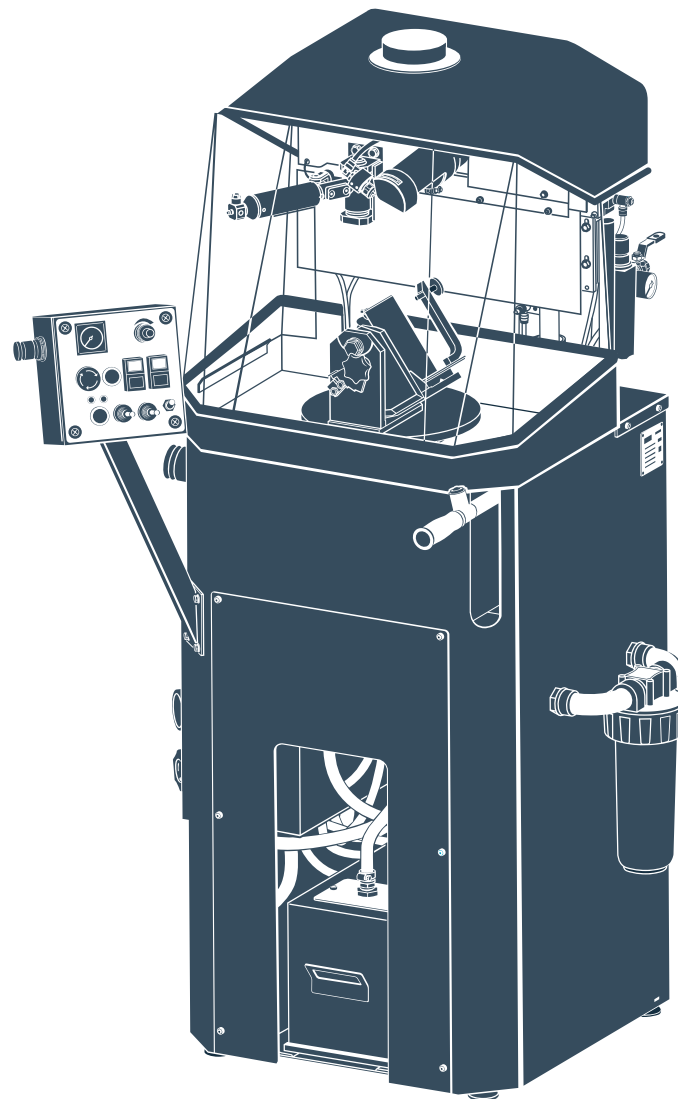


Grind Matic BQ3



Operator's instructions
Spare parts list



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Original instructions.



Before using the machine, read the operator's instructions carefully and then put them in a safe place for future reference.



It can be dangerous to use the machine if the care and maintenance instructions are not followed carefully.



Electricity.



Emergency STOP.



Risk of crushing.

Always replace damaged or illegible signs.

Safety instructions

- Before using the machine, read through the operator's instructions carefully.
- Important safety information is given at various points in these instructions.
- Special attention must be paid to the safety information contained in frames and accompanied by a warning symbol (triangle) and a "signal word", as shown below:



DANGER

Indicates an immediate risk that **WILL** result in serious injury or death if the warning is not observed.



WARNING

Indicates hazards or hazardous procedures which **COULD** result in serious injury or death if the warning is not observed.



CAUTION

- Indicates hazards or hazardous procedures which **COULD** result in injury or damage to equipment if the caution is not observed.
- Use approved spare parts only. Any damage or malfunction that can be attributed to the use of unauthorized spare parts is not covered by the machine warranty and invalidates product liability.

Also observe the following general safety instructions:

- Make sure that there are no other personnel close to the grinding machine while grinding is in progress.
- Always wear goggles, protective clothing, steel toe safety shoes, gloves and hearing protection during grinding and handling of grinding bits. Any local regulations must also be observed.
- Wear an approved dust mask or arrange an effective dust-extraction system. This is especially important when grinding indoors.
- The machine must not be used for any purpose other than that for which it is intended. See "Applications".
- The machine must not be modified without the permission of the manufacturer. Modifications not approved by Epiroc Drilling Tools can incur the risk of serious injury to yourself and others.
- Before intervening in the air or electrical systems, make sure there is no pressure in the air system and that the electrical system is shut down.
- Beware of the risk of fire and explosion that could be initiated by sparks from the grinding work.
- Before using the machine, visually check the hoses and electric wiring for any damage. If any visible damage is detected, replace before using machine.
- If lifting equipment is used, make sure it's approved for its purpose.
- The splash guards supplied together with the machine must be used during grinding.

Technical data

Maximum height of drill bit	200 mm
Maximum diameter of drill bit	127 mm
Minimum distance between buttonws	3.5 mm
Output, spindle motor	1.50 kW
Output, table drive motor	0.37 kW
Output, cooling-fluid pump motor	0.44 kW
Voltage, working lights (40 W E27)	24 V
Air pressure, minimum	80 psi / 5,5 bar
Air pressure, maximum	101 psi / 7 bar
Air consumption	40 l/min
Speed, spindle (50 Hz)	14,900 r/min
Speed, spindle (60 Hz)	14,900 r/min
Speed, table (50 Hz)	62 r/min
Speed, table (60 Hz)	74 r/min
Capacity of cooling-fluid tank	22 l
Weight, exclusive of packaging	222 kg
Noise level during grinding*	96.5 dB(A)
Sound power level during grinding**	101 dB(A)
Vibration level during grinding***	< 2.5 m/s ²

Manufactured: Epiroc Drilling Tools AB, Fagersta, Sweden

* Equivalent continuous A-weighted sound pressure level measured at operator's ear level during grinding. Possible spread due to measuring method and production factors: 3 dB(A).

** Sound power level established in accordance with SS/ISO 3741. Possible spread due to measuring method and production factors: 3 dB(A). Average value for frequency range 100-6300 Hz.

*** Vibration measurement according to EN/ISO 8662.

ACCESSORIES INCLUDED	
Description	Product No.
Centring device (1 piece)	87000776
Centring cup, 11 mm	87000840

General

The Secoroc BQ3 grinding machine is designed to grind cemented-carbide buttons and the surrounding body steel in the same operation using a diamond-coated grinding wheel. The machine has an automatic feeding device, which makes it simple to use.

For grinding to be carried out, the machine must be fitted with a grinding wheel, a centring cup, a bit holder and an indexing ring to suit the bit that is to be ground.

Applications

The Secoroc BQ3 is intended for grinding threaded and tapered button bits up to 127 mm in diameter, and has a high grinding capacity.

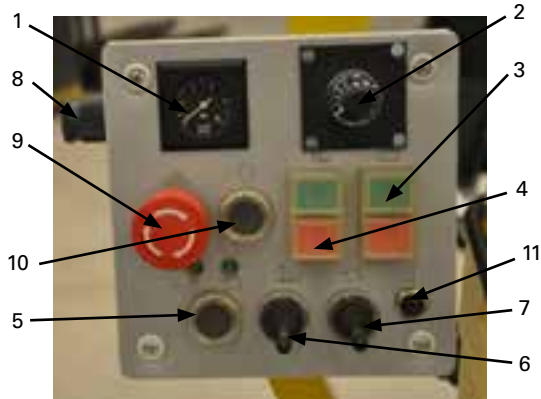
Technical description

The Secoroc BQ3 consists principally of the following component assemblies:

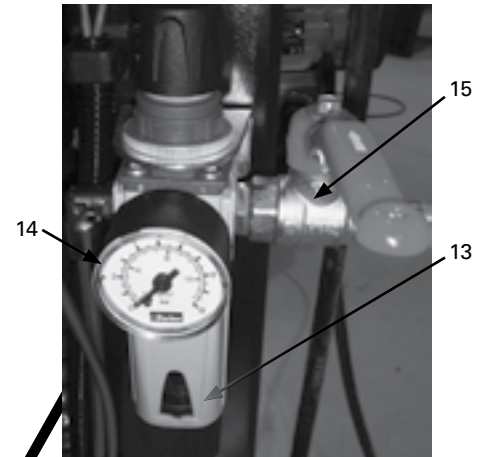
- A driving plate that is rotated by an electric motor via a worm gear.
- A grinding plate that is placed on the driving plate. When the centring button on the feed lever is pressed, an air cushion is created under the grinding plate to facilitate centring of the button that is to be ground. When the centring button is released, the grinding plate is locked in position by a vacuum.
- An indexing template with grooves that correspond to the button configuration in the drill bit.
- A main holder, with a bit holder in accordance with the used thread size.
- A centring device that adopts the centre position automatically when the centring button is pressed. The centring device is in its lower position when centering the button.
- A spindle that is rotated by an electric motor via a drive belt.
- An automatic feeding system for advancing the grinding wheel on to the button. Feeding is effected by a pneumatic cylinder, but manual feed is also possible.
- A coolant tank with pump to circulate the flushing fluid used to cool the cemented-carbide buttons and the grinding wheel. Flushing starts automatically when table rotation starts.

The button to be ground must first be centred directly under the grinding wheel. Table rotation is then started and the profiled grinding wheel fed down to the rotating drill bit. The centred cemented-carbide button rotates inside the profiled groove in the grinding wheel and is quickly restored to its spherical or ballistic shape.

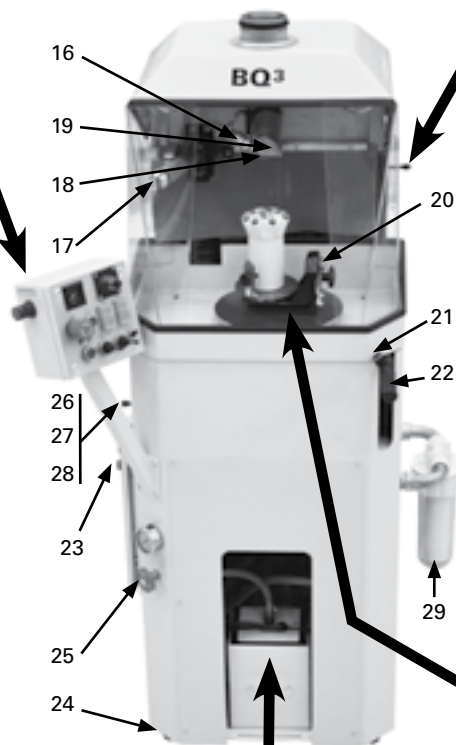
Controls and other parts



- 13 Filter/regulator
- 14 Pressure gauge
- 15 ON/OFF valve for air



- 1 Feed-pressure gauge
- 2 Potentiometer
- 3 Table rotation and coolant pump
- 4 Grinding spindle
- 5 Manual / Automatic
- 6 Feed movement, manual
- 7 Feed movement, automatic
- 8 Feed-pressure regulator
- 9 Emergency STOP
- 10 Work lights
- 11 Stroke limiter



- 16 Coolant nozzle
- 17 Centring arm
- 18 Diamond grinding wheel
- 19 Grinding spindle
- 20 Main holder
- 21 Centring button
- 22 Feed lever
- 23 Reset button
- 24 Machine feet
- 25 Coolant valve
- 26 Return-pressure gauge
- 27 Return-pressure regulator
- 28 Vacuum valve
- 29 Water filter



- 12 Coolant pump



- 30 Bit holder
- 31 Indexing template
- 32 Clamping device
- 33 Grinding plate

General care instructions

To ensure that your Secoroc BQ3 grinding machine functions satisfactorily for a long time:

- Use original spare parts only.
- Read the maintenance instructions carefully before using the machine.
- Keep the machine clean.
- Make sure that the compressed air is always clean and dry.
- Check the water cooling function regularly.
- The incoming air and electricity supplies must always be disconnected during installation, servicing and moving of the machine.
- If the machine is not going to be used for a long time, make sure that it is lubricated and cleaned before being left idle.

Installation

WARNING

- Always follow the safety instructions with regard to installation, operation and maintenance.

There is a lifting eye on the upper part of the frame. Always make use of the lifting eye when hoisting the machine into place. The weight of the machine is normally 222 kg. Make sure valid lifting equipment is used.

To be able to work, the machine needs electricity, compressed air and water. Before start-up fill up the pump and filter cup with water.

The feet underneath the machine must be adjusted so that runoff water flows towards the drainage hole.

Electricity

WARNING

- Electrical connection of the machine is restricted to qualified electricians only.
- Check that the electrical data for the machine is compatible with the mains voltage.

On delivery, the machine is connected for the specified voltage and frequency. A power cable is supplied with the machine.

IMPORTANT

A main circuit-breaker must be fitted between the power cable and the electricity mains when the machine is installed. Always observe local regulations in respect of electrical connection.

After connection: Check that the motors rotate in the right direction. The grinding wheel should rotate in the direction of the arrow. If the grinding wheel rotates in the wrong direction, switch the phases.

The machine is protected against overload. In the event of overload, the motor overload protector will trip. Re-setting occurs automatically after a period of standstill.

The machine is also equipped with an undervoltage circuit breaker and an emergency STOP device. In the event of undervoltage or activation of the emergency STOP device, the system must be re-set prior to re-starting.

Compressed air

CAUTION

The exhaust air from pneumatic components contains oil mist, which can be bad for your health if inhaled. Always adjust the lubricator so that the correct amount of lubrication is obtained.

- Before filling up with lubricating oil, ALWAYS switch off the compressed air supply and vent the machine.
- The maximum permissible working air pressure for grinding machines with pneumatic components is 7 bar.

The compressed air must be clean and free of water. The machine is equipped with an air filter.

On the Secoroc BQ3, compressed air performs the following functions:

- It creates the vacuum that locks the grinding plate to the driver plate
- It creates an air cushion under the grinding plate to make it easily moveable during centring
- It provides a suitable grinding pressure.
- Operate the centring arm.

Cooling

The drill bit and grinding wheel are cooled with water mist. At the bottom of the machine is a sedimentation tank for grinding residue. If the machine is used every day, the sedimentation tank must be cleaned at least once a week.

Cooling water is switched on automatically when the grinding spindle starts to rotate. Then, when the grinding plate starts to rotate, the coolant valve opens and cooling water starts to flow. With the coolant nozzle, water is sprayed over the whole of the grinding wheel.

Cooling is very important to the service life of the grinding wheel and to the grinding result. If cooling is poor, thermal stresses can be ground into the cemented carbide button, with subsequent button breakage as a result. The service life of the grinding wheel falls dramatically if cooling is poor.

A coolant mixture consisting of cooling concentrate and water (mix ratio 1:30) should be used. Use the recommended cooling concentrate. The concentrate contains a rust inhibitor.

Grinding plate

Before the grinding plate is put on, the contact surface must be clean and preferably oiled as well. Check that the O-ring on the driver plate is fitted.

Place the grinding plate carefully on to the driver plate. Turn on the compressed air and check that the grinding plate "floats" smoothly when the centring button on the feed lever is pressed. In the beginning, the plate can bind a little. If so, move it around for a few moments to alleviate the problem.

The air cushion can be regulated by means of a valve, located next to the return pressure regulator. If there are great pressure

variations in the compressed-air supply, it may be necessary to stabilize the pressure by means of an external pressure regulator.

