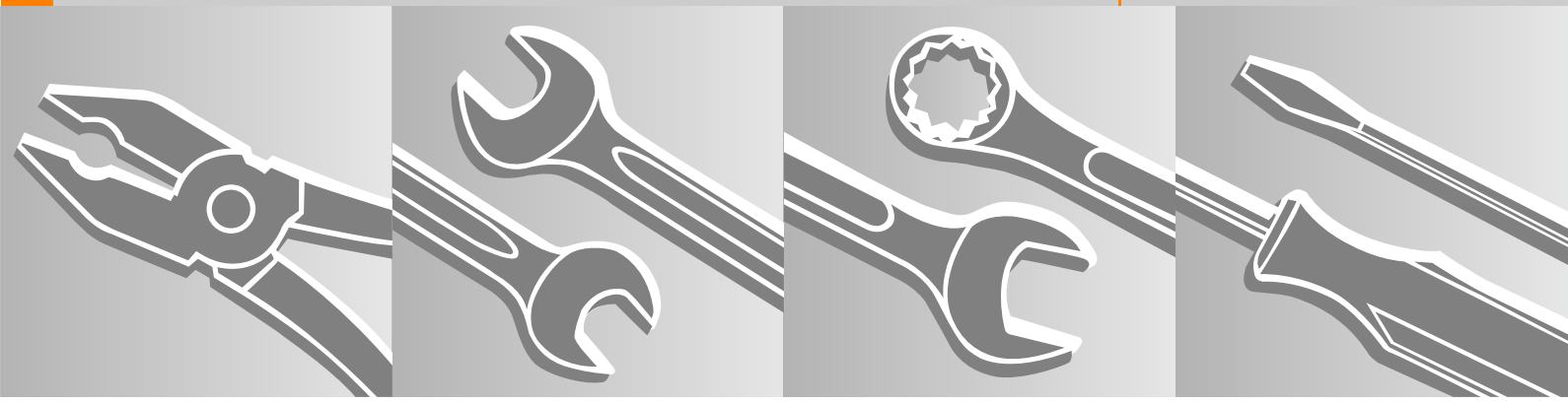
STIHL MS 311, 391

2009-06



Contents

RA_542_00_01_01

STIHL®

1.1 Introduction

This service manual contains detailed descriptions of all the repair and servicing procedures specific to this power tool.

You should make use of the illustrated parts lists while carrying out repair work. They show the installed positions of the individual components and assemblies.

Refer to the latest edition of the relevant parts list to check the part numbers of any replacement parts.

A fault on the machine may have several causes. To help locate the fault, consult the chapter on "Troubleshooting" and the "STIHL Service Training System" for all assemblies.

Refer to the “Technical Information” bulletins for engineering changes which have been introduced since publication of this service manual. Technical information bulletins also supplement the parts list until a revised edition is issued.

The special tools mentioned in the descriptions are listed in the chapter on "Special Servicing Tools" in this manual. Use the part numbers to identify the tools in the "STIHL Special Tools" manual. The manual lists all special servicing tools currently available from STIHL.

Symbols are included in the text and pictures for greater clarity.
The meanings are as follows:

In the descriptions:

- Action to be taken as shown in the illustration above the text

– Action to be taken that is not shown in the illustration above the text

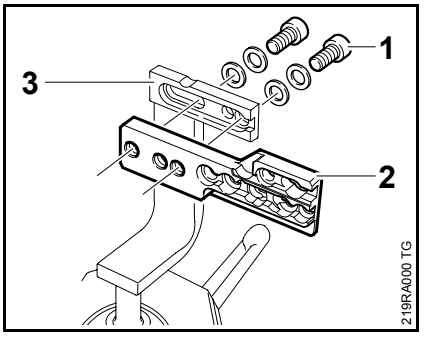
In the illustrations:

➔ Pointer

➔ Direction of movement

📖 4.2 =Reference to another chapter, i.e. chapter 4.2 in this example.

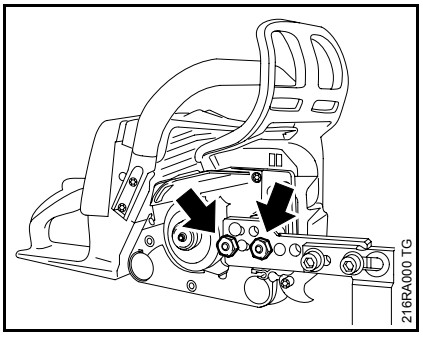
Service manuals and all technical information bulletins are intended exclusively for the use of properly equipped repair shops. They must not be passed to third parties.



Servicing and repairs are made considerably easier if the machine is mounted to assembly stand (3) 5910 890 3100. To do this, secure the mounting plate (2) 5910 850 1650 to the assembly stand with two screws (1) and washers.

The screws must not project since they, depending on the machine, may damage housings when the machine is clamped in position.

The above operation is not necessary with the new assembly stand 5910 890 3101 since the mounting plate is already fitted.



Engage the bar mounting studs in the outer bores in the mounting plate and secure the machine in position with the nuts (arrows).

Preparations for servicing

Remove the chain sprocket cover, saw chain and guide bar before carrying out repairs or mounting the machine to the assembly stand.

