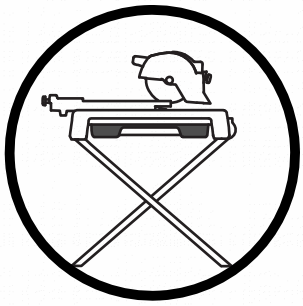
Husqvarna

GB

Workshop manual
TS60



HUSQVARNA CONSTRUCTION PRODUCTS

HUSQVARNA
TS60

CONTENT

Workshop Manual

The Workshop Manual includes virtually all workshop procedures that can come into question on the TS 60. Some very simple and self-evident repairs have been omitted.

OUTLINE

The manual describes dismantling and reassembling of various components through the different chapters.

This means that as a mechanic, at least until you have learnt the basic composition of the machine, you need to start with some earlier chapters to allow for access to the service items concerned. Each chapter begins with what should be performed prior to the service item concerned.

Chapter 10 comprises functional tests for deciding what major components are faulty in case of doubt.

LAYOUT – PICTURES AND TEXT

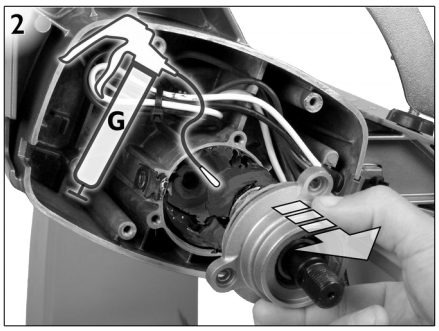
The pictures are mostly enough to guide the mechanic through the various procedures. The text on the right hand column has further references and explanations for the repair work on the machine.

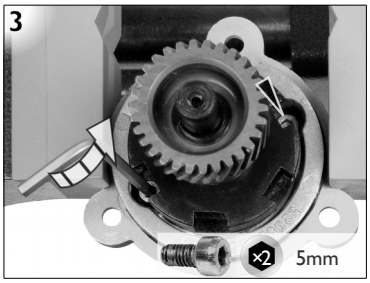
CONTENTS

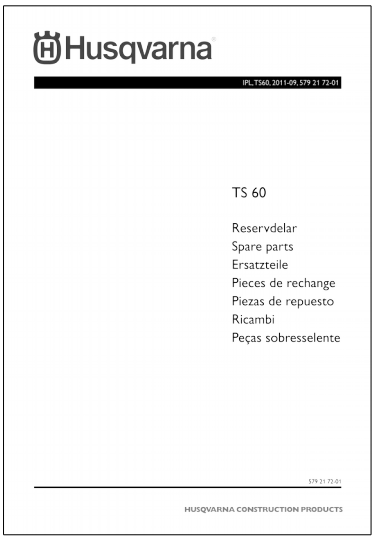
The manual is divided into numbered chapters with chapter headings that are stated in bold at the top of each page.

The list of contents has chapter references as well as page references for relevant subtitles.

Dismantling in basic steps







Spare parts

SPARE PARTS TS 60

All accessory spare parts for these TS machines are part of the latest machine's IPL, available from the EPC (Electronic Parts Catalogue).

All components of the IPLs are illustrated in exploded views, where each component's position, spare part number and appearance can be easily identified. The EPC is available from the Husqvarna support site.

General precautions

READ THE OPERATOR'S MANUAL

- Familiarize yourself with the machine. Read the operator's manual.
- The user's manual contains much information concerning basic service and maintenance, which is important in order to keep the machine safe and reliable.

WARNING

- This symbol indicates that hazardous safety risks to persons must be avoided.

- This symbol indicates when risk of machine damage should be avoided.

HIGH VOLTAGE

- Risk of electric shock. Service work on the machine should be performed with the power cable disconnected.
- Certain service actions that need connection to power mains, such as troubleshooting electric system should be performed by a qualified electrician.

Prevent electrical hazards

CHECK BEFORE DISASSEMBLING

- Prevent the risk of the wrong cable being accidentally connected to power mains. A simple method is to wrap tape around the power cable contact pins.

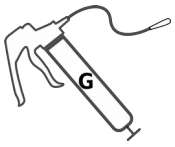
TEST AFTER REASSEMBLING

- Always perform an Insulation and Continuity test after reassembling to ensure that the machine is safe to use.

Chemical substances
When performing service tasks involving the use of chemical substances (such as lubricants or retainer compounds), please refer to the instructions from the manufacturer.

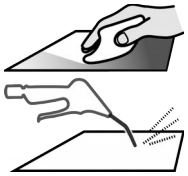
Occurring symbols in the manual

Several graphical symbols are inserted in the manual's illustrations as simple means to better show details on actions to be taken, thus reducing the need to read through too much text.

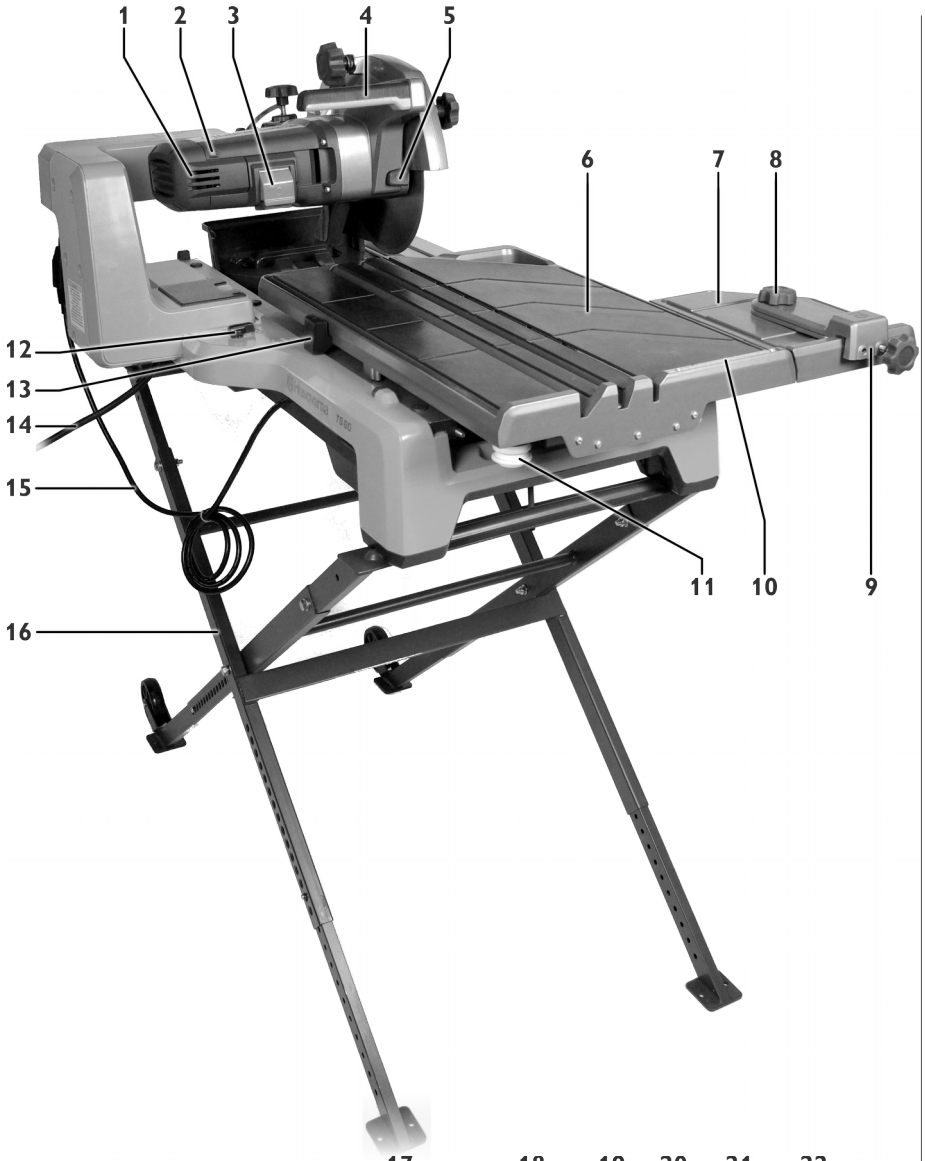


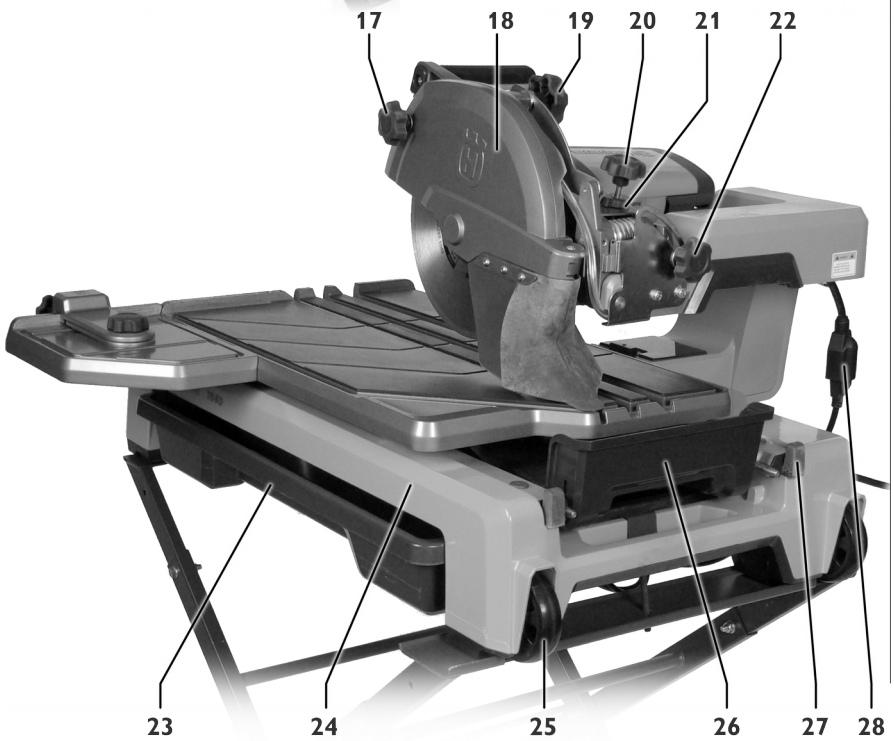
LUBRICATING GREASE
- Apply lubrication of recommended quality
  See chapter 11 under “Recommended tools”

SCREWS OR FASTENERS (EXAMPLE)
- Quantity: 4
- Suitable tool: Allen wrench, size 2,5mm



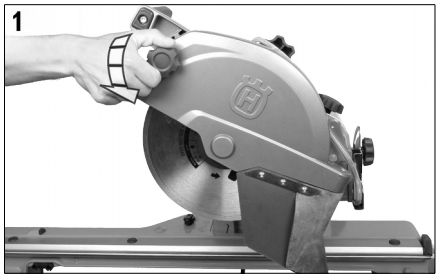
KEEP MACHINE AND WORK AREA TIDY
- Prior to service; thoroughly clean areas concerned
- Remove dirty grease and lubricants
- Wipe clean with suitable solvent or cleaning agent and use compressed air to remove any dust or debris

