

# Repair Manual DK12/14

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## Preface

This repair manual is intended for authorized repair centres only.  
Important technical details are passed on herein.  
To copy this manual is not allowed.

**To pass over to a third person is strictly prohibited, especially to competitors.**

The numbers given in round brackets ( ) refer to the positional number in the spare parts drawing respectively to the spare parts list. The numbers put into square brackets [ ] refer to the tools and the special equipments on page 5.

The remarks in *italics* are concerned with extremely important safety features.

For the correct technical repairing the special tools listed in this instruction are essentially required.

For cleaning the parts use a non-aggressive cleanser, like special petrol, petroleum etc.

*Operations on electrical parts of the machine (motor switch handle, terminal case) are to be handled by instructed persons only, according to the general regulations.*

*According to the corresponding regulations for electric drills, the high voltage check and the check of the earth wire are to be strongly observed.*

The suitable equipment is listed in this instruction on page 5.

Special tools and machines can be ordered in our company.

This instruction is suitable exclusively for experts because basic knowledge of mechanics and electromechanics are necessary.

*Please note that you can be hold liable for any damage caused by an improperly enforced repair.*

### Lubricant

Only use lubricants with specifications as follows:

Transmission oil: CLP 100 according DIN 5519, viscosity at 40E C: 95 mm<sup>2</sup>/s (cSt).  
E.g. Spartan EP 100 from Exxon, or Mobil EP 100.

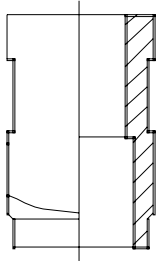
Ball bearing grease: basic lithiumkomplexsoap-esteroil, viscosity at 40E C: 28 mm<sup>2</sup>/s,  
temperature range up to 130E C, e.g Klüber  
GLY 32.

WEKA Elektrowerkzeuge, Auf der Höhe 20, D 75387 Neubulach - Altbulach, Germany  
Telephone: +49 7053 96816-0 " Telefax: +49 7053 3138  
Internet: [www.weka-elektrowerkzeuge.de](http://www.weka-elektrowerkzeuge.de) " E-mail: [weka@weka-elektrowerkzeuge.de](mailto:weka@weka-elektrowerkzeuge.de)

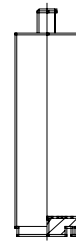
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## Special tools

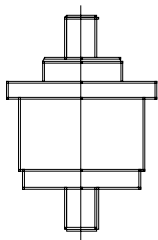
1 Machine holding fixture



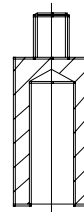
2 Press tool for rotary shaft seal  
5022357 (128)



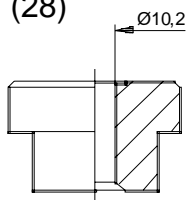
3 Press tool for rotary shaft seal  
5024407 (127)



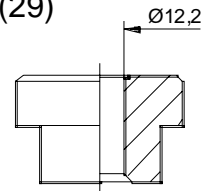
4 Press tool for ball bearings  
6060011, 6060002 (28, 29)



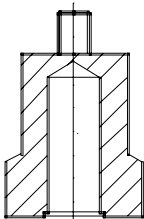
5 Press tool base for ball bearing  
6060011 (28)



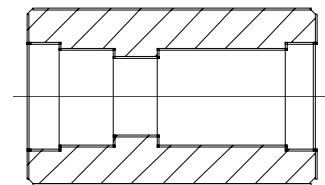
6 Press tool base for ball bearing  
6060002 (29)



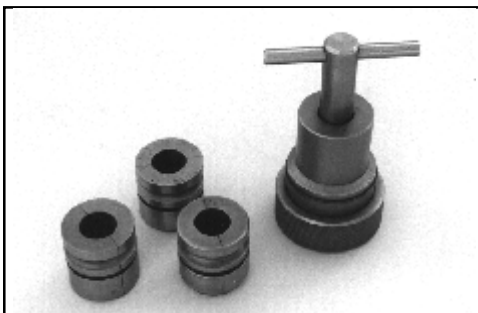
7 Press tool for fan  
DK20105 (73)



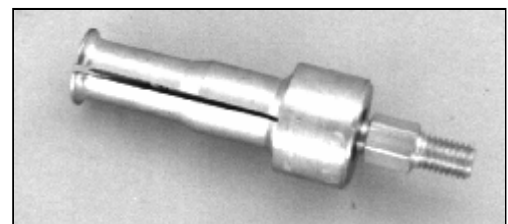
8 Press tool for shaft wearing sleeves  
DK10220 (114)



