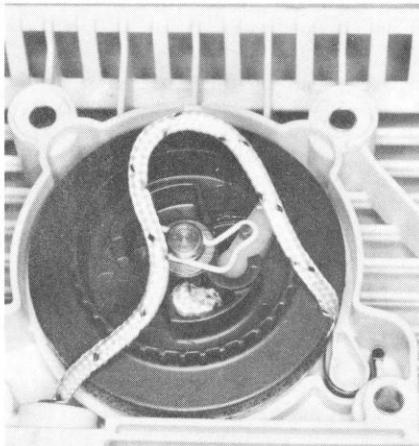
Note: The wooden assembly block can be placed over the spring housing to simplify refitting.

Install the rope rotor - see 6.2.

6.5 Tensioning the Rewind Spring

Top:
Loop for tensioning rewind spring

Bottom:
Tensioning the rewind spring



Pull the starter rope out to full length. Make a loop in the rope between the rope rotor and the starter cover. Grip the rope close to the rotor and use it to turn the rope rotor seven times counterclockwise. Hold the rope rotor steady, straighten out the twisted rope and pull it out through the hole in the starter cover.

Release rope very slowly so that it can wind itself onto the rope rotor.

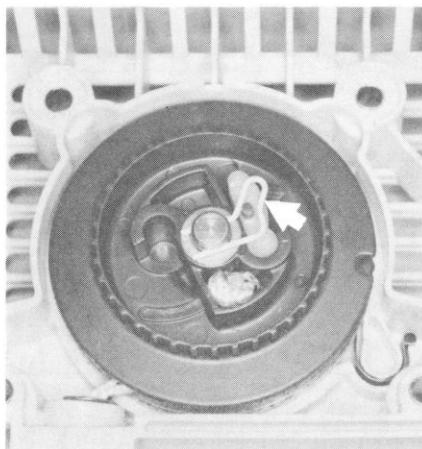
6.6 Replacing Pawl

6.7 Replacing Starter Rope Guide Bush

Starter grip on starter cover

Top:
Spring clipBottom:
Pawl

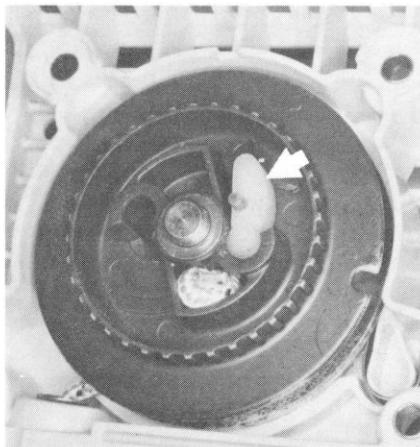
Starter rope guide bush



Note: The rewind spring is correctly tensioned when the starter grip sits firmly on the starter cover without drooping to one side. When the starter 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 the case, hold the rope rotor firmly and take off one turn of the rope.

Do not overtension the rewind spring as this will cause it to break.

Refit the starter cover.



Carefully remove the spring clip from the starter post.

Note: Do not pull the rope rotor off the starter post.

Pull the pawl out of the rope rotor and install the new one.

Note: Make sure the spring clip engages on the pawl's guide peg and points it in the counterclockwise direction.

The wear on the bush is accelerated by the starter rope being pulled sideways during starting. The wall of the bush eventually wears through, becomes loose and must be replaced.

Remove the starter cover.

Relieve tension on rewind spring (see 6.2) and remove the starter grip.

Use a suitable tool to pry the old bush out of the starter cover.

To install the new rope bush:

Place new bush in its seat in the starter cover.

Insert the threaded end of installing tool through the bush from inside the cover.

Fit the thrust sleeve, tapered end first, and the hexagon nut.

6.8 Replacing Starter Cup

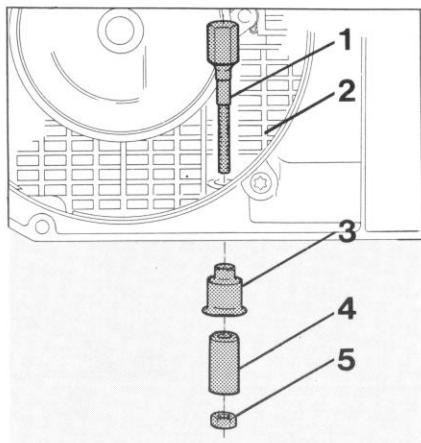
Top:

Fitting new rope bush with installing tool
0000 890 2201 (schematic)

- 1 = Threaded end
- 2 = Starter cover
- 3 = Rope guide bush
- 4 = Thrust sleeve
- 5 = Hexagon nut

Bottom:

Flaring the new rope bush

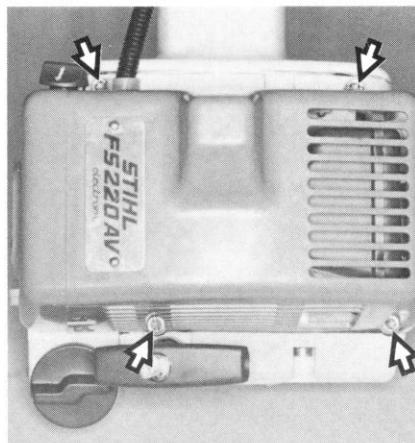


Top:

Shroud mounting screws

Bottom:

Starter cup locknut

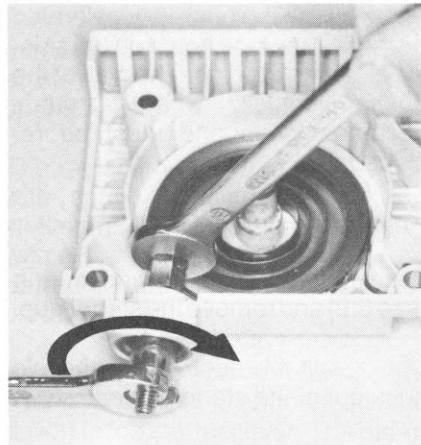
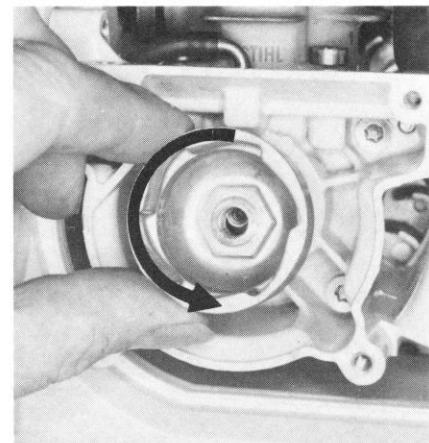


Top:

Unscrewing starter cup

Bottom:

Tightening the starter cup



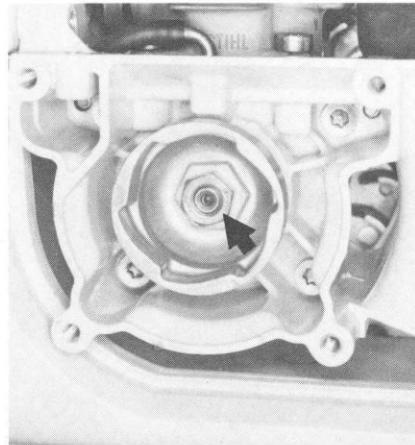
Tighten down the hexagon nut until the bush is firmly seated.

Note: The installing tool flares the lower end of the rope bush.

Refit the starter rope and the starter grip.

Tension the rewind spring - 6.5.

Fit the starter cover.

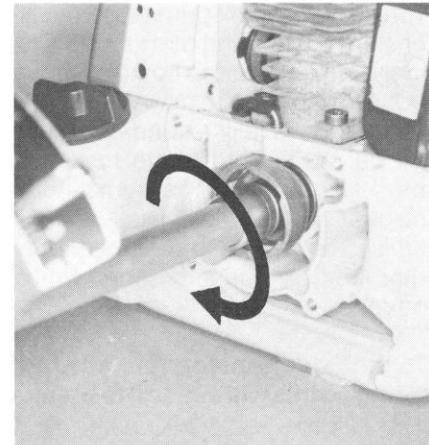


Remove the mounting screws and lift away the shroud.

Unscrew the spark plug. Fit the locking screw in the cylinder and tighten it down by hand.

Remove the starter cover.

Unscrew the locknut from the starter cup.



Unscrew the starter cup from the crankshaft journal.

Fit the new starter cup and tighten it to a torque of 10 Nm (7.5 lbf.ft).

Fit the locknut and tighten it to a torque of 24 Nm (18 lbf.ft).

Reassemble the starter cover. Remove the locking screw, refit the spark plug.

Install the shroud.

7. THROTTLE CONTROL

7.1 Replacing Throttle Cable with Stop Switch Wire

Top:
1 = Throttle cable
2 = Slotted pin

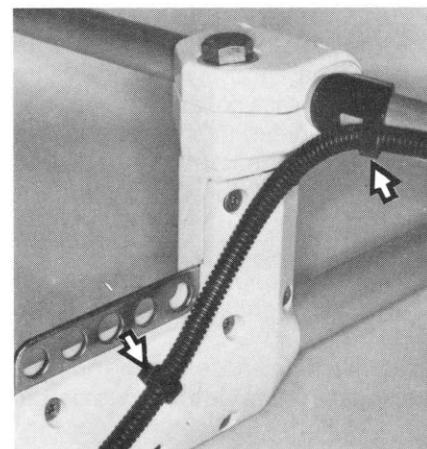
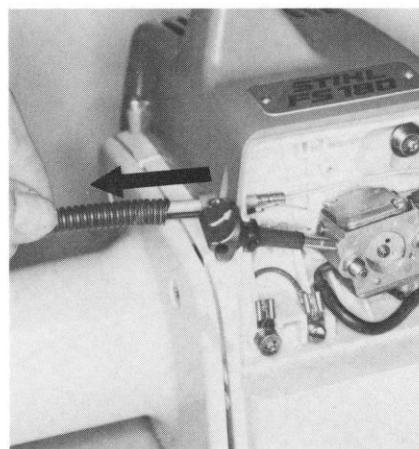
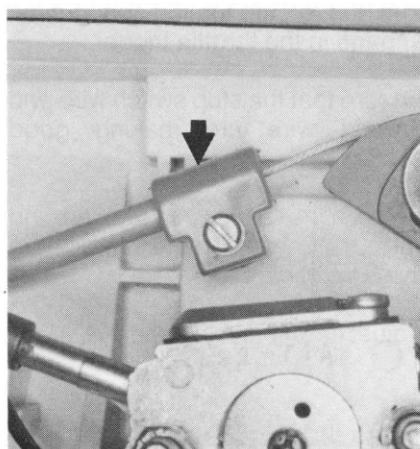
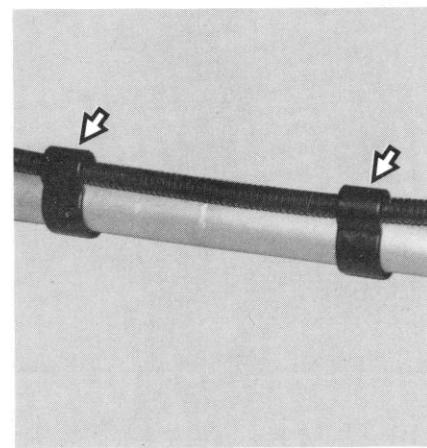
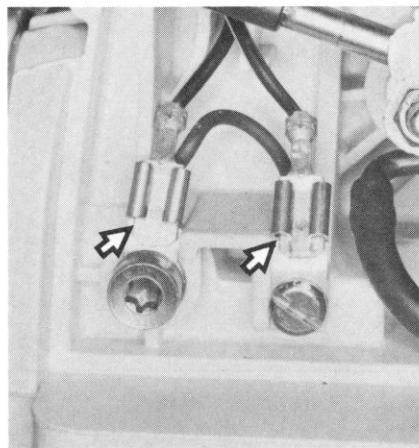
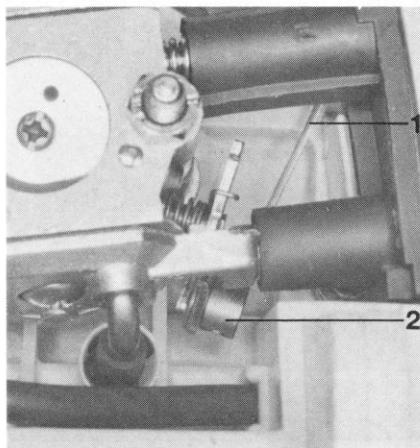
Bottom:
Throttle cable clamp

Top:
Short circuit wire spade terminals

Bottom:
Withdrawing throttle cable from tank housing

Top:
Throttle cable retainer on drive shaft

Bottom:
Throttle cable retainers on handlebar and clamp



Remove the air filter - see 8.6.

Disconnect throttle cable nipple from slotted pin on throttle lever.

Unscrew and remove clamp from throttle cable.

Pull spade terminals of short circuit wire out of sockets.

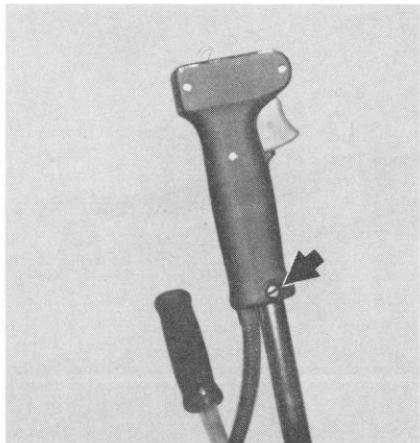
Pull throttle cable with short circuit wire out of tank housing.