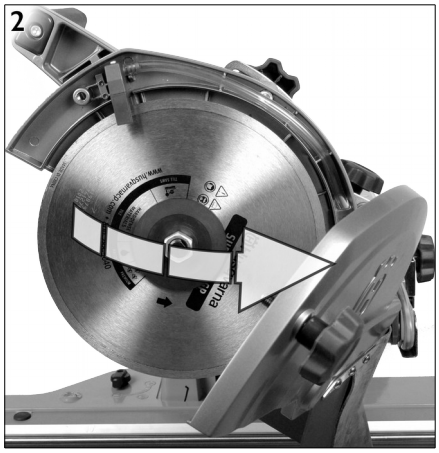


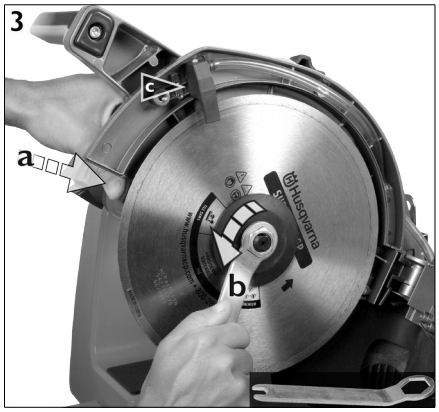


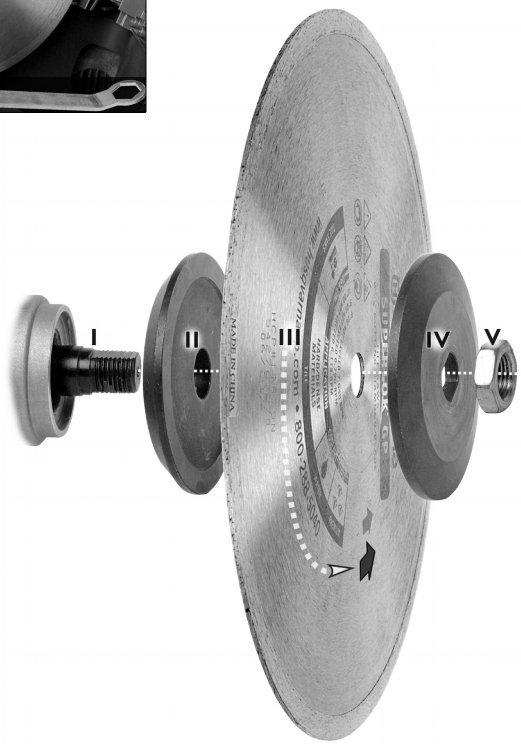
Components

1. Electric motor
2. Load indicator, Elgard™
3. Power switch*: has different design depending on country.*
4. Handle, cutting arm
5. Button, locking blade shaft
6. Conveyor cart
7. Side table
8. Locking knob, angle adjustment cutting guide
9. Cutting guide with locking knob
10. Adjustable ruler
11. Conveyor cart roller(s)
12. Water knob, water to blade ON/OFF
13. Conveyor cart lock
14. Power cable
15. Power cable to water pump (in tray)
16. Folding stand
17. Locking knob, blade guard
18. Blade guard
19. Locking knob, depth adjustment
20. Knob, depth stop adjustment
21. Locking nut, depth stop adjustment
22. Locking knob, miter cutting
23. Water tray
24. Frame
25. Transport wheels
26. Slurry collector tray
27. Cart stop
28. Machine power outlet for water pump (in tray)









REMOVING THE CUTTING BLADE

Make sure to unplug machine from power outlet and do as follows:

Blade guard

1. Turn blade guard knob counterclockwise
2. Fully open blade guard

3. Remove the cutting blade:
   (a) press the spindle lock knob
   (b) unscrew the cutting blade nut
   - use the supplied blade key that fits under the motor arm

   (c) blade water nozzle fixed in cast grove (see next page)

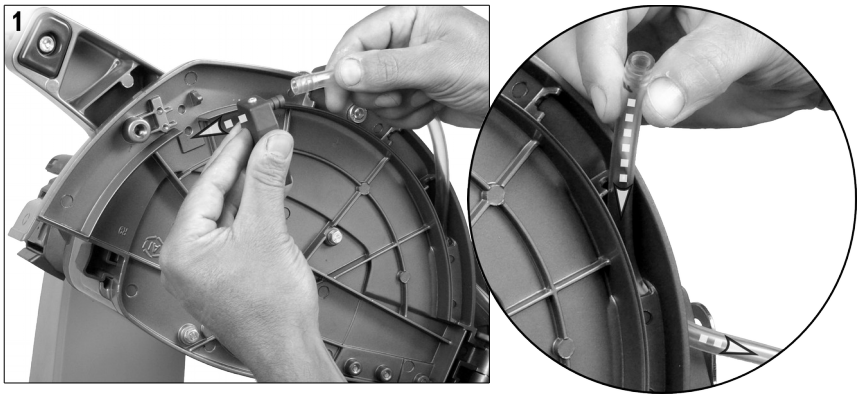
Cutting blade attachment

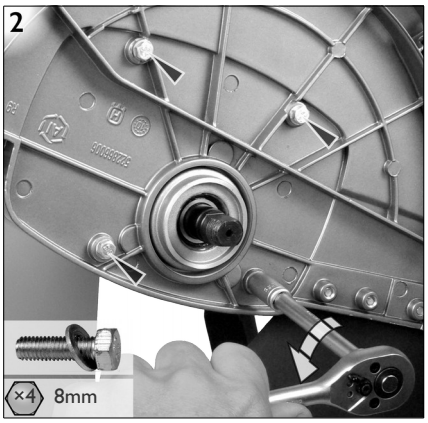
Locate the following parts:

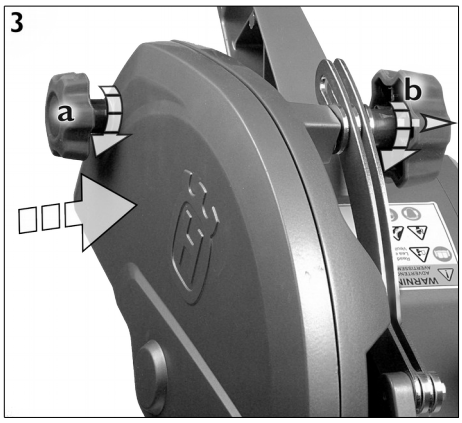
I. spindle
II. inner flange
III. cutting blade
– note rotation arrow – counterclockwise
IV. outer flange
V. cutting blade nut

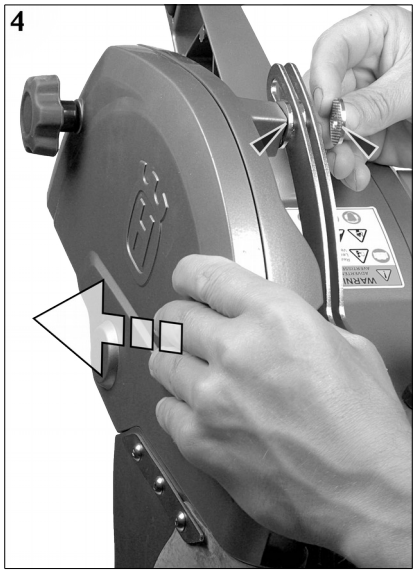
REASSEMBLING

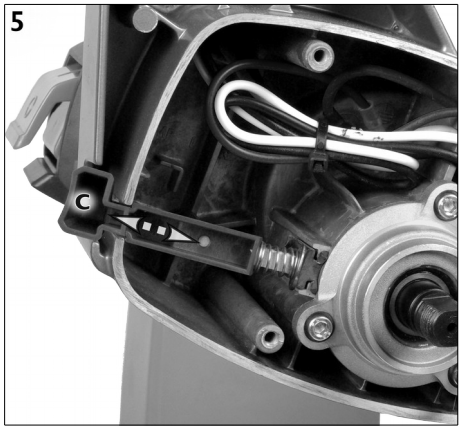
Simply reverse the above steps

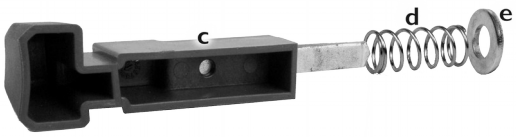












THE BLADE WATER SUPPLY

1. Remove water hose nozzle
   - thread the hose out of the blade guard

BLADE GUARD

2. Remove the four blade guard fasteners with washers
   - use a 8mm socket key
3. Close the blade guard
   (a) attach the blade guard knob
   (b) remove the blade depth knob
   - hold blade guard in place

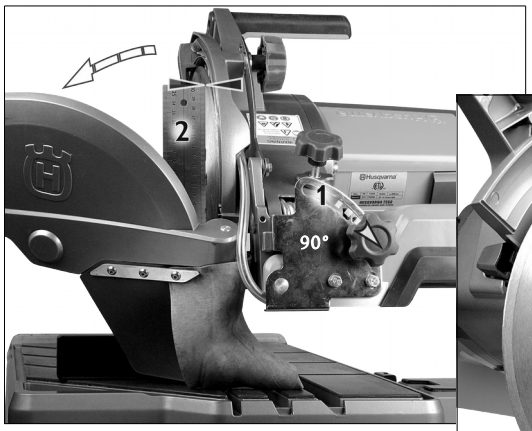
4. Remove the blade guard
   - take care of the washers:
     – one friction on either side of the blade depth guide and a standard washer in between.