9 Special withdrawing tool for armature bearings  
6060011, 6060002 (28, 29)



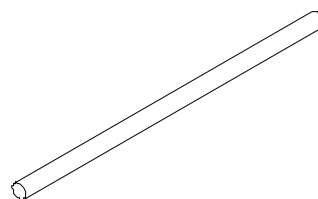
10 Withdrawing tool for needle bush  
6310100 (120)



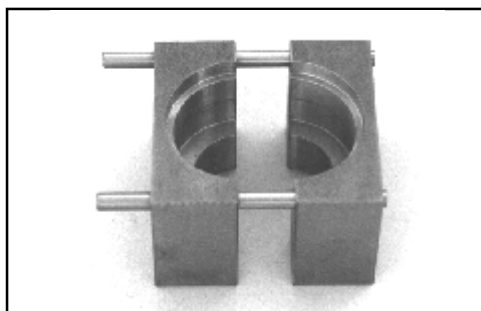
11 Separating device for shaft wearing sleeve DK10220 (114)



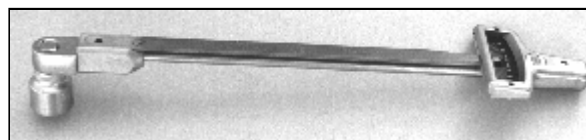
12 Aluminium piercer for disassembling the seal bush DK10113 (11)



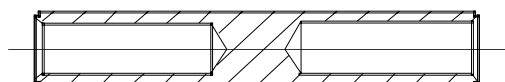
13 Clamp device for adjusting the safety clutch



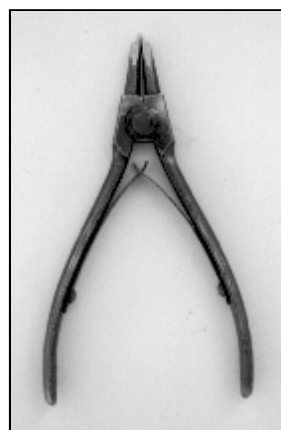
14 Torque wrench for adjusting the safety clutch



15 Assembly sleeve for V-seal (34) 5112000

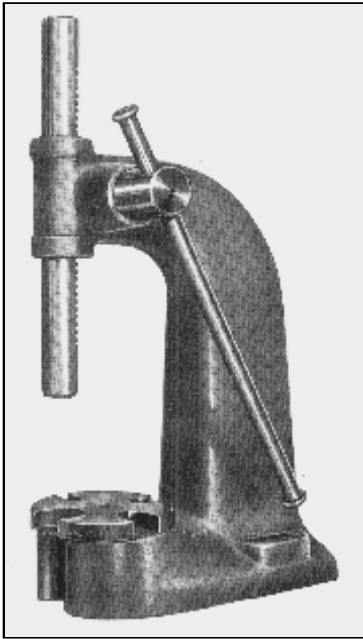


16 Assembly tongs for retaining ring 3618000 (149)



## Special appliance

17 Piercing press



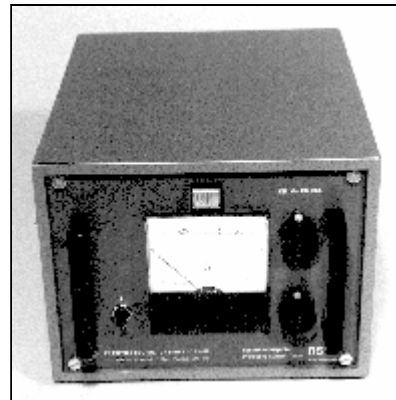
18 Induction tester



19 High voltage tester



20 Earth wire tester



21 Ampmeter



## A Disassembling the machine in its main parts

Clamp the machine holding fixture [1] into the vice and install the machine. The fixture is prepared for both kinds of tool fixtures. Side A for all spindles with thread G 1/2" (DK 12, DK 14) and side B for threads 1 1/4" UNC (DK 13, DK 22, DK 42).



Remove the 4 hexagon socket screws (37), twist the top hood (3) by 45° and take it off by hitting it softly with a plastic hammer.

Take the brushes out of the brush holders.

Remove 4 hexagon socket screws (155, 156) and lift off the motor casing. Lift off the armature together with the intermediate flange (2).

### 1 Changing the oil

Clamp the machine holding fixture [1] into the vice, install the machine and remove the 4 hexagon socket screws (155, 156), as shown above. Now lift off the complete motor including the intermediate flange (2). Change the transmission oil (130 ml), put the whole motor back on again and screw it on.