Withdraw throttle cable from retainers on the drive shaft.

Note: On FS 220/280: Withdraw throttle cable from retainers on the handlebar and clamp.

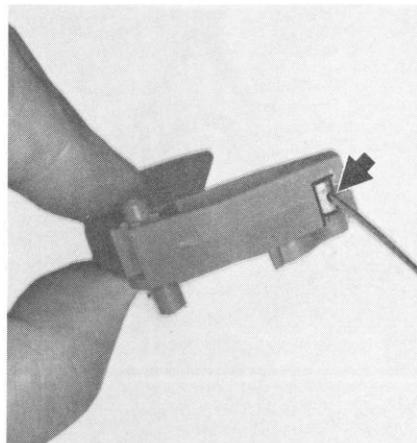
Top:
Control handle mounting screw

Bottom:
Handle molding fastening screws

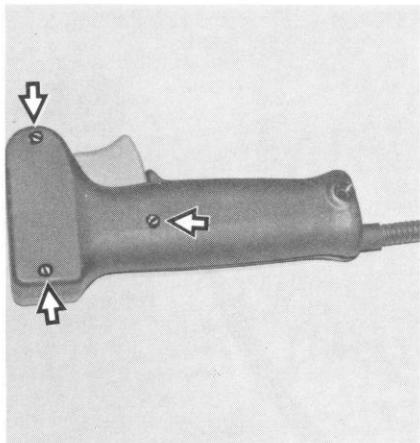
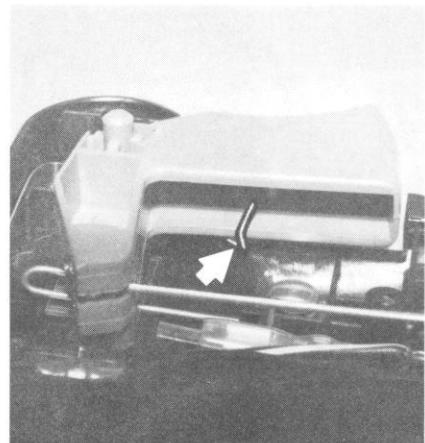


Top:
Disconnecting throttle cable from throttle trigger

Bottom:
Connecting wires to contact springs



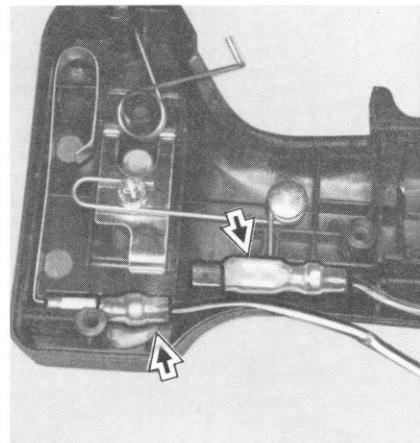
Throttle cable torsion spring



Unscrew the control handle's mounting screw and pull the handle off the handlebar.

Take the fastening screws and open up the two halves of the control handle.

Remove the throttle cable, stop switch wire, ground wire and throttle trigger from the handle molding.



Detach the throttle cable nipple from the trigger.

Pull the stop switch wire and ground wire off the connector tags on the contact springs.

Installation is a reversal of the removal sequence.

Pay special attention to the following points:

The leg of the torsion spring must engage in the throttle trigger.

Ensure that the stop switch wire and ground wire are making good contact.

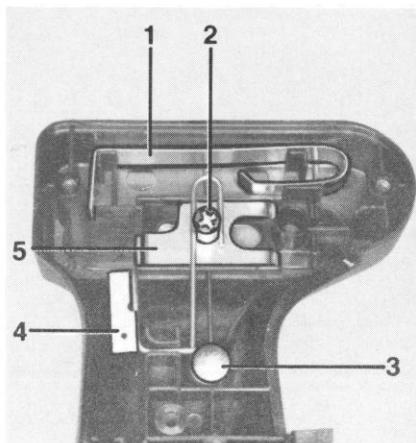
Position the stop switch wire, ground wire and throttle cable correctly in the control handle.

Adjust throttle cable - see 7.3.

7.2 Contact Springs in Control Handle

Top:
 1 = Contact spring
 2 = Collar screw
 3 = Rivet
 4 = Contact spring
 5 = Detent spring

Bottom:
 Slide control

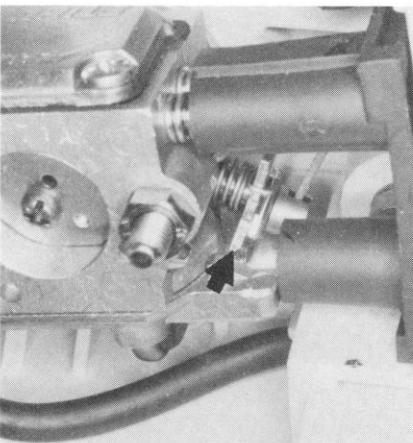
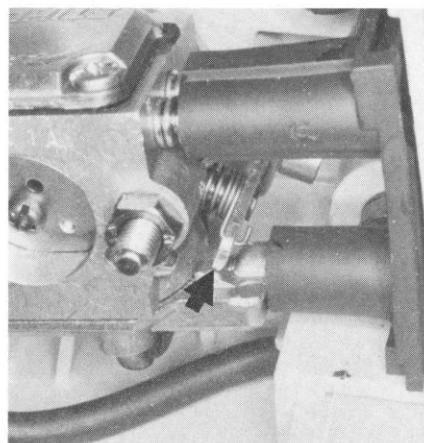
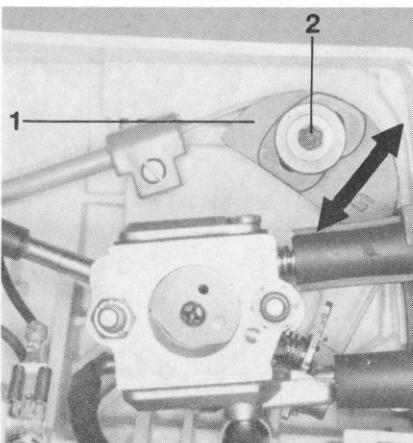


7.3 Adjusting Throttle Cable

Top:
 1 = Tensioner
 2 = Mounting screw

Bottom:
 Throttle lever butts against idle speed adjusting screw (idle)

Throttle lever butts against carburetor body (full throttle)



Remove throttle cable - see 7.1.

Pull out the contact spring.

Remove collar screw from slide control, lift out the slide control and detent spring. Withdraw the rivet and take out the contact spring.

Note: The contact spring must engage the annular groove in the collar screw.

Move the tensioner to adjust length of throttle cable so that the carburetor's throttle lever butts against the idle speed adjusting screw when the throttle trigger is in the idle position and against the carburetor body when the throttle trigger is in the full throttle position.

Important: Note adjustment range of idle speed adjusting screw.

Tighten down the tensioner's mounting screw securely after completing the adjustment. Then refit the air filter.

Remove the air filter - see 8.6.

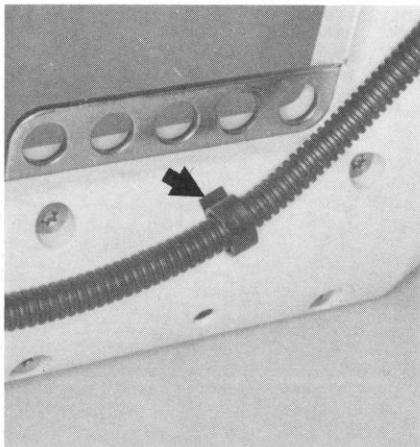
Adjustment of the throttle cable is carried out by moving the tensioner.

Slacken the mounting screw so that the tensioner can just be moved.

7.4 Replacing Molded Support on Drive Shaft (FS 220, FS 280)

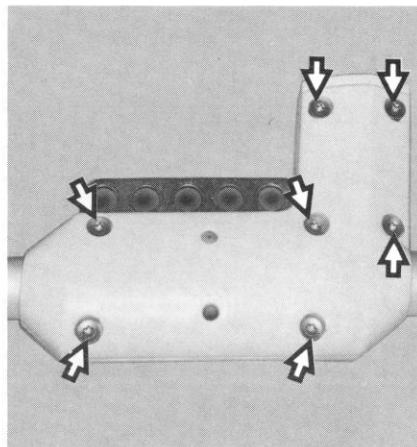
Top:
Throttle cable retainer

Bottom:
1 = Mounting screw
2 = Clamp

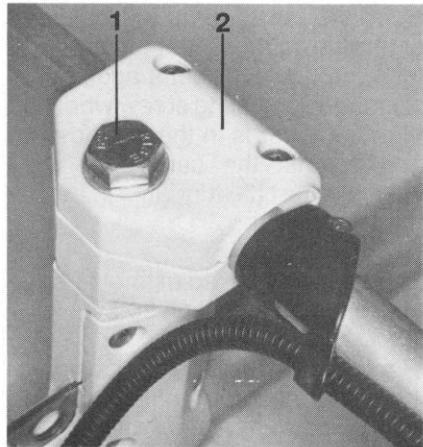
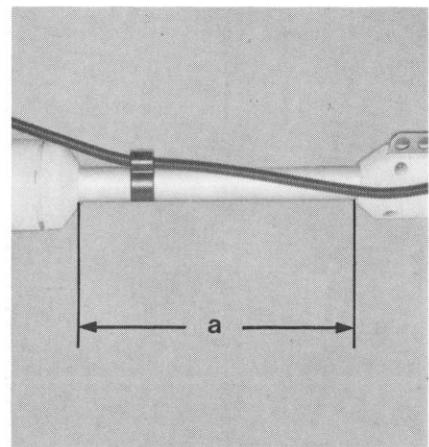


Top:
Fastening screws on molded support

Bottom:
Harness attachment strip

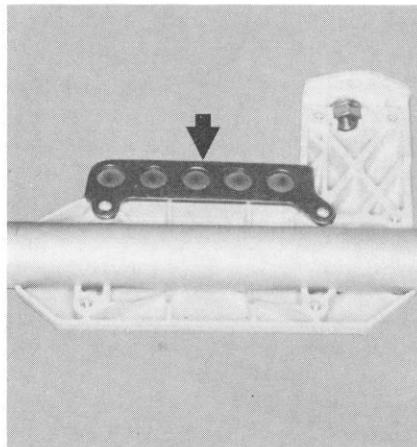


Correct position of molded support relative to clutch housing
($a = 24 \text{ cm} / 9 \frac{1}{2} \text{"}$)



Pull the throttle cable retainer out of the molded support.

Remove the mounting screw from the handlebar clamp. Take off the clamp with the handlebar and put it to one side.



Remove the fastening screws from the molded support and take the two halves of the support off the drive shaft.

Installation is a reversal of the disassembly sequence.

Before finally tightening the fastening screws, position the molded support so that the distance "a" to the clutch housing is 24 cm (9 1/2").

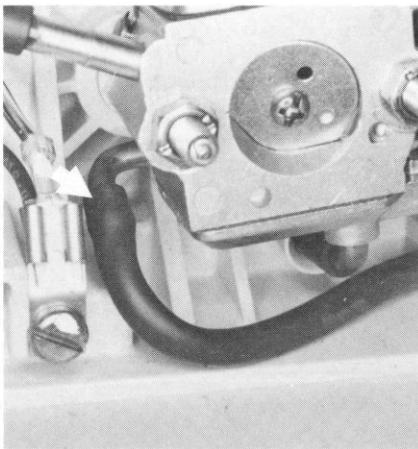
Note:
Secure the harness attachment strip between the two halves of the support with two screws.

8. FUELSYSTEM

8.1 Leakage Testing the Carburetor

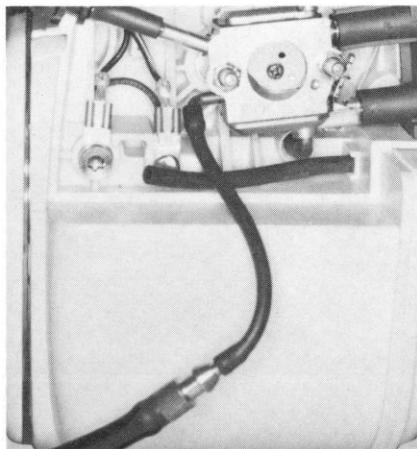
Top:
Fuel hose on elbow connector

Bottom:
Nipple 0000 855 9200 with fuel line 1110 141 8600

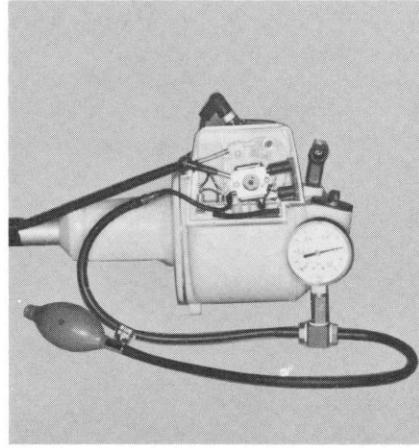
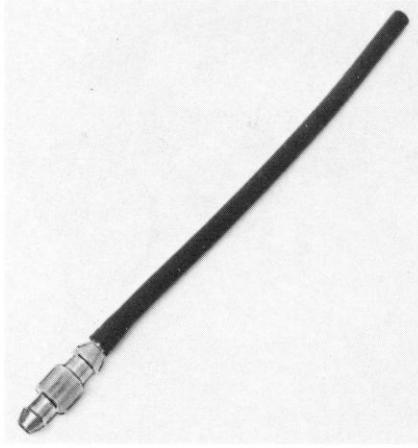
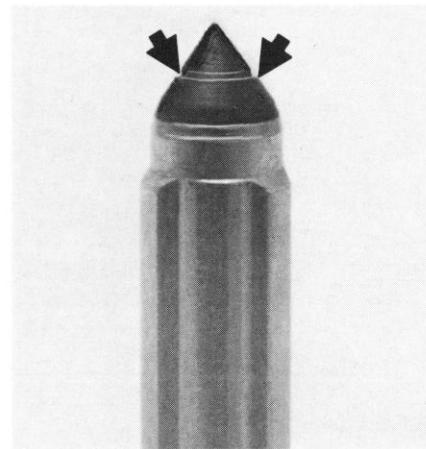


Top:
Tester's fuel line fitted on elbow connector

Bottom:
Pressure testing carburetor with carburetor/crankcase tester 1106 850 2905



Damaged inlet needle



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

Troubleshooting chart - see 2.5.