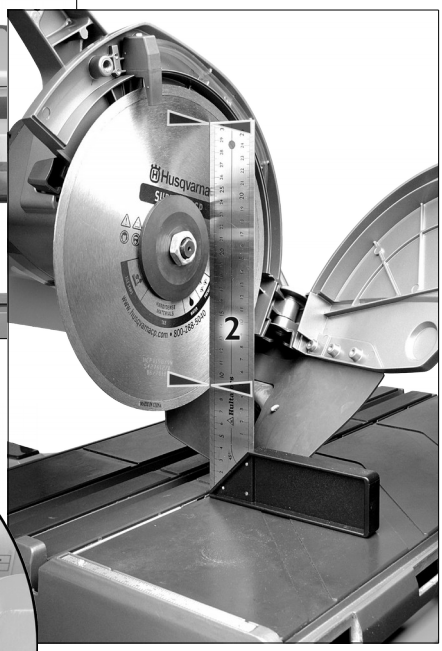
Spindle lock knob

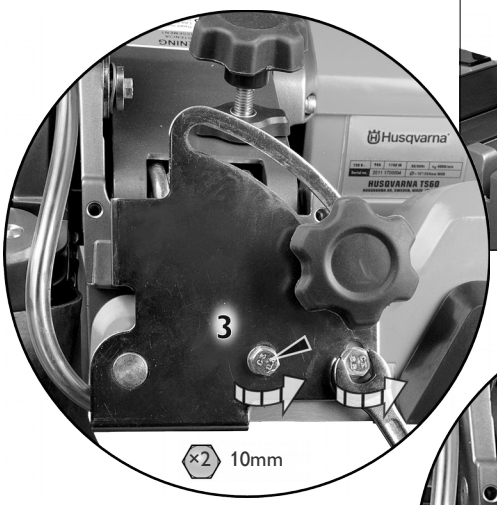
5. The spindle lock knob (c) comprises the following parts:
   (c) spindle lock knob with metal blade end
   (d) spring
   (e) spring washer

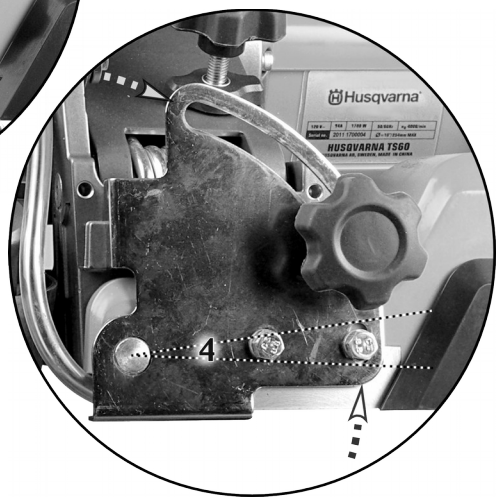
REASSEMBLING

Simply reverse the above steps









CUTTING BLADE ADJUSTMENT

Checking blade at 90°

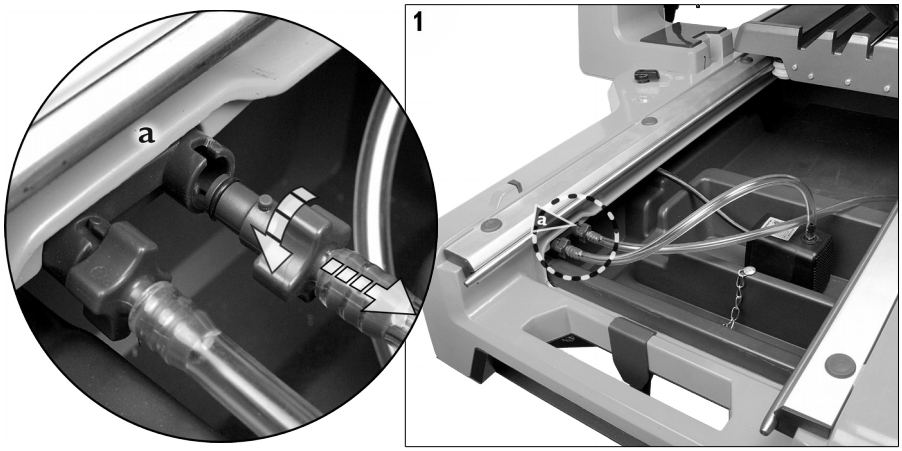
1. Lock angle knob in fully down position (90°)

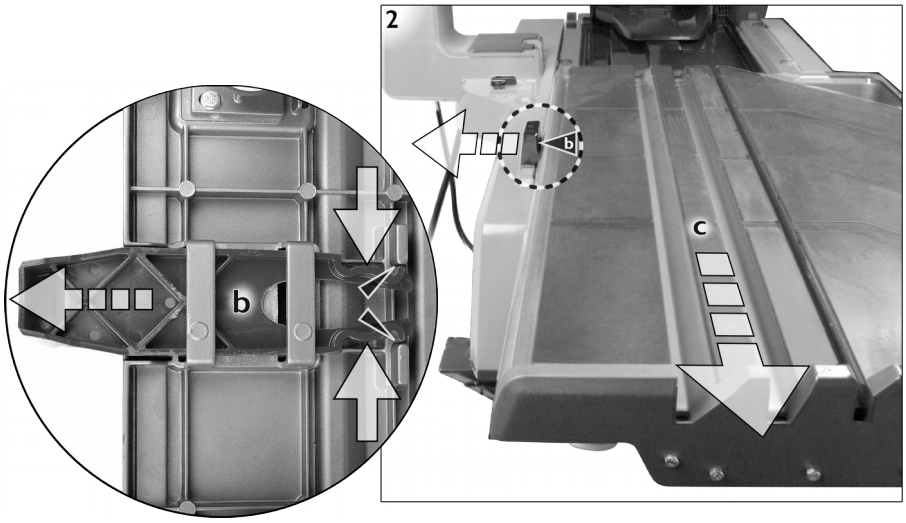
2. Fit an L square angle ruler between conveyor cart and the vertical blade
   - if blade is parallell with the L-square, no further adjustments are needed
   - if the blade is not parallel with the L square, proceed with fine tuning, see step 3 below

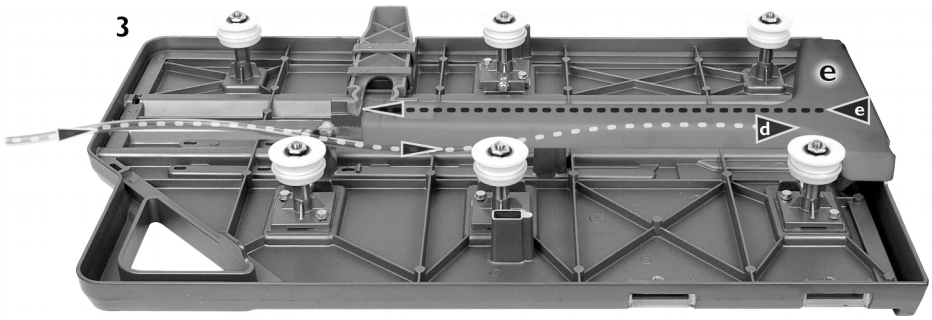
Fine tuning perpendicular cut (90°)

3. Loosen slightly the two angle fine tuning fasteners
   - use a 8mm spanner

4. Use a mallet to carefully knock the angle guide in the desired direction
   - check blade with L square ruler
   - tighten the two angle fine tuning fasteners when the cutting blade is properly tuned







The water system is crucial to:

- keep the environment dust free
- cool the cutting blade and work piece
- lubricate the cutting blade

DISMANTLING

Conveyor cart

The conveyor cart hose supply water through the 90° cutting track to flush off dust and debris.

1. Locate the conveyor cart hose coupling
   (a) twist counterclockwise and pull out
   – check O-ring, replace if worn

2. Locate the conveyor cart lock device
   (b) squeeze lock springs together (from underneath) and pull out the lock device
   (c) pull out conveyor cart

3. Put conveyor cart upside-down on a work bench
   (d) conveyor cart hose and connection to cart cutting slot
   (e) cutting slot drain way

Water pump

4. Locate water pump with connections:
   (f) water pump, inside water tray
   (g) power cable with plug connected to machine power outlet
   (h) pump hose connector (proceed as with 1a above)

Disassembling the pump

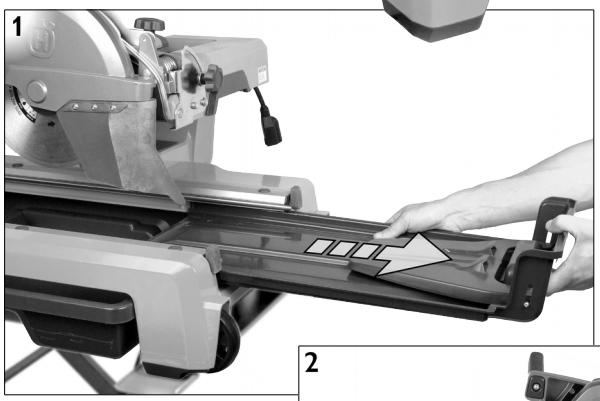
Clean pump interior and components by disassembling the following parts:

(a) pump cover
(b) impeller cap
(c) impeller
(d) pump house

Water system to cutting blade

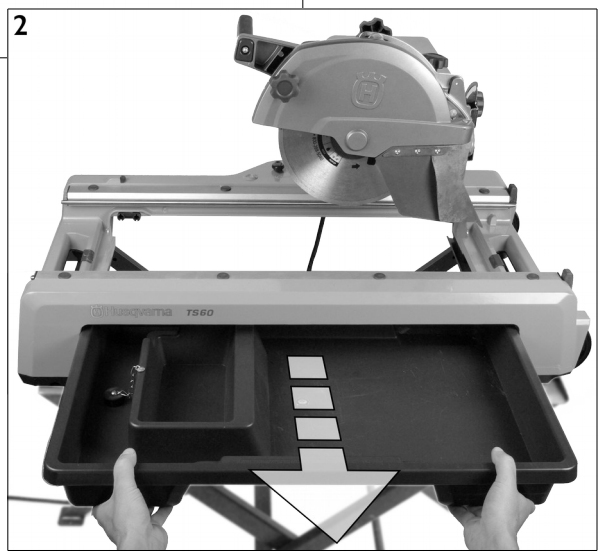
Hoses inside frame and arm comprise:

(e) hose connection from pump
– see previous page 4h
(f) water flow control
(g) hose nozzle above blade
– see previous chapter “Cutting blade”