Grinding wheel

CAUTION

- Before fitting or removing a grinding wheel, switch off the electricity supply.
- The grinding wheel is hot immediately after grinding. Take care not to burn your fingers when changing the grinding wheel.

Fit the grinding wheel to the grinding spindle.

The on the grinding wheel must face away from the grinding machine. Make sure that the journal of the spindle is clean and lightly oiled. This will make it easier to remove the grinding wheel.

If the grinding wheel cannot be removed using hand force only, make use of the extractor supplied with the machine.

IMPORTANT

Do NOT use impact or excessive force on the spindle or grinding wheel!

Grinding

DANGER

- Always check that there are no traces of explosive in the flushing holes of the drill bit. To clean out the flushing holes, ONLY a wooden stick, a length of copper wire or flushing water may be used.
- Beware of the risks of fire or explosion that might be initiated by sparks from the grinding work.

CAUTION



- Never remove the grinding guard from the machine.
- Make sure that the grinding station or place of work is well ventilated.
- Always wear goggles, protective clothing, gloves, dust mask and hearing protection during grinding.
- Before removing or fitting a grinding wheel and before changing the drill bit, always switch OFF the electricity supply.
- The grinding wheel is hot immediately after grinding. Take care not to burn your fingers when changing the grinding wheel.
- To prevent injuries caused by crushing, avoid moving parts when the machine is running.

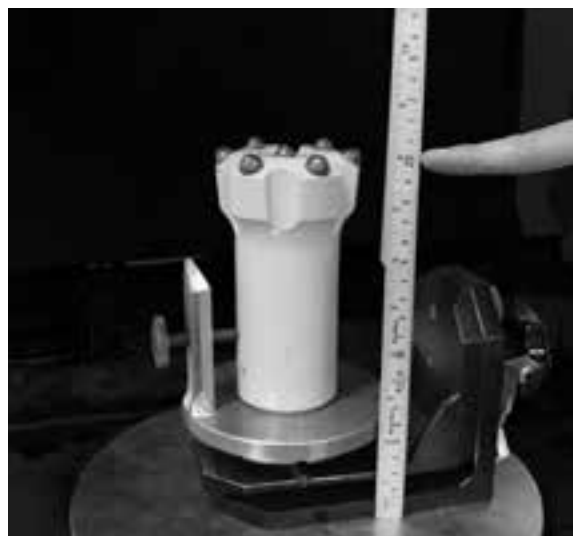
General rules

Adequate cooling is crucial to the service life of the grinding wheel, and also to the grinding result. Poor cooling can result in heat stresses being “ground into” the cemented-carbide buttons, with button fracture as a result. The service life of the grinding wheel falls dramatically if cooling is poor.

Pressing the grinding wheel too hard on to the cemented-carbide button will reduce the service life of the wheel. Both the grinding wheel and the cemented-carbide button can be damaged by excessive heat generation. A new grinding wheel must always be “run in”. Start grinding carefully and increase the feed pressure gradually. This practice will increase the service life of the grinding wheel substantially.

Setting the grinding pressure

To get the most out of your grinding machine, make sure that the operating pressure is set to a level that provides an optimal grinding force of 150 N. This can be done by easy means.



- Measure the distance between the grinding disc and the top button that is about to be ground.
- Search for the closest distance in the table.
- Adjust the pressure settings accordingly.

Distance ►	200 mm		250 mm		300 mm	
Return P	Feed P	Force	Feed P	Force	Feed P	Force
5,5	2,6	148	2,5	149	2,4	149
6,0	3,3	153	3,1	148	3,0	148
6,5	3,9	152	3,8	153	3,7	154
7,0	4,5	151	4,4	152	4,3	153

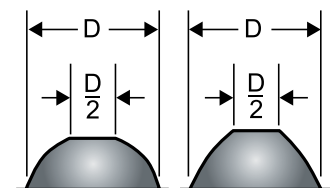
P = pressure

Force column figures in Newton (N)

Grinding hints

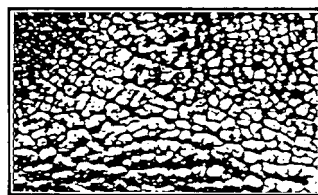
The rate of bit wear depends on the rock formation, and is highest in rocks with a high quartz content. A suitable grinding interval should be determined according to the rate of bit wear. It is more economical to regrind too early rather than to suffer poor penetration rates and risk damaging the drill bit through overdrilling. A few hints about the care of drill bits:

When to regrind



Button bits should be regrind when the penetration rate drops, or if any of the cemented-carbide buttons are damaged (fractured buttons should be ground flat). It is both practical and economical to redress the buttons when the wear flat reaches about $\frac{1}{2}$ of the diameter of the button.

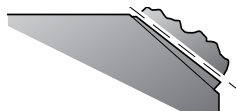
Look out for "snake skin"



If microscopic fatigue cracks – so-called "snake skin" – begin to appear on the cemented carbide buttons, the cracks must be ground away. In any event, bits should be reground after 300 metres of drilling at the most.

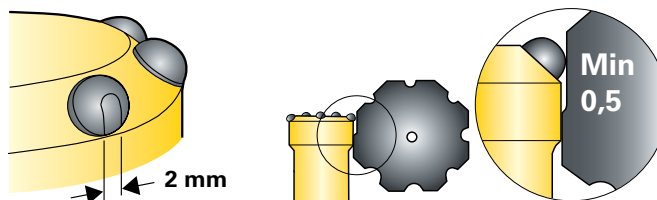
This should be done even if there are no visible signs of wear and the penetration rate continues to be good. If snake-skin is not removed, the cracks will deepen and ultimately result in button fracture.

Always grind broken buttons flat



A drill bit can remain in service as long as the gauge buttons maintain the diameter of the bit. Fractured buttons must always be ground flat to prevent chips of cemented carbide from damaging the other buttons.

Avoid grinding the perimeter



Gauge button anti-taper has to be removed by grinding, although excessive reduction of the bit diameter should be avoided. Leave about 2 mm of the wear flat.

If necessary, remove some of the bit-body steel below the gauge buttons, so that a clearance (taper) of 0,5 mm is maintained.

Make sure that the flushing holes are open.

Grinding instructions

With the Secoroc BQ3 grinding machine, there are two different operating modes to choose between:

- Automatic feeding with pre-set bit-grinding time
- Automatic feeding only

Automatic feeding with pre-set bit-grinding time



IMPORTANT

When grinding in the most automated mode (A), the switch should be turned so that the lamp at the rectangular symbol with arrows lights.

Before grinding, make the following adjustments:

Adjust the grinding pressure by means of the regulator and table.

1. Fix the indexing template to the bit holder and tighten the screws. Now position the assembly so that a ground groove fits over the lip in the main holder. Place the bit on the bit holder and turn it so that the clamping screw lines up with a side flushing hole, and then clamp the bit in place. In the case of more symmetrical bits without side flushing holes, turn the bit so that one

of the front flushing holes lines up with the clamping screw. In the case of retrac bits, only one of the front flushing holes (the one that is in line with the recess in the bit skirt) is normally used to line up the clamping screw.

2. Adjust the angle of the clamping device to match the angle of the gauge buttons in the drill bit. The angle can be found in the Secoroc Tophammer product catalogue.



IMPORTANT

The centre line of the button must be vertical during grinding.

3. Press and hold the centring button on the feed lever. The centring arm moves to the centring position and an air cushion is formed under the grinding plate, which causes it to float.

4. Align the grinding plate and press down the feed lever so that the button to be ground locates exactly in the middle of the centring cup. (Make sure that the size of the centring cup agrees with the size of the button.)

5. Release the centring button, whereupon the grinding plate is locked into position on the driver plate by a vacuum, and the centring arm retreats. Note that there is a built-in delay in the system to ensure that the centring arm stays in the centring position to prevent the bit from moving while the vacuum is being formed. The delay time can be adjusted by means of the time relay.

6. Set the desired grinding time by turning the graduated wheel on the potentiometer. Make sure that the light for AUTO is on.

7. Start the grinding spindle by pressing the button on the control panel.

8. By means of the feed lever, lower the grinding wheel carefully toward the button.

9. When the grinding wheel is about 15 mm above the button, switch on the automatic feed. Bit rotation starts, coolant begins to flow through the nozzle and the feed cylinder is activated.

10. Put the stroke limiter switch into ON position to lock the stroke position. Leave the switch in this position until the last gauge button has been ground.

11. When the pre-set grinding time expires, the feed cylinder releases, the flow of coolant stops and table rotation stops. The grinding spindle rises to about 10 mm above the button. If the button has not been ground enough, set the potentiometer to a longer interval. If the button has been ground too much, a shorter grinding interval should be set. As a rule, buttons are ground more quickly when the grinding wheel is new.

12. Check the grinding result and adjust the potentiometer as necessary. Make sure that full dome height is obtained, but always leave a 1-2 mm wear flat on top of the button to avoid grinding away too much of the cemented carbide.

13. Index the next button by turning the drill bit.

14. Switch on the automatic feed.

15. Repeat steps 13–14 until all gauge buttons have been ground.

Automatic feeding only



IMPORTANT

When grinding in semi-automatic mode (B), button should be set so that the lamp by the hand symbol lights.

1. See points 1–5 under “Automatic feeding with pre-set grinding time”

2. Start the grinding spindle and table rotation by pressing the respective buttons on the control panel.

3. By means of the feed lever, lower the grinding wheel carefully toward the button.

4. When the grinding wheel touches the button, activate and hold the switch until the desired grinding result has been obtained.

5. Check the grinding result. Make sure that full dome height is obtained, but always leave a 1-2 mm wear flat on top of the button to avoid grinding away too much of the cemented carbide.

6. Stop the table rotation.

7. Index the next button by turning the drill bit.

8. Repeat steps 3–7 until all gauge buttons have been ground.

For best grinding results and wheel life:

- Centralize the buttons precisely.
- Make sure there is a generous flow of coolant at the point of contact.
- Grind carefully and do not rush.
- Let the machine do the work.
- Do not try to speed up grinding by adding hand pressure to the feed lever.
- Use original grinding wheels only.
- Do not use higher than recommended pressures.



IMPORTANT

The manufacturer disclaims all responsibility for any problems (or consequences thereof) attributable to the use of non-original grinding wheels.

Grinding wheel

Diamond grinding wheels are sensitive to impact, vibration and heat.

The grinding wheel must therefore work without vibration and with generous cooling!

The grinding wheel must be mounted with the marking on the wheel facing away from the grinding machine. Use original wheels only.

Steel removal

In the case of heavy bit wear, one should remove the steel around the button to obtain maximum service life of the diamond grinding wheel. This is done in the simplest way by means of using the grinding wheel for removing body steel, alternatively by using a straight silicon-carbide grinding wheel or by sand-blasting.

Maintenance

CAUTION

- Before attempting service or repair work on the machine, ALWAYS switch off and disconnect the electricity supply and the compressed air supply.

Cleaning

Keep the machine clean at all times. This is the cheapest and easiest way to maintain the machine.

Lubrication

Most bearings and bushings in the machine are permanently lubricated and do not normally need any maintenance. Use the grease nipples to lubricate moving parts.

Disposal



A used machine must be treated and disposed in such a way that the greatest possible portion of the material can be recycled and any negative influence on the environment is kept as low as possible, and with respect to local restrictions.

Cooling liquid

Particles of cemented carbide and steel gradually accumulate in the sedimentation tank. Empty and clean out the tank regularly. If the machine is used every day, the sedimentation tank should be cleaned out at least once a week. Since the water in the tank contains particles of cemented carbide, local regulations (in respect of water contamination) must be observed when it is emptied.

Fill the sediment tank with new fluid consisting of a mixture of cooling concentrate and water (mixing ratio 1:30). Apart from cooling the grinding wheel and cemented-carbide buttons, the cooling fluid serves to prevent rust in the machine.

If the machine is not going to be used for some time, the cooling system should be drained. If the machine is not going to be used for a long time, it should be oiled generously.

Water filter



Use the key to open and/or close the cup.

Air filter

The air filter prevents particles of dirt and also water from entering the pneumatic system. It should be drained and cleaned regularly. The water level in the bowl must not be allowed to rise as high as the separator disc.

Draining the air filter

Drain the air filter regularly by pressing the drainage valve upwards. The filter is also drained automatically when the compressed air is switched off. A 5 mm ID hose can be connected to the drainage valve if required (to discharge the water in a convenient place).

Cleaning the air filter

- Unscrew the filter bowl.
- Unscrew the separator disc.
- Clean the filter in benzine or a similar substance.
- Blow clean the filter from the inside out.
- Fit back the filter.
- Fit back the filter bowl.

Ejector

The pneumatic system includes an ejector that serves to create the vacuum which locks the grinding plate and driver plate to each other. The ejector does not normally need any maintenance. If it needs to be cleaned, simply remove the connection nipples and blow clean the ejector housing.

Grinding spindle

The spindle is manufactured with great precision. Rough handling can reduce the service life of grinding wheels. Care must therefore be taken when changing the grinding wheel. If necessary, use the extractor to remove the grinding wheel, product code 8700-5058.

Before fitting a new grinding wheel, lightly grease the spindle.

The bearings of the grinding spindle are permanently lubricated and does not normally need further lubrication.



Dismantle, overhaul and assemble

The outer nut threads are different. The one at the front end (95000780) has a right hand thread, turn counter-clockwise to open. The one at the back (87000781) is a left hand thread.

The inner nuts are all right hand thread.

To remove the ball bearings, pull them off. Use a puller. Check that the spindle shaft is in good condition. If the shaft has run out larger than 0.02 mm, replace it.

IMPORTANT

Vibrations will effect the grinding result and the life of your diamond grinding wheel.

When mounting the bearings back on to the spindle. Press them back. Use a sleeve.

Fill each of the new ball bearings to 25% with the recommended grease; Klüber Isoflex NBU 15. Important, do not overfill the bearings!

Note the direction of the disc springs (87005058).

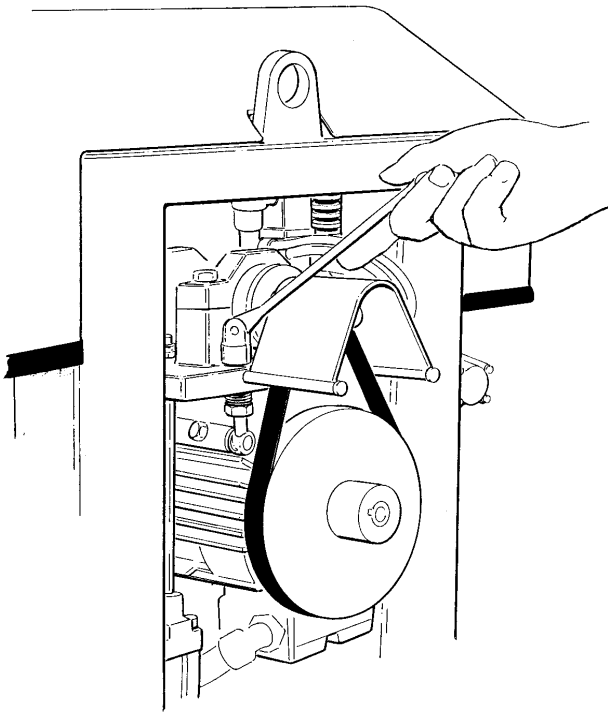
Grinding plate and driver plate

Make sure that the surfaces between the grinding plate and the driver plate are always clean. The o-ring between the two plates must be checked regularly. Damage to the o-ring will reduce the strength of the vacuum. Small amounts of oil can be used to prevent corrosion.