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

Remove the air filter - see 8.6.

Pull the fuel line off the carburetor's connector and connect up the tester's pressure hose - a separate nipple and a length of fuel hose are required as an adapter to make this connection.

Close the vent screw on the rubber bulb and pump air into the carburetor until the pressure gauge shows a reading of approx. 0.8 bar (12 psi). If this pressure remains constant, the carburetor is airtight. However, if it drops, there are two possible causes:

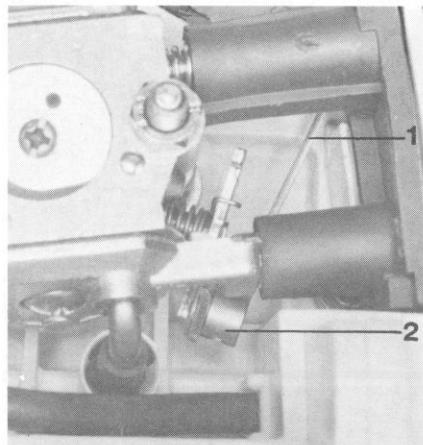
1. The inlet needle valve is not sealing (foreign matter in valve seat or sealing cone of inlet needle damaged or inlet control lever sticking).
2. The metering diaphragm is damaged.

In either of these cases the carburetor must be removed and serviced.

8.2 Disassembling the Carburetor

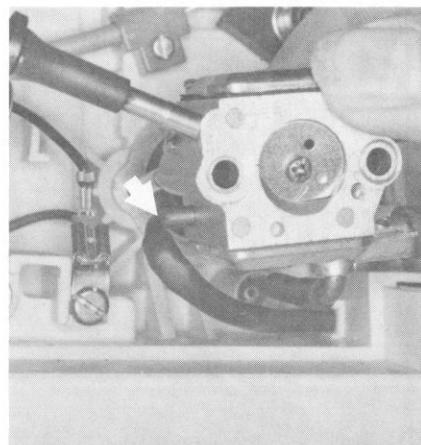
Top:
1 = Throttle cable
2 = Slotted pin

Bottom:
Carburetor mounting nuts



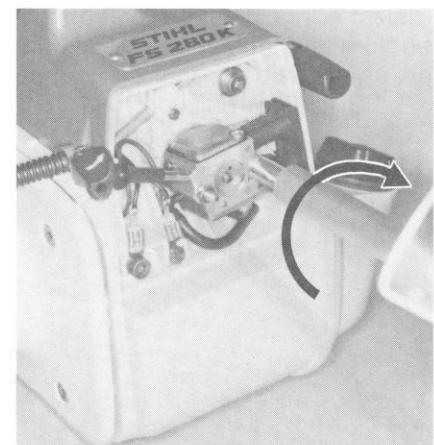
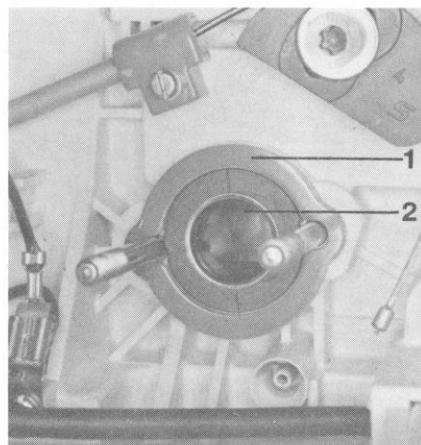
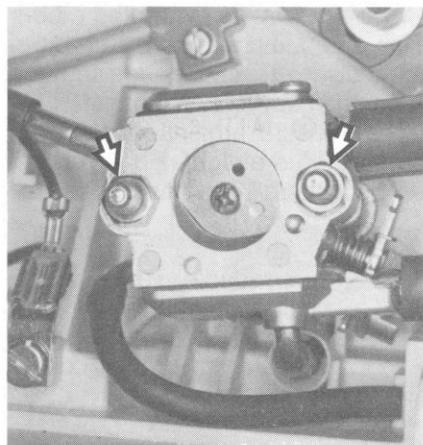
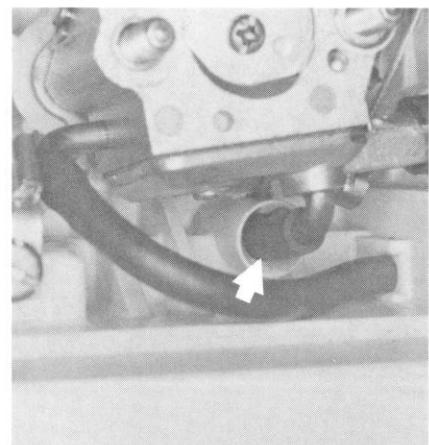
Top:
Remove carburetor and pull fuel hose off connector

Bottom:
1 = Washer
2 = Sleeve



Top:
Correct position of impulse hose

Bottom:
Tightening carburetor nuts



Remove the air filter - see 8.6.

Disconnect throttle cable nipple from slotted pin on carburetor's throttle lever.

Unscrew the carburetor mounting nuts.

Pull the carburetor off the mounting studs.

Pull fuel hose off the connector.

Installation is a reversal of the removal sequence.

Note:

Before installing carburetor on studs, check that sleeve (in manifold) and washer are in position.

Install the carburetor, making sure the impulse hose engages properly on connector.

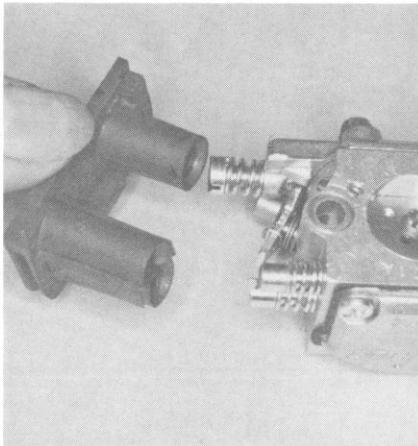
Tighten mounting nuts to a torque of 4 Nm (3 lbf.ft).

Carry out leakage test after installing the carburetor.

8.3 Servicing the Carburetor

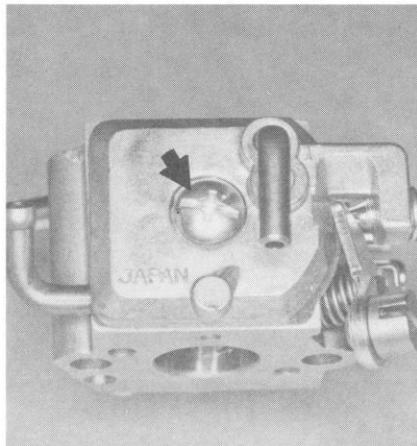
Top:
Pulling grommet off the adjusting screws

Bottom:
Impulse hose on elbow connector



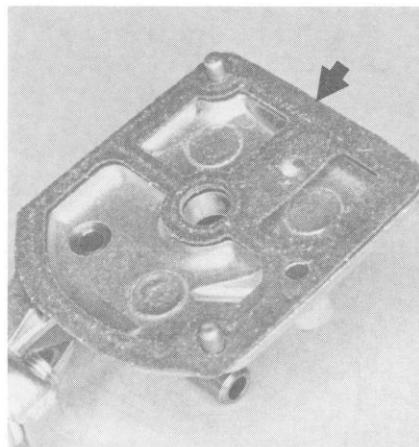
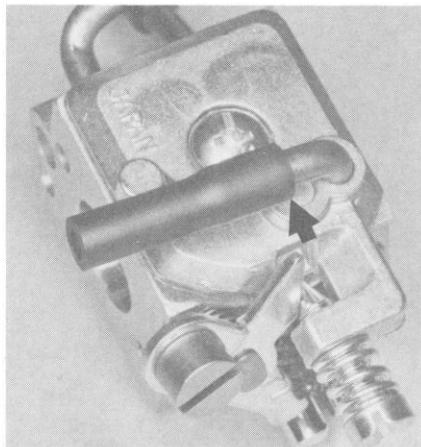
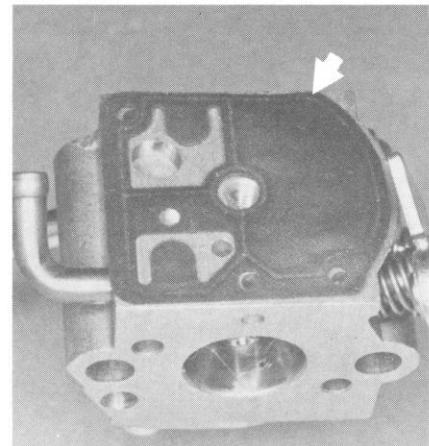
Top:
End cover fastening screw at pump side

Bottom:
End cover with gasket at pump side



Top:
Pump diaphragm on carburetor body

Bottom:
Fuel strainer in carburetor body



Remove the carburetor - see 8.2.

Pull the grommet off the carburetor adjusting screws.

Pull the impulse hose off the elbow connector.

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

Unscrew the end cover at the pump side and remove the gasket and pump diaphragm. The diaphragm and gasket often stick to the cover or the carburetor body. 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, use a screwdriver to pry it out and then clean it.

Important: If the fuel strainer is damaged, always fit a new one.

In such a case the fuel pickup head should also be inspected and replaced if necessary - see 8.7.

Top:
Fastening screws on metering diaphragm end cover

Bottom:
Separating gasket and diaphragm

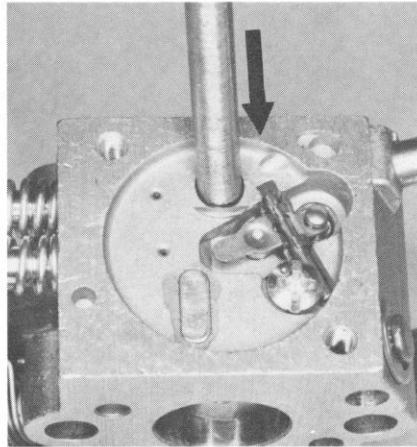
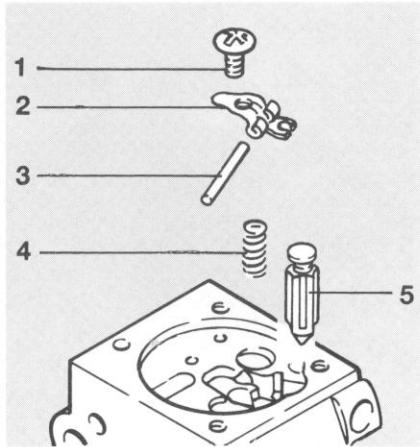
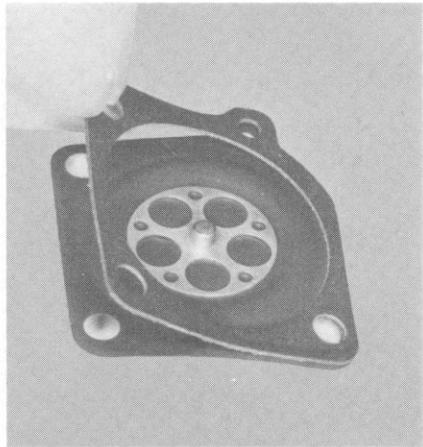
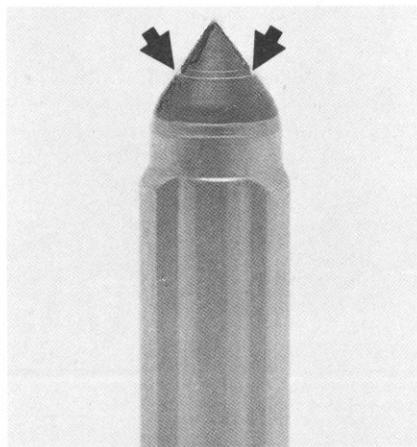
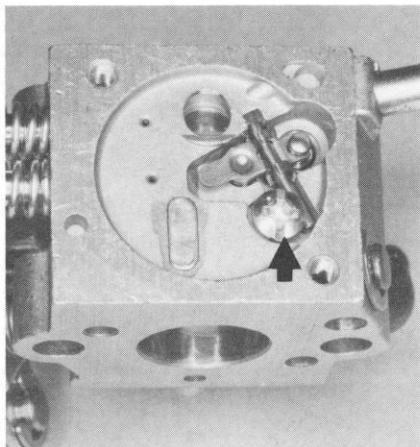
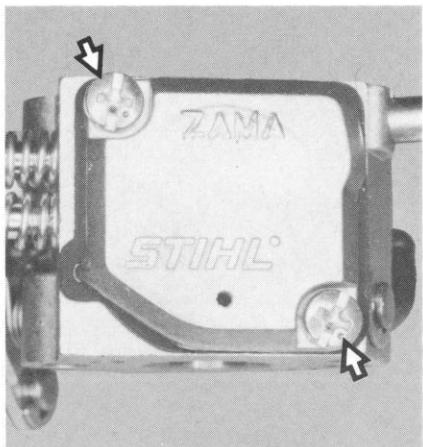
Top:
Retaining screw on inlet control lever spindle

Bottom:

- 1 = Screw
- 2 = Inlet control lever
- 3 = Spindle
- 4 = Helical spring
- 5 = Inlet needle

Top:
Damaged inlet needle

Bottom:
Pressing out valve jet



To disassemble the carburetor, unscrew the metering diaphragm end cover and take out the metering diaphragm and gasket. This diaphragm and the gasket may also be stuck together and must be separated with great care.