1. Remove the slurry collector tray

• Pull straight out past the slide stop

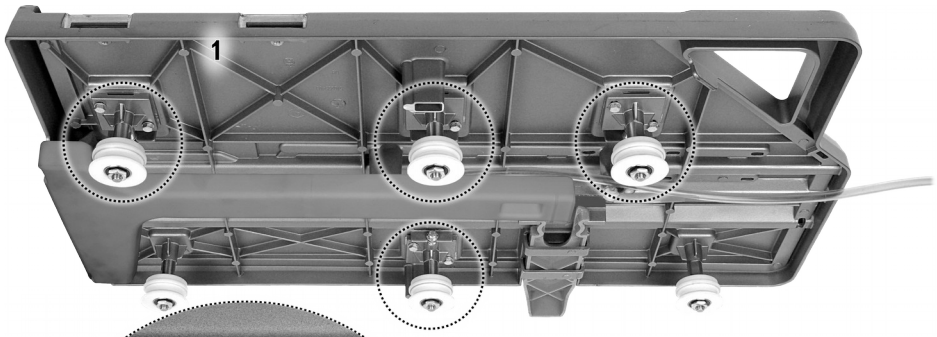


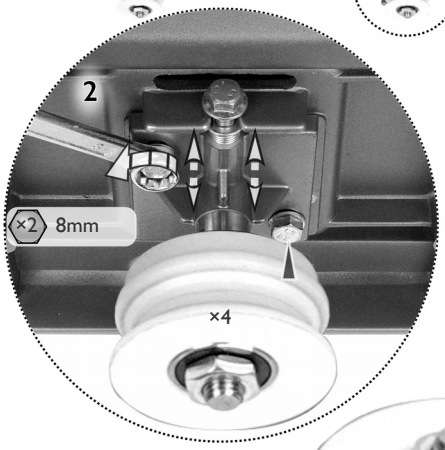
2. Remove the water tray

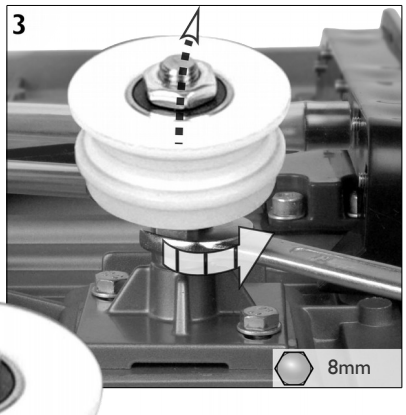
• Pull straight out

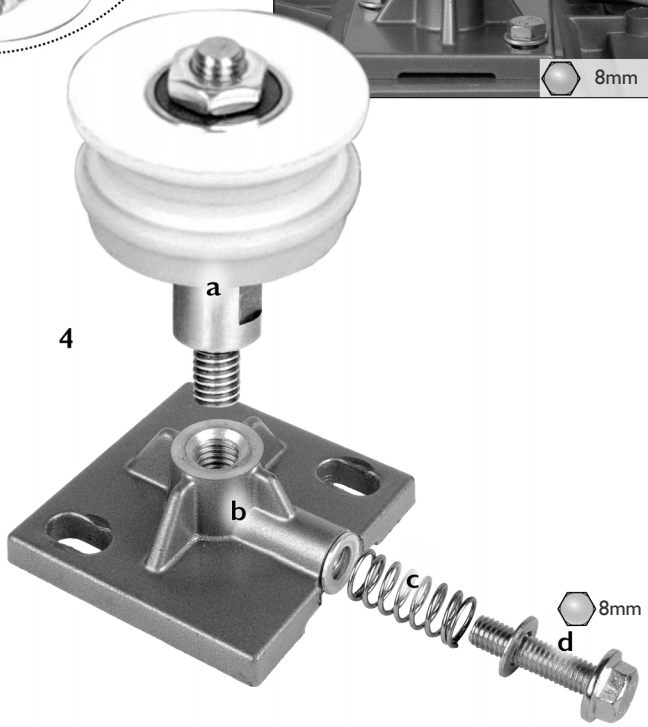
REASSEMBLING

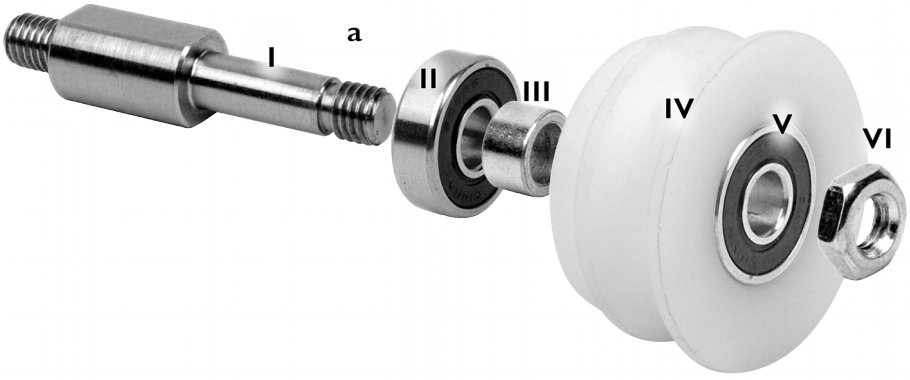
Reverse the steps described above.











CHECK THE GUIDE ROLLERS

The conveyor cart should slide firmly but smoothly. In case of resistance or imprecise sliding; clean from dirt or debris and check that roller shafts are properly tightened.

If this does not help, the rollers may need adjustment.

Preparations

- Remove slurry collector tray, pump and water tray to access the guide rollers (see previous chapter).

Out of six guide rollers, two are fixed and four are adjustable:

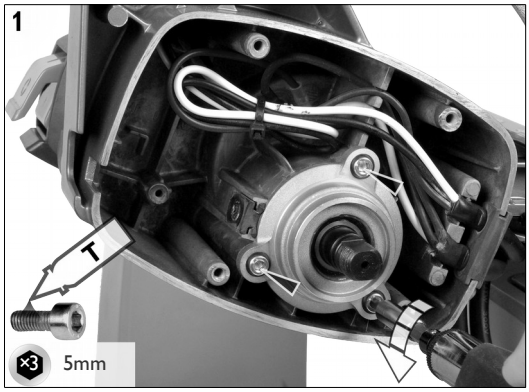
1. Lock the cart in its mid position
   - rotate each roller by hand
     - – check that each one rotates freely using roughly equal force
     - – if not equal, realign the rollers:

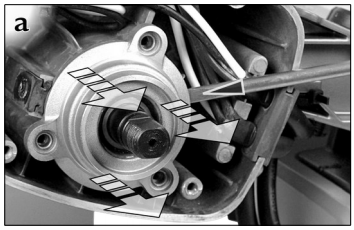
ALIGNING THE GUIDE ROLLERS

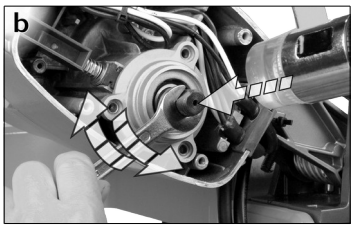
2. Loosen the four roller brackets
   - loosen all fasteners
     - – rock the cart back and forth to allow all springs (a) to push rollers towards the guides
   - re-tighten fasteners of all roller brackets
3. **Disassembling a roller**
   - remove the conveyor cart
     - – see the first two steps of previous chapter
   - unscrew the roller shaft from the bracket with a spanner

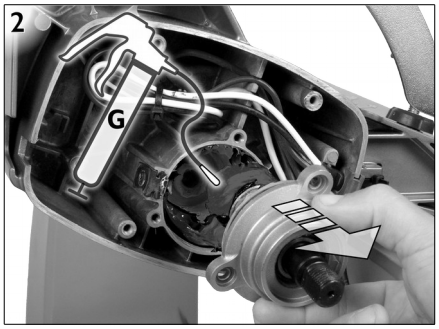
4. **Roller and adjustable bracket**

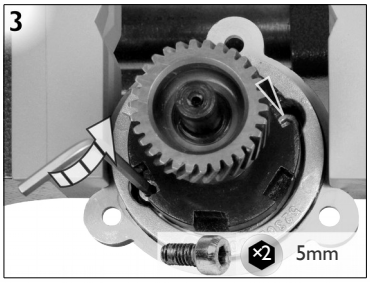
(a) roller shaft with nylon roller comprising:
 I. roller shaft
 II. upper bearing
 III. spacer tube
 IV. nylon roller
 V. lower bearing
 VI. roller nut
(b) adjustable guide roller bracket
(c) roller push spring
(d) spring fastener with washers

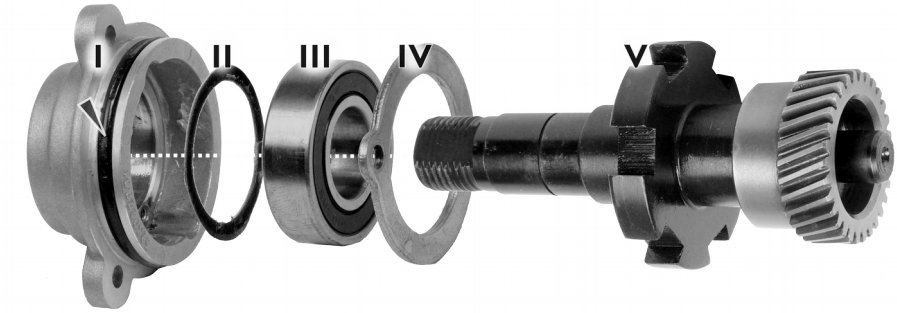


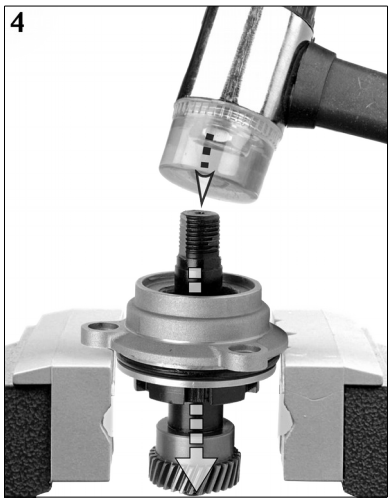


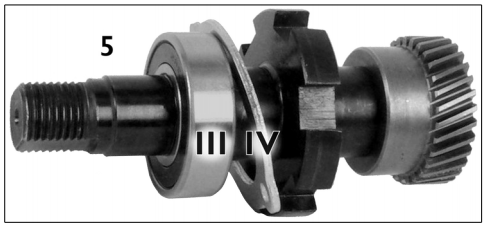


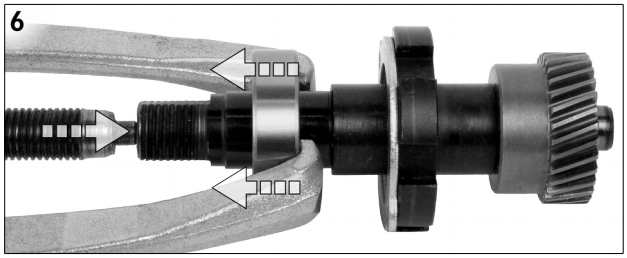












Preparation

- Remove cutting blade and blade guard (see chapter 4)

DISMANTLING

1. Remove the three bearing housing fasteners with an Allen key.

T. when reassembling, secure the two fasteners with threadlock compound, see chap. 11

(a) Remove bearing housing:

- use a bladed screwdriver around the bearing housing to evenly lift it out

(b) when reassembling, use a spanner to slightly turn spindle while knocking the gears in place

2. Lift out the bearing housing

G: when reassembling, apply 30 g (1 oz) of lubricator to contact surfaces, see chapter 11