Protective bellows

The bellows serve to protect the tubular ball guides from dirt. Make sure that they remain in good condition in order to prevent grinding dust from entering and damaging the tubular ball guides.

Drive belt



The drive belt between the motor and grinding spindle can be tensioned by adjusting a spring-loaded screw on the motor shelf.

Belt position can be adjusted by screws on the motor shelf.

IMPORTANT

It is important for the motor shelf to be correctly adjusted, otherwise the drive belt can wander on the jockey wheels, which can result in damage.

Centring the machine

The machine is adjusted correctly at the factory. If mishandled during transportation, however, its centring can be upset.

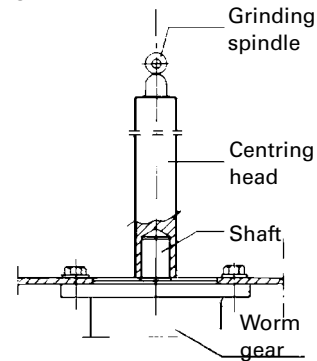
IMPORTANT

It is important that the driver plate, centring cup and grinding wheel have the same centre.

Adjustment is carried out as follows:

- Remove the protective covers (top and rear plastic covers).
- Remove the grinding plate.
- Remove the screw in the driver plate and lift off the plate.
- Place the centring head (supplied with the machine) on the shaft
- Move the grinding spindle (without grinding wheel) down toward the centring head.
- Check that the centring head and grinding spindle align perfectly with each other in the left/right plane. See fig. A.

Fig. A



IF NOT:

7. Knock down both the tension pins that fix the worm gear to the machine frame. Then loosen the four screws that secure the worm gear to the frame and adjust the worm gear in relation to the grinding spindle. Tighten the screws. Drill two new holes for the tension pins and fit the pins. (see the Spare parts list - Rotating table)

8. Fit the grinding wheel (uncoated 11 mm).

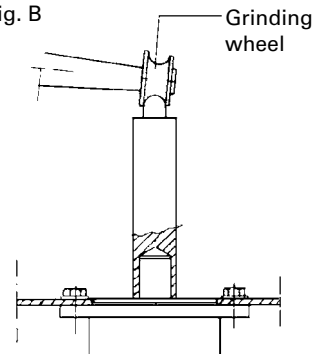
9. Move the grinding wheel (not rotating) down toward the centring head. The centring head should pass perfectly into the centre of the cup-groove in the grinding wheel.

IF NOT:

10. Loosen the two screws that secure the grinding spindle and push the spindle outwards or inwards as necessary. Tighten the screws. (see the Spare parts list - Grinding unit)

11. Swing the centring arm into the guide position. Check that the 11 mm centring cup aligns perfectly with the centring head.

Fig. B



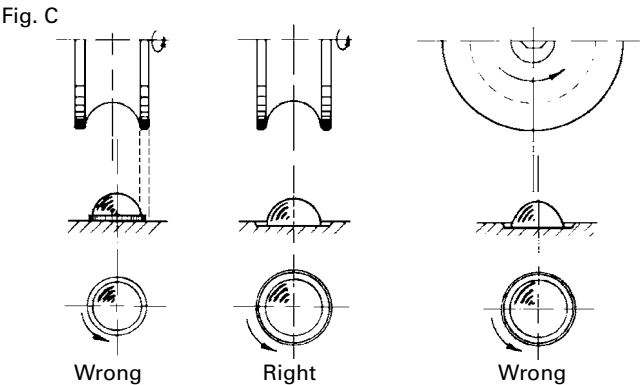
IF NOT:

12. Adjust the set-screw at the attachment point of the centring arm. If this does not rectify the problem, the centring-arm bracket can be moved as follows:

- Remove the 4 fixing screws for the centring-arm bracket.

- Carefully remove the bracket from the tension pins.
- Remove the tension pins.
- Fit back the 4 fixing screws but do not tighten.
- Adjust the centring arm so that the 11 mm centring cup lines up
- Tighten the 4 fixing screws.
- Drill two new holes for the tension pins.
- Press the pins into the new holes.

13. Check the alignment of the machine by grinding a button carefully. The grinding wheel should now produce an even, regular dome shape that agrees with the diameter of the button. If the right size grinding wheel is used, there should be no lip on the button. See fig. C.



Circuit breakers

The standard settings of the circuit breakers are as the following:

Part	Description	Voltage	Frequency	Current
Spindle	LRD 10	230 V	50, 60 Hz	6.0 A
	LRD 08	400 V	50, 60 Hz	3.5 A
	LRD 08	440 V	60 Hz	3.2 A
Table	LRD 07	230 V	50, 60 Hz	2.0 A
	LRD 06	400 V	50, 60 Hz	1.15 A
	LRD 06	440 V	60 Hz	1.0 A
Pump	LRD 07	230-440 V (1-p)	50, 60 Hz	2.4 A
	LRD 07	230 V	50, 60 Hz	1.9 A
	LRD 06	400-440 V	50, 60 Hz	1.1 A

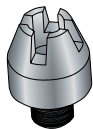
Recommended lubricants and cooling liquids

Worm gear	
Permanently lubricated with	
BP	Energol SGR 150
Shell	TIVELA OIL WB
Tubular ball guides	
Permanently lubricated with:	
	Bearing grease
Grinding spindle	
Permanently lubricated with:	
Klüber	Lubrication
Isoflex	NBU 15
Centring-cup shaft	
	Bearing grease
Cooling liquid	
Product No.	
Concentrate - mixing ratio 1:30	
0,5 litres	87001038
10 litres	87002844

Accessories

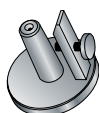
Centering cups

For button size	Product No.
7,0 mm	87001040
8,0 mm	87000842
9,0 mm	87001047
10,0 mm	87001041
11,0 mm	87000840
12,0 mm	87001042
12,7 mm	87000839
13,0 mm	87001385
14,0 mm	87001043
14,5 mm	87001443
15,0 mm	87001386
16,0 mm	87001387
18,0 mm	87003943
19,0 mm	87003944



Bit holders for button bits

Description	Product No.
Threaded bits	
Holder R25	87003475
Holder R28	87003476
Holder SR28	87003960
Holder R32	87003477
Holder SR32	87003962
Holder SR35	87003956
Holder R38, T38	87003478
Holder SR38	87003978
Holder SR38 retrac, guide	87004081
Holder TC42	87004641
Holder T45	87003479
Holder T51 and retrac	87003521
Holder T-WiZ60*	87005052
Holder GT60*	87005085
Tube bits	
Holder ST58	87003522
Holder ST68	87003523
Tapered bits	
Holder 7° taper	87003524
Holder 12° taper	87003525
Reaming bits	
Holder 64, 76 and 89 mm reamer	87003526
Holder 89, 102 and 127 mm reamer	87003527
Guide bits	
Holder R32 guide bit	87003992
Holder SR35 guide bit	87004056



* Must be used together with clamping device 87004777 (observe max bit height).

Diamond-grain wheels



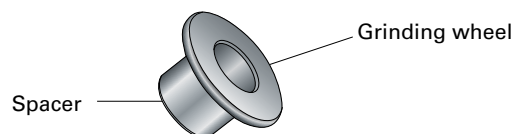
Spherical



Ballistic

Dimension, mm	Product No.	Dimension, mm	Product No.
Spherical		Ballistic	
7	87004554	7	87004556
8	87004555	8	87004557
9	87003969	9	87003974
10	87003970	10	87003975
11	87003971	11	87003976
12	87003972	12	87003977
13	87003973	13	87003413
14	87001025	14	87003414
15	87001384	15	87003415
16	87001027	16	87003416
18	87003964	18	87003965
19	87003966	19	87003967

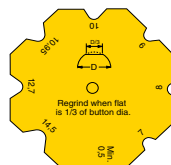
Grinding wheels for removing body steel



Description	Product No.
Grinding wheel	87001530
Spacer 2,0 mm for 10 mm button	87001631
Spacer 2,5 mm for 11 mm button	87001632
Spacer 3,0 mm for 12 mm button	87001633
Spacer 3,5 mm for 13 mm button	87001634
Spacer 4,0 mm for 14 mm button	87001635

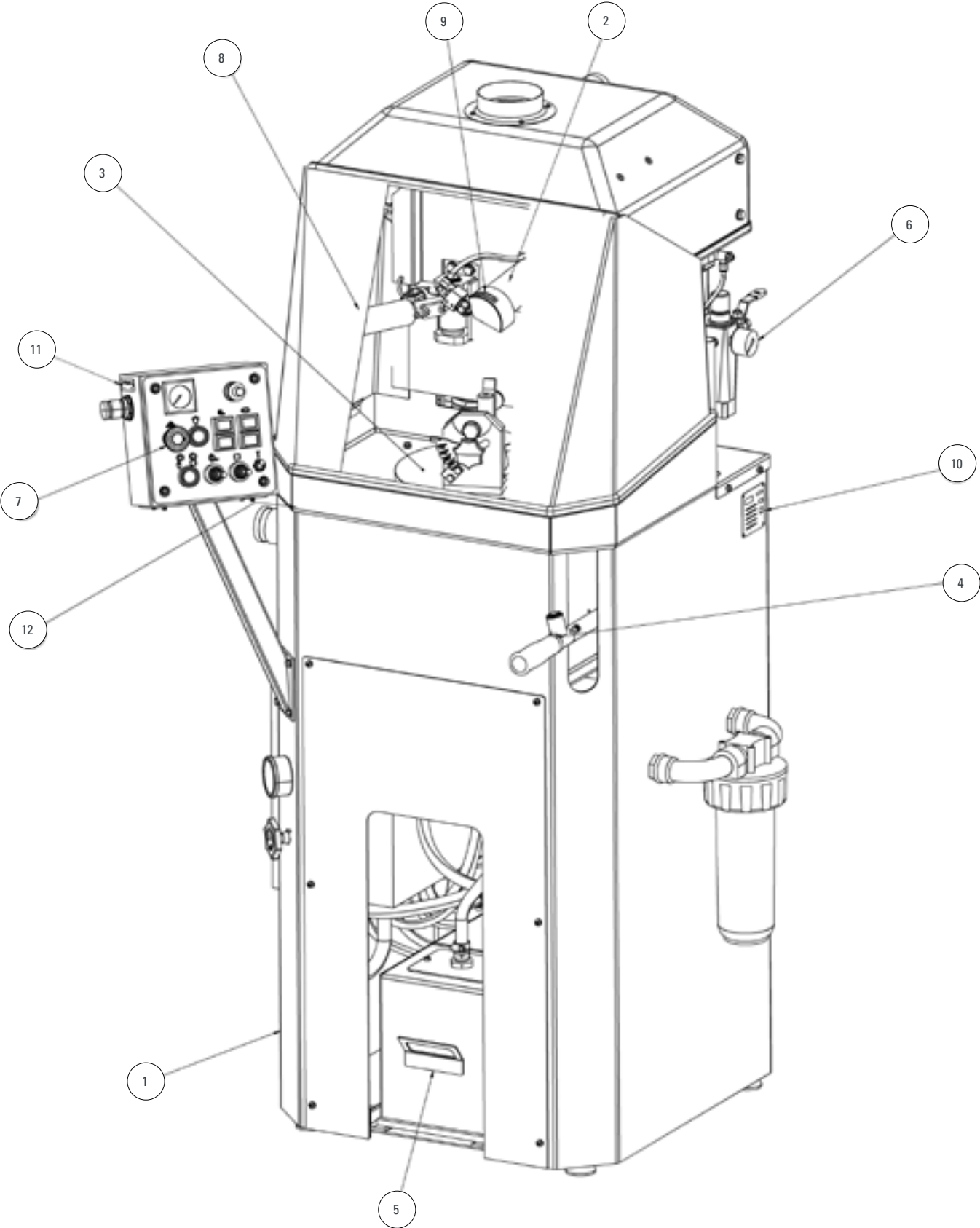
For 15 mm button combine 2,0 mm spacer and 2,5 mm spacer.
For 16 mm button combine two 2,5 mm spacers.

Grinding templates for button bits



Description	Product No.
Button bits, spherical	90002944
Button bits, ballistic	90503414
Button bits DTH, spherical	90510753
Button bits DTH, ballistic	90510758

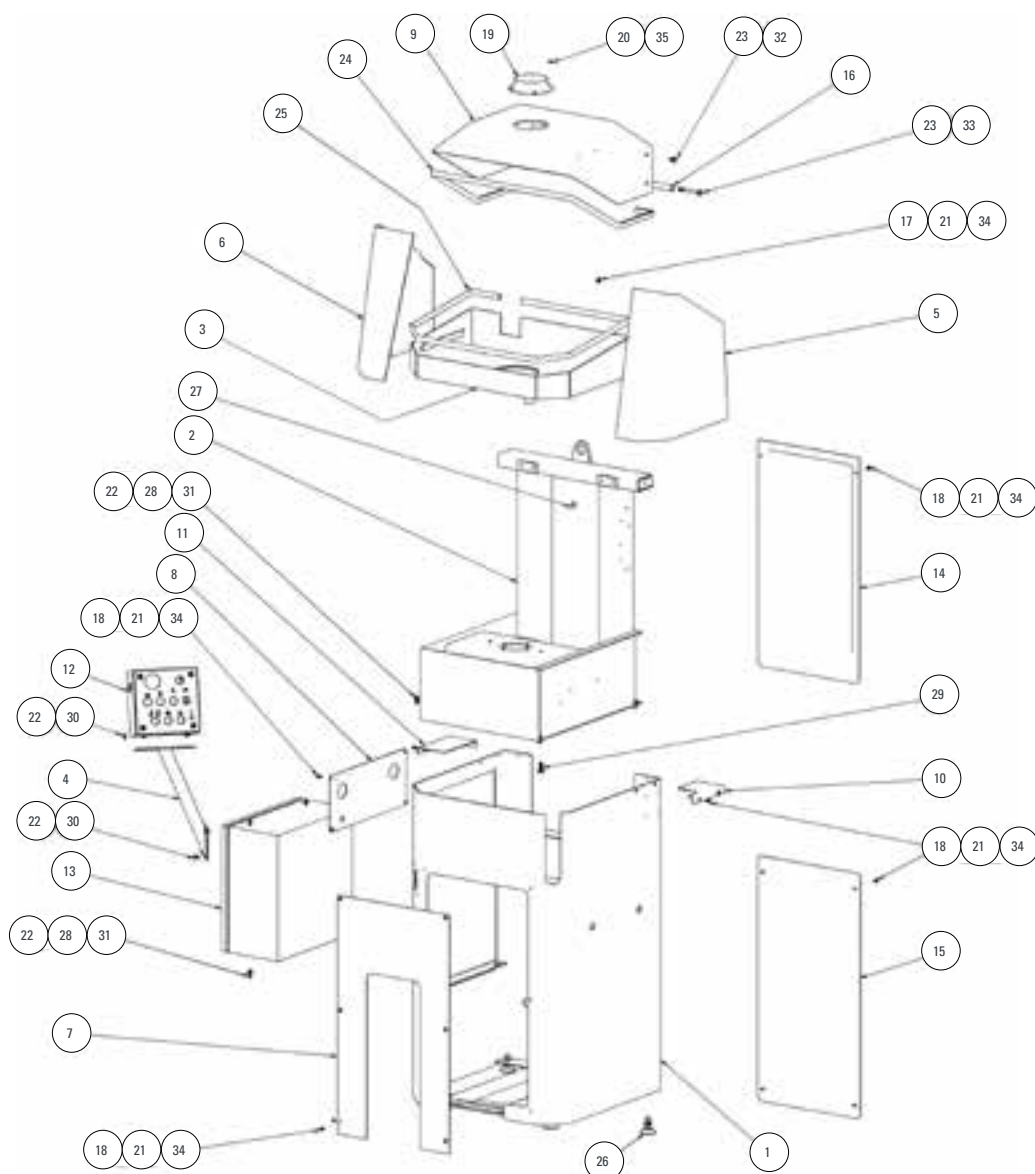
Spare parts list



Ref. No.	Description	See page
1	Frame complete	15
2	Grinding unit	16
3	Rotating table	18
4	Lifting arm	19