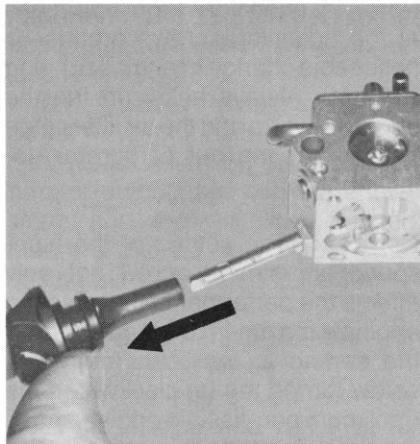
The diaphragms are the most delicate parts of the carburetor. They are subjected to continuous alternating stresses and the material eventually shows signs of fatigue, i.e. the diaphragms distort and swell and have to be replaced.

The inlet needle valve is located in a recess in the metering diaphragm chamber. Take out the round-head screw and remove the inlet control lever with spindle, helical spring and inlet needle. If there is an annular indentation on the sealing cone of the inlet needle, it will be necessary to replace the inlet needle because it will no longer seal properly. This is indicated by constant flooding of the carburetor even though the needle is clean.

If the small plastic plate in the valve jet (main jet) no longer moves freely, use a suitable tool (approx. 4,5 mm/3/16" dia.) to press out the jet in the direction of the venturi.

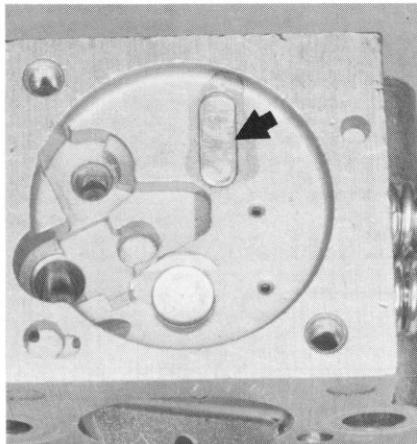
Top:
Pull knob off choke shaft

Bottom:
Carburetor adjusting screws

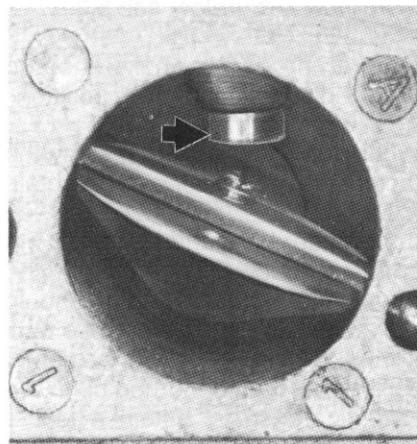
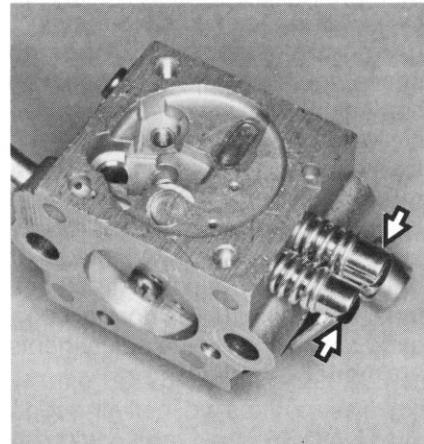
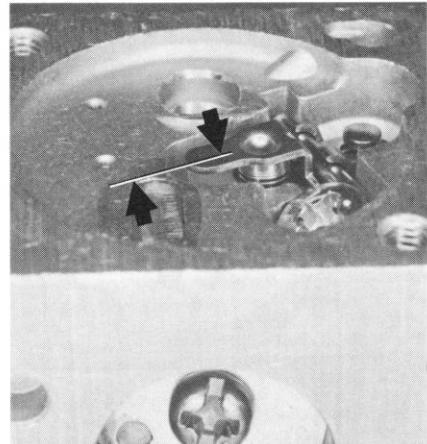


Top:
Sealing plug

Bottom:
Valve jet in position - lower edge of valve jet flush with venturi wall



Correct position of inlet control lever



Pull the knob off the choke shaft.

Wash the carburetor body and all serviceable parts in fresh white spirit and blow clear with compressed air, paying special attention to the bores and ports.

Both adjusting screws and the sealing plug in the metering chamber must be removed for this purpose.

Caution: The sealing plug is destroyed during removal. It should, therefore, only be removed if a replacement is available.

When inserting the valve jet make sure that it is exactly vertical in the bore. The lower edge of the valve jet must be flush with the venturi wall.

Fit the inlet needle and the helical spring in their respective bores. Insert spindle in inlet control lever, engage clevis in annular groove on the head of the inlet needle and tighten down the round head screw. Make sure that the helical spring locates on the control lever's nipple.

Important: The top edge of the inlet control lever must be exactly level with the metering diaphragm's mounting face. If necessary, use a suitable pair of pliers to carefully bend the inlet control lever into position.

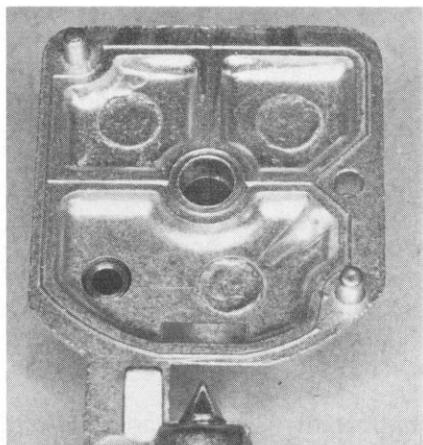
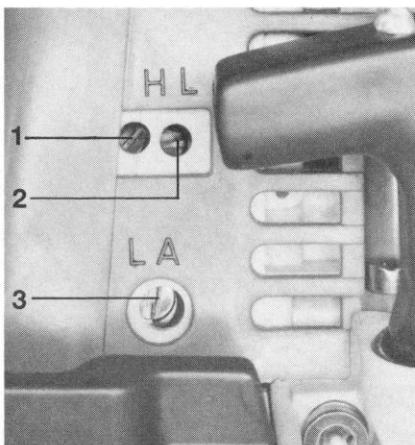
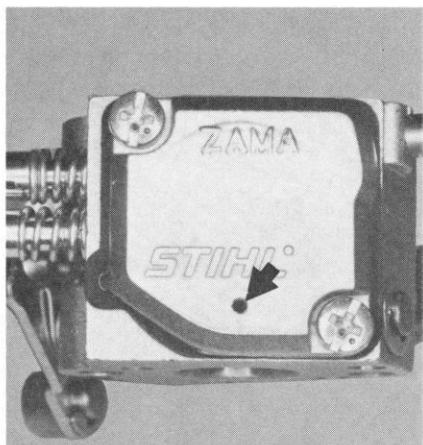
Check easy action of inlet control lever.

8.4 Carburetor Adjustment (FS 160, FS 180, FS 220)

Top:
Hole in end cover

Bottom:
Locating pegs on end cover at pump side

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



Fit the gasket, metering diaphragm and end cover and tighten down securely. The hole in the end cover must be at the throttle valve side.

Insert the fuel strainer at the pump side. Fit the gasket, pump diaphragm and end cover and tighten down securely. The pump diaphragm and gasket are held in position by the integrally cast pegs on the end cover.

Install the carburetor - see 8.2.

Note: Push on the choke knob so that it engages securely in position.

When the engine is tested at the factory the carburetor is set to obtain a slightly richer mixture to provide the cylinder bore and bearings with additional lubricant during the break-in period. This setting should be left as it is for the first three tank fillings. The high speed adjusting screw may then be turned up to 1/4 turn clockwise to obtain a leaner mixture. Caution: The engine's maximum allowable speed must not be exceeded.

If the unit is used at high altitudes (mountains) or near sea level, it may be necessary to alter the carburetor setting slightly. This correction is made at the two adjusting screws (H and L) as follows: Turn clockwise for a leaner mixture (at high altitudes) or counterclockwise for a richer mixture (at sea level).

Note that even very slight variations at the adjusting screws produce a noticeable change in engine running behavior. Always make sure that the engine is warm and the air filter clean before carrying out carburetor adjustments.

Caution: The setting of the high-speed adjustment screw not only affects the performance but also the engine's maximum off-load speed. If the setting is too lean (adjusting screw turned too far clockwise), the maximum permissible engine speed will be exceeded. This can result in damage to the engine being caused by lack of lubricant and overheating. Corrections to the setting of the high speed adjusting screw may only be carried out if the maximum permissible speed of 12,500 rpm (with cutting tool) can be checked with an accurate tachometer. Furthermore, a cutting tool with a low drag coefficient (e.g. grass cutting blade or brush knife 300) must be fitted and the machine held in its normal operating position while the adjustments are made.

Important: The following additional points must be observed when adjusting the FS 280:

In order to achieve maximum engine power and the highest degree of operational reliability, carry out carburetor adjustment with the engine warm and the air filter cleaned. Mount a circular saw blade, grass cutting blade or brush knife 300.

On the FS 280 and FS 280 K with electronic speed limiter:

First set the idle speed correctly. Start the engine and run it at full throttle (maximum speed) and turn the high speed adjusting screw (H) clockwise (leaner) at the same time until engine speed drops. From this position, rotate the high speed adjusting screw one half turn clockwise (richer). Then check that engine accelerates smoothly when the throttle is opened. If necessary, rotate the high speed adjusting screw a little further in the counter-clockwise direction (approx. 1/8 turn).

On the FS 280 and FS 280 K with speed limited by control valve (on machines from No. X 25 484 444):

First set idle speed correctly. It should be between 2,500 and 2,600 r.p.m. Run the engine at full throttle and turn the high speed adjusting screw (H) counterclockwise until the engine speed is 8,500 r.p.m. From this position, turn the high speed adjusting screw one quarter turn clockwise (leaner mixture). Check that full-throttle engine speed is now between 11,500 and 13,000 r.p.m. and the engine accelerates smoothly when you open the throttle.

Basic setting

If the carburetor has to be adjusted from scratch, carefully screw both adjusting screws clockwise down onto their seats to obtain a starting point for fine tuning.

Then make the following adjustment:

High speed adjusting screw H:
back off 1 turn

Low speed adjusting screw H:
back off 1 turn

If no facilities are available for checking the engine's maximum permissible speed, do not turn the high speed adjusting screw beyond this basic setting in order to obtain a leaner mixture.

Notes for adjustment of idle speed

Engine stops while idling

Turn idle speed adjusting screw clockwise until cutting tool begins to rotate and then turn it back one half turn. The cutting tool must not rotate.

Cutting tool rotates at idle speed

Turn idle speed adjusting screw counterclockwise until the tool stops and then turn it about another half turn in the same direction.

Erratic idling behavior; poor acceleration

Idle setting too lean: turn low speed adjusting screw counterclockwise until engine runs and accelerates smoothly.

Exhaust smokes at idle speed

Idle speed setting too rich: turn low speed adjusting screw clockwise until engine speed drops. Then turn screw back one quarter turn and check that engine still accelerates smoothly when the throttle is opened.

A correction at the low speed adjusting screw usually necessitates a change in the setting of the idle speed adjusting screw.

Mean engine idle speed: see 1.1.