## B Repairing the gear

### 1 Disassembling the gear

#### 1.1 Removing the drilling spindle



Required if: Damaged gear, replacing the rotary shaft seals, damaged ball bearing (119).

Disassemble the machine as described in A.

Drive out the complete pinion shaft (107) by hitting strongly onto the front side of the gear box (100) with a plastic hammer.

Remove the retaining ring (148) with the assembly tongs. Take off the gear wheel (110), turn the gear change grip (104) clockwise to the stop to disengage the slide gear wheel (111). Take off the slide gear wheel and remove the parallel key (140). Open the retaining ring (149) with the assembly tongs [16] and pull it back.



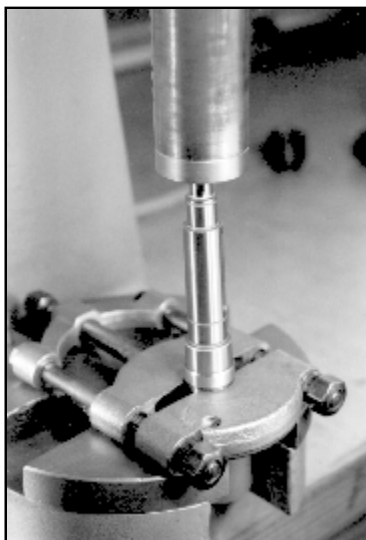
Remove the retaining ring (151) and drive the drilling spindle out of the gear box with a plastic hammer.

Check ball bearing (119) and if necessary, press it off the drilling spindle (106) with the press after having removed the retaining ring (150).



Push out the rotary shaft seal (127, 128) with a screwdriver or something like that. (Do not damage the case surface.)

Thoroughly clean the snug fit for the rotary shaft seals in the gear box from dirt and limestone. Thoroughly clean and dry all parts.



If the gear change grip (104) is hard to move, take it off by removing the hexagon socket screw (157); clean it and if required take out seized spots with emery cloth. Grease the snug fit and assemble the grip again.

Check the protective sleeves (114) on wear. Change them if the diameter of the worn grooves is less than 23,85 mm. In the course of changing, thoroughly clean the spindle between the protective sleeves and press them off with the separating device [11].

## 1.2 Replacing the needle bushes (120)

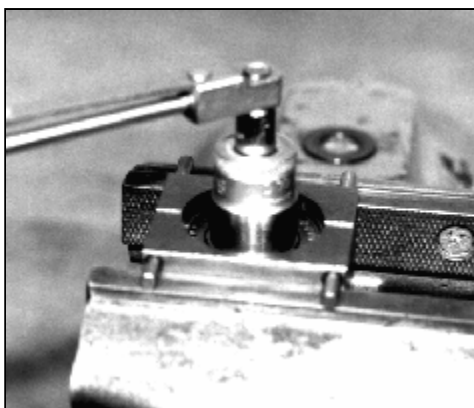
Use the withdrawing tool [10] and set it into the needle bush. Clamp the shaft of the withdrawing tool into the vice and warm up the intermediate lid to approx. 100 °C with a soft gas flame or an electric heater. Now knock against the lid for withdrawing the needle bush.

## 1.3 Repairing the safety clutch and adjusting it

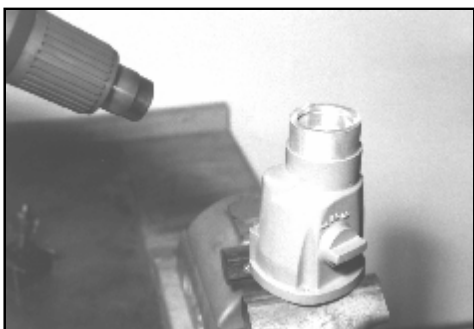
Put the whole pinion shaft (107) into the clamp device [13] and tighten it in the vice in that way that the clutch wheel (108) stands over - **pinion shaft clamping** -. Screw out hexagon nut (153), take off disk spring (134), pressure disk (113), clutch wheel (108) with the bearing socket (103) and both brake disks (112). Check all the parts on wear. Pay attention to the following items:

1. The height of spring disk (134) has to be 2,0-2,1 mm.
2. Pressure disk (113) has to be even.
3. If brake disks (112) have less than 0,95 mm, replace them.
4. The bearing socket should have an outer diameter of 17,65 mm and an inner diameter of max. 14,05 mm.

Fit the safety clutch according to the spare parts drawing and tighten the nut.



Clamp the whole pinion shaft at the clutch wheel (108) into the tool [13] -**clutch wheel clamping** -. Put the torque wrench [14] onto the nut (153) and turn it several times clockwise. Look at the torque indicator while turning; it should be 12-14 Nm. If it is more, the nut has to be reverted or replaced; do not tighten it too strongly. If it is less, tighten it more (do not overturn it). If it is still too less, replace the brake disks (112) and the disk spring (134).