Always use original STIHL replacement parts.
They can be identified by the STIHL part number, the STIHL logo and the STIHL parts symbol. This symbol may appear alone on small parts.

Storing and disposing of oils and fuels

Collect fuel or lubricating oil in a clean container and dispose of it properly in accordance with local environmental regulations.

1.2 Safety Precautions

If the machine is started up in the course of repairs or maintenance work, observe all local and country-specific safety regulations as well as the safety precautions and warnings in the instruction manual.

Gasoline is an extremely flammable fuel and can be explosive in certain conditions.

Always wear suitable protective gloves for operations in which components are heated for assembly or disassembly.

Improper handling may result in burns or other serious injuries.

Do not smoke or bring any fire, flame or other source of heat near the fuel. All work with fuel must be performed outdoors only. Spilled fuel must be wiped away immediately.

Always perform leakage test after working on the fuel system and the engine.

Always replace damaged parts. Check disassembled parts for wear or damage before re-installing – replace as necessary.

Run the machine only with the shroud mounted in position – there is otherwise a risk of injury from the fanwheel and a risk of engine damage due to overheating.

The chapter on tightening torques lists all machine components that have to be tightened to a specific torque or coated with threadlocking adhesive. The specifications must be maintained when tightening down screws, nuts and other fasteners in all the procedures described in this service manual.

Fuel system – hose barb connectors

Pull off or push on fuel hoses in line with the connector, preferably by hand, to ensure the tightness of the fuel system.

Avoid damaging the hose barb – do not use sharp-edged pliers, screwdrivers, etc.
Do not cut open fuel hoses with a knife or similar tool.

Do not re-use fuel hoses after removal. Always install new hoses – fuel hoses can be overstretched during removal.

Install new fuel hoses either dry or with the aid of STIHL press fluid, 🕮 14.

Other press fluids are not approved and may result in damage to the fuel hoses.

Coat the ends of the hoses and the connectors with STIHL press fluid and then push the new hoses on to the hose barbs, 🕮 14.

2. Specifications

2.1 Engine

	MS 311	MS 391
Displacement:	59 cm^3	64.1 cm^3
Bore:	47 mm	49 mm
Stroke:	34 mm	34 mm
Engine power to ISO 7293:	3 kW (4 bhp) at 9,500 rpm	3.2 kW (4.4 bhp) at 9,500 rpm
Maximum permissible engine speed with guide bar and chain:	13,000 rpm	13,000 rpm
Idle speed:	2,800 rpm	2,800 rpm
Clutch:	Centrifugal clutch without linings	Centrifugal clutch without linings
Clutch engages at:	3,500 rpm	3,500 rpm
Engine housing leakage test		
at gauge pressure:	0.5 bar	
under vacuum:	0.5 bar	

2.2 Fuel System

Carburetor leakage test at gauge pressure:	0.8 bar
Operation of tank vent at gauge pressure:	0.5 bar
Fuel:	as specified in instruction manual

2.3 Ignition System

Air gap between ignition module and fanwheel:	0.20...0.30 mm
Spark plug (resistor type):	NGK BPMR 7 A BOSCH WSR6F
Electrode gap:	0.5 mm

2.4 Chain Lubrication

Speed-controlled oil pump with reciprocating piston and manual flow control

Oil delivery rate: Ematic oil pump	11.5 (+2.5) cm^3/min at 10,000 rpm
Oil delivery rate: Adjustable oil pump	6.0 (+/-2.0)...17.5 (+3.0 / -4.5) cm^3/min at 10,000 rpm

2.5 Tightening Torques

DG and P (Plastoform) screws are used in polymer and light metal components. These screws form a permanent thread when they are installed for the first time. They can be removed and installed as often as necessary without impairing the strength of the screwed assembly, providing the specified tightening torque is observed.
For this reason it is **essential to use a torque wrench.**

Fastener	Thread size	For component	Torque Nm	Remarks
Screw	P 4x14	Chain tensioner cover/engine housing	1.5	
Screw	P 4x12	Brake band/engine housing	2.0	
Collar screw	M 10	Collar stud for bar / engine pan	30.0	1)
Collar screw	D 8x24	Collar stud for bar / engine housing	16.0	
Screw	P 5x16	Cover, chain brake / engine housing	4.0	
	M 10x1	Decompression valve	14.0	
Screw	P 5x16	Handlebar/plug, AV spring	3.0	
Screw	P 6x26.5	Handlebar / tank housing, right (polymer)	7.0	
Screw	P 6x26.5	Handlebar / tank housing, bottom (polymer)	7.0	
Screw	P 6x25	Hand guard / fan housing	8.0	
Screw	M 6x30	Shroud / engine housing	10.0	
Screw	P 6x38	Chain catcher / bearing plug	6.0	
Screw	P 5x16	Spiked bumper / engine housing	4.0	
Screw	M 4x12	Manifold/cylinder	4.0	3)
Screw	P 6x21.5	Bearing plug / engine housing	6.0	
Screw	M 5x16	Bearing plug/cylinder	10.0	4)
Screw	P 5x20	Fan housing / engine housing	4.0	
Screw	P 4x12	Air baffle / engine housing	2.0	
Carrier	M 12x1 LH	Carrier / crankshaft	50.0	
Screw	M 6x25	Engine housing / cylinder, stage 1	4.0	3)
Screw	M 6x25	Engine housing / cylinder, stage 2	12.0	3)
Screw	D 4x18	Oil pump	4.0	3)
Screw	M 5x16	Muffler / cylinder	10.0	1) 3)
Screw	M 8x1	Flywheel/crankshaft	33.0	5)
Nut	M 5	Carburetor/collar stud	3.5	
Screw	P 4x14	Pre-separator / engine housing	2.0	
Screw	P 4x12	Cover plate/fan housing	2.0	
Spark plug	M 14x1.25	Spark plug	25.0	
Screw	D 4x18	Ignition module / engine pan	4.0	3)