8.5 AirFilter

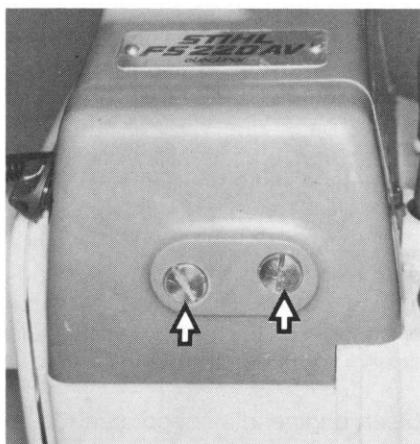
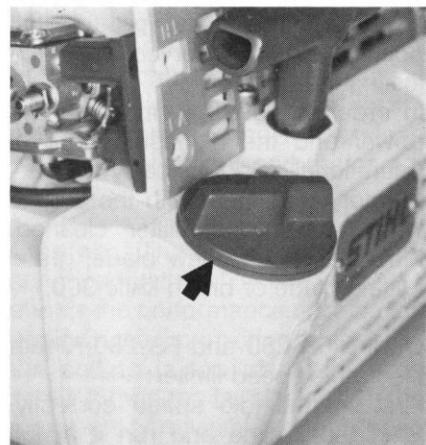
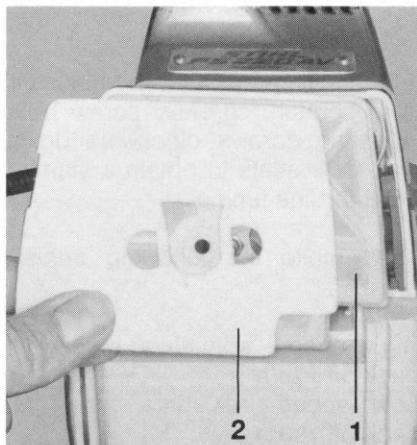
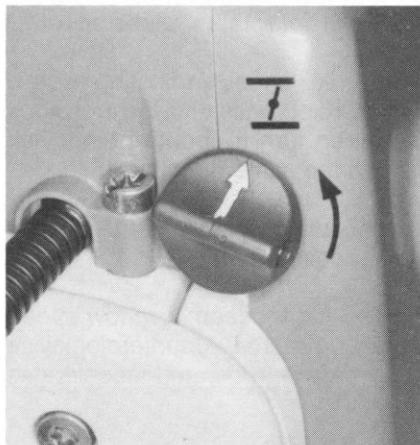
8.6 Fuel Filter and Fuel Hose

Top:
Choke shutter closed

Bottom:
Slotted nuts on carburetor box cover

1 = Air filter
2 = Felt mat

Fuel filler cap



The air filter's function is to remove the dust and dirt sucked in with the combustion air and thus help reduce wear on engine components to a minimum.

Dirty and clogged air filters reduce engine power, increase fuel consumption and make starting more difficult.

The air filter must therefore be cleaned when engine power begins to drop off.

Before removing the filter, close the choke shutter (choke knob to choke) to prevent dirt getting into the carburetor.

Remove the slotted nuts and take off the carburetor box cover.

Take out the air filter and felt mat.

Wash out the foam filter element in clean white spirit and dry it. Clean the felt element by knocking it out on the palm of your hand or blowing it out with compressed air. Renew element if it is heavily loaded.

Never refit a damaged filter, i.e. always install a new one.

Installation is a reversal of the removal sequence.

The diaphragm pump draws fuel out of the tank and into the carburetor via the fuel hose. Any impurities mixed with the fuel are retained by the pickup body (filter). The fine pores of the filter in the pickup body eventually become clogged with minute particles of dirt. This restricts the passage of fuel and results in fuel starvation.

In the event of trouble with the fuel supply system, always check the fuel tank and the pickup body first. Clean the fuel tank if necessary.

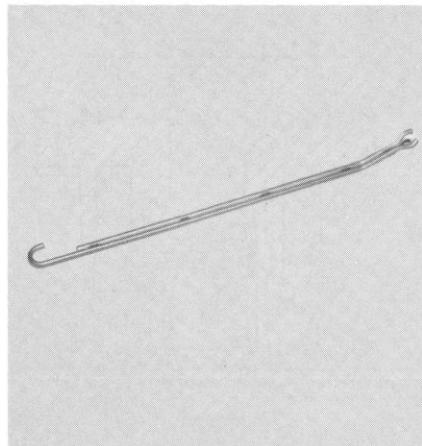
Remove the air filter - see 8.5.

Unscrew and remove the tank filler cap, i.e. pull out the tank retainer.

Drain the fuel tank.

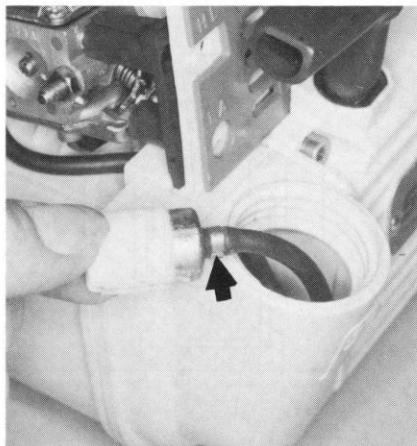
Top:
Assembly hook 5910 893 8800

Bottom:
Withdrawing pickup body



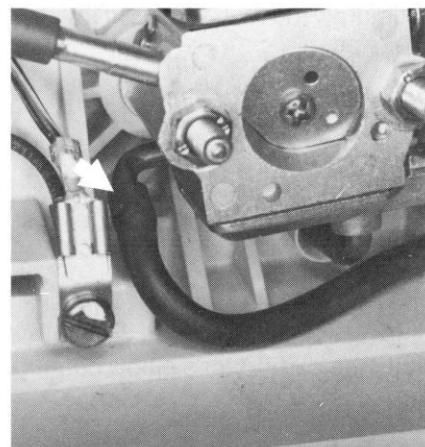
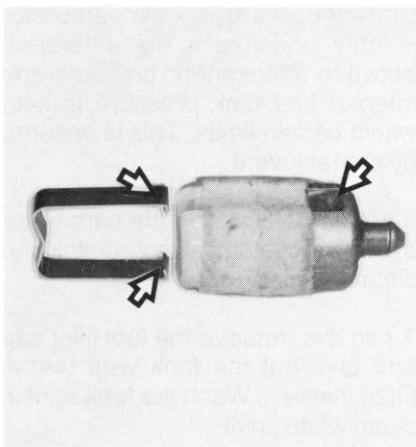
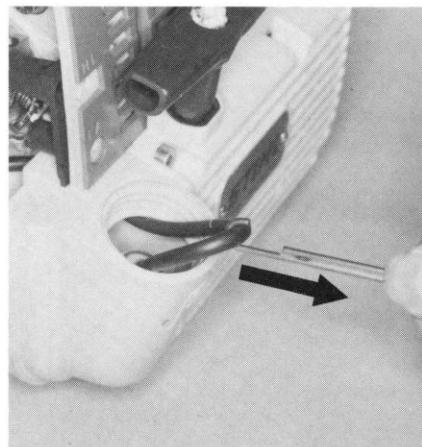
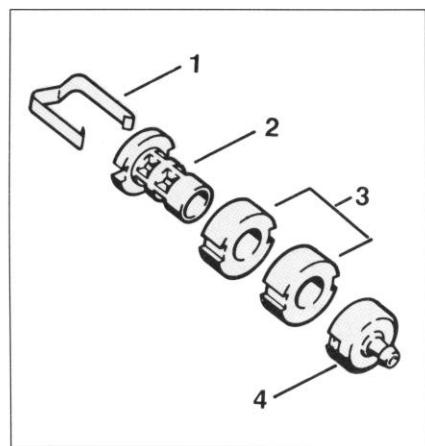
Top:
Clip on hose of pickup body

Bottom:
Spring clip on pickup body



Top:
1 = Spring clip
2 = Pickup body
3 = Filter
4 = Cap

Bottom:
Fuel hose on carburetor's connector



Use the special assembly hook to pull the pickup body out through the filler neck.

Note: Make sure you do not over-stretch the hose when pulling out the pickup body.

Bend open the metal clip and remove the pickup body from the hose.

It is not advisable to clean the filter - always fit a new one. To do this, disconnect the spring clip from the cap and pull it away.

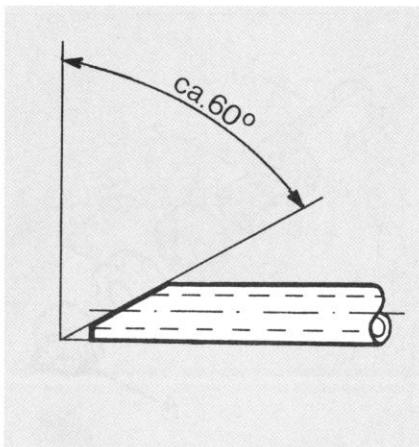
Pull the filter off the pickup body, fit a new one and secure it with the spring clip.

Note: The hooked ends of the spring clip must engage the slots in the cap.

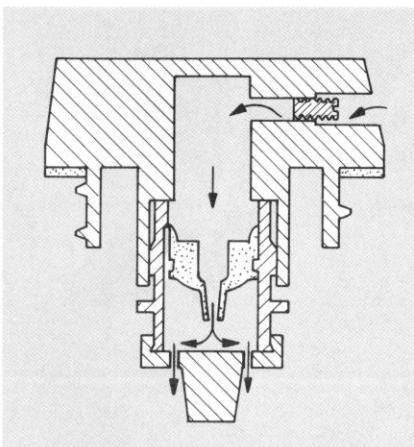
Pull the fuel hose off the carburetor's connector.

8.7 Tank Vent

Fuel hose cut at angle



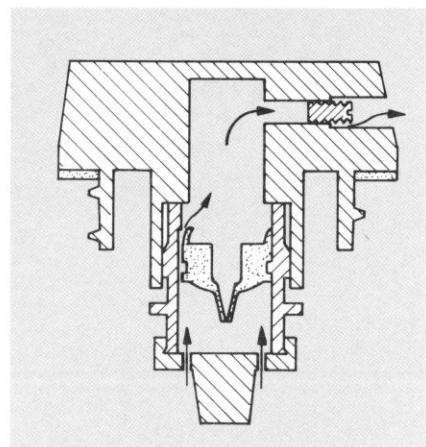
Fuel filler cap showing air inlet (schematic)



Top:
Fuel filler cap showing air outlet (schematic)

Bottom:

- 1 = Cap
- 2 = Diaphragm
- 3 = Fuel filler cap
- 4 = Vent insert
- 5 = Vent insert (grub screw)



Withdraw the fuel hose from the tank housing.

Note:

The new fuel hose is fitted from inside the tank.

Fitting is easier if the end of fuel hose is cut to an angle of approx. 60°.

The angled end of the hose must be cut off square before it is pushed onto the carburetor's elbow connector.

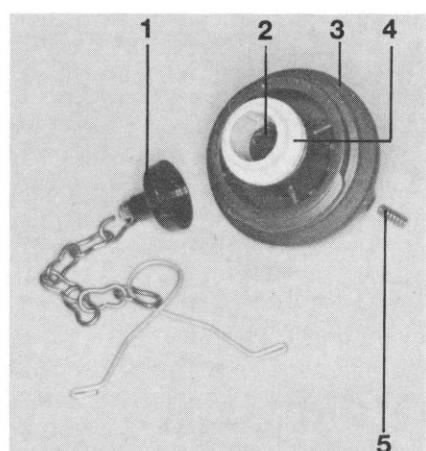
Correct operation of the carburetor is only possible if the difference between atmospheric pressure and internal fuel tank pressure is kept within certain limits. This is ensured by the tank vent.

If problems occur on the carburetor or the fuel system, always check and clean the tank vent.

To do this, remove the fuel filler cap and take out the tank vent that is fitted inside it. Wash the tank vent in clean white spirit.

Equalization of tank pressure in both directions takes place via the screw thread on the vent insert.

Check both functions by performing pressure and vacuum tests on tank via the pickup hose



Test as follows:
Vacuum test \leq 0,1 bar (1.5 psi)
Pressure test \leq 0,5 bar (7.25 psi)

If the diaphragm is damaged, pull the cap off the vent insert, take the vent insert out of the fuel filler cap and install a new one.

8.8 Tank Housing

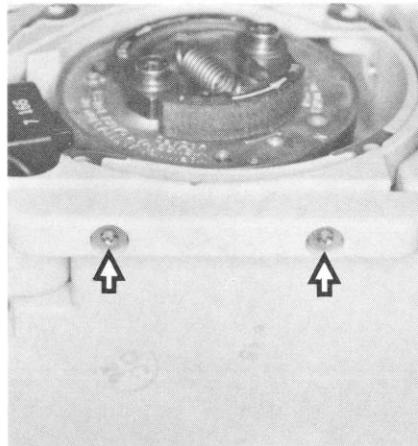
Top:
Starter cover mounting screws

Bottom:
Impulse hose on elbow connector



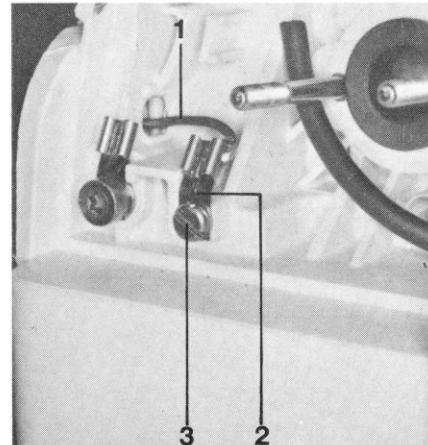
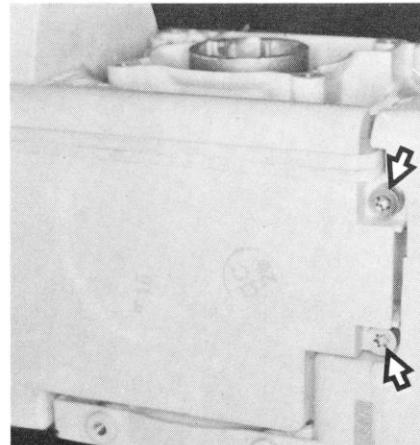
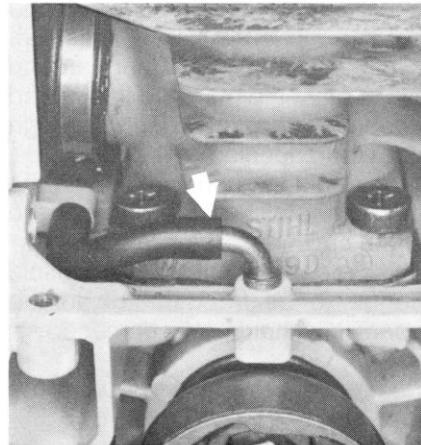
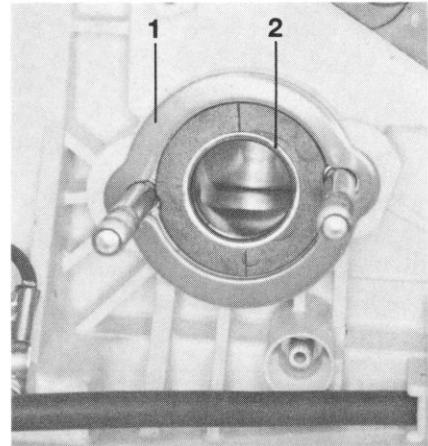
Top:
Support mounting screws

Bottom:
Lower mounting screws on tank housing



Top:
1 = Washer
2 = Sleeve

Bottom:
1 = Short circuit wire
2 = Socket
3 = Fastening screw



Remove clutch housing with drive shaft - see 3.1.