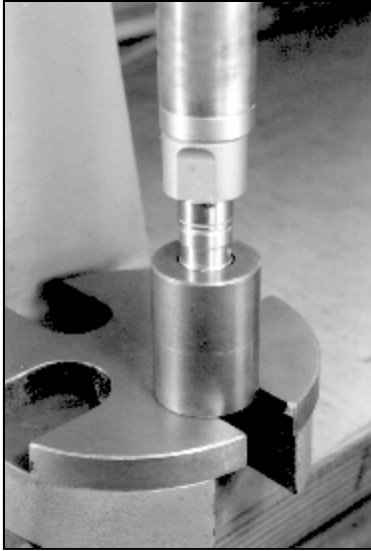
Check the ball bearing (118) for clearance and wear out, and should the occasion arise, replace it. In this case warm up the bearing area on the outside with a soft gas flame or a hot air pistol until the bearing falls out. Immediately put in a new bearing as long as it is warm.

## 2 Assembling the gear

### 2.1 Pressing on the protective sleeves

If the protective sleeves (114) are worn out, respectively the worn grooves are too deep, they have to be replaced. For disassembling this sleeves use the separating device [11].



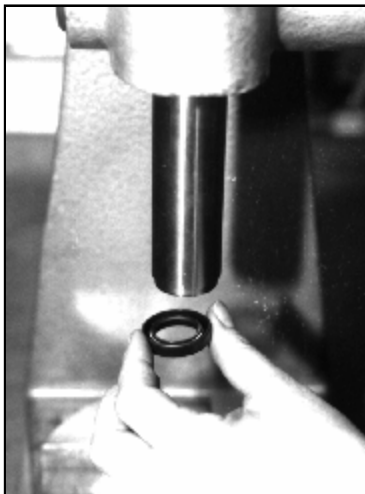


Press the new sleeves (114) with tool [8] onto the drilling spindle (106). Do this in putting the sleeve (114) into the tool [8] and pressing the spindle into the sleeve against the stop. First press side A, then side B.  
Pay attention that the sleeves don't sit oblique into the tool.

## 2.2 Replacing the rotary shaft seals

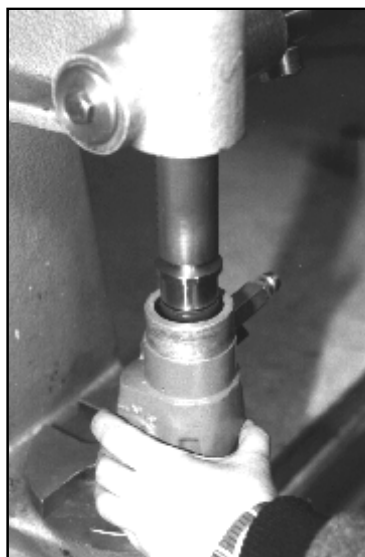
Push out the seals as described in 1.1.  
While assembling, note the following instructions:

For not to damage the rotary shaft seals while pressing them in, check that the reception hole has no building hips. Sharp edges are to be deburred, if necessary.



Put rotary shaft seal (128) onto the press tool [2], oil the reception hole and cautiously press in the seal.

Insert shim ring (147) into the reception hole for rotary seal (127).



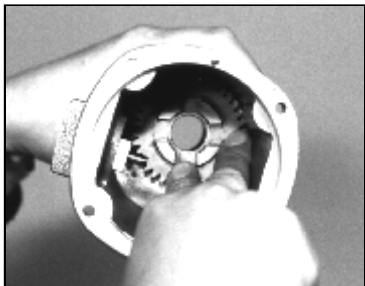
Put rotary shaft seal (127) onto press tool [3], oil the reception hole and press the seal in.

Turn over the press tool [3], put on the second rotary seal (127), and press it in cautiously.

## Inserting the drilling spindle

Press the bearing (119) onto the spindle (106) and make it secure with the retaining ring (150).

Put gear wheel 1 (109) into the gear box and align it to the middle of the axis. Press it with middle and forefinger against the base of the casing.



Turn over the gear box, put in the supporting ring (146) and push the drill spindle (106) cautiously through the gear wheel (109) against the stop.

Attention: When pushing in the spindle, do not glide beside the seal (128). This could be damaged by the sharp edge of the parallel key groove in the spindle.

Press in the spindle (106) completely.

Install retaining rings (149, 151).

Put in parallel key (140).