Ref. No.	Description	See page
5	Flushing components	20
6	Pneumatic components	24
7	Electrical components	22
8	Centring device complete	17

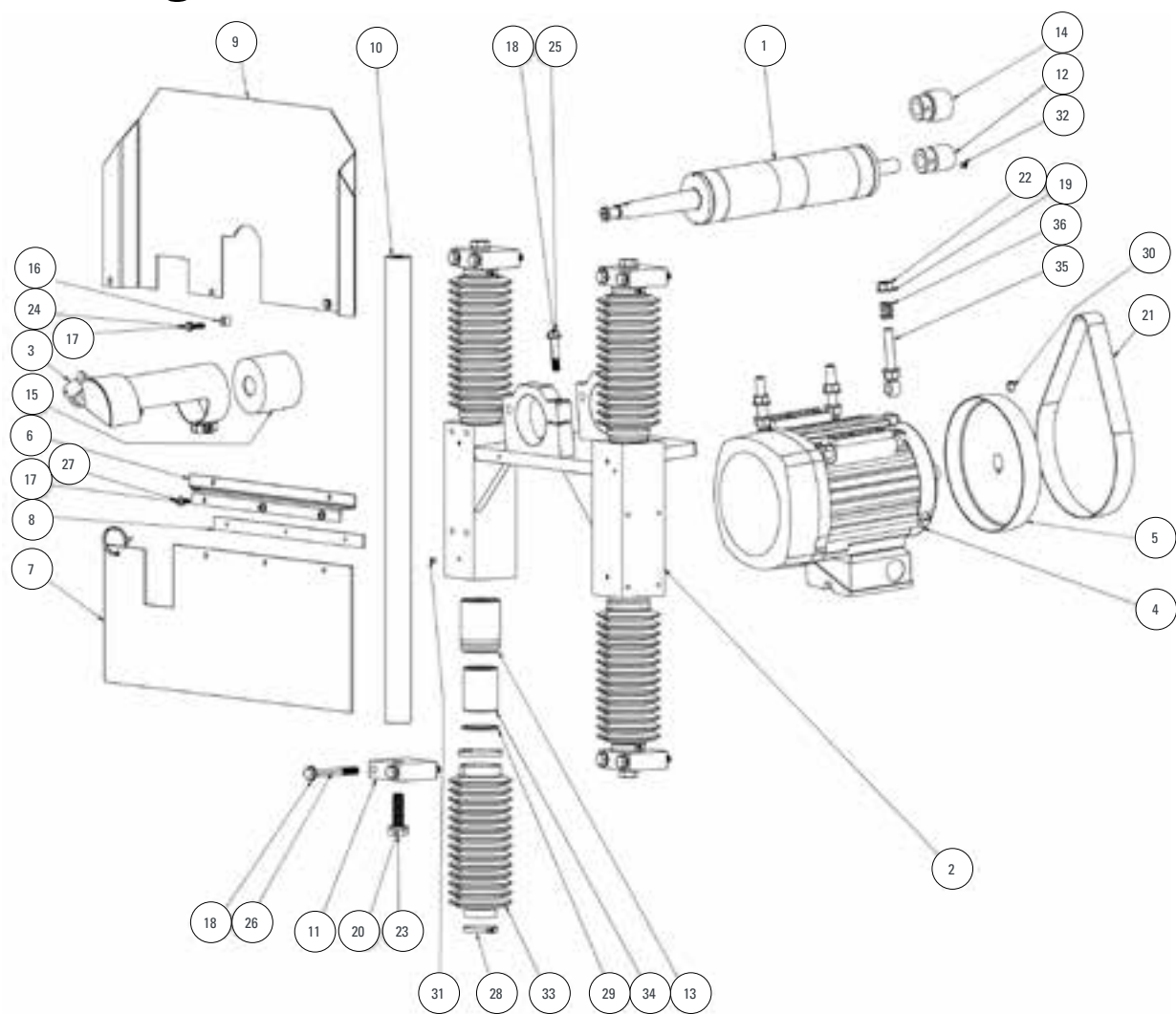
Frame, complete



Ref. No.	Product No.	Qty	Description	Specification
1	87003782	1	Stand lower	
2	87003757	1	Stand upper	
3	87003422	1	Collection tray	
4	87003767	1	Bracket control panel	
5	87003702	1	Splash guard	Right
6	87003703	1	Splash guard	Left
7	87004631	1	Front door	
8	87004632	1	Cover pneumatics	Panel
9	87003450	1	Top cover	
10	87003468	1	Bracket	Right
11	87003471	1	Bracket	Left
12	87003433	1	Control box	
13	87003443	1	Electric cabinet	
14	87003464	1	Protection hood	
15	87003667	1	Rear cover plate	
16	87003682	2	Spacer	
17	87001066	4	Rubber seal	6 X 9 X 11
18	87004732	22	Washer	

Ref. No.	Product No.	Qty	Description	Specification
19	87004633	1	Ventilator frame	Ø 100
20	87000946	4	Washer	BRB 4.3
21	87000503	26	Washer	BRB 5.3
22	87000788	24	Washer	BRB 6.4
23	87000131	4	Washer	BRB 8.4
24	87003420	1	Rubber sealing strip	L = 1650
25	87003420	1	Rubber sealing strip	L = 1850
26	87003419	4	Rubber feet	M10
27	87003438	1	Rubber stop	M6
28	87000838	8	Nut	M6
29	87000166	2	Screw	10 X 25
30	87001885	8	Screw	6 X 12
31	87000145	8	Screw	6 X 20
32	87000926	2	Screw	8 X 16
33	87003695	2	Screw	8 X 80
34	87004634	26	Screw	5 X 12
35	87001901	4	Pop rivet	4 X 10

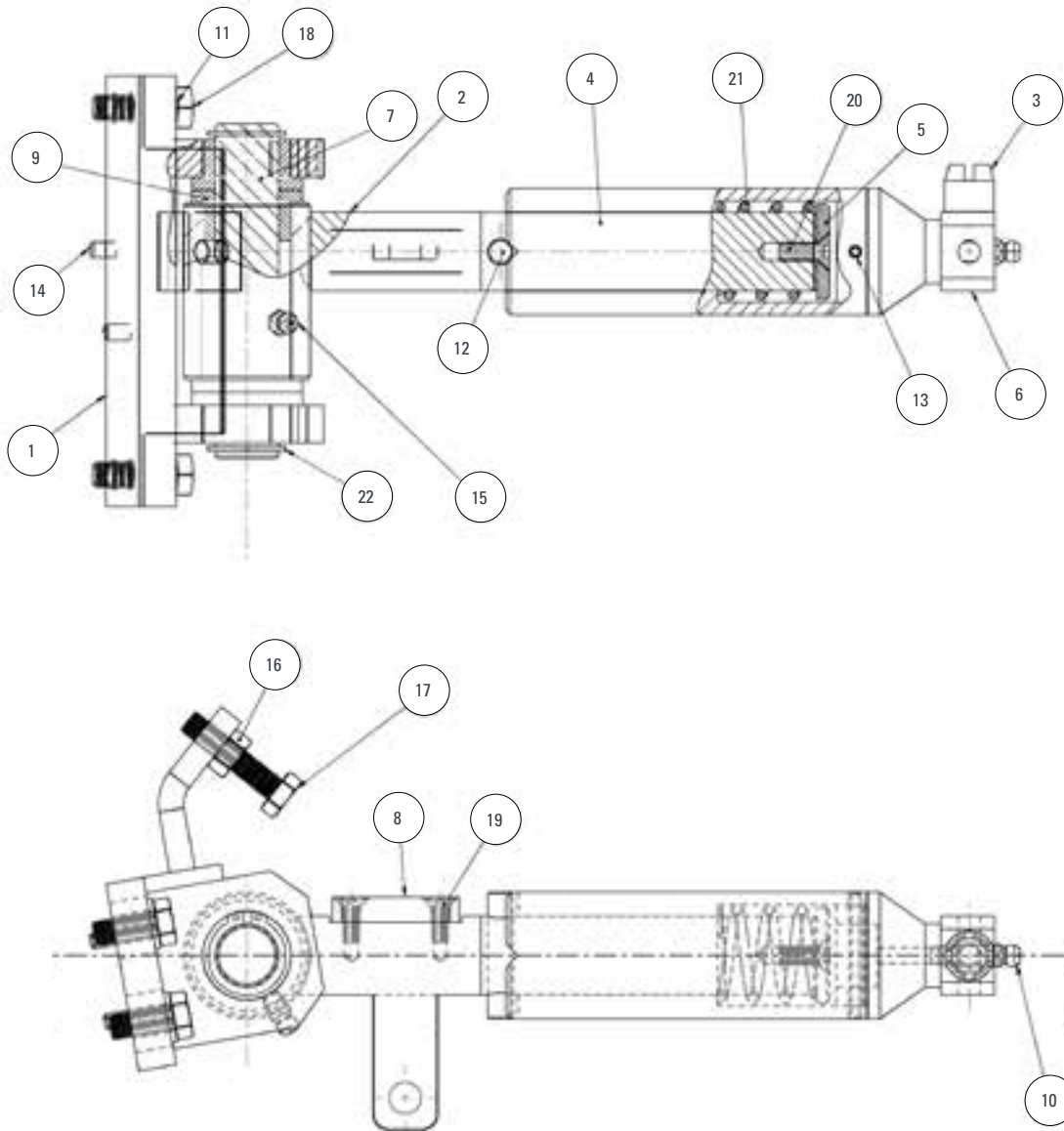
Grinding unit



Ref. No.	Product No.	Qty	Description	Specification
1	87000777	1	Spindle	
2	87004642	1	Guide	
3	87004509	1	Holder complete	
4	87004638	1	Electric motor	1,5 kW
5	87000786	1	Pulley	
6	87003683	1	Z-strip	
7	87003699	1	Rubber mat	
8	87004637	1	Strip	
9	87003763	1	Splash guard	
10	87003705	2	Shaft	
11	87001667	4	Bracket	
12	87000783	1	Pulley	50 Hz
13	87003431	4	Socket	
14	87003512	1	Pulley	60 Hz
15	87003566	1	Splash guard	
16	87000913	2	Spacer	
17	87000503	5	Washer	BRB 5.3
18	87000131	10	Washer	BRB 8.4
19	87000167	6	Washer	BRB 10.5
20	87000430	4	Washer	BRB 13

Ref. No.	Product No.	Qty	Description	Specification
21	87004640	1	Driving belt	L=620 W=25
22	87000185	6	Nut	M10
23	87001678	4	Screw	12 X 40
24	87002385	2	Screw	5 X 20
25	87000186	2	Screw	8 X 40
26	87000810	8	Screw	8 X 65
27	87004634	3	Screw	5 X 12
28	87000203	9	Clip	
29	87001676	4	Circlip	SGH 40
30	87000481	1	Screw	8 X 10
31	87003469	4	Screw	5 X 6
32	87003430	1	Screw	6 X 8
33	87000462	4	Bellows	
34	87001671	4	Ball bushing	LBBR 30
35	87001621	3	Screw	10 X 70
36	87001489	1	Spring	2.5 X 12.5 X 17.9
37	87004508	1	Splash cover	
38	87004643	1	Cover	
39	87004505	1	Holder	
40	87004506	1	Bracket	

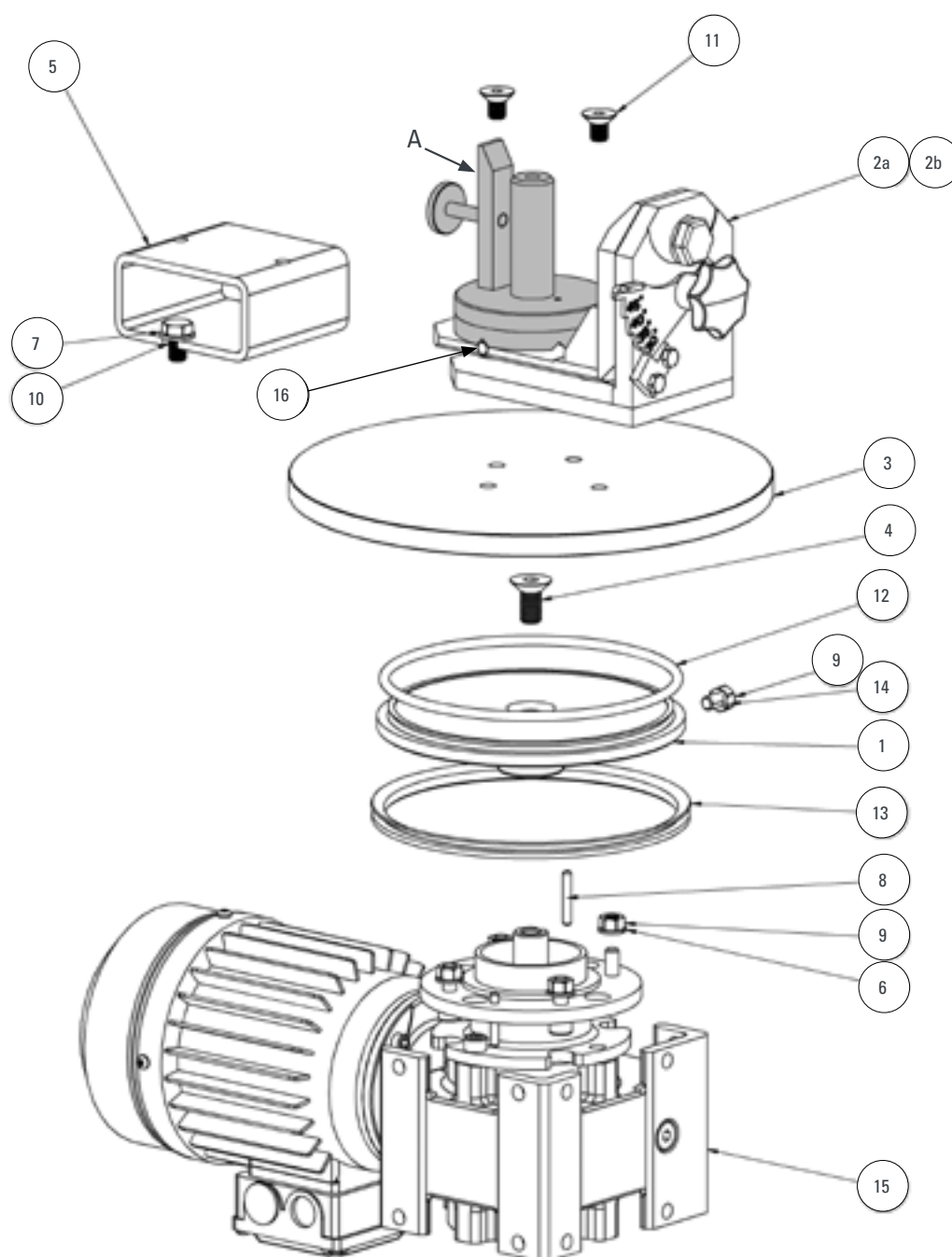
Centring device



Ref. No.	Product No.	Qty	Description	Specification
1	87004646	1	Bracket	
2	87003587	1	Arm	
3	87000840	1	Centering cup	11 mm
4	87003586	1	Turning sleeve	
5	87003582	1	Lock washer	
6	87003585	1	Centering head	
7	87003583	1	Shaft	
8	87003573	1	Stop lug	
9	87000527	4	Bushing	
10	87004014	1	Grease nipple	M6
11	87000131	4	Washer	BRB 8.4
12	87003581	1	Cylindrical pin	8 X 40