Remove the carburetor - see 8.2.

Remove starter cover mounting screws and lift away the starter cover.

Pull the impulse hose off the elbow connector.

Remove mounting screws from support and take off the support.

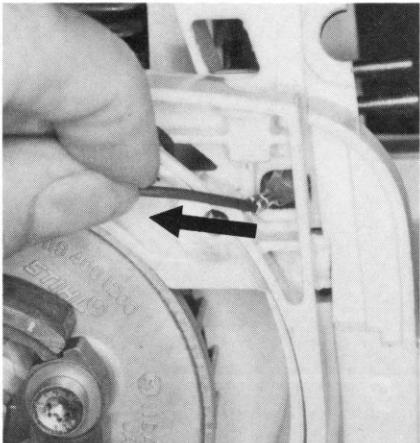
Remove lower mounting screws from tank housing.

Remove washer from studs and take the sleeve out of the manifold.

Remove fastening screw from short circuit wire to ignition module.

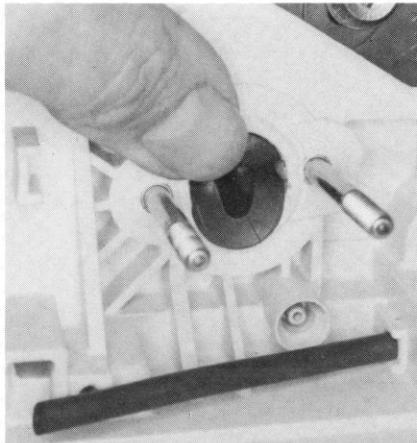
Top:
Withdrawing short circuit wire

Bottom:
Lateral mounting screws on tank housing

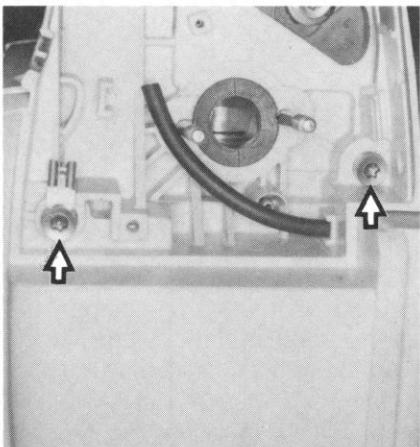
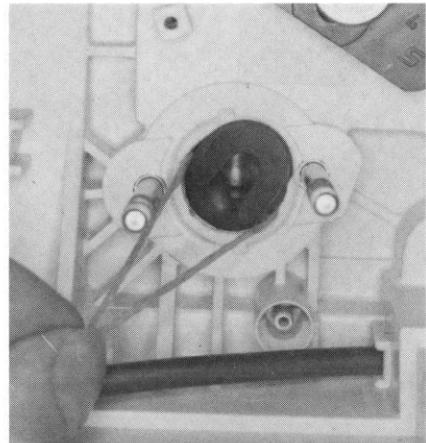


Top:
Pushing manifold flange out of tank housing

Bottom:
Correct position of string for installing manifold in tank housing

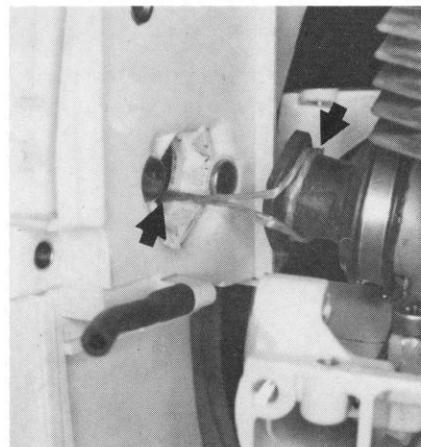


Pulling manifold into tank housing



Pull the short circuit wire out of the tank housing.

Remove the lateral mounting screws from the tank housing.



Take off the tank housing and, at the same time, push the manifold flange out of the tank housing's intake chamber.

Assembly is a reversal of the disassembly sequence.

Note: To install the manifold flange on the tank housing, wind a piece of string (about 15 cm/6" long) around the back of the manifold flange and thread the ends of the string through the intake opening.

Press the tank housing against the manifold and pull the ends of the string outward at the same time. This procedure enables the manifold flange to be fitted in the intake opening without being damaged.

Secure the terminal socket under the fastening screw.

Secure the terminal socket under the screw at the flywheel side.

Coat threads of screws with Loctite 242 before installing.

9. AVSYSTEM

9.1 Repair

Top:
Clutch housing mounting screws (fourth screw hidden in this view)

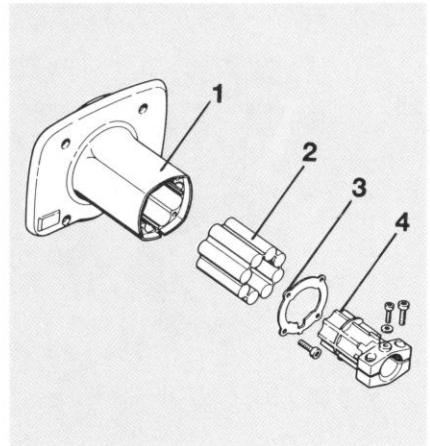
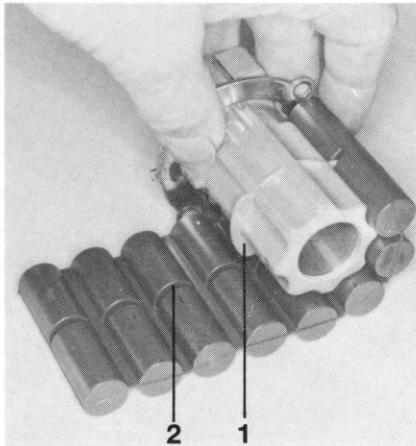
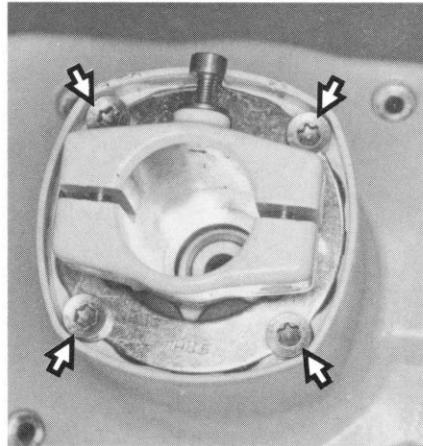
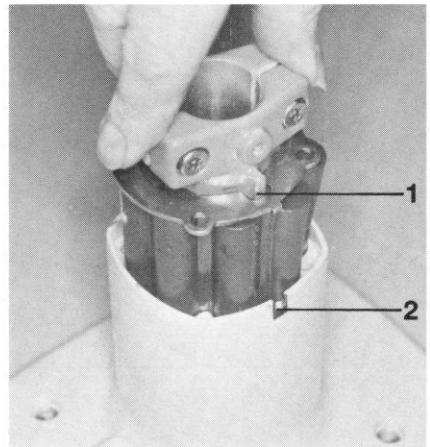
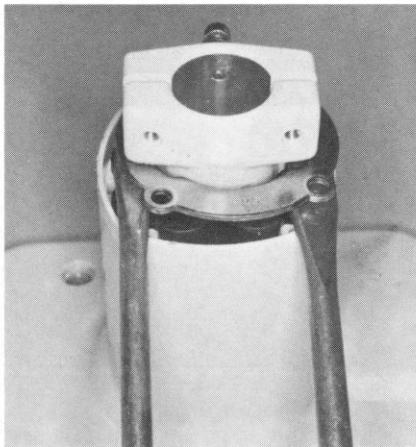
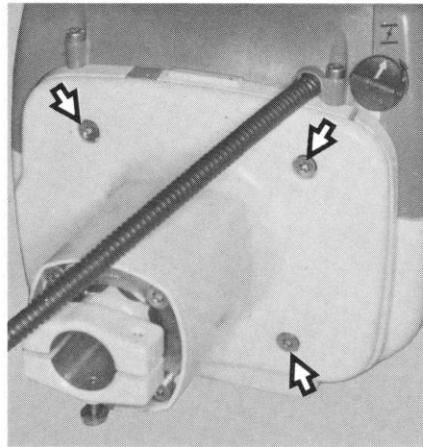
Bottom:
Ring mounting screws

Top:
Prying out sleeve with rubber element

Bottom:
1 = Ridge
2 = Slits

Top:
Correct position of sleeve in clutch housing
1 = Lug on sleeve
2 = Notch in clutch housing

Bottom:
1 = Clutch housing
2 = Rubber element
3 = Ring
4 = Sleeve



The AV system is fitted between the guard tube and the clutch housing.

Remove the guard tube and drive shaft - see 10.2.

Remove clutch housing mounting screws and take it off the engine.

Remove the mounting screws from the retaining ring.

Pry sleeve with rubber element out of the clutch housing.

Assembly is a reversal of the above sequence. However, pay special attention to the following points:

Push the retaining ring over the sleeve and wrap the rubber element round the sleeve so that the slits engage the ridge.

Push the sleeve with rubber element into the clutch housing so that the lug on the sleeve lines up with the notch in the clutch housing.

10. CUTTING TOOL DRIVE

10.1 Clutch Drum

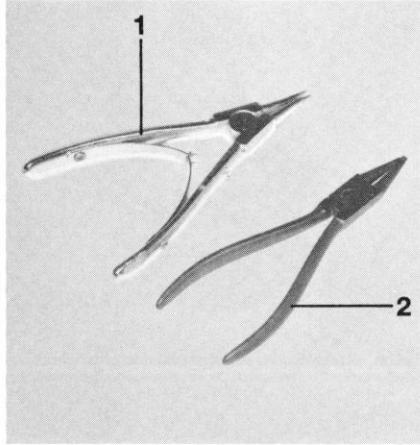
Top:

1 = Pliers 0811 611 8200

2 = Pliers 0811 641 8380

Bottom:

Removing circlip

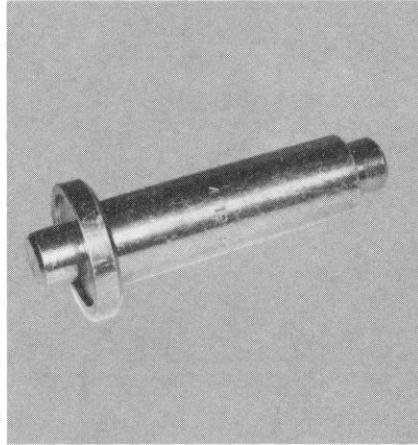


Top:

Press arbor 4119 893 7205

Bottom:

Pressing out clutch drum

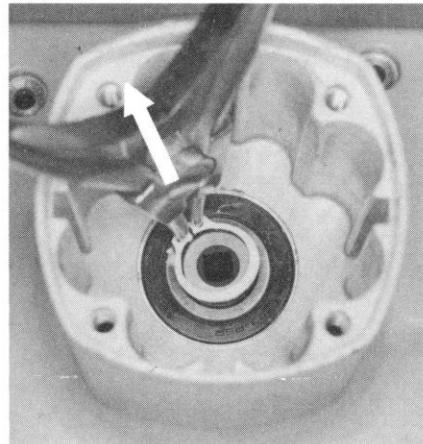
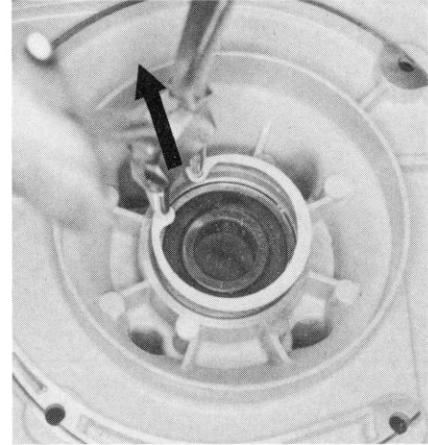


Top:

Removing circlip

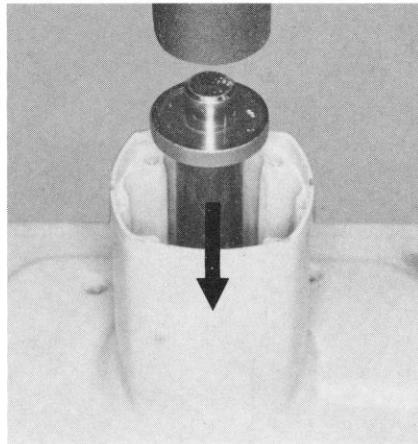
Bottom:

Pressing in ball bearing



Remove the AV system's rubber element - see 9.1.