Push the slide gear wheel (111) onto the spindle and, in the same time, insert the parallel pin (141) into the groove of the wheel by turning the gear change grip (104).

Put gear wheel 3 (110) onto the spindle and fit retaining ring (148).

Insert the whole pinion shaft (107) into the ball bearing (118) by knocking slightly on it with a plastic hammer. Put shim ring (145) onto the pinion shaft and fill in the gear oil (130-135 ml).

## C Repairing the motor

### 1 Replacing the seal between motor and gear

#### Exchanging of armature bearing and fan

If gear oil is coming out of the ventilation slots, the oil seal immediately has to be replaced. Proceed according to the following instructions:

1. Remove the motor top hood as described in A.
2. Take off motor casing as described in A.
3. Take off the intermediate flange (2) as described in A.



Disassemble the armature from the intermediate flange, exchange the V-seal (34) and assemble again as follows:

Disassemble the armature (8) from the intermediate flange (2) by knocking onto the armature pinion with a plastic hammer.

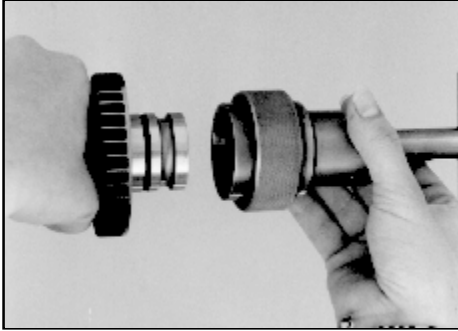
If the seal bush (11) remains in the flange push it out with the aluminium piercer [12].

Caution! Do not damage the V-seal (34) and the fixing ring (12). Don't use a steel piercer.

Clean the parts, blow out the armature with compressed air and check it.

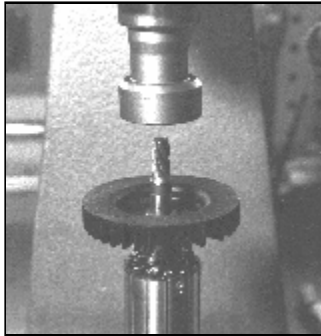
## Exchanging the armature ball bearings

If the armature bearings (28, 29) have been used for more than 50 hours or more than 5 months they have to be changed while a general repairing is done. Look for an absolutely clean working and installation.

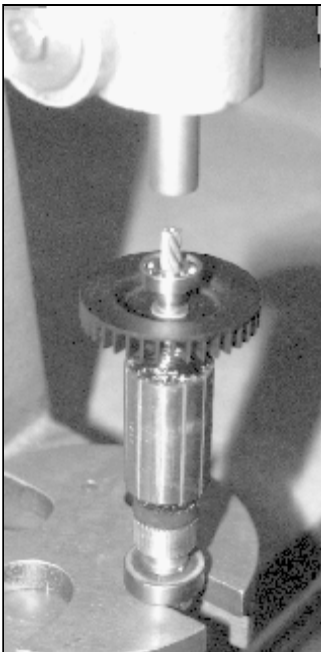


Pull off the bearings (28,29) with the special withdrawing tool [9].

Press off the fan (73) if it is damaged.  
Use for that wor the separating device [11].



Press on a new one axially parallel with tool [5, 7].

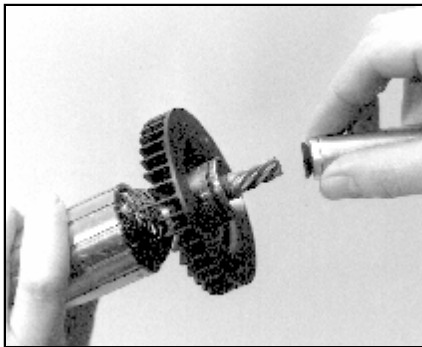


Press on the bearing (28) with tool [4, 5].



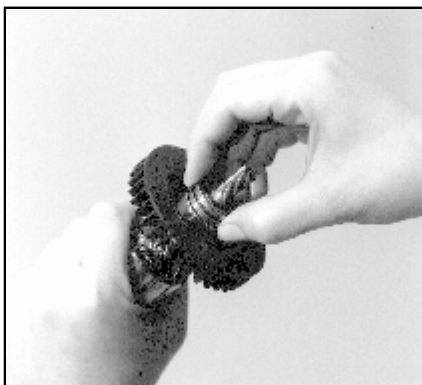
Press on the bearing (29) with tool [4, 6], or use the slide insertion.

Provide bearing (28) with special grease; fill only half of the bearing.



Put the sealing bush (11) onto the bearing (28). Put the fixing ring (12) onto the assembly tool [15] and insert the V-seal (34) into the fixing ring.