Remarks:

1) Loctite 242 or 243, medium strength
2) Loctite 648, high strength
3) Screws with antifricton coated binding head
4) Screws with micro-encapsulated binding head
5) Degrease crankshaft/flywheel and mount oil-free

Use the following procedure when refitting a DG or P screw in an existing thread:

Place the screw in the hole and rotate it counterclockwise until it drops down slightly.
Tighten the screw clockwise to the specified torque.

Coat micro-encapsulated screws with medium-strength threadlocking adhesive before re-installing.

This procedure ensures that the screw engages properly in the existing thread and does not form a new thread and weaken the assembly.

Power screwdriver setting for polymer: DG and P screws max. 500 rpm
Do not use an impact wrench for releasing or tightening screws.

Do not mix up screws with and without binding heads.

3. Troubleshooting

3.1 Clutch

Condition	Cause	Remedy
Saw chain stops under load at full throttle	Clutch shoes badly worn	Install new clutch
	Clutch drum badly worn	Install new clutch drum
Saw chain rotates at idle speed	Engine idle speed too high	Readjust with idle speed screw **LA** (counterclockwise)
	Clutch springs stretched or fatigued	Replace the clutch springs or install new clutch
	Clutch spring hooks broken	Replace the clutch springs or install new clutch
Loud noises	Clutch springs stretched or fatigued	Replace the clutch springs or install new clutch
	Needle cage damaged	Fit new needle cage
	Clutch shoe retainer broken	Install new retainer or clutch
	Clutch shoes and carrier worn	Install new clutch

3.2 Chain Drive, Chain Brake, Chain Tensioner

Condition	Cause	Remedy
Chain sprocket wears rapidly	Chain not properly tensioned	Tension chain as specified
	Wrong chain pitch	Fit chain of correct pitch
	Insufficient chain lubrication	Check chain lubrication
	Chain sprocket worn	Fit new chain sprocket
Saw chain stops under load at full throttle	Clutch shoes badly worn	Install new clutch
	Clutch drum badly worn	Install new clutch drum
	Brake band blocked	Check freedom of movement and operation of brake band
Saw chain rotates at idle speed	Engine idle speed too high	Readjust with idle speed screw **LA** (counterclockwise)
	Clutch springs stretched or fatigued	Replace the clutch springs or install new clutch
	Clutch spring hooks broken	Replace the clutch springs
Saw chain does not stop immediately when brake is activated	Brake spring stretched or broken	Fit new brake spring
	Brake band stretched or worn	Fit new brake band
	Clutch drum worn	Install new clutch drum

3.3 Chain Lubrication

In the event of trouble with the chain lubrication system, check and rectify other sources of faults before disassembling the oil pump.

Condition	Cause	Remedy
Chain receives no oil	Oil tank empty	Fill up with oil and check setting of oil pump if necessary
	Oil inlet hole in guide bar is blocked	Clean oil inlet hole
	Intake hose or pickup body clogged or intake hose ruptured	Fit new intake hose and pickup body
	Valve in oil tank blocked	Clean or replace valve
	Teeth on worm worn	Install new worm
	Worm drive spring broken	Install new worm
	Oil pump damaged or worn	Install new oil pump
Machine losing chain oil	Oil pump body damaged	Install new oil pump
	Oil pump damaged or worn	Install new oil pump
	Oil intake hose connection damaged	Install new oil intake hose
Oil pump delivers insufficient oil	Oil pump worn	Install new oil pump
	Worm drive spring not engaged in clutch drum	Engage drive spring in notch in clutch drum
	Oil pump delivery rate set too low	Adjust oil pump (only on version with adjustable oil pump)

Condition	Cause	Remedy
Starter rope broken	Rope pulled out too vigorously as far as stop or over edge, i.e. not vertically	Fit new starter rope
	Normal wear	Fit new starter rope
Starter rope does not rewind	Very dirty or corroded	Clean or replace rewind spring
	Insufficient spring tension	Check rewind spring and increase tension
	Rewind spring broken	Fit new rewind spring
Starter rope cannot be pulled out far enough	Spring overtensioned	Check rewind spring and reduce tension
Starter rope can be pulled out almost without resistance (crankshaft does not turn)	Guide peg on pawl or pawl itself is worn	Fit new pawl
	Spring clip on pawl fatigued	Fit new spring clip
Starter rope is difficult to pull or rewinds very slowly	Starter mechanism is very dirty	Thoroughly clean complete starter mechanism
	Lubricating oil on rewind spring becomes viscous at very low outside temperatures (spring windings stick together)	Coat rewind spring with a small amount of standard solvent-based degreasant (containing no chlorinated or halogenated hydrocarbons), then pull rope carefully several times until normal action is restored
	Decompression valve is not open	Open, check and replace decompression valve if necessary

3.5 Ignition System

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.