3. Remove the two bearing plate fasteners
   – use a 5mm Allen key

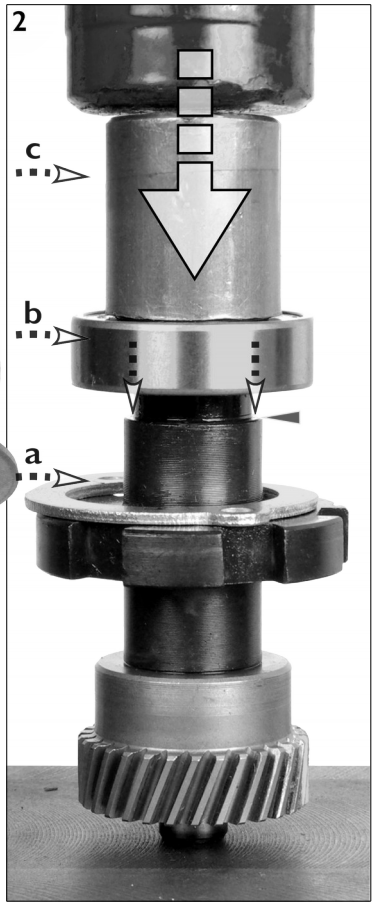
Gear shaft parts

I. Bearing housing with O-ring
II. Bearings seal
III. Bearing
IV. Bearing plate
V. Gear shaft assembly

4. Remove bearing housing
   - Fit bearing housing in a support, e.g. a vice:
     – use a rubber mallet to knock out gear shaft with bearing

5. Gear shaft with bearing and bearing plate

6. Pull off bearing
   – use a bearing puller



Reassembling gear shaft

FITTING ON SHAFT BEARING

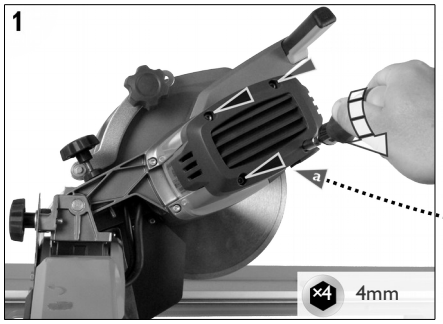
1. Place gear shaft with spindle upwards in a dedicated press tool:
   (a) first, fit on the bearing plate
2. Press bearing with the following set-up:
   (a) bearing plate
   (b) bearing
   (c) press cylinder
   – use a size to fit the bearing inner diameter (Ø 17mm)
   • press bearing fully down on its seat

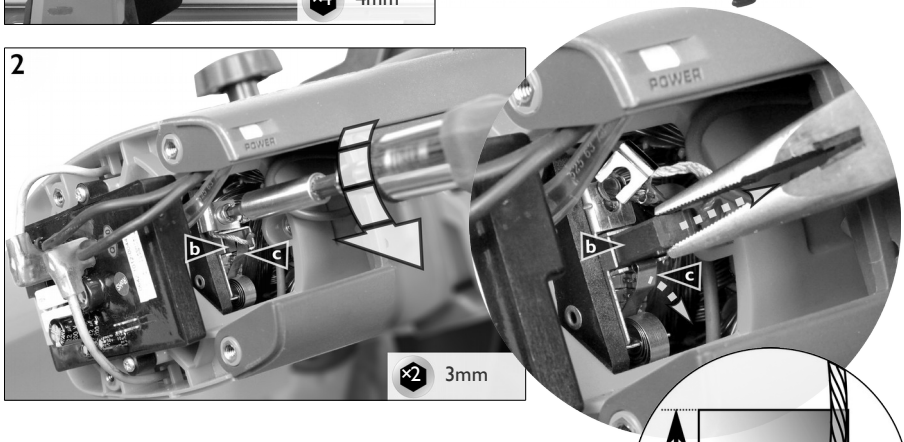
3. **Replacing gear shaft needle bearing**
   (d) needle bearing
   (e) bearing puller mounted on glide hammer
   • remove the needle bearing with a inner bearing puller and a glide hammer
   – a removed needle bearing must be replaced with a new one!

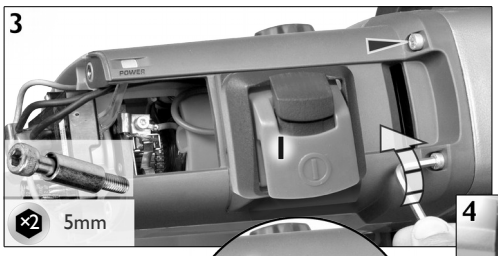
   – *use a press tool to fit the new needle bearing in place*

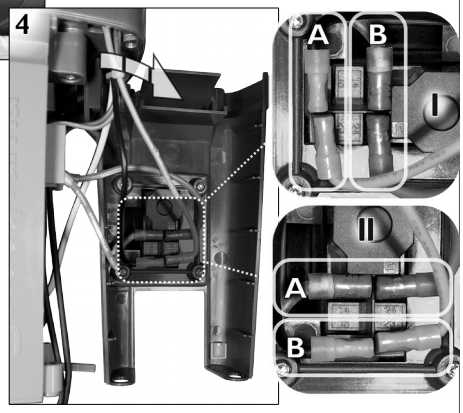
FURTHER REASSEMBLING

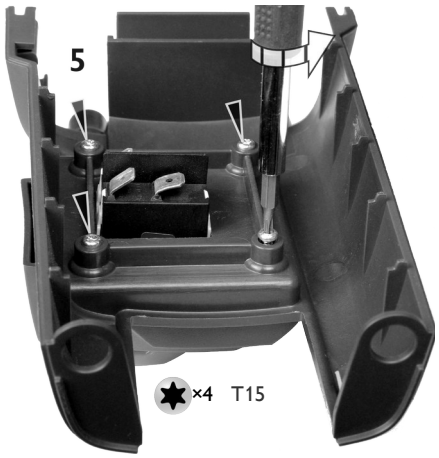
Carry on by reversing step 1–5 on previous page.











Disassembling

1. **Electric components cover**
   - remove the four Allen fasteners
     – take care of the spacers

   (a) direct notch downwards when reassembling

Carbon brushes

2. One brush on either side.
   - take out brushes before removing motor cover (see chapter 8)
   - remove the brush cable screw with a 3 mm Allen key

   (b) carbon brush
   – replace brushes before they go deeper than 9mm (0.38 in) into their slots (≈100hrs high current usage)
   – lift off spring before pulling out brush

   (c) carbon brush spring
   - *to remove brush kit, first remove circuit board, see next page*

Power switch module

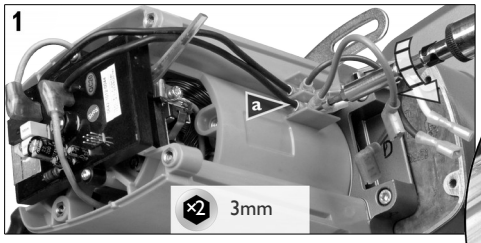
3. Remove the two power switch cover fasteners with a 5 mm Allen key.
   - take care of the spacers

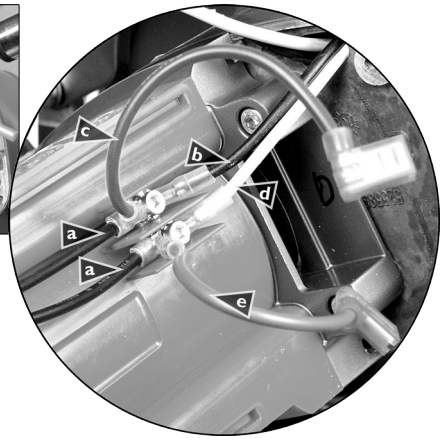
   Power switch module:
   I. USA
   II. Other countries
4. Fold out the cover and remove the cables:

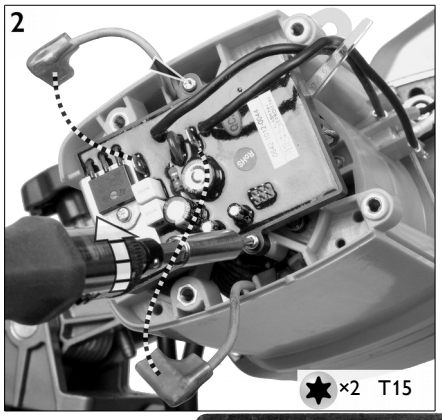
	I USA	II Other countries
A	blue brown	blue brown
B	white black	black red

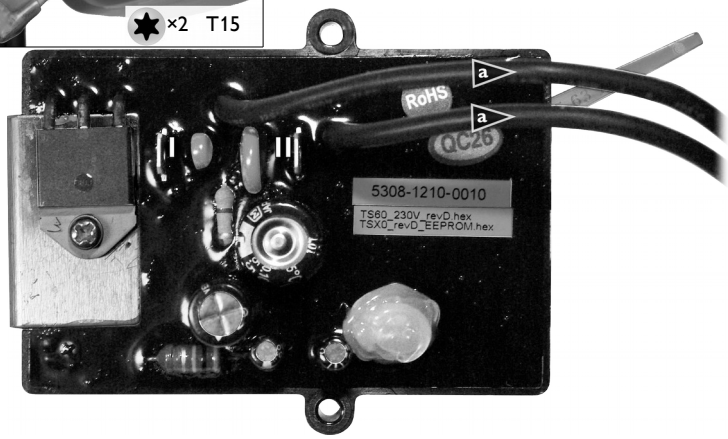
5. Power switch module: I or II
   - remove the four fasteners with a T15 Torx key
6. Separate power switch module from its cover

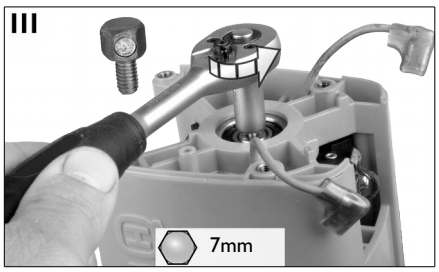
REASSEMBLING
Perform the above steps in reverse.

