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Introduction

The RLM is a small but powerful dry film laminator especially made for small companies, schools, research and development departments. All commercial laminates for PCB manufacture and mould-etching part technique can be processed. Due to adjustable pressure control and adjustable laminating speed, solder mask application is also possible without problems.

Features:

Electrically heated lamination rollers with uniform temperature distribution

Adjustable lamination pressure

Wrinkle free lamination due to separation of transport and heating rollers

patented heating roller system with sturdy ceramic heating elements

Infra-red sensors for fast and precise temperature control

Easy and fast mounting of resist rollers of nearly all coil diameters

Detachable inlet table for easy access to low resist roll

step-less adjustable laminating speed

digitally adjustable roller temperature with actual and set-point display and programmed control behaviour

starting 2012: Reverse drive for transport

Technical Data

Lamination width max.:	400 mm
Transport width max.:	440 mm
Lamination speed:	0.2-1.2 m/min adjustable
Resist tension:	adjustable
Lamination pressure:	adjustable
Temperature range:	20-145 °C (factory set max. temperature 120°C)
Power supply:	230 V 50 Hz, 2 kW
Weight:	38 kg
Dimensions (W x D x H):	69 x 63 x 57 cm
Laminat mounting coil inner-Ø	75 and 133 mm (3" and 5 ¼"); max. laminate width 400mm
Board thickness:	0.3 – 5 mm
Board size:	Min 50 x 50mm; max. 450mm x endless

EG-Declaration of Conformity



EG-Konformitätserklärung/Declaration of Conformity

Hersteller / Supplier:	Bungard Elektronik GmbH & Co. KG Rilkestraße 1 51570 Windeck Germany
Bevollmächtigte Person für die Zusammenstellung der technischen Unterlagen: Person in charge	Jürgen Bungard, Geschäftsführer /general director Rilkestraße 1 51570 Windeck Germany
Produkt:	Laminator RLM 419 p

Hiermit erklären wir, dass die oben beschriebenen Maschinen allen einschlägigen Bestimmungen der Maschinenrichtlinie 2006/42/EG entspricht.

Die oben genannte Maschine erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We hereby declare that the machines described above complies with all relevant provisions of the Machinery Directive 2006/42/EC.

The above machine meets the requirements of the following guidelines and standards:

- **Maschinenrichtlinie 2006/42/EG / Machinery Directive 2006/42/EC**
- **EMV-Richtlinie 2014/30/EG / EMC Directive 2014/10830EC**
- **Niederspannungsrichtlinie 2014/35/EG / Low Voltage Directive 2014/35/EC**
- **DIN EN 60204-1** Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen / Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- **DIN EN ISO 14121-1** Sicherheit von Maschinen - Risikobeurteilung - Teil 1: Leitsätze / Safety of machinery - Risk assessment - Part 1: Principles
- **DIN EN ISO 12100-1** Sicherheit von Maschinen - Allgemeine Gestaltungsleitsätze, Risikobeurteilung und Risikominderung / Safety of machinery - Basic concepts, risk assessment and risk reduction
- **DIN EN 55014-1 2012-05** Elektromagnetische Verträglichkeit, Anforderungen an Haushaltsgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte, Teil 1: Störaussendung / Electromagnetic compatibility Requirements for household appliances, electric tools and similar electrical appliances Part 1: Emission
- **DIN EN 55014-2-2009-06** Elektromagnetische Verträglichkeit - Anforderungen an Haushaltgeräte, Elektrowerkzeuge und ähnliche Geräte - Teil 2: Störfestigkeit - / Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity
- **Niederspannungsrichtlinie / Low Voltage Directive 2014/35/EG**
- **Maschinenrichtlinie / Machinery Directive 2006/42/EG/37/EG**

Windeck, 2.3.2016

Jürgen Bungard Geschäftsführer



Intended Use of Machine

The system is designed for laminating tenting resist or solder mask on printed circuit boards.

All other applications require our written consent or happen on full risk of the user.

The Bungard GmbH & Co. KG accepts no liability for damages incurred in non-authorized use or application of the machine.

Safety Instructions

General

Please read the following instructions carefully and pay particular attention to information on operating safety and set up.

Keep these instructions at a safe place. It contains information which also refer for later maintenance and cleaning.

The machines are intended for physical treatment of printed circuit boards.

The machines are not designed to be embedded or interconnected with other machines or systems. They may only be used in specially equipped rooms and be operated only by qualified staff. Children and pets are to be kept away!

Prepare preventive fire fighting measures, because the machine develops heat. Do not touch the heating rollers. Danger of burn! Don't put your fingers between heating or transport rollers.

Read the information for the laminates and observe the material safety data sheets.

Do not run the unit unattended

Transport

Only use suitable lifting and transport equipment such as forklifts or pallet lifts. Secure the machine against sliding / tilting.

Place of installation

The machine must be standing level and around the machine there has to be sufficient space for operation and maintenance work (approx 1m on all sides).

Do not place the unit in a location near heat sources such as radiators, hot air ducts, furnace and the like.