Slightly oil the transition of armature pinion to the V-seal snug fit and push the V-seal including the fixing ring over the pinion totally close to the sealing bush (11), as shown.



Draw back the sealing bush for around 1,5 mm, parallel to the bearing until a clear resistance can be felt.

Now the V-seal lip has a correct pretension and presses the seal bush against the bearing again, after releasing it.

Put the compensation washer (30) into the bearing hole of the intermediate flange (2) and slightly grease the bearing snug fit.

Put the complete armature axially parallel into the intermediate flange (2), if required by support of pressure, to press it in completely.

If required, exchange gear oil (130 - 135 ml). A first exchange should be done after 100 operating hours, every following change after 300 operating hours.

Put the complete intermediate flange onto the gear box. Do not damage the O-ring in doing so.

Put the motorcase (1) onto the intermediate flange (2) and fix it with the screws (155, 156).

Put in the brushes (25) as described in 2 if it is required.

Put on the motor top hood (3) loosely, insert the screws (37). Align the top hood at the 4 thread holes and fix it by softly knocking, then tighten the screws (37).

## 2 Replacing the carbon brushes

For it is possible to tear back the armature slightly, when taking off the motor top hood (3), it is necessary in the same step to check on the V-seal (37). At the latest the brushes (25) are to be replaced when they are worn out to 6 mm of length. This happens after having used the machine for about 350 hours with full load; this also requires a replacement of the V-seal (34) and the gear oil. Take action as described in 1.



Fit the brushes respectively the claw terminals to the brush holder as shown.

## 3 Mechanical and electrical check on individual parts

Every time the motor gets opened these checks should be done on principle. They have to be done when the motor is suspected to be defective.

### 3.1 Checking the armature

#### Check by view



If there are visible traces of wiping on the lamination surface it is to be assumed that the armature in the case is not exactly concentric.

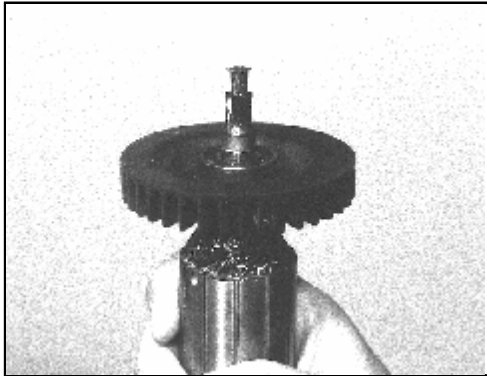
In this case check the top hood (3) on damages caused by hits, measure the diameter of 88 mm. If it is more than 0,1 mm out of round, change the top hood.

Measure the depth up to the ground of the bearing snap fit. The measure should be 44 mm. If the ground is more than 0,1 mm oblique, change the part.

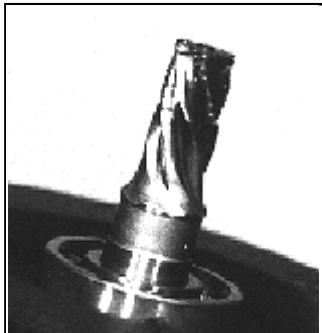
Check the intermediate flange (2) and the motorcase (1) on damages and measure the roundness of the snug fits. At a difference of more than 0,15 mm replace the parts that are concerned.

Check the fan on damage.

Check the armature pinion on wear. At a great wear the following factors are the main reasons:



a) The safety clutch is used too much or too long. The great arising temperature in the clutch is transferred to the clutch wheel and armature pinion - blue temper colour.

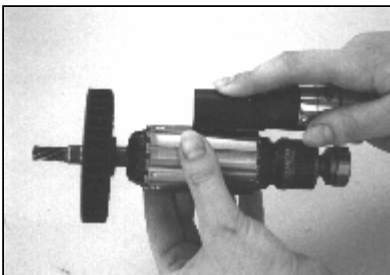


b) Deficiency of lubrication caused by not enough gear oil. Thereby a great amount of the surface hardness gets lost.

Check the commutator on wear.

The commutator surface is to be finish-turned if the wear of the diameter is more than 0,07 mm.

### Electrical check

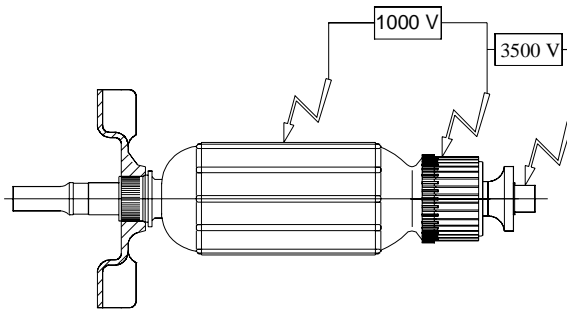


Check the armature winding with the induction testing device [18] for short circuit.