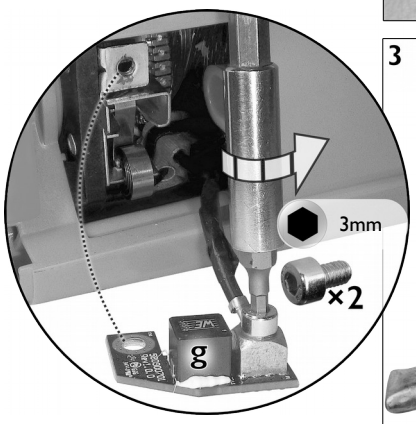


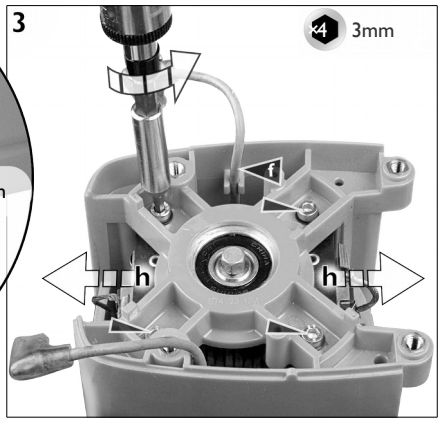












Circuit board

REMOVE THE ELECTRIC CABLES

1. Remove the cable junction fasteners:

	USA	Other countries
(a)	black×2	black×2
(b)	black	brown
(c)	blue	blue
(d)	white	green
(e)	brown	brown

2. Remove the two stator cables from the circuit board
   - unscrew the two card fasteners
     – use a T15 Torx key
   - remove the circuit board

Circuit board components/attachments

(a) black×2 (to cable junction, see 1a)
I. connector to stator kit cable
II. connector to other stator kit cable

III. rotation speed sensor
– remove rotation sensor magnet with a 7 mm socket wrench

REMOVE THE BRUSH KITS

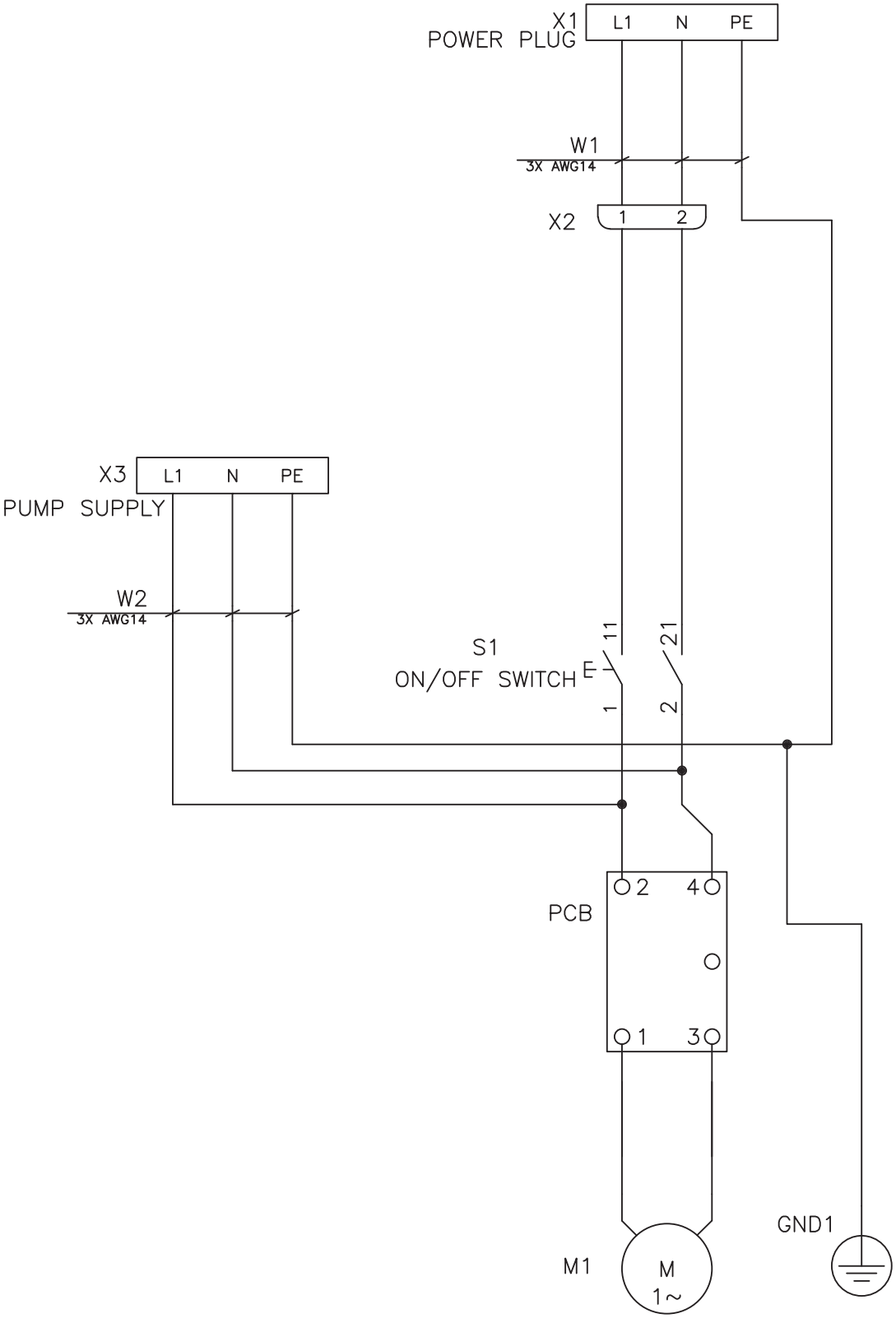
3. Remove each pair of brush kit fasteners
   – use a 3mm Allen wrench

(f) remove brush kit cable from plastic clip
(g) for non-USA countries, remove the filter cards, attached with the brush kits:
– use a 3mm Allen wrench
(h) disengage and remove the brush kits

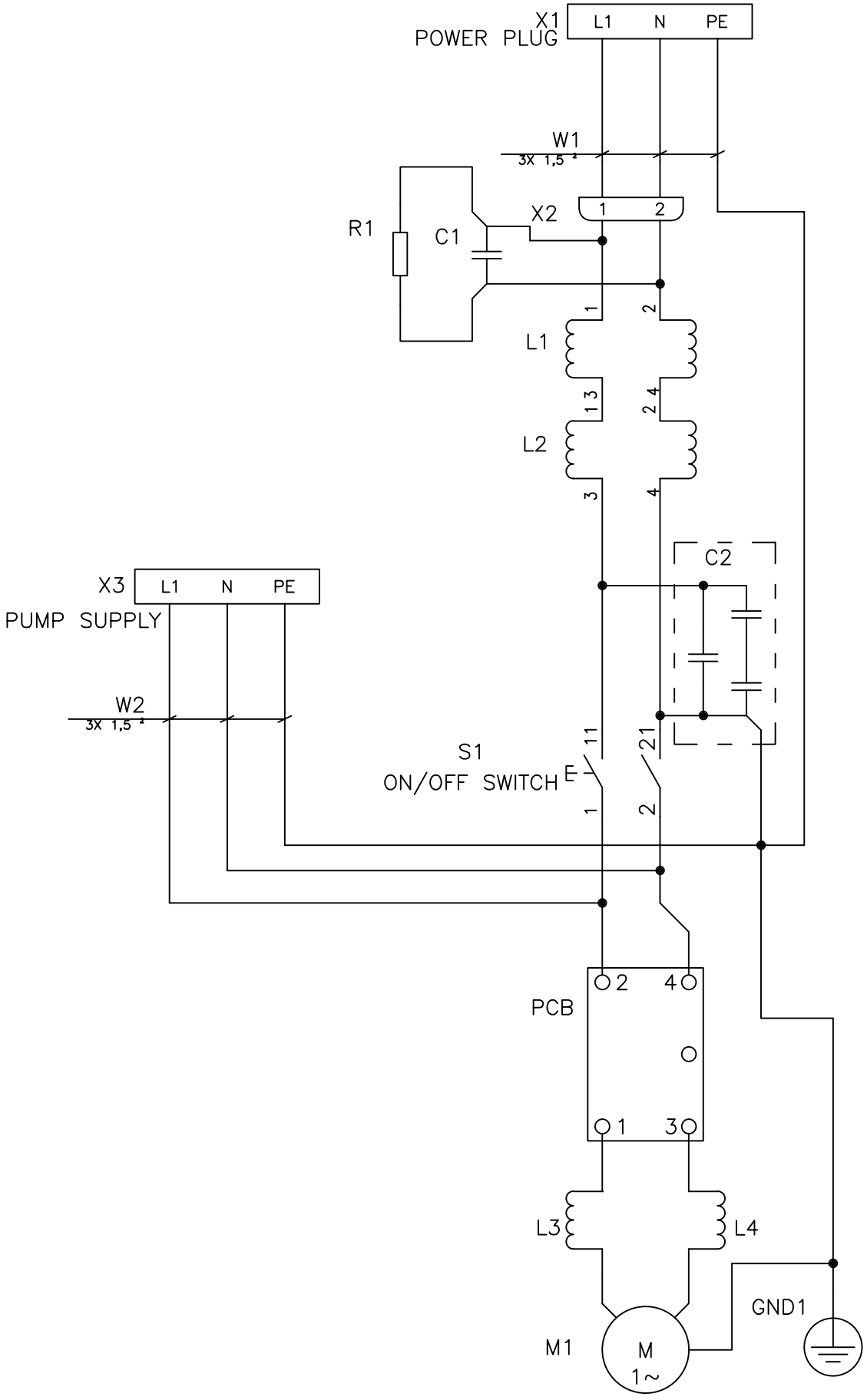
REASSEMBLING

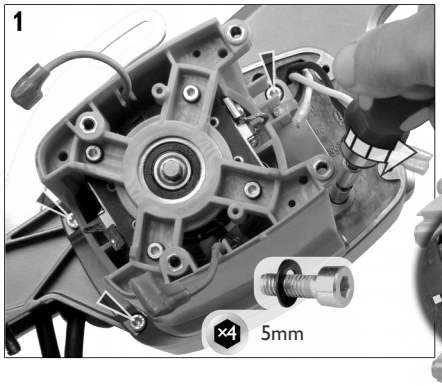
Perform the above steps in reverse.

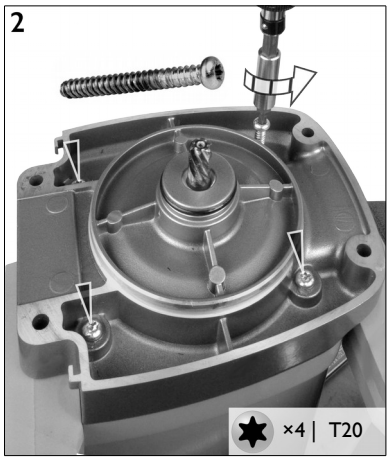
Electric diagram – USA

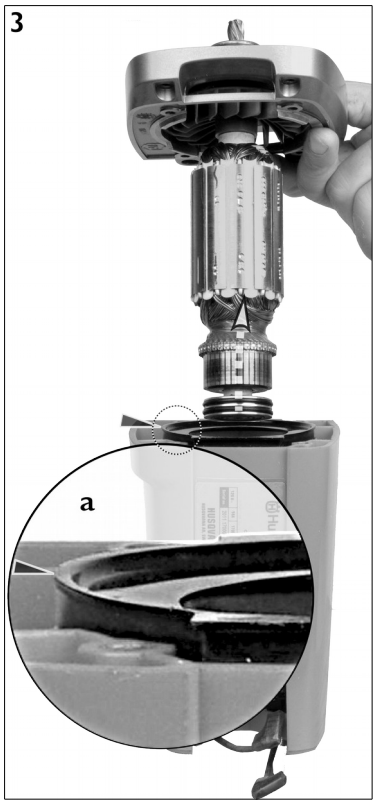


Electric diagram – 230V









Removing motor and motor shaft

PREPARATIONS

- Remove the electric components as described in previous chapter 8 “Electric system”.