The laminator should be installed on a table where you have access to the front and rear side of the unit. Special care must be taken to avoid any UV light emission to the laminate. Even white light from normal room illumination will expose the laminate. We recommend that you install yellow safe-light tubes or at least dim the room illumination during use and cover the laminator after it has cooled down. A good ventilation of the room, or even a separate air exhaust close to the laminator are recommended.

Do not run the machine in corroding, humid, dusty, extremely hot or explosive atmosphere. If you do run the machine in an atmosphere as described above be aware that this happens on your own risk and responsibility.

The operator has to provide appropriate safety precautions and equipment. We explicitly exclude any warranty for damages resulting from running the machine in an atmospheres as described above.

Electricity

The machine is made from certified parts according to standard practice for electrical safety. This does not relieve the user of his duty of care when handling electrically powered devices.

Connect the device only to the designated power supply as indicated in this manual or on the machine plate.

The red main switch disconnects the machine from the power supply. We presuppose that the safety fuses of the circuit and the residual current circuit are provided by the building's power supply. After completion of work, the main switch should always be turned off.

Before all maintenance work on the machine (filling, emptying, cleaning, etc.) turn off machine and pull the plug.

To avoid the risk of electric shock, do not remove the casing or open the back. There are no user serviceable parts inside. Leave servicing to the experts! Keep this unit out of the rain and away from moisture.

Pay attention to the warning signs on the machine. If you are not going to use the unit for some time, remove the plug from the socket.

Avoid power peaks! Make sure heating and transport are switched off before turning on the unit. Set speed down to 0.4m/min before using the reverse transport switch. Do not quickly repeat switching on and off.

Water connection

After work or prolonged interruption, close the cock valve of the building's water supply to prevent water damage from a possible leak in the hose.

Personal protection equipment

Do not touch heating elements and tubes. Danger of burn!

Rinsing water

The legislation generally prohibits to exceed certain maximum concentrations and quantities of copper (and other heavy metals) in the waste water (usually 0.5 mg copper / liter of water). After brushing the boards should not be rinsed under running water and do not dispose used rinsing water into the sewer! Operate the rinsing water only either in a closed loop rinse or treat the rinse water with a copper centrifuge or some special filter system. Metallic copper will be hardly removed in a ion exchanger system.

We recommend to use the water in the closed loop rinsing zone(s) as long as possible.

Collect used rinsing water and dispose the surplus together with the used chemicals.

Maintenance

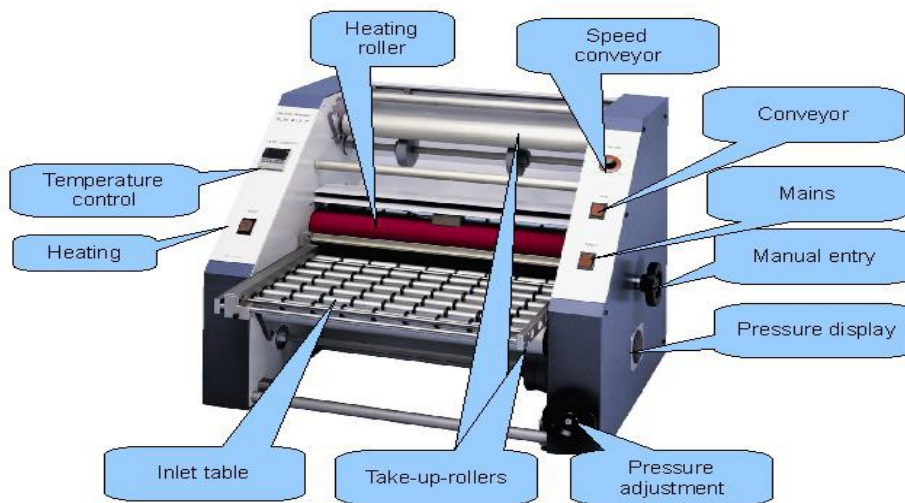
The unit should only be maintained and repaired by qualified personnel. Never try to do more in the way of maintenance to your unit than the operating instructions allow. Beyond that, always consult an expert for repair work.

When changing the brush you must pay attention to the correct rotating direction of the brush.

For security reason, brushing rollers can only be activated if top cover is closed.

Attention: Do not start brush motor when brush is under load.

Short instructions



Examine the machine on delivery for any visible transport damage and if there inform shipping agent and us immediately.

Read the instructions carefully and follow the safety instructions. Read the information for the laminates and observe the material safety data sheets. Keep this manual in a safe place. It contains information you might later on for maintenance or cleaning.

Remove the packaging and set the laminator to its destination. Unpack all the accessories (2 hand wheels, power cord, 4mm Allen wrench, inlet table). Mount one hand wheel for pressure adjustment at the front of the machine and the other on the right side for manual board transport.

The photo laminates are light sensitive. For this reason, the RLM 419p is usually operated in a yellow light room. UV Filter foils and tubes can be purchased through us.

Connect the laminator to 230 V 50 Hz and do a functional test: turn on main switch - a welcome message with version number appears on the controller display. After some seconds the actual and the target temperature are displayed.

Turn on the transport and check the speed of adjustment.