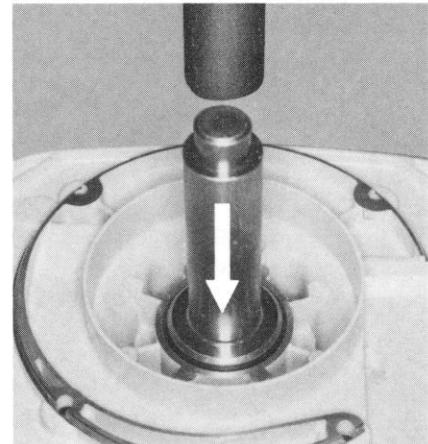
Take circlip off clutch drum's stub and remove the clutch drum.



Place the clutch housing on a wooden block.

Use the press arbor to press the clutch drum out of the ball bearing.

Remove the circlip from inside the clutch housing.



Use the press arbor to press the ball bearing out of the clutch housing.

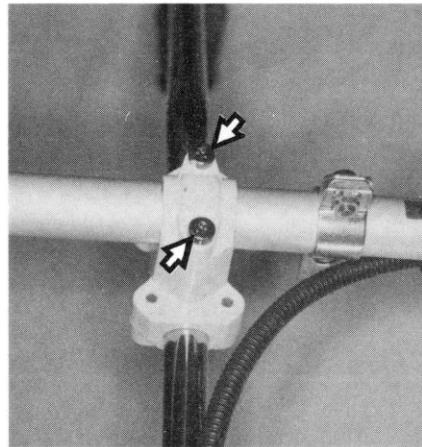
Install the ball bearing with the press arbor. It should be pressed home as far as the stop.

Installation of the clutch drum is a reversal of the above sequence. Make sure the circlips are properly seated in their respective grooves.

10.2 Guard Tube and Drive Shaft

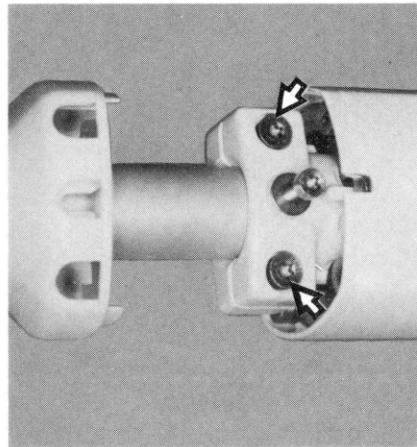
Top:
Clamp mounting screws (FS 160, FS 180)

Bottom:
Guard tube fixing screw



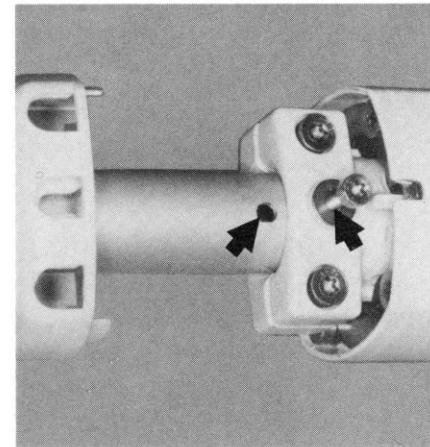
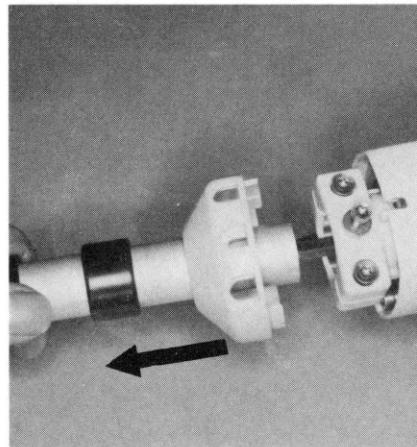
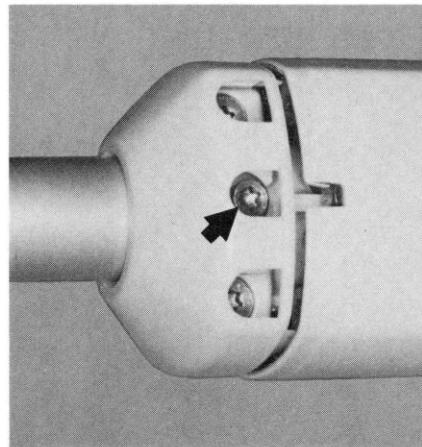
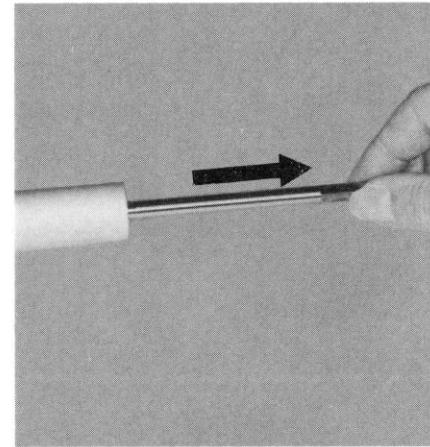
Top:
Guard tube clamp screws

Bottom:
Pulling guard tube out of sleeve



Top:
Withdrawing the drive shaft

Bottom:
Correct alignment of hole in guard tube relative to fixing screw



The drive shaft is supported in bearing bushes inside the guard tube. It is not possible to change the bearing bushes, i.e. the complete guard tube has to be replaced in the event of bearing damage.

Remove the mounting screws from the clamp for the two-handed handlebar and put the handlebar to one side.

Note: Remove the molded support on the FS 280 - see 7.4.

Release the guard tube fixing screw and push back the cap.

Loosen the guard tube clamp screws.

Pull the guard tube out of the sleeve and slip the cap and throttle cable retainer off the guard tube at the same time.

Withdraw the drive shaft from the guard tube.

To replace the guard tube, remove the gearhead - see 10.3.

Installation is a reversal of the removal sequence. When sliding the guard tube into the sleeve, make sure the fixing screw lines up with the hole in the guard tube.

10.3 Gearhead

10.3.1 Disassembly

Top:

- 1 = Clamp screws
- 2 = Fixing screw

Bottom:

Deflector shield mounting screws

Top:

Prying out retaining ring for guard ring
(press-fitted version)

Bottom:

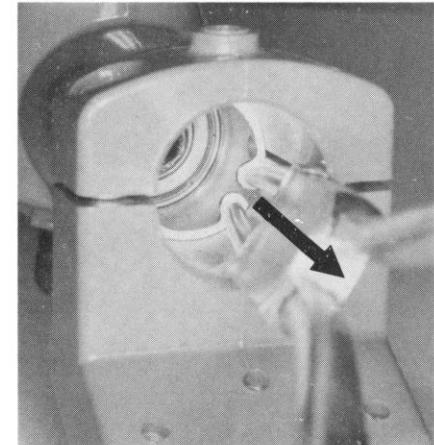
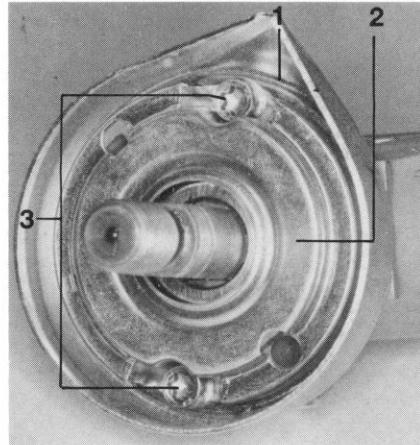
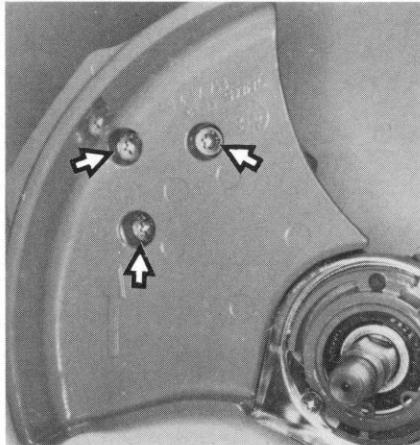
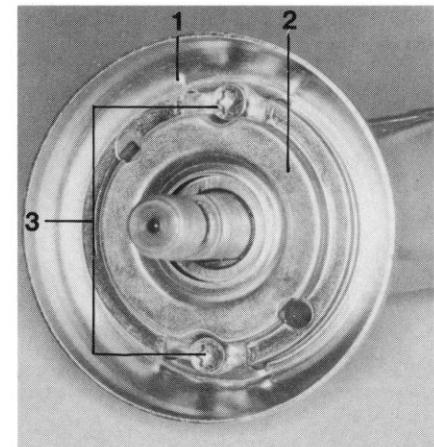
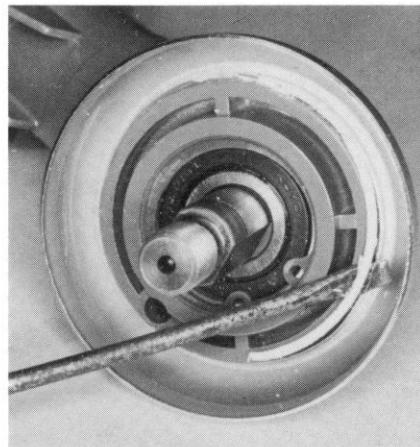
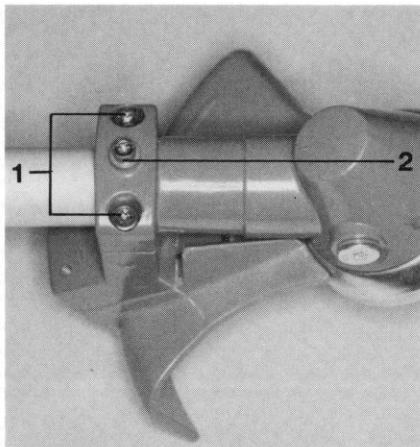
- 1 = Guard ring (screwed version for sawing)
- 2 = Cover plate
- 3 = Mounting screws

Top:

- 1 = Guard ring
(screwed version for mowing)
- 2 = Cover plate
- 3 = Mounting screws

Bottom:

Removing circlip with pliers 0811 641 8380
(input side)



To remove the gearhead, loosen the clamp screws, take out the fixing screw and pull the gearhead off the drive tube.

Unscrew the cutting tool mounting screw (19 mm wrench, left-hand thread), take off the thrust washer, guard washer and thrust plate.

Remove the deflector shield or stop from the gearhead

On the press-fitted version of the gearhead, pry the retaining ring out of the groove and take off the guard ring.

On the screwed version of the gearhead, remove the mounting screws and take off the cover plate with guard ring.

Remove the circlip from the groove in the input side of the housing.

Top:
Removing circlip (output side)

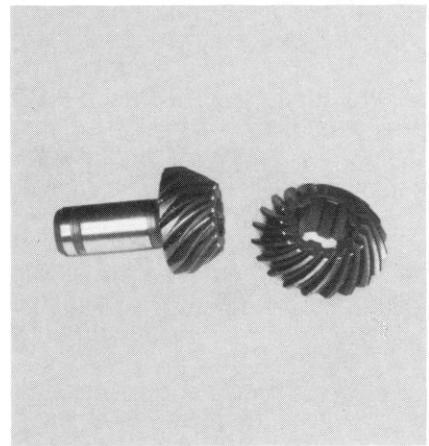
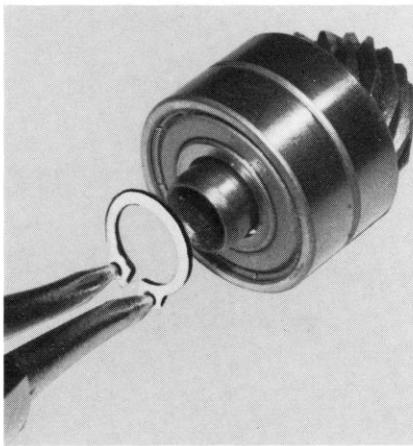
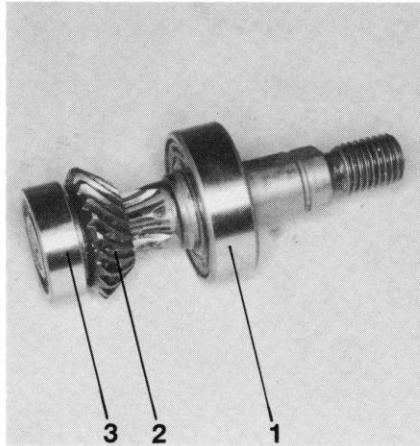
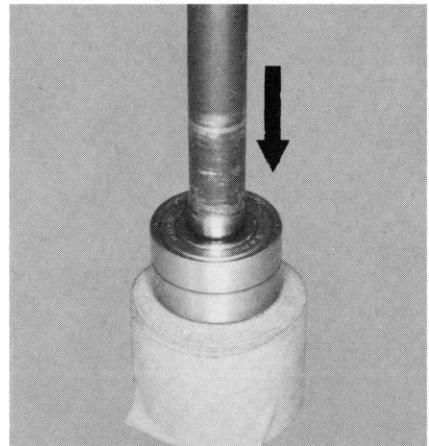
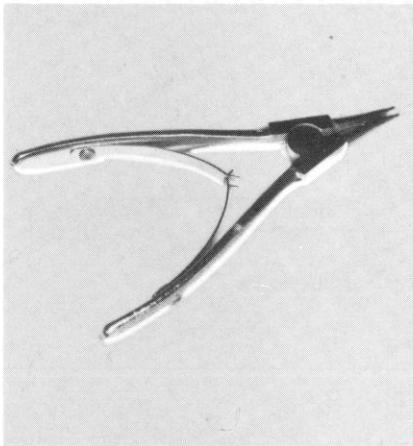
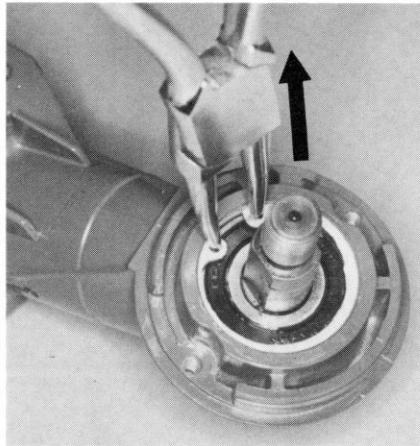
Bottom:
1 = Ball bearing
2 = Bevel gear
3 = Ball bearing

Top:
Pliers 0811 611 8200

Bottom:
Removing circlip from drive pinion

Top:
Pressing drive pinion out of ball bearings

Bottom:
Pinion set



Remove the circlip from the groove in the output end of the housing.

Remove the circlip from the drive pinion.

Press the drive pinion out of the ball bearing.

Heat the gearhead housing to about 110° - 140°C (230° - 280°F). Remove gearhead components at the output end by knocking the housing against a wooden base.

Pull the ball bearing and bevel gear off the output shaft.

Clean all parts and inspect them for signs of damage or wear.

The drive pinion and bevel gear are only available as matched pairs, i.e. as a pinion set.

10.3.2 Assembly

Top:
1 = Ball bearing
2 = Drive pinion

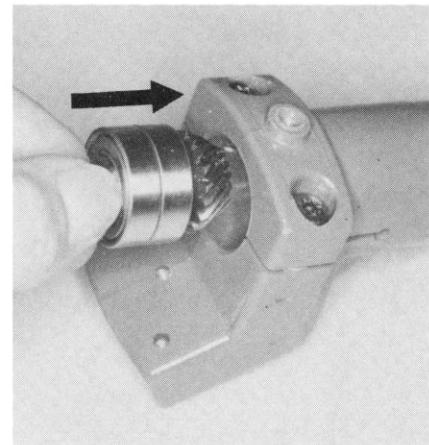
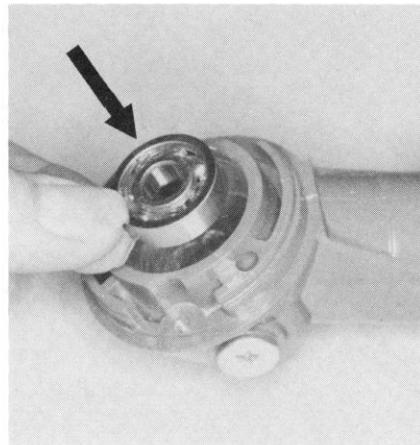
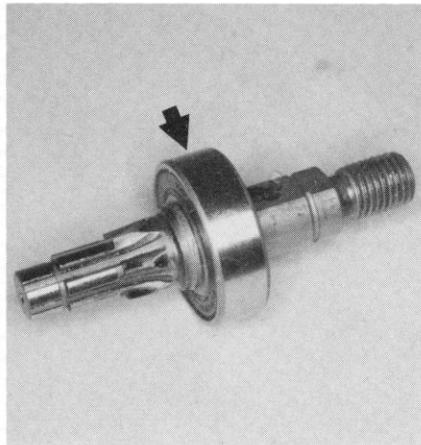
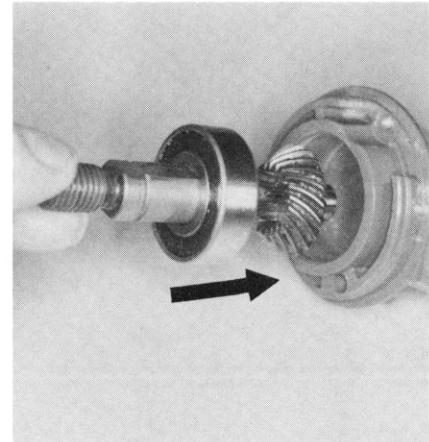
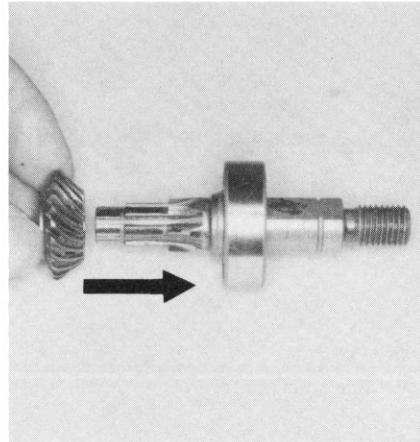
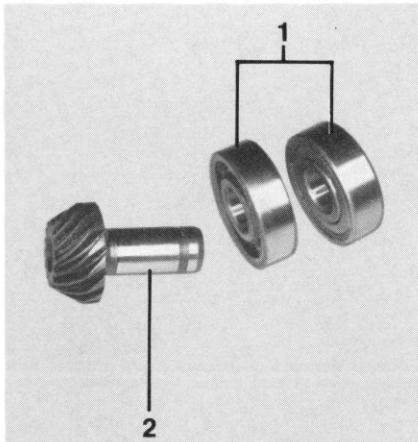
Bottom:
Ball bearing on output shaft

Top:
Pushing bevel gear onto output shaft

Bottom:
Fitting the ball bearing in the gearhead housing

Top:
Fitting the output shaft

Bottom:
Fitting the drive pinion



Heat ball bearings for input end to about 50°C (120°F) and push them onto the drive pinion so that open bearing locates against the pinion.

Fit circlip in the groove.

Heat ball bearing for output end to about 50°C (120°F) and push it onto the output shaft as far as stop.

Push the bevel gear (teeth first) onto the output shaft.

To install the bearing, heat the gearhead to about 140°C (285°F), e.g. on a heating plate or with a hot air blower.

Press the ball bearing into the gearhead housing as far as stop.

Fit the preassembled output shaft and press it home as far as stop.

Fit the preassembled drive pinion and press it home as far as stop.

Note: Make sure the teeth of the drive pinion and bevel gear engage properly during assembly.

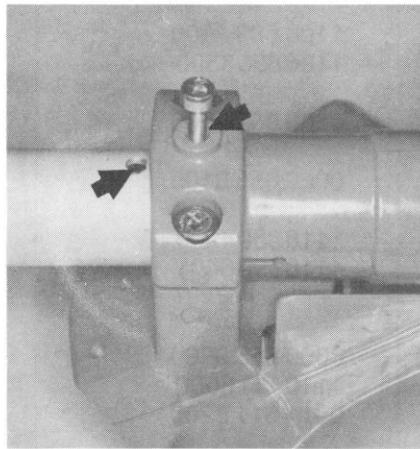
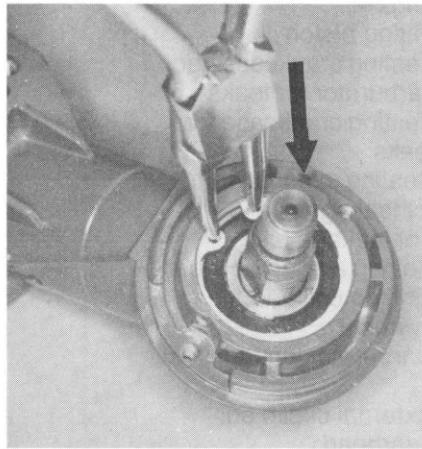
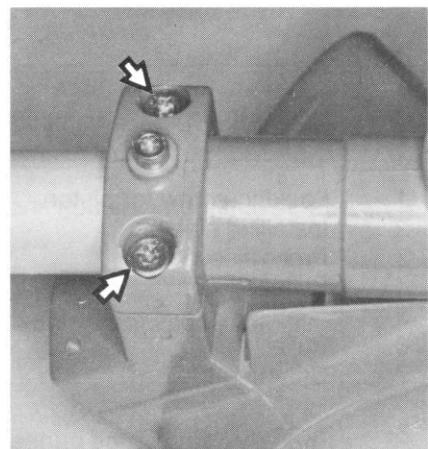
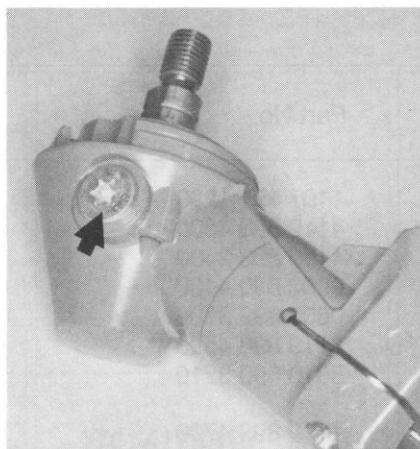
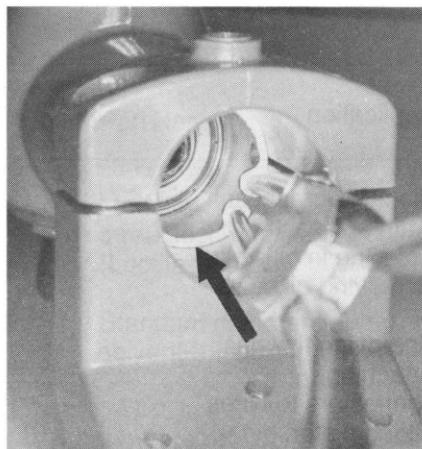
Top:
Fitting circlip (input side)

Bottom:
Fitting circlip (output side)

Top:
Filler plug for gear lubricant

Bottom:
Correctly aligned fixing screw and hole in
guard tube

Clamp screw on gearhead



Fit the circlips in their respective grooves at the input and output ends of the gearhead housing.

Remove the filler plug and pack the gearhead with grease.

Note: Use STIHL gear lubricant, see 11.2, for lubrication of the bevel gears.

Important: Fill the gearhead with approx. 20 g (3/4 oz) of grease.

Service note: When carrying out maintenance work only top up gearhead (max. 5 - 10 g / 1/4 - 3/8oz) if no grease is visible on the inside of the filler plug.

Depending on the gearhead version,
refit the guard ring or guard ring and
cover plate.

Slide gearhead onto guard tube so
that the hole in the guard tube lines
up with the fixing screw.

Tighten down the clamp screws.

Important: If there are shims in the
slits in the gearhead neck (clamp),
tighten the clamp screws in the follow-
ing sequence:

- pretighten one clamp screw to 1 - 2 Nm (0.75 - 1.5 lbf.ft)
- then tighten the other clamp screw to 7 - 8 Nm (5 - 6 lbf.ft)
- finally tighten the first clamp screw to 7 - 8 Nm (5 - 6 lbf.ft).

Fit the deflector shield or stop on the
gearhead.

Fit the thrust plate, guard washer
and thrust washer on the output
shaft and tighten down the hexagon
nut (left-hand thread).

11. Special Servicing Tools and Aids

11.1 Special Servicing Tools

No.	Part Name	Part No.	Application
1	Locking screw for piston	1107 191 1200	Blocking crankshaft
2	Installing sleeve	4119 893 4600	Fitting oil seal
3	Press sleeve	4119 893 2400	Pressing in oil seals
4	Puller	0000 890 4400	Removing oil seals
5	- Jaws	0000 893 3706	
6	Puller	4119 890 4590	Removing flywheel
7	Crimping tool	5910 890 8210	Attaching connectors to wires
8	Assembly drift	1110 893 4700	Fitting piston pin
9	Clamping strap	0000 893 2600	Compressing piston rings
10	Wooden assembly block	1108 893 2600	Fitting piston
11	Carburetor and crankcase tester	1106 850 3500	Testing crankcase and carburetor for leaks
12	Vacuum pump	0000 850 3500	Testing crankcase for leaks
13	Sealing plate	0000 855 8105	Sealing exhaust port for leakage test
14	Testflange	1118 850 4200	For leakage test
15	Setting gauge	4118 890 6401	Setting air gap between ignition coil and flywheel
16	Nipple	0000 855 9200	Carburetor leakage test
17	- Fuel hose	1110 141 8600	
18	Pliers A 10	0811 611 8200	External circlip on gearhead
19	Pliers C 19	0811 641 8380	Internal circlip on gearhead
20	Screwdriver bit	0812 542 2104	For spline screws
21	Assembly hook	5910 893 8800	Withdrawing pickup body
22	Installing tool	5910 890 2210	Fitting hookless snap rings in piston
23	Puller	4119 890 4600	Removing crankshaft
24	Press arbor	4119 893 7200	Installing crankshaft bearings
25	Assembly hook	5910 890 2800	Detaching spring from clutch shoes
26	Installing tool	0000 890 2201	Fitting rope guide bush

11.2 Servicing Aids

No.	Part Name	Part No.	Application
1	Medium-strength threadlocking fluid (Loctite 242)	07861111101	Tank housing mounting screws
2	Standard commercial, solvent-based degreasant		Cleaning crankshaft stub
3	STIHL low temperature lubricant	0781 417 1315	Bearing bore in rope rotor, rewind spring
4	STIHL gear lubricant	0781 120 1117	Gearhead lubrication

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