1. **Motor unit**
   - remove the four motor unit fasteners with an Allen key
   - lift off motor and secure the carbon brushes:

   I. pull out the brushes about 1cm

   II. the springs should keep the carbon brushes securely fixed

   – *this will also keep brushes secure from being damaged when reassembling*

2. **Motor cover**
   - remove the four motor unit fasteners with a Torx key

3. Separate cover from motor with shaft

   (a) remove the air conductor

   Reassembling:

   – *fit air conductor in position to aluminum fixture before reassembling, the single framed side facing upwards*

   – *check that carbon brushes are secure, (see step 1 I–II above)*

STATOR

4. Remove the two stator fasteners with an Allen key
   - take care of the two-piece wedge cam washers

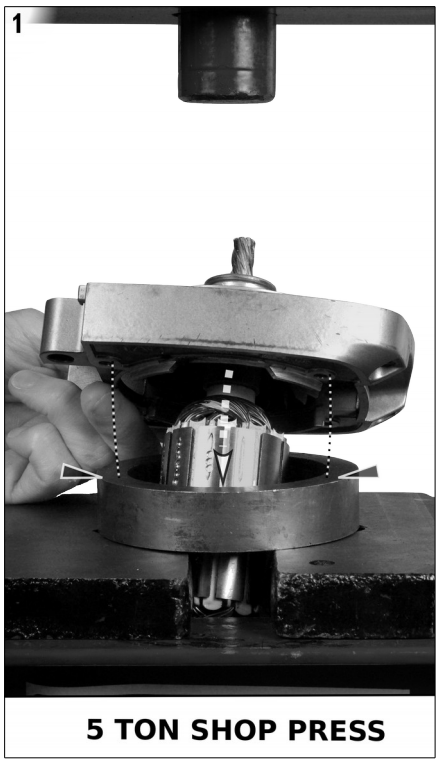
5. Separate stator from motor cover

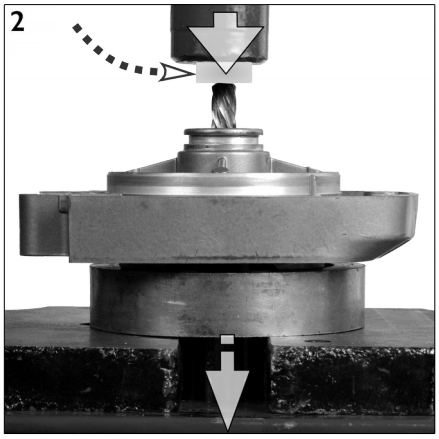
   (b) remove the brush kits as in previous chapter

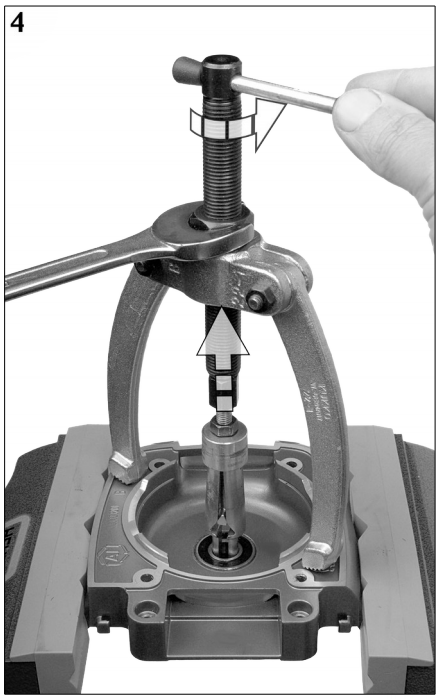
   – *brush kits are easier to attach to motor cover prior to reassembling*

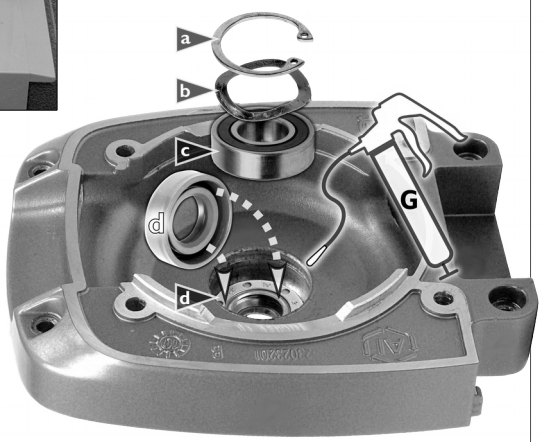
REASSEMBLING

Where otherwise not stated, follow the above steps in reverse.









Removing motor shaft bearings

Proceed from step 3, previous page.

PINION BEARING

1. Place motor in shop press with the pinion up.
   - use a spacer to evenly support the pinion bearing house/cover
2. Fit in a nylon piece as pinion protection and press down
   - take care of motor as motor shaft is pressed out

3. Turn pinion bearing house/cover around
   (a) remove the bearing circlip
   (b) remove the wave spring washer

4. Remove bearing
   - use an internal bearing puller

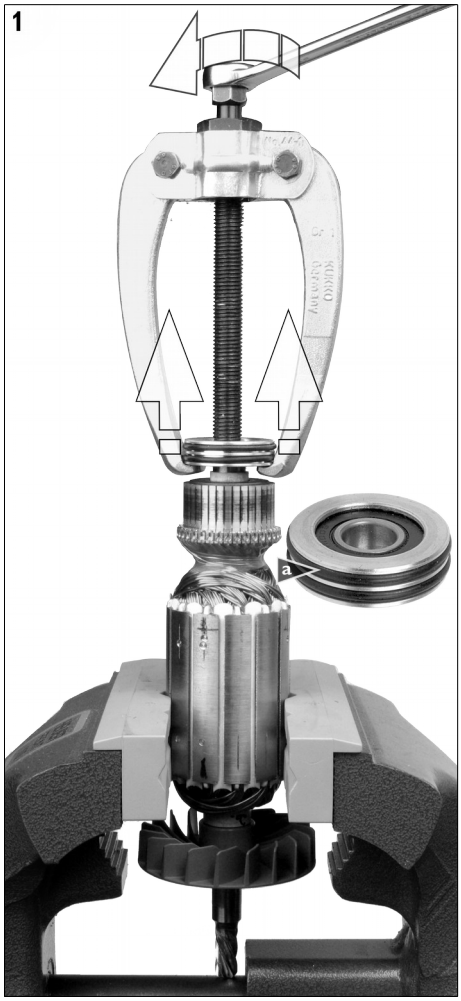
PINION BEARING PARTS

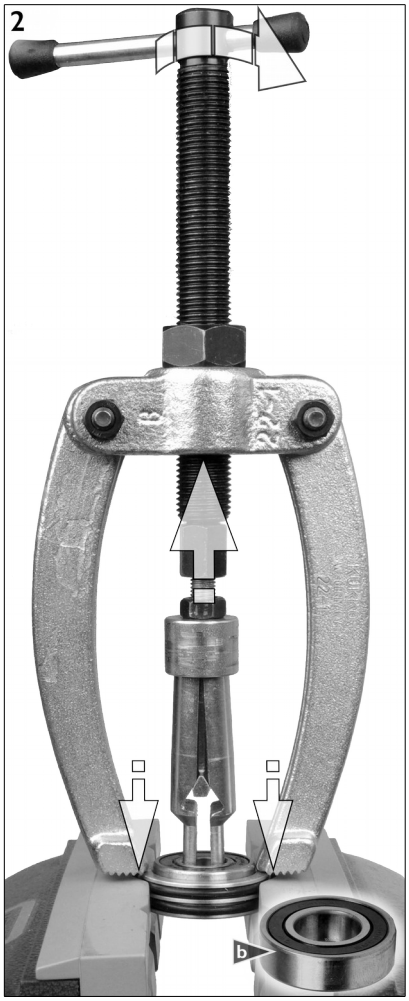
(a) bearing circlip
(b) wave spring washer
(c) bearing
(d) bearing seat with radial seal
N.B. replace radial seal if removed
Insertion: Flat surface upwards

G: Apply grease to contact surfaces when reassembling, especially if radial seal is replaced.

REASSEMBLING

Follow the instructions on the following pages “Reassembling motor shaft bearings”.





EXTERIOR BEARING

1. Remove the bearing and it's support
   - use a universal puller

   (a) bearing support
   - check the dual O-rings, replace if worn or if cracks are visible

   – pull off only the bearing support by fitting the pullers claws close to the edge. The bearing can then be pulled off using the same method.

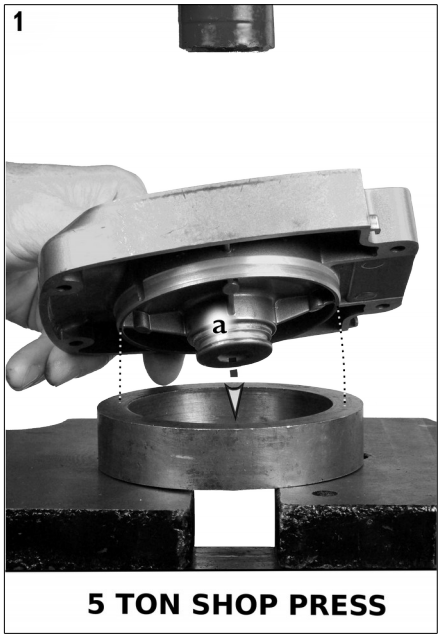
2. Pull bearing out of support by means of an internal bearing puller

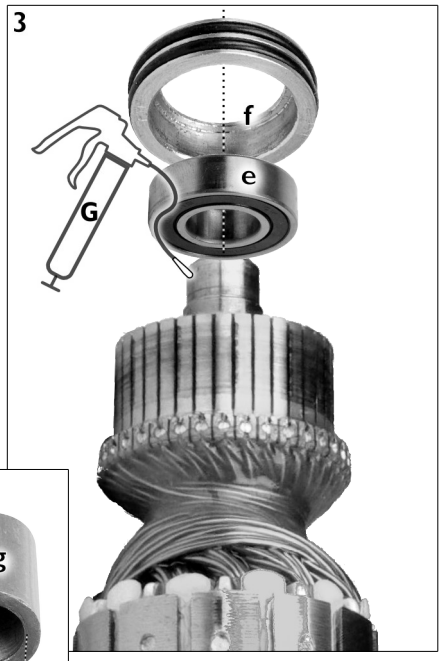
   (b) bearing

By fitting the puller's claws close to the edge of bearing support at step 1, the bearing can then be removed by repeating the process a second time.

REASSEMBLING

Follow the instructions on the following pages “Reassembling motor shaft bearings”.





Reassembling motor shaft bearings

PINION BEARING

The bearing parts should be fitted as follows:

G: Apply grease to contact surfaces before reassembling, especially if radial seal is replaced.