Ref. No.	Product No.	Qty	Description	Specification
13	87003579	1	Spring tension pin	4 X 40
14	87001333	2	Spring tension pin	6 X 20
15	87004015	1	Grease nipple	M6
16	87001703	1	Nut	M8
17	87003707	1	Screw	8 X 35
18	87001071	4	Screw	8 X 20
19	87003576	2	Screw	5 X 14
20	87000453	1	Screw	6 X 16
21	87003578	1	Spring	3 X 25 X 40
22	87003577	2	Circlip	SGA 20
	87003758	1	Centring device	Complete

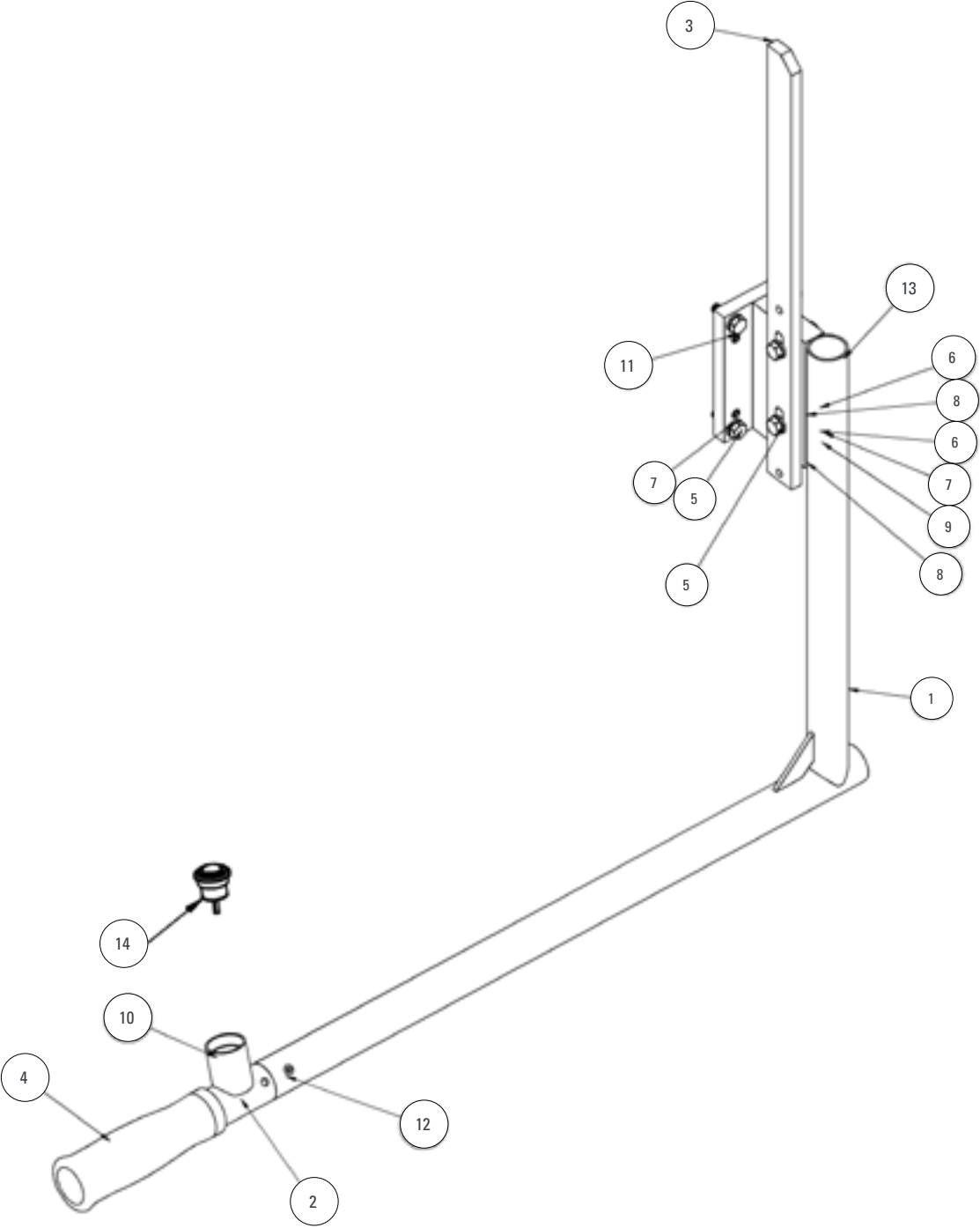
Rotating table



Ref No.	Product No.	Qty	Description	Specification
1	87003462	1	Dog	
2a	87003542	1	Clamping device	Bit holder (A) not incl.
2b	87004777	1	Clamping device for T-WiZ60	Bit holder (A) not incl.
3	87000771	1	Grinding disc	
4	87000768	1	Screw	
5	87003737	1	Spacer	
6	87000131	4	Washer	BRB 8.4
7	87000167	2	Washer	BRB 10.5

Ref No.	Product No.	Qty	Description	Specification
8	87001998	2	Tension pin	5 X 32
9	87000496	5	Nut	M8
10	87000497	2	Screw	10 X 16
11	87000805	2	Screw	10 X 16
12	87000854	1	O-ring	154,3 X 5,7
13	87001054	1	Rubber seal	VL-170
14	87001746	1	Screw	8 X 20
15	87004650	1	Gearbox unit	
16	87129971	5	Pin	8 X 20

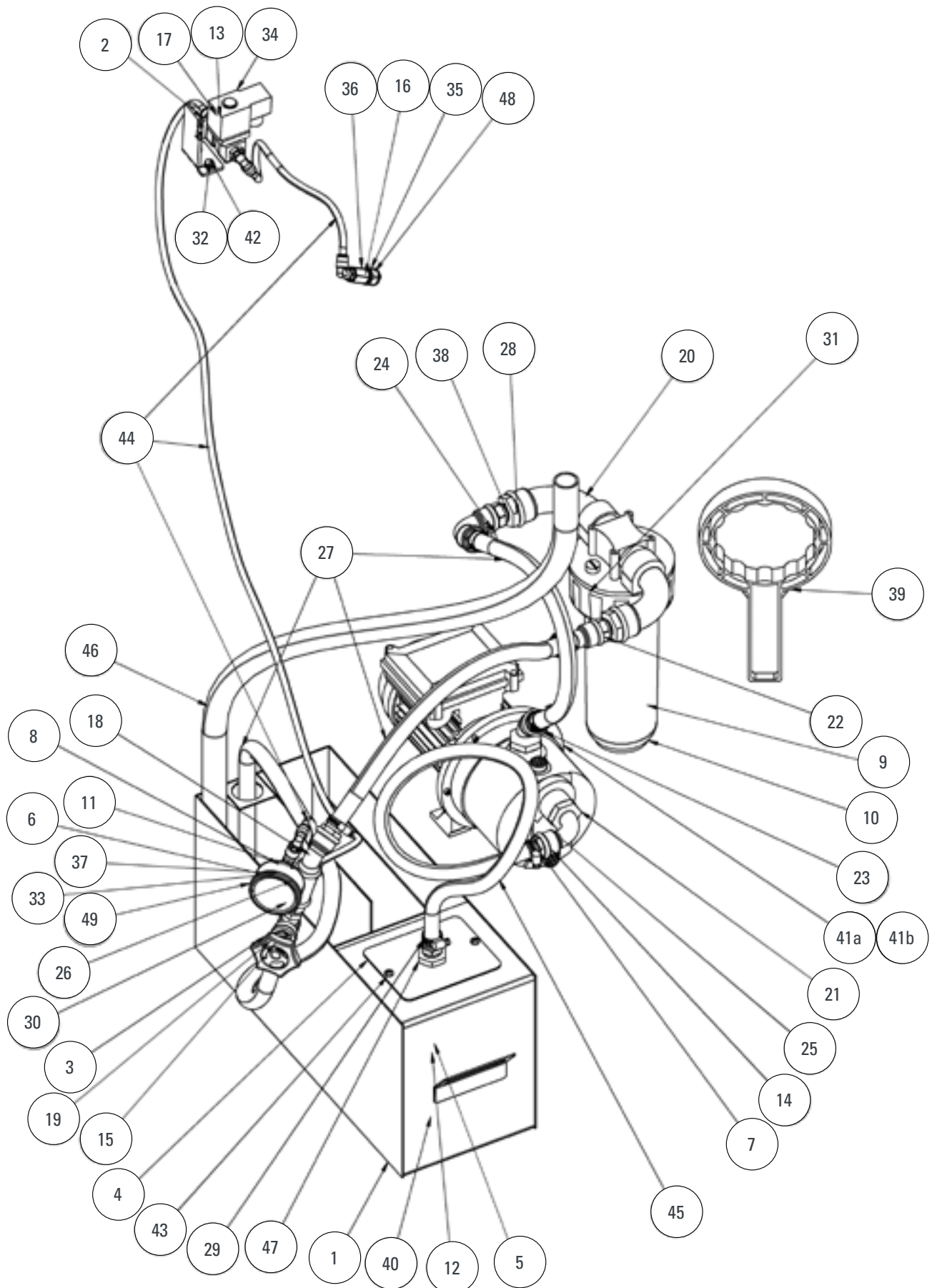
Lifting arm



Ref. No.	Product No.	Qty	Description	Specification
1	87004647	1	Arm	
2	87004649	1	Handle	
3	87003773	1	Bar	
4	87001888	1	Rubber grip	
5	87000788	6	Washer	BRB 6.4
6	87000838	4	Nut	M6
7	87000145	5	Screw	6 X 20

Ref. No.	Product No.	Qty	Description	Specification
8	87000829	3	Screw	6 X 30
9	87003764	1	Spring	1 X 8 x 25
10	87004289	1	Screw	4 X 5
11	87003759	2	Screw	6 X 12
12	87003430	1	Screw	6 X 8
13	87004293	1	Plug	Ø 22
14	87001087	1	Electric button	

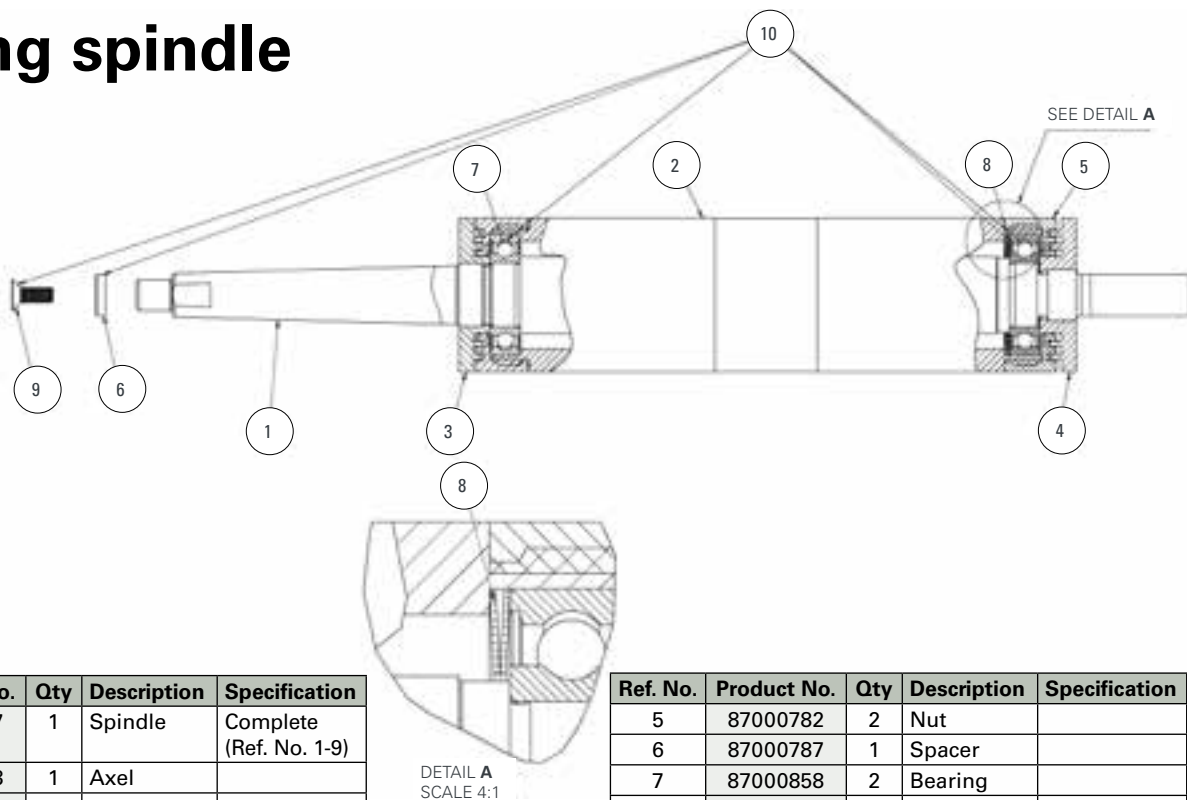
Flushing components



Ref. No.	Product No.	Qty	Description	Specification
1	87003421	1	Coolant tank	
2	87003780	1	Bracket	
3	87001270	1	Valve	
4	87004651	1	Bracket	
5	87004652	1	Pipe	1/2"
6	87004653	1	Spacer	
7	87001819	7	Hose clamp	13/20
8	87004662	1	T-pipe	1/4"
9	87004565	1	Water filter	25 micron
10	87004588	1	Filter cup	
11	87001886	1	Bushing	1/2"-1/4"
12	87000022	1	Bushing	
13	87001850	2	Bushing	3/8"-1/4"
14	87000066	5	Nipple	1/2"
15	87000263	1	Nipple	3/8"
16	87004665	1	Strainer	
17	87001855	1	Coupling	8-1/4"
18	87000849	5	Elbow	8-1/4"
19	87001271	1	Nut	G3/8
20	87004657	2	Angle	1"
21	87004583	4	Bushing	
22	87004658	1	Angle	1/2"
23	87000016	2	Angle	
24	87003514	1	Angle	1/2"
25	87000017	1	Angle	