Condition	Cause	Remedy
Engine runs roughly, misfires, temporary loss of power	Spark plug boot is loose	Press boot firmly onto spark plug and fit new spring if necessary
	Spark plug sooted, smeared with oil	Clean the spark plug or replace if necessary. If sooting keeps recurring, check air filter
	Ignition lead loose in ignition module	Secure ignition lead properly
	Fuel/oil mixture – too much oil	Use correct mixture of fuel and oil
	Incorrect air gap between ignition module and flywheel	Set air gap correctly
	Flywheel cracked or damaged or pole shoes have turned blue	Install new flywheel
	Ignition timing out of adjustment, flywheel warped, machined key in flywheel sheared	Install new flywheel, check crankshaft stub for damage and replace crankshaft if necessary
	Weak magnetization in flywheel	Install new flywheel
	Irregular spark	Check operation of switch shaft/ contact springs and ignition module. Faulty insulation or break in ignition lead or short circuit wire. Check ignition lead/ignition module and replace ignition module if necessary. Check operation of spark plug. Clean the spark plug or replace if necessary.
	Engine housing damaged (cracks)	Install new engine housing

Condition	Cause	Remedy
Carburetor floods; engine stalls	Inlet needle not sealing – foreign matter in valve seat or cone	Remove and clean the inlet needle, clean the carburetor
	Inlet needle worn	Replace the inlet needle
	Inlet control lever sticking on spindle	Check the inlet control lever and replace if necessary.
	Helical spring not located on nipple of inlet control lever	Remove the inlet control lever and refit it correctly
	Perforated disc on diaphragm is deformed and presses constantly against the inlet control lever	Fit a new metering diaphragm
	Metered diaphragm deformed	Fit a new metering diaphragm
Poor acceleration	Setting of low speed screw too lean	Check basic carburetor setting, correct if necessary
	Setting of high speed screw too lean	Check basic carburetor setting, correct if necessary
	Inlet needle sticking to valve seat	Remove inlet needle, clean and refit
	Diaphragm gasket leaking	Fit new diaphragm gasket
	Metering diaphragm damaged or shrunk	Fit a new metering diaphragm
	Tank vent faulty	Replace tank vent
	Leak on fuel hose from tank to carburetor	Seal connections or install new fuel hose

Condition	Cause	Remedy
Engine will not idle, idle speed too high	Throttle shutter opened too wide by idle speed screw **LA**	Reset idle speed screw **LA** correctly
	Oil seals/engine housing leaking	Seal or replace oil seals/engine housing
	Throttle shutter does not close	Replace throttle shutter and shaft
	Air valve does not close	Replace end cover with air valve.
Engine stops while idling	Idle jet bores or ports blocked	Clean the carburetor
	Low speed screw too rich or too lean	Reset low speed screw **L** correctly
	Setting of idle speed screw **LA** incorrect – throttle shutter completely closed	Reset idle speed screw **LA** correctly
	Tank vent faulty	Replace tank vent
	Leak on fuel hose from tank to carburetor	Seal connections or install new fuel hose
Saw chain rotates at idle speed	Engine idle speed too high	Readjust with idle speed screw **LA** (counterclockwise)
	Clutch springs stretched or fatigued	Replace the clutch springs or install new clutch
	Clutch spring hooks broken	Replace the clutch springs

Condition	Cause	Remedy
Engine speed drops quickly under load – low power	Air filter dirty	Clean air filter or replace if necessary
	Throttle shutter not opened fully	Check throttle cable and rod
	Tank vent faulty	Replace tank vent
	Fuel pickup body dirty	Install new pickup body
	Fuel strainer dirty	Clean fuel strainer in carburetor, replace if necessary
	Leak on fuel hose from tank to carburetor	Seal connections or install new fuel hose
	Setting of high speed screw **H** too rich	Check basic carburetor setting, correct if necessary
	Main jet bores or ports blocked	Clean the carburetor
	Pump diaphragm damaged or fatigued	Fit new pump diaphragm
	Ignition timing wrong, flywheel out of adjustment, key in flywheel has sheared off	Fit key if necessary and secure flywheel properly or install new flywheel
Engine running extremely rich, has no power and a very low maximum speed	Air valve does not open	Check the carburetor and service or replace if necessary.
Engine running too rich, loss of power and maximum speed too low	Air valve does not open fully in full throttle position	Check the carburetor and service or replace if necessary.
Erratic idle – too lean	Air valve does not close completely	Check the end cover with air valve and replace if necessary
	Intake manifold faulty	Install new intake manifold

3.7 Engine

Always check and, if necessary, repair the following parts before looking for faults on the engine:

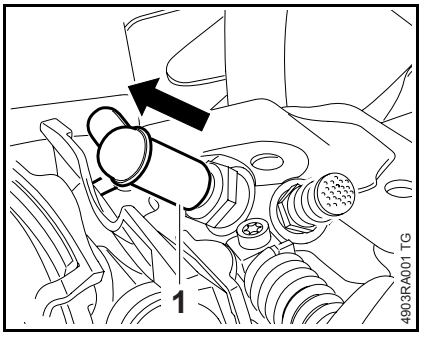
- Air filter
- Fuel system
- Carburetor
- Ignition system

Condition	Cause	Remedy
Engine does not start easily, stalls at idle speed, but operates normally at full throttle	Oil seals in engine housing damaged	Replace the oil seals
	Engine housing leaking/ damaged (cracks)	Seal or replace the engine housing
Engine does not deliver full power or runs erratically	Piston rings worn or broken	Fit new piston rings
	Muffler / spark arresting screen carbonized	Clean the muffler (inlet and exhaust), replace spark arresting screen, replace muffler if necessary
	Air filter dirty	Replace air filter
	Fuel/impulse hose severely kinked or damaged	Fit new hoses or position them free from kinks
	Decompression valve is not closed	Close, check and replace decompression valve if necessary
Engine overheating	Insufficient cylinder cooling. Air inlets in fan housing blocked or cooling fins on cylinder very dirty	Thoroughly clean all cooling air openings and the cylinder fins

– Troubleshooting, 🕮 3.1

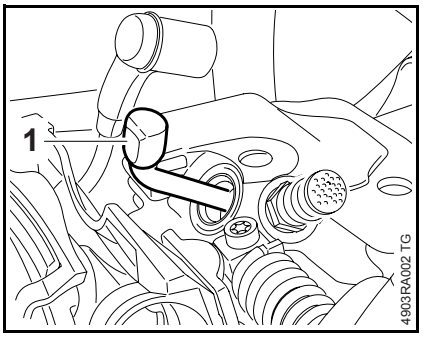
– Remove the shroud, 🕮 6.4.

– Remove the clutch drum, 🕮 4.1

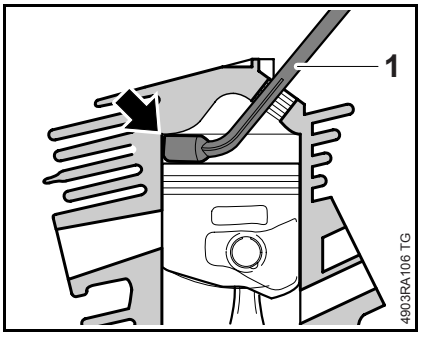


● Pull boot (1) off the spark plug.

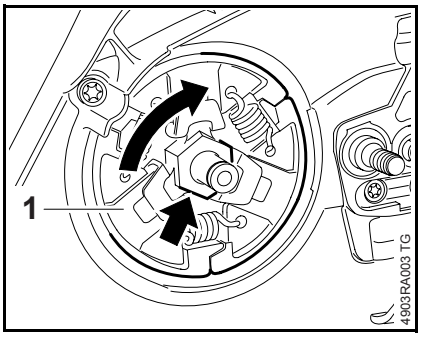
– Unscrew the spark plug.



● Push the locking strip (1) 0000 893 5903 into the spark plug hole, wide end first, so that "OBEN-TOP" faces up.



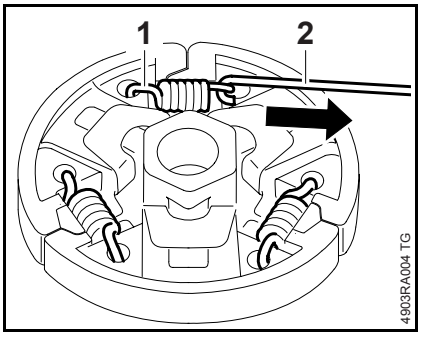
● The locking strip (1) 0000 893 5903 must butt against the cylinder wall (arrow) as shown.



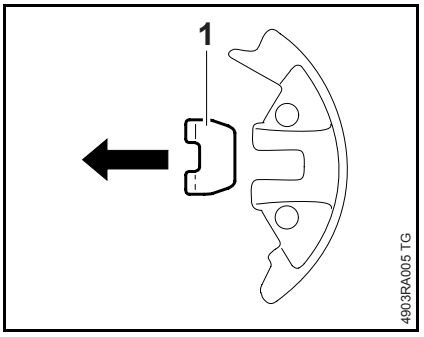
● Apply wrench to hexagon (arrow) and unscrew the clutch (1).

Note that the clutch has a left-hand thread.

Disassembling

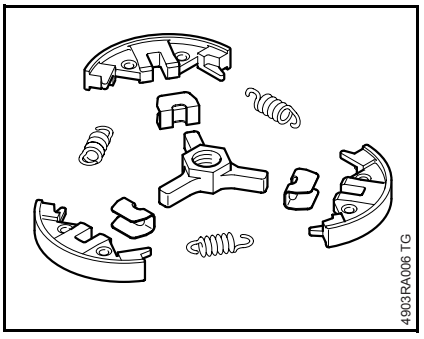


● Use hook (2) 5910 890 2800 to remove the clutch springs (1).