(a) bearing seat with radial seal
N.B. flat surface upwards!
(b) bearing
(c) wave spring washer
(d) circlip

1. Place bearing housing/cover in shop press
   - use a spacer to evenly support the pinion bearing house/cover
2. Fit motor shaft pinion through bearing and press in position

EXTERIOR BEARING

3. Fit on bearing and it's support:

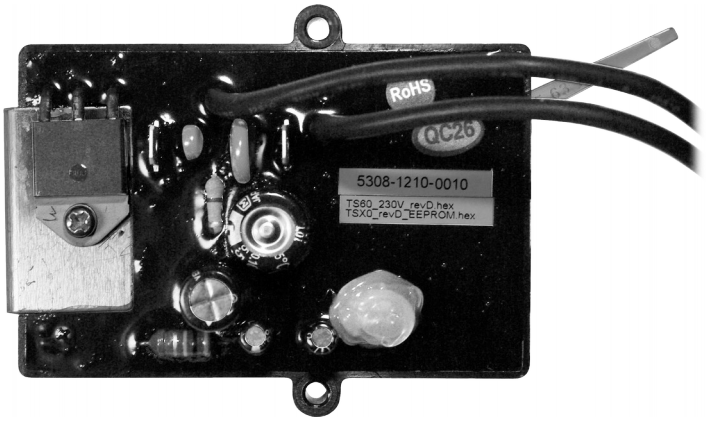
G: Apply grease to contact surfaces, including the O-rings

(e) press bearing on shaft, (see step 4)
(f) press bearing support on bearing (without a spacer tube)

4. Press bearing on shaft:
   (g) use a spacer tube to distribute pressure to inner ring of bearing

FURTHER REASSEMBLING

See first page of this chapter and follow the steps in reverse.



Circuit board

Troubleshooting the circuit board directly requires specialist skills. However, you can normally conclude that the circuit board is defective if the motor and stator are found to be in working order, see below.

Rotor

The condition of the motor can be checked by measuring its inductance, L. The unit for inductance is Henry (H).

PREPARATIONS

Tools needed:

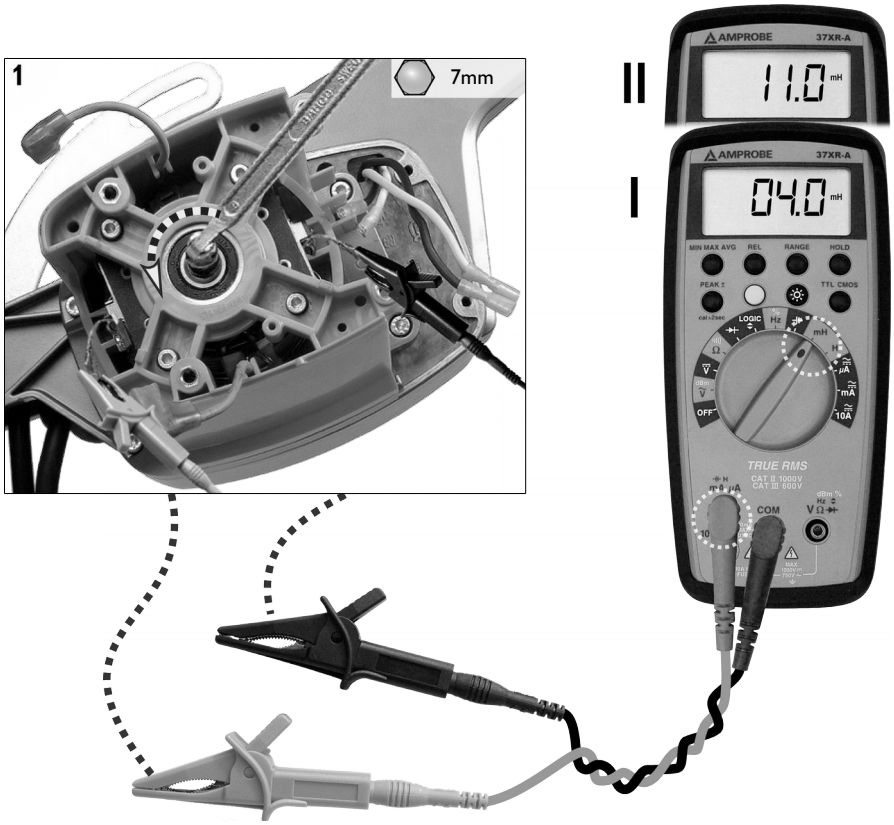
- digital multimeter capable of measuring inductance (L: mH)
- short probe cables with crocodile clips
  - for accurate reading, twist the probe cables (avoid coils).

Disassembling (see "Electric system")

- remove electric components cover (see chap. 8:1)
- remove fasteners for circuit board to access the rotation speed sensor with a socket key (see chap. 8: pg 18)
- remove carbon brush cable screws (see chap. 8: 2) and fold out wire

1. Testing rotor inductance

- set digital meter to **mH**
- attach probe cable clips to carbon brush cables
- turn motor slowly with a 7 mm socket wrench and check readings:



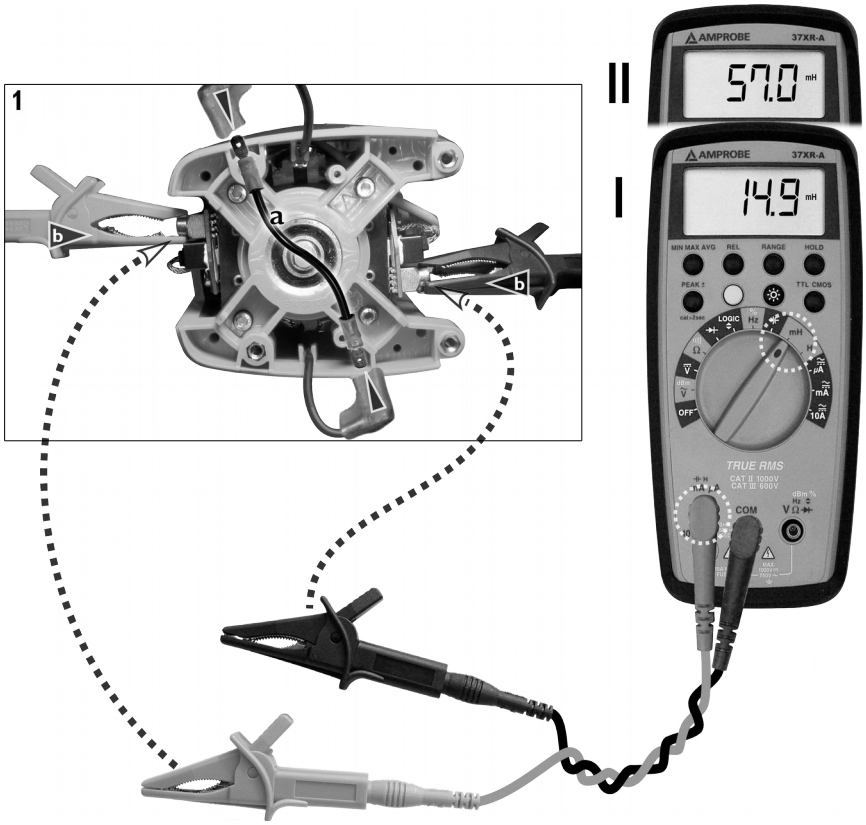
	I **USA**	II **Other countries**
V	≈ 4mH	≈ 11mH
V	*normal for a fully functional motor*	
X	< 3mH	< 8mH
X	**Replace motor** *low reading anywhere during a full turn indicates faulty winding*	

Stator

The condition of the stator can be checked by measuring its inductance, (L: mH) and resistance (R: Ω).

Resistance measurement is a certain indicator of a broken stator winding, but not so for short-circuited winding turns.

The impact of short-circuited windings depend on the amount of turns lacking current. Only a few short- circuited turns are hard to detect and will concurrently have little or no impact on the motor's performance.



PREPARATIONS

Tools needed:

- digital multimeter capable of measuring inductance (L: mH) and resistance (R: Ω)
- short probe cables with crocodile clips
  - for accurate reading, twist the probe cables (avoid coils).

Disassembling (see "Electric system")

- remove electric components cover
- slide out carbon brushes slightly and lock them with the springs leaving the brush cables attached (see chap. 9, step 1: I–II)
  - make sure that carbon brushes are not touching the rotor!

1. **Performing tests**
   (a) bridge the two stator female contacts:
   - use a steel plate or short cable with flat male contacts

   (b) Attach probe cables to:
   USA: carbon brush cables
   Other countries: screw heads where stator connect to the filter card.

CHECKING INDUCTION

Indicator of stator condition

- set digital meter to **mH**

	I USA	II Other countries
V	≈ 15mH	≈ 57mH
V	*normal for a fully functional stator*	
X	< 11mH	< 45mH
X	**Replace stator!** ***O.L*** *indicates broken winding*	

CHECKING RESISTANCE

Indicator of broken winding

- prepare digital meter to measure **Ω**

	I USA	II Other countries
V	≈ 0.3 Ω	≈ 1.6 Ω
V	*normal for a fully functional stator*	
X	≈ 0 Ω or immeasurable value (*may vary depending on instrument being used)*	
X	**Replace stator!** *broken winding*	

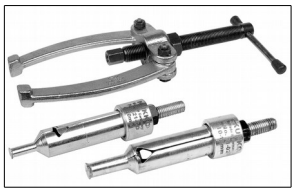
● = Service action

Service tools – recommended

BEARINGS AND GEARS (CHAPTER 7, 9)

Universal puller

● Bearing dismantling



Internal bearing puller

6–10, 10–14 (mm)

● Dismantling of ball bearings and needle bearings

Cir-clip pliers

Internal

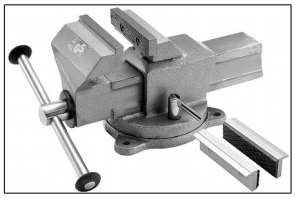
● Dismantling of bearings etc.

Lubricator

Klübersynth GE 14-111 (yellow colour) or **Shell Alvania EP LF (1) (dark brown colour)**

● Lubrication of gears and gear house

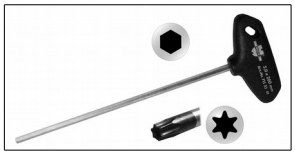
COMMON SERVICE ACTIONS



Vise

With soft jaws

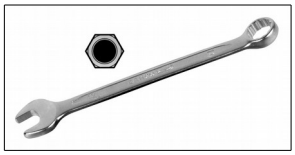
● Fixation of work pieces



Workshop wrenches/bits

Allen: 3–4 (mm)
Torx: T10–T25

● Occurring screws and fasteners



Spanners

Hexagonal: 7–13 (mm)

● Occurring nuts and bolt heads

Thread lock compound

Loctite 243 (or equiv.)

● Securing various fasteners

ELECTRICS – MAY BE ACQUIRED FROM HUSQVARNA (CHAPTER 8, 10)

Digital multimeter

Capable of measuring inductance and resistance

Art. No: 581 54 15 – 01

Make: Amprobe 37XR-A

● Functional tests and troubleshooting of motor components

Husqvarna

www.husqvarnacp.com

English

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