Ref. No.	Product No.	Qty	Description	Specification
26	87000019	1	T-pipe	1/2"-1/4"
27	87004585	3	Hose	L = 2000
28	87000021	2	Nipple	1/2"
29	87004655	1	Nipple	1/2"
30	87003700	1	Nipple	1/2"-3/8"
31	87004566	1	O-ring	89 X 5.3
32	87000788	2	Washer	BRB 6.4
33	87000430	1	Washer	BRB 13
34	87003604	1	Electric valve	
35	87004664	1	Nut	1/4"
36	87004663	1	Nozzle holder	1/4"
37	87001724	1	Washer	13/17 Copper
38	87004661	2	Washer	20 X 24 Copper
39	87004659	1	Filter key	
40	87004654	1	Valve	3/4"
41a	87004559	1	Pump unit, 1-p	Serial≤1319
41b	87004764	1	Pump unit, 3-p	Serial>1319
42	87001885	2	Screw	6 X 12
43	87004634	2	Screw	5 X 12
44	87004063	3	Hose	L=2100
45	87004656	1	Hose	Ø12 l=1000
46	87003677	1	Hose	Ø25 l=1500
47	87003516	2	Nut	1/2"
48	87004666	1	Nozzle	
49	87004667	1	Gauge pressure	Ø63

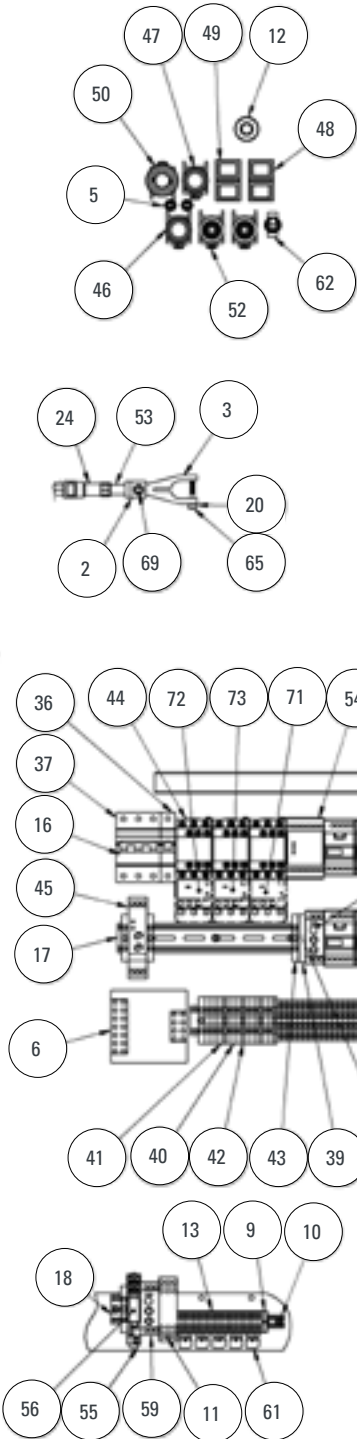
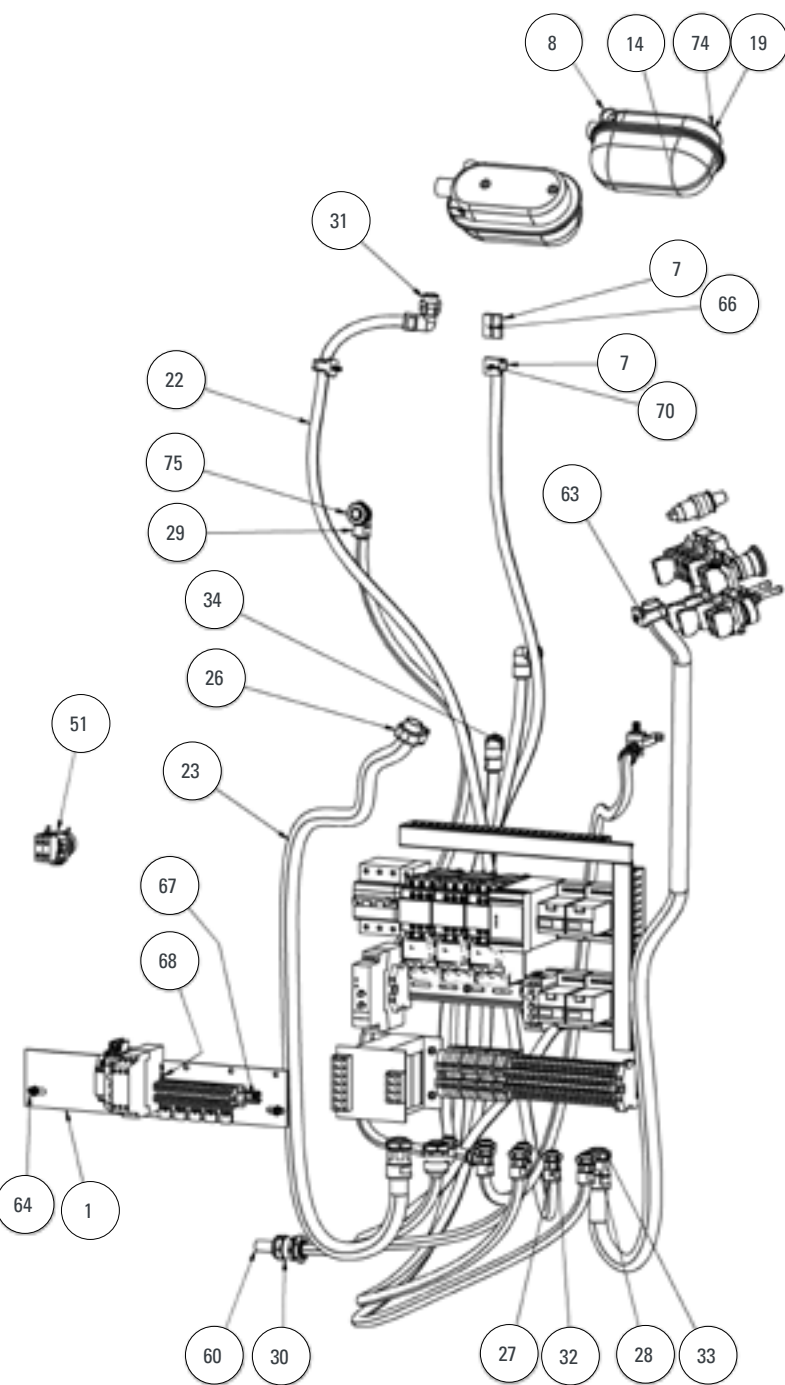
Grinding spindle



Ref. No.	Product No.	Qty	Description	Specification
-	87000777	1	Spindle	Complete (Ref. No. 1-9)
1	87000778	1	Axel	
2	87000779	1	Housing	
3	87000780	1	Nut	cw
4	87000781	1	Nut	ccw

Ref. No.	Product No.	Qty	Description	Specification
5	87000782	2	Nut	
6	87000787	1	Spacer	
7	87000858	2	Bearing	
8	87001081	2	Spring	
9	87000453	1	Screw	M6x16
10	87004729	1	Spare kit	Ref. No. 6-9

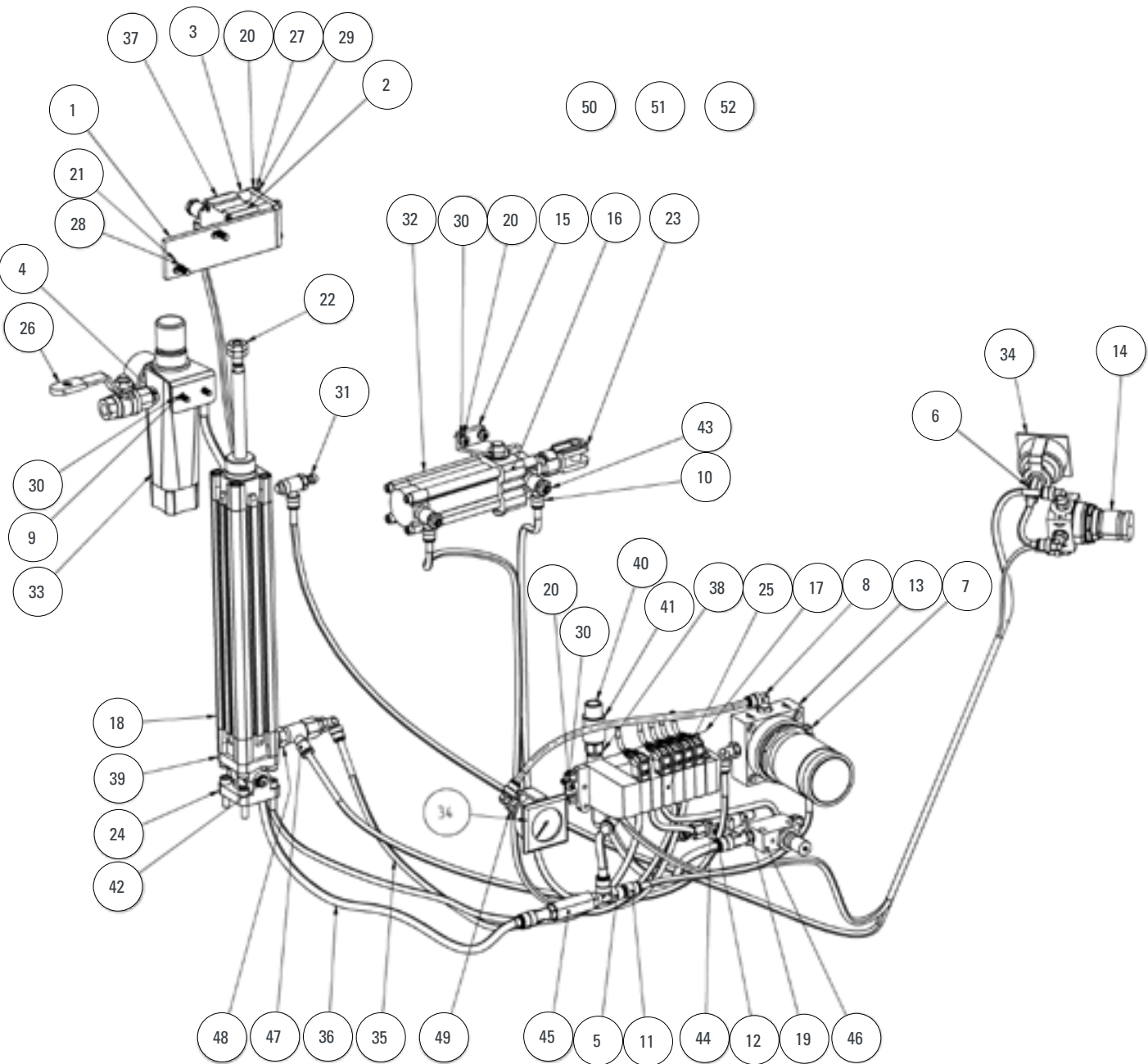
Electrical components



Ref. No.	Product No.	Qty	Description	Specification
1	87003793	1	Mounting rail	
2	87003679	1	Bracket	
3	87003678	1	Fork bridge	
4	87001087	1	Electric button	For lifting arm
5	87001509	2	Light diode	24V
6	87004689	1	Electric trans- former	
7	87001706	1	Plinth	
8	87003603	2	Electric lamp unit	
9	87004699	1	Din rail support	15 X 5
10	87004698	1	Din rail	15 X 5 L=130
11	87004091	1	Time relay	
12	87004266	1	Potentiometer	ABB
13	87004697	20	Din rail connec- tion block	2.5/15
14	87004696	2	Bulb	24V/40W E27
15	87004670	1	Din rail	35x7.5 L=260
16	87004670	1	Din rail	35x7.5 L=325
17	87004670	1	Din rail	35x7.5 L=330
18	87004670	1	Din rail	35x7.5 L=80
19	87000946	4	Washer	BRB 4.3
20	87000503	1	Washer	BRB 5.3
21	87004695	2	Flex channel	
22	87003647	1	Flex pvc pipe	
23	87003645	1	Flex pvc pipe	
24	87003652	1	Cable connec- tor	
25	87003670	2	Clamp	
26	87003671	2	Clamp	
27	87003278	5	Screw cap	
28	87003648	2	Screw cap	
29	87003828	7	Screw cap	
30	87003653	2	Screw cap	
31	87003654	1	Screw cap	
32	87003672	7	Nut	15.2
33	87003655	4	Nut	22
34	87004288	2	Screw cap	
35	87003567	1	Fuse	4A
36	87003569	1	Circuit breaker	2A 1P
37	87000892	1	Circuit breaker	10A 3P
38	87003616	23	Plinth	
39	87003618	1	Fuse holder	
40	87003624	10	Din rail connec- tion block	WDU 2.5
41	87004694	2	Din rail connec- tion block	WDU 2.5
42	87003626	5	Din rail connec- tion block	WPE 4

Ref. No.	Product No.	Qty	Description	Specification
43	87003623	3	Din rail support	
44	87000895	3	Contactor	
45	87004693	1	Electric soft starter, 1-p	Serial≤1319
	87004761	1	Electric soft starter, 3-p, 230 V	Serial>1319
	87004762	1	Electric soft starter, 3-p, 400V	Serial>1319
	87004762	1	Electric soft starter, 3-p, 440V	Serial>1319
46	87004684	1	Button	Man/aut
47	87004679	1	Button	Light
48	87004683	1	Button	Rotation
49	87004682	1	Button	Spindle
50	87004678	1	Button	Emergency
51	87004680	1	Button	Reset
52	87004677	1	Joystick	
53	87003791	1	Inductor	
54	87003613	1	Relay	24V
55	87004692	1	Socket	
56	87004691	1	Relay	24V
57	87003622	1	Socket	
58	87003607	4	Relay	
59	87004899	2	Time relay	
60	87004690	2	Electric wire	L = 2.5 m
61	87004733	5	Rectifier	
62	87003783	1	Switch	
63	87000504	1	Nut	M5
64	87000838	1	Nut	M6
65	87001958	2	Screw	5 X 35
66	87000945	1	Screw	6 X 12
67	87000693	1	Screw	4 X 6
68	87001209	2	Screw	5 X 6
69	87003912	26	Screw	8 X 16
70	87004634	1	Screw	5 X 12
71	87000896	1	Circuit breaker	LRD 07 230V, 1-p
	87000896	1	Circuit breaker	LRD 07 230V, 3-p
	87000977	1	Circuit breaker	LRD 06 ≥380V
72	87001411	1	Circuit breaker	LRD 10 230V
	87000975	1	Circuit breaker	LRD 08 ≥380V
73	87000896	1	Circuit breaker	LRD 07 230V
	87000977	1	Circuit breaker	LRD 06 ≥380V
74	87001901	1	Rivet	4 X 10
75	87004739	1	Screw cap	