– Pull the clutch shoes off the carrier.

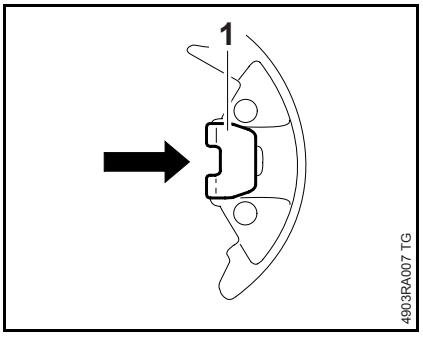
● Remove the retainers (1).



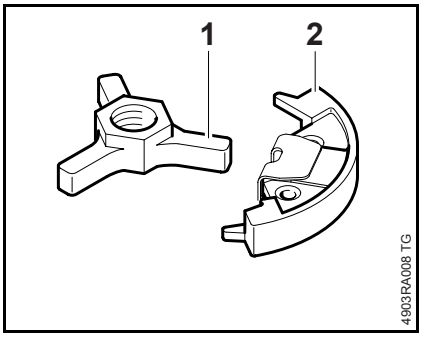
– Clean all parts, 🕮 14

– Replace any damaged parts.

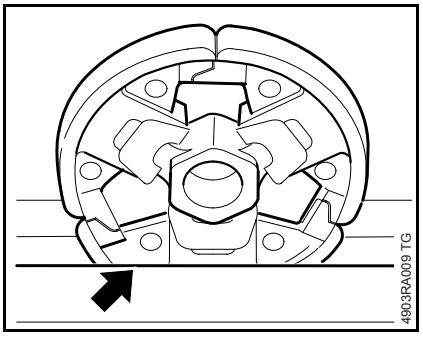
If the clutch is noticeably worn, replace all three clutch shoes at the same time – not individual shoes – since runout may otherwise affect correct operation of the clutch.



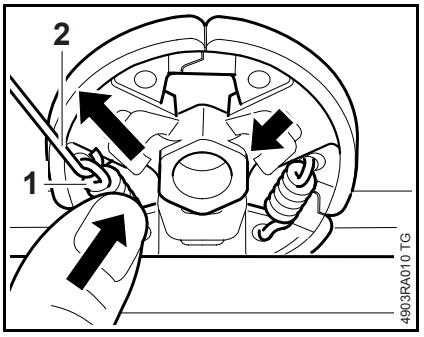
- Fit the retainers (1).



- Fit the clutch shoes (2) over the arms (1).

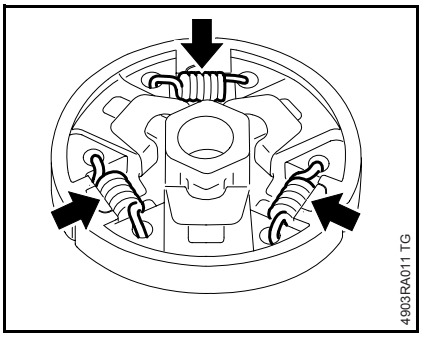


- Clamp the clutch in a vise (arrow).

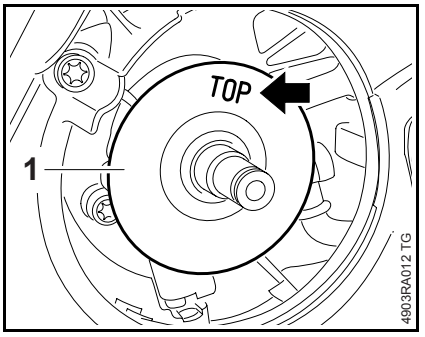


Attach the springs (1) on the side with the raised hexagon (arrow).

- Attach one end of each spring (1) to the clutch shoes.
- Use the hook (2) 5910 890 2800 to attach the other ends of the springs and press them firmly into the clutch shoes.

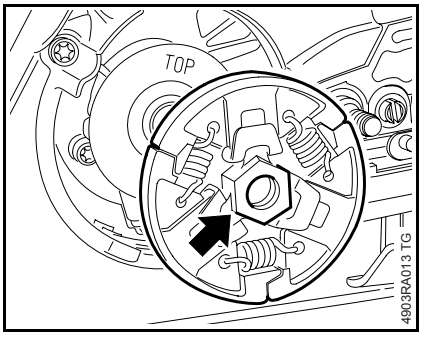


- Check the clutch – all springs (arrows) must be properly attached.

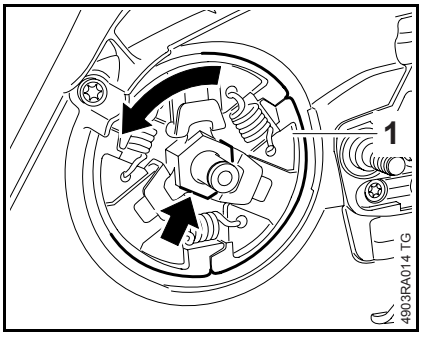


Make sure the washer (1) is in place.

Installed position is correct when **TOP** (arrow) faces outwards.