Check the armature winding with earth wire tester [20] or a resistance meter on interruption. In doing so also check one after one every two neighbouring commutator segments on volume resistance.

$R = 0,14 \text{ S}$  for 230 V  
 $R = 0,03 \text{ S}$  for 110 V



*Check the armature for electric strength - Check of high voltage. This check is done with the high voltage tester [19] between commutator surface and armature lamination with 1000 V.*

*For armatures in safety class II (double insulation) check also between commutator and shaft with 3500 V*

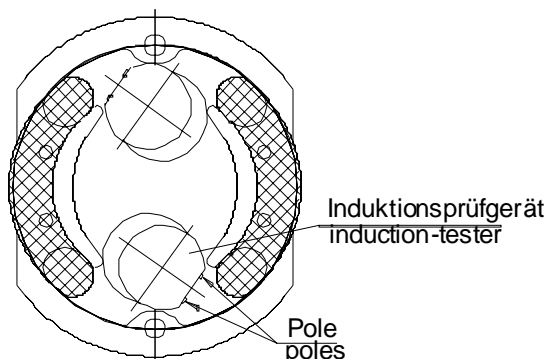
### 3.2 Checking the magnetic field

Take out the air conducting disk (16).  
Clean the motor casing without flooding the inner space. Take care that no detergent gets in the switch handle (5). Blow out the inner space of motorcase with compressed air.

#### Check by view

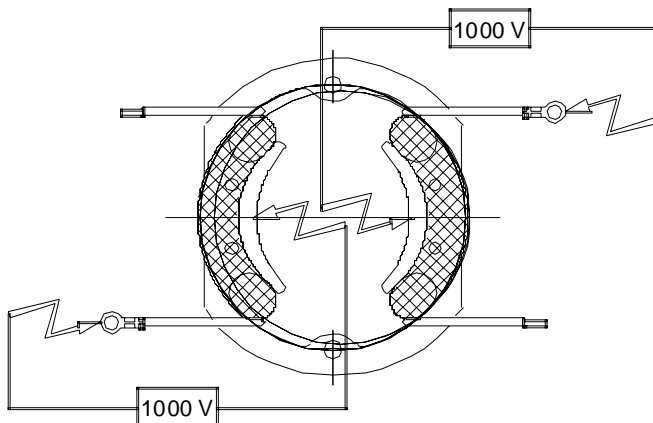
Check windings and wires on damage.  
Check the screws (39) and tighten, if necessary. Do not overscrew them.

#### Electrical check



Check the field windings with the induction tester [18] on short circuit on the windings by putting the poles of the device as shown. Check both windings, or check it by measuring the resistance of one coil.

$R = 0,6 \text{ S}$  for 230 V  
 $R = 0,15 \text{ S}$  for 110 V



*Check the magnetic field for electric strength - check of high voltage. The check is done with the high voltage tester [19] between the field wires and the field lamination with 1000 V on both of the windings.*

## 4 Replacing the magnetic field

Remove the screws (39). Disassemble the brushes (25) and take off the brush holder disk (15).

At DK 12 open the switch handle (5) by removing the screws (44) and (38).

At DK 14 open the terminal case by removing the screws (47).

Disconnect the terminals of motor switch and overload switch, respectively the electronic module and pull the stranded wire back into the motorcase.

Warm up the motorcase (1) from the outside with a hot air pistol to 70°C for being able to get out the magnetic field. Take care that the wires, switch and switch handle etc. do not become overheated. (Warm up the side in opposition to the switch handle).

Now take out the whole field and immediately install a new one in the still warm case as described in the following.

### Installing the magnetic field

Put the fieldscrew insulation sleeve (14) into the motorcase (1). Warm it up from the outside with a hot air pistol to 70°C. (This step can be left out if the case is still about 60°C warm). Put the complete magnetic field into the motorcase. Take care that the holes of the field screw insulations and the recesses of the field lamination are exactly one upon another, and that the window in the field insulation tube points towards the switch handle, respectively the terminal case.

Put the motor terminal stranded wires (black) through the drilling in the insulation tube into the switch handle or terminal case, respectively.

At DK12 fix the angled receptacle 6,3 x 0,8 - 1,5 with a crimping tool to one motorwire, if it isn't done yet.