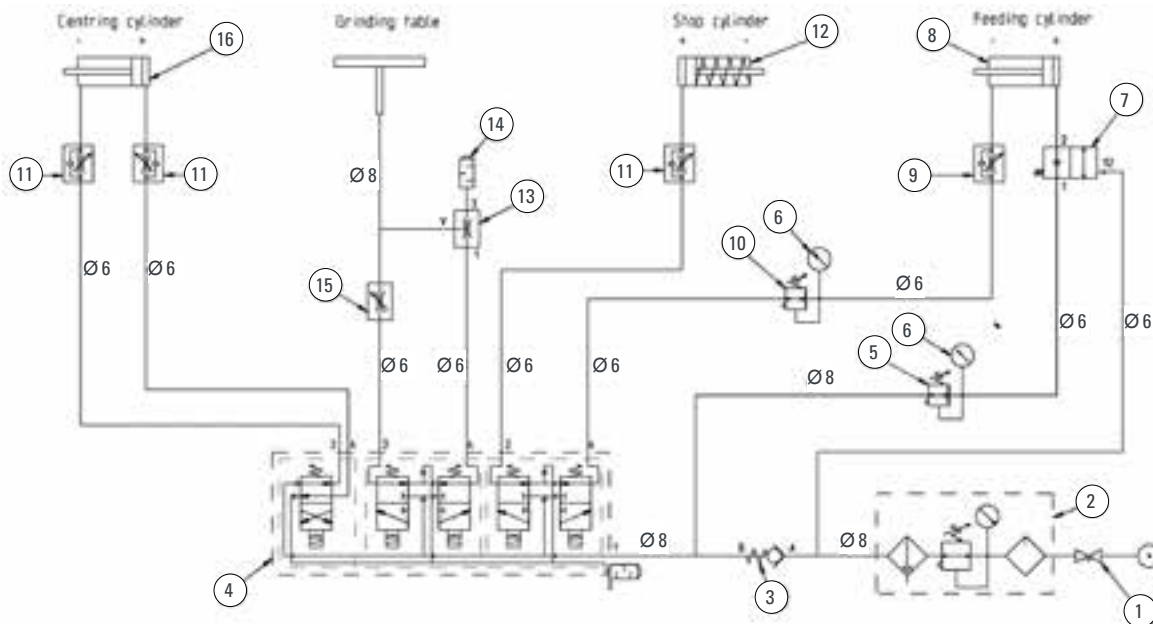
Pneumatic components



Ref. No.	Product No.	Qty	Description	Specification
1	87003753	1	Bracket	
2	87003771	1	Pressure plate	
3	87003762	4	Spacer	
4	87127883	1	Nipple	1/4"
5	87003661	3	T-coupling	8-1/4"
6	87003817	2	Coupling	6-1/8"
8	87003816	6	Coupling	6-1/8"
9	87000849	1	Coupling	6-1/4"
10	87003820	4	Coupling	6-1/8" Banjo
11	87004668	1	Adapter	6-8
12	87004672	1	Adapter	8-1/8"
13	87003531	1	Regulator	1/4"
14	87001624	1	Regulator	1/8"
15	87003453	1	Bracket	
16	87003454	1	Trunnion	C40/41m-32
17	87004670	1	Din rail	35 X 7.5 L=150
18	87003427	1	Cylinder	
19	87001063	1	Muffler	G1/8"
20	87000503	10	Washer	BRB 5.3
21	87000788	2	Washer	BRB 6.4
22	87003681	1	Nut	M10 X 1.25
23	87003665	1	Fork link	G25-32
24	87003425	1	Bracket	H-41-32
25	87004671	1	Valve block, complete	

Ref. No.	Product No.	Qty	Description	Specification
26	87000863	1	Shut off valve	1/4"
27	87000504	4	Nut	M6M M5
28	87000145	2	Screw	6 X 20
29	87003794	4	Screw	5 X 55
30	87004634	8	Screw	5 X 12
31	87003821	1	Control valve	1/8"
32	87003452	1	Cylinder	
33	87004480	1	Filter regulator	G1/4"
34	87001623	2	Pressure gauge	1/8"
35	87004669	1	Hose	Ø 6 l=10000
36	87004660	1	Hose	Ø 8 l=2000
37	87003754	1	Cylinder	
38	87004674	1	Swivel	8-3/8"
39	87003424	1	Trunnion rear	
40	87000852	1	Screw bushing	3/8"
41	87004688	1	Coupling	3/8"
42	87003426	1	Shaft kit	
43	87001222	3	Throttle check valve	1/8"
44	87004673	1	Ejector	
45	87003529	1	Non return valve	
46	87000869	1	Check valve	
47	87004675	1	Blocking valve	
48	87004740	1	Coupling	1/4-1/8"
49	87001507	1	Pipe	1/8"

Pneumatic diagram

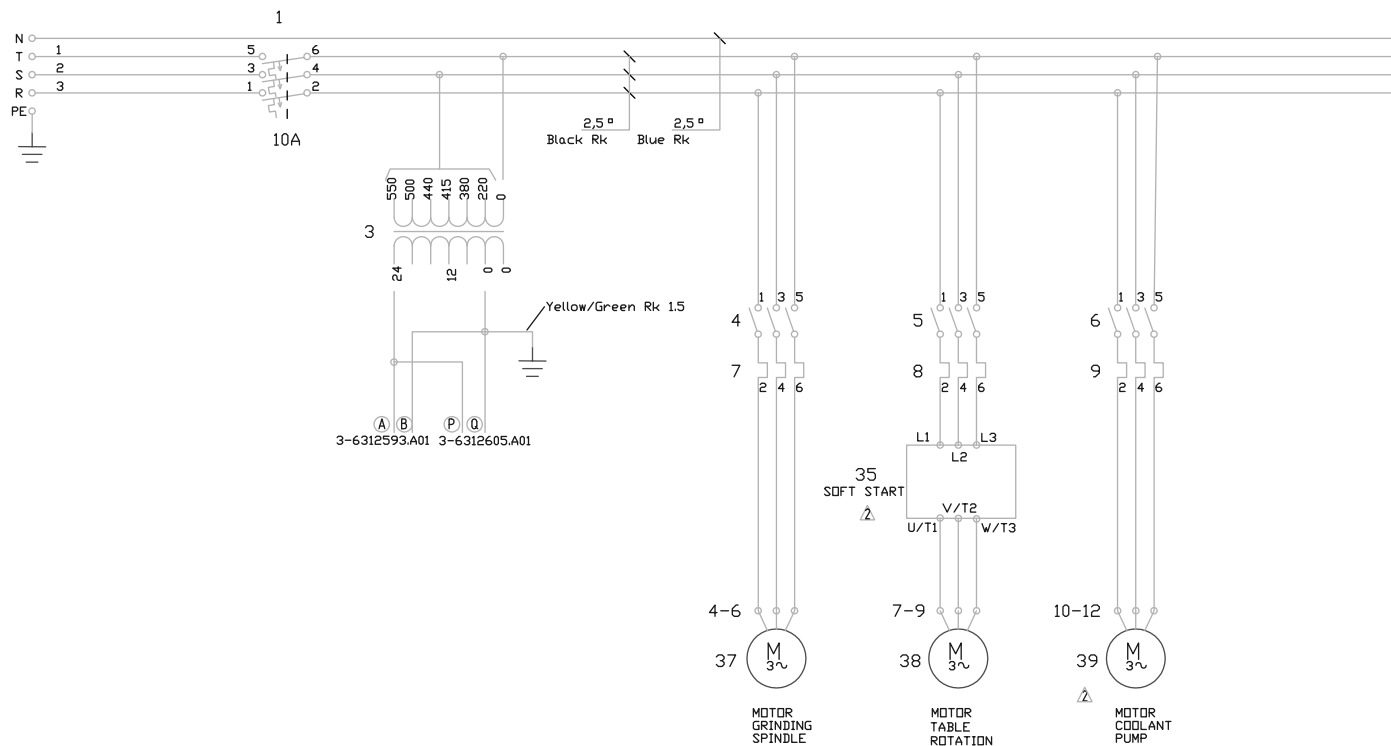


Ref. No.	Product No.	Qty	Description	Specification
1	87000863	1	Shut-off valve	
2	87004480	1	Filter regulator	
3	87003529	1	Non return valve	
4	87004671	1	Valve block	
5	87003531	1	Regulator	
6	87001623	2	Gauge	
7	87004675	1	Blocking valve	
8	87003427	1	Cylinder	

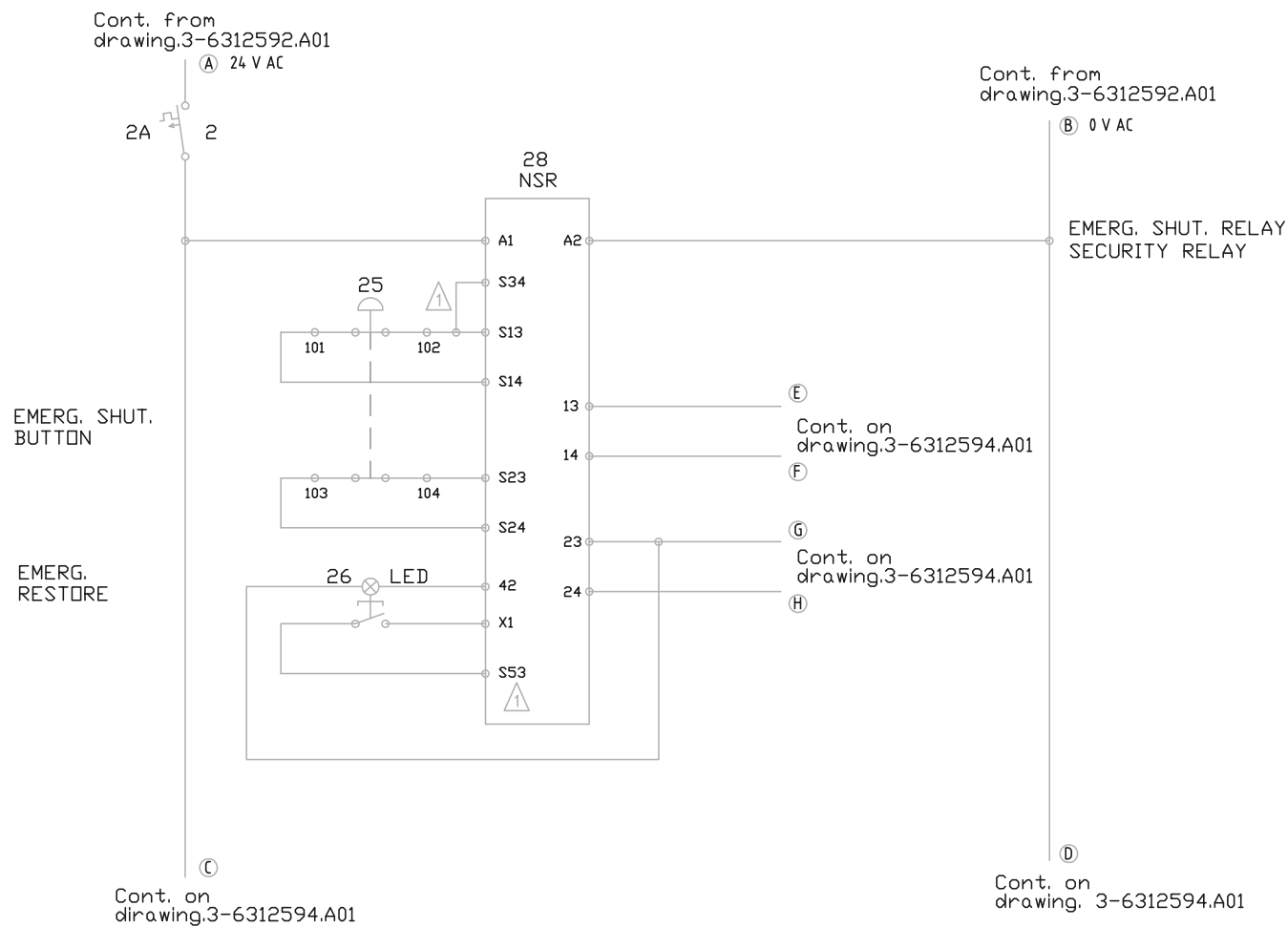
Ref. No.	Product No.	Qty	Description	Specification
9	87003821	1	Control valve	
10	87001624	1	Regulator	
11	87001222	3	Throttle check valve	
12	87003754	1	Cylinder	
13	87004673	1	Ejector	
14	87001063	1	Muffler	
15	87000869	1	Check valve	
16	87003452	1	Cylinder	