- Position the clutch on the crankshaft stub so that the raised hexagon (arrow) faces outwards.



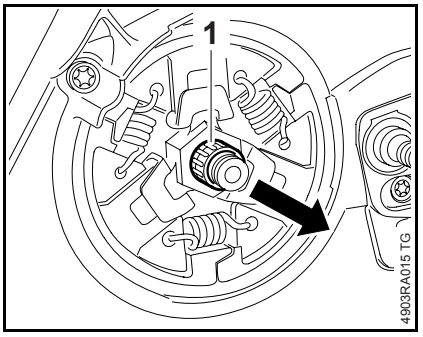
- Screw the clutch (1) on to the crankshaft stub and tighten down the hexagon (arrow) firmly – left-hand thread.

– Remove the locking strip from the cylinder.

– Reassemble all other parts in the reverse sequence.

4.1 Clutch Drum

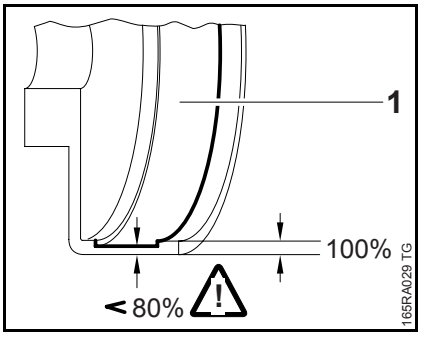
– Remove and install the clutch drum, see instruction manual.



- Pull off the needle cage (1).

– Clean the needle cage and crankshaft stub, 🕮 14

– Lubricate the needle cage and crankshaft stub, 🕮 14



– Inspect the clutch drum (1) for signs of wear.

If there are signs of serious wear on the inside diameter of the clutch drum (1), check the remaining wall thickness. If it is less than about 80% of the original thickness, install a new clutch drum.

– Install the clutch drum.

5.1 Checking Operation

The chain brake is one of the most important safety devices on the machine. Its efficiency is measured in terms of the chain braking time, i.e. the time that elapses between activating the brake and the saw chain coming to a complete standstill.

Contamination (with chain oil, chips, fine particles of abrasion, etc.) and smoothing of the friction surfaces of the brake band and clutch drum impair the coefficient of friction, which prolongs the braking time. A fatigued or stretched brake spring has the same negative effect.

– Starting the engine

– With the chain brake activated (locked), open the throttle wide for a brief period (max. 3 seconds) – the chain must not rotate.

– With the chain brake released, open the throttle wide and activate the brake manually – the chain must come to an abrupt stop.

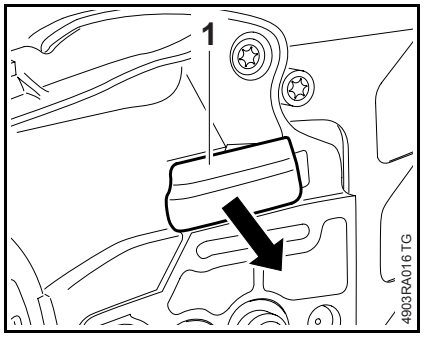
The braking time is in order if deceleration of the saw chain (less than a second) is imperceptible to the eye.

If the chain brake does not operate properly, refer to troubleshooting, 🕮 3.2.

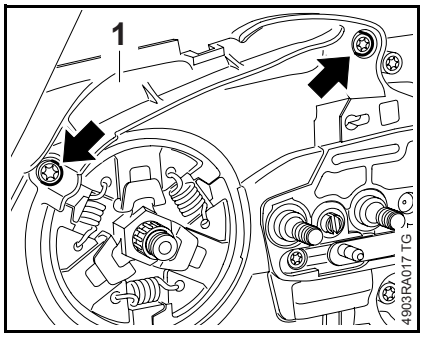
5.2 Brake Band

– Remove the clutch drum, 🕮 4.1

– Troubleshooting, 🕮 3.2

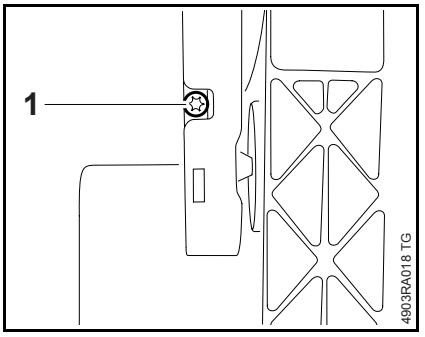


● Pull off the bumper strip (1).



● Take out the screws (arrows).

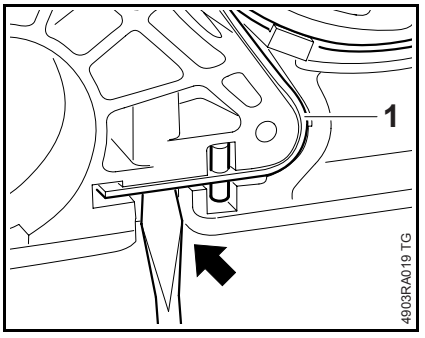
– Remove the cover (1).



– Engage the chain brake.

The brake band is now tensioned.

● Remove the screw (1) from the underside of the machine.