At DK 14 shorten the wires to 100 mm (measured from the field insulation tube) and combine each of them with always one wire of the interference suppression capacitor (60) by the means of a receptacle 6,3 x 0,8 - 2,5 DIN 46247.

Connect the motor stranded wires with the motor switch and the motor overload switch (67), respectively the electronic module (7) as shown in the wiring diagram. Put the field wires for the brushes (yellow for 230 V and blue for 110 V) through the drilling into the brush holder disk (15) and put this onto the motorcase. Take care that the wires form a loop which is brought in between the magnetic field, and the field insulation tube; **the loop must not touch the armature (8) in any case.**

Fix the brush holder disk (15) with parts (39, 48, 54).

Fix the carbon brushes and the field terminal wires (yellow or blue) with screws and washers (40, 56) to the brush holder as shown in 2. Introduce brushes into the holder as shown. Insert the air conduction disk (16).

## 5 Replacing motor switch (66) and motor protective switch (67) as well as the cord

### Checking the motor protective switch (67)

The motor protective switch (only for 110 V types) of the DK12 is fixed separately in the switch handle (5). The motor switch (66) of the DK 14 includes a motor overload trip.



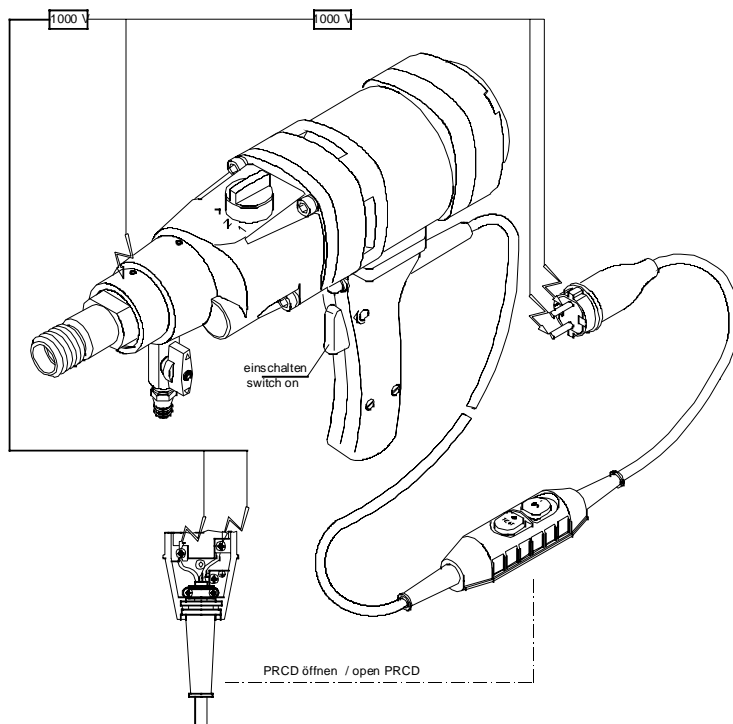
The motor protective switch (67) can be checked with the earth wire tester [20] as follows:

Bring the testing pins of the device and the terminals of the switch (67) in contact and stop the time until a switch off reaction can be seen. It has to take 3-4 seconds. Push the restart button back into initial position. Connect motor switch (66) and motor protective switch (67) with the power source.

## 6 Check for technical safety and final check

This check has to be done on principle after every working on the motor. See also the DIN VDE 0701 part 1 and 260, or your national regulations.

*Check for high voltage with high voltage tester [19]*



*Switch on the motor switch and lock it - in case of DK 12. If the machine is provided with a PRCD (GFCI) open the lid of it. Adjust the high voltage tester [19] to 1000 V. With one test adapter contact touchable metal parts (aluminium casing), with the other contact one after another the both terminals in the PRCD - machine side - and then the plug pins and hold them there for at least three seconds. The tester [19] must not indicate any signals of a mistake.*

*Checking the earth wire with the earth wire tester [20]*

*With one testing pin contact touchable metal parts, with the other the earth contact of the plug. The measured resistance is not to be more than 0,3S.*

Let the machine work for 10-15 minutes in idleness to get it warm. Measure the idle current with the ammeter [21].

It has to be 2,1 A - 2,5 A for 230 V types, and 4A - 5 A for 110 V types

WEKA Elektrowerkzeuge, Auf der Höhe 20, D 75387 Neubulach

Phone: +49 7053 96816-0 " Fax: +49 7053 3138

Internet: [www.weka-elektrowerkzeuge.de](http://www.weka-elektrowerkzeuge.de) " E-mail: [weka@weka-elektrowerkzeuge.de](mailto:weka@weka-elektrowerkzeuge.de)