Electrical diagrams

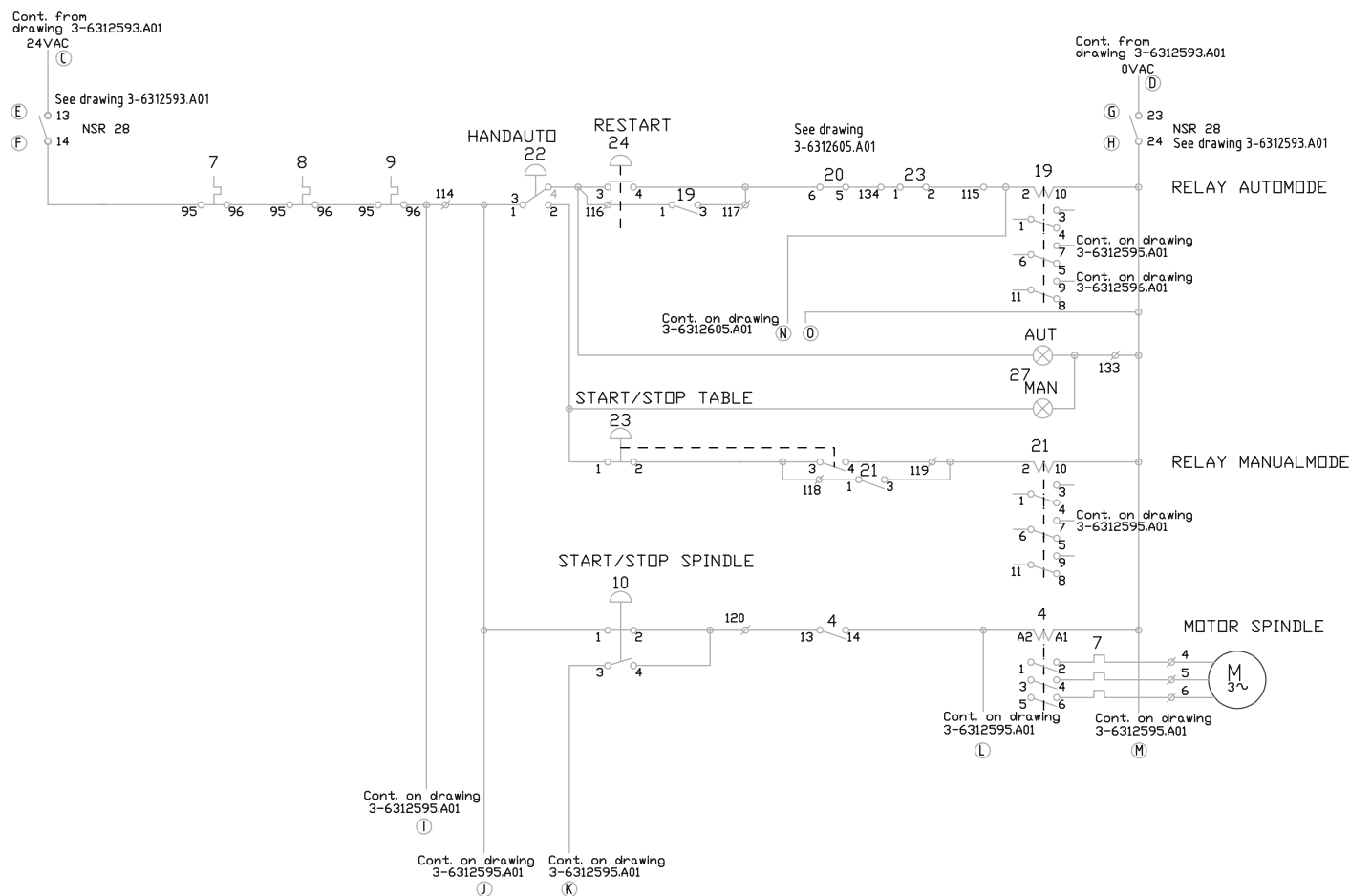
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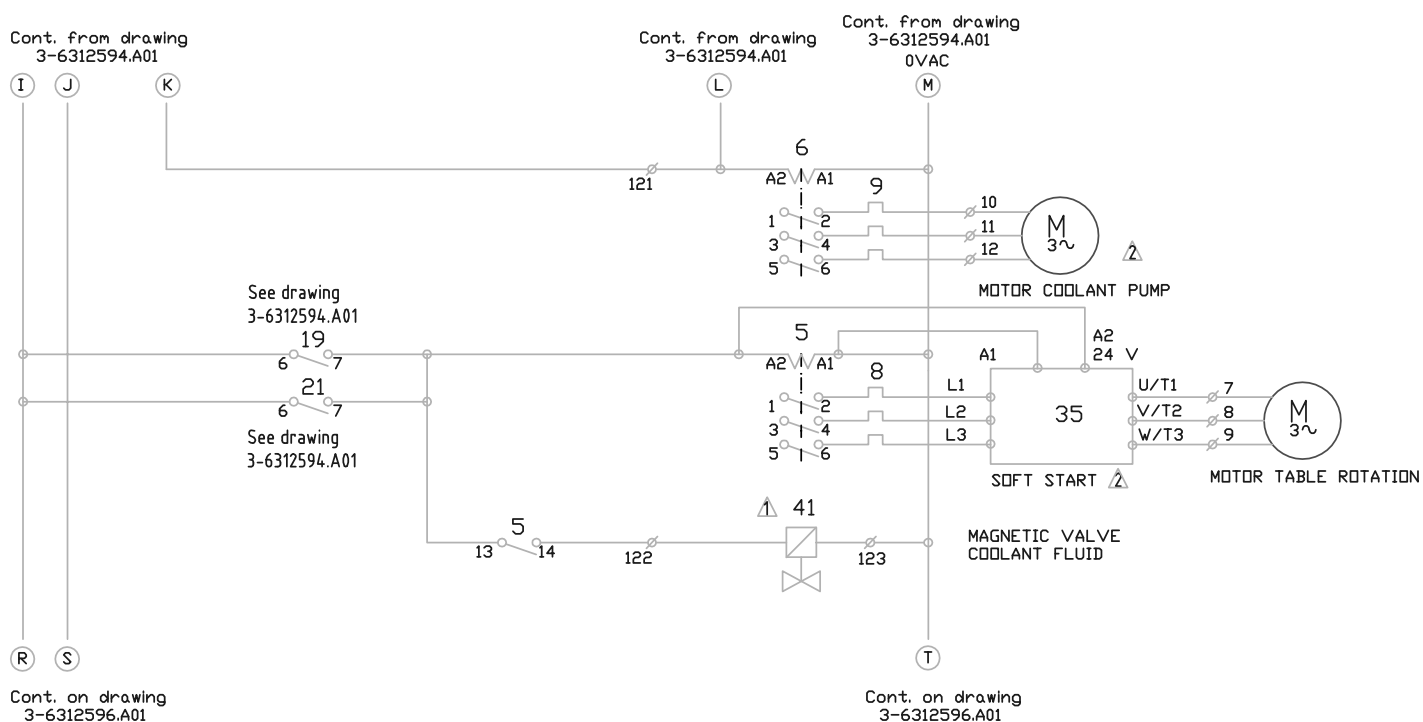
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Drawing: 3-6312594.A01

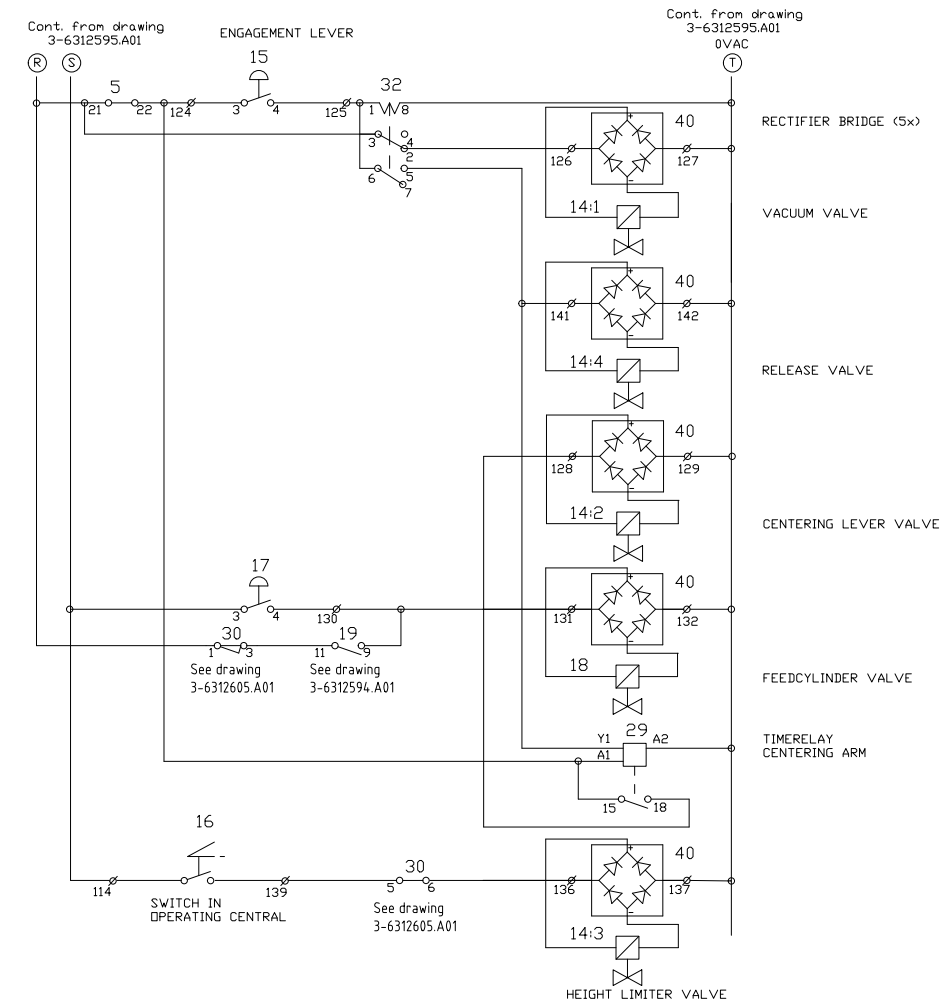


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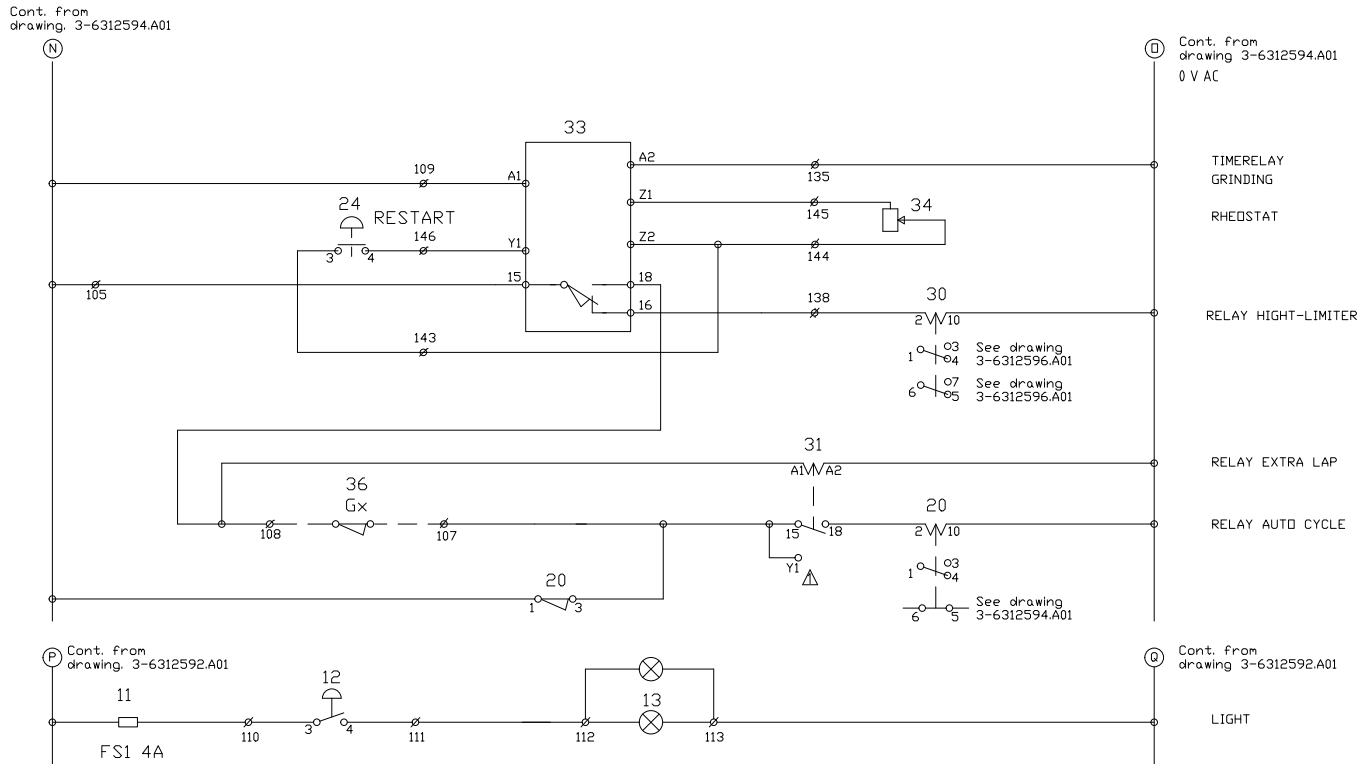


Electrical diagrams

Drawing: 3-6312596.A01



Drawing: 3-6312605.A01



Ref. No.	Product No.	Qty	Description	Specification
1	87000892	1	Circuit breaker	10A 3P
2	87003569	1	Circuit breaker	2A 1P
3	87004689	1	Electric trans- former	
4	87000895	1	Contactor	
5	87000895	1	Contactor	
6	87000895	1	Contactor	
7*	87001411	1	Circuit breaker	LRD 10 230V
	87000975	1	Circuit breaker	LRD 08 ≥380V
8*	87000896	1	Circuit breaker	LRD 07 230V
	87000977	1	Circuit breaker	LRD 06 ≥380V
9*	87000896	1	Circuit breaker	LRD 07 230V, 1-p
	87000896	1	Circuit breaker	LRD 07 230V, 3-p
	87000977	1	Circuit breaker	LRD 06 ≥380V
10	87004682	1	Button	Spindle
11	87003618	1	Fuse holder	
	87003567	1	Fuse	4A
12	87004679	1	Button	Light
13	87003603	2	Lamp	IP44
	87004696	1	Bulb	
14	87004671		Valve block, complete	Incl. ref. 18
		1	Vacuum valve	14:1
		1	Centering level valve	14:2
		1	Height limiter valve	14:3
		1	Release valve	14:4
15	87001087	1	Button	Centering
16	87003783	1	Toggle switch	
17	87004677	1	Joystick	Feed
18	–	1	Valve feed cylinder	Incl. in valve block ref. 14

* Settings for circuit breakers can be found in section
Maintenance-Circuit breakers.

Ref. No.	Product No.	Qty	Description	Specification
19	87003607	1	Relay	
20	87003607	1	Relay	
21	87003607	1	Relay	
22	87004684	1	Button	MAN/AUT
23	87004683	1	Button	Table rotation
24	87004677	1	Joystick	START/RE- START
25	87004678	1	Button	Emergency
26	87004680	1	Button	Reset
27	87001509	2	Led	Green 24V
28	87003613	1	Safety relay	
29	87004899	1	Time relay	
30	87003607	1	Relay	
31	87004899	1	Time relay	
32	87004691	1	Relay	
33	87004091	1	Time relay	
34	87004266	1	Potentiometer	ABB
35	87004693	1	Electric soft starter, 1-p	Serial≤1319
	87004761	1	Electric soft starter, 3-p, 230 V	Serial>1319
	87004762	1	Electric soft starter, 3-p, 400V	Serial>1319
	87004762	1	Electric soft starter, 3-p, 440V	Serial>1319
36	87003791	1	Inductor	
37	87004638	1	Motor	Spindle
38	87004650	1	Worm gear	Incl. motor
39	87004559	1	Coolant pump	Incl. motor
40	87004733	5	Rectifier bridge	
41	87003604	1	Electric valve	

Fault finding

Problem	Cause	Solution
No electric voltage (no load).	Incorrect connected.	Check and verify voltage.
	Loose, broken or corroded connections.	Check terminals and wiring. Repair or renew.
	Tripped circuit breakers.	Reset circuit breakers.
Spindle.	Wrong rotation direction.	Adjust supply electric wire phase positions.
	Position.	Lineup centering arm and spindle.
	Vibrating.	Replace bearings.
Centering function.	Jagged or no movement.	Check timer settings.
		Check function at centering button.
		Check pneumatic valve diode for signal.
		Grease.
	Slow movement or stuck.	Check air cylinder.
	Incorrect position.	Lineup centering arm and spindle.
Table rotation.	No vacuum.	Check and clean ejector.
		Check for leakages in swivel and pneumatic hoses.
		Check for scratches under disc and at o-ring.
	Poor rotation.	Check settings at slow start relay.
	Loose disc.	Lift disc and replace bolt at shaft.
Pump and cooling.	Low pressure at pump.	Pump (and filter cup) must be filled before start.
	No cooling at spindle.	Clean magnetic valve at back of machine.
	Poor cooling.	Clean tank and replace filter.
	Collection tray overfilled.	Adjust machine feet level.
Pneumatic.	Poor lifting force at spindle guide.	Adjust main regulator (turn counter clockwise).
		Check incoming air pressure and volume.
		Check air hose size and length from compressor.
	Vacuum.	Clean ejector.
		Check for leakage at swivel.
	General.	Clean and dry incoming air is important.

[illegible]

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