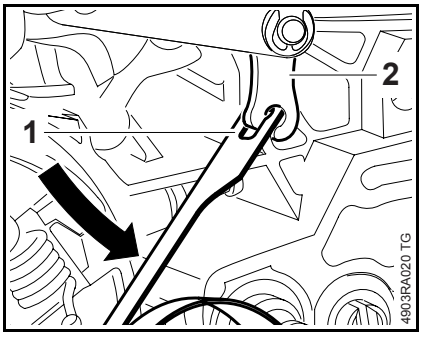


● Pry the brake band (1) out of its seat (arrow).

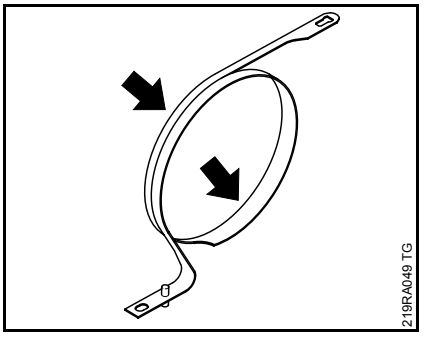
– Remove the brake band (1).

Do not overstretch the brake band.

– Pull the hand guard towards the handlebar to simplify assembly of the brake band.

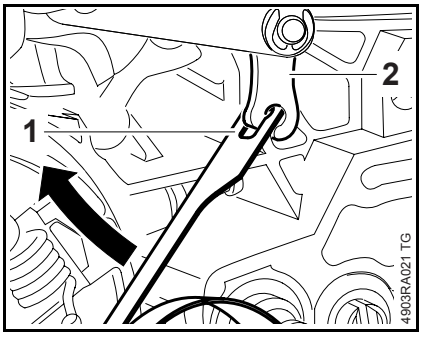


- Turn the brake band (1) to one side and disconnect it from the brake lever (2).

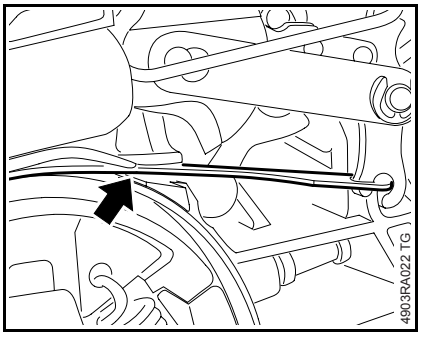


Install a new brake band if there are noticeable signs of wear (large areas on inside diameter and/or parts of outside diameter – arrows) and its remaining thickness is less than 0.6 mm.

Installing

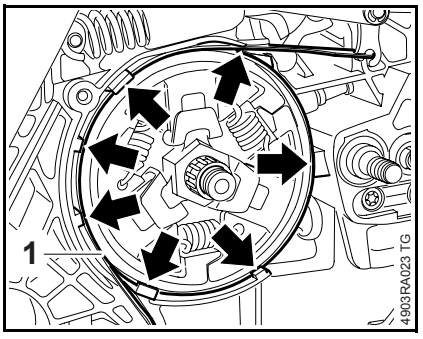


- Hold the brake band (1) sideways, attach it to the brake lever (2) and then swing it in the direction of its seat.

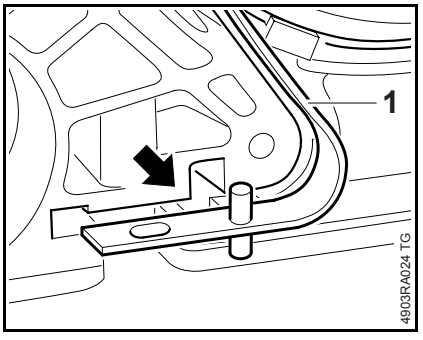


- Position the brake band (1) it the guide (arrow) first.

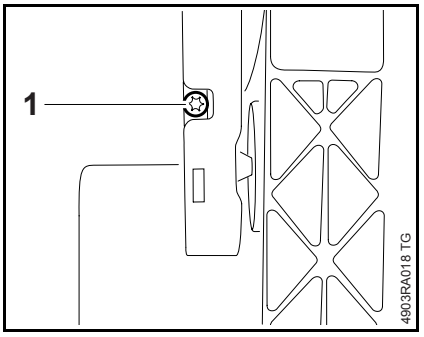
– Disengage the chain brake.



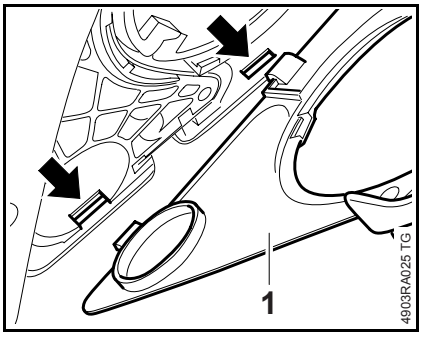
- Push the brake band (1) over the guide lugs (arrows) and into its seat.



- Push the brake band (1) into its seat (arrow) as far as stop.



- Fit the screw (1) on the underside of the machine and tighten it down firmly.



- Engage the cover (1) in the slots (arrows) first and then swing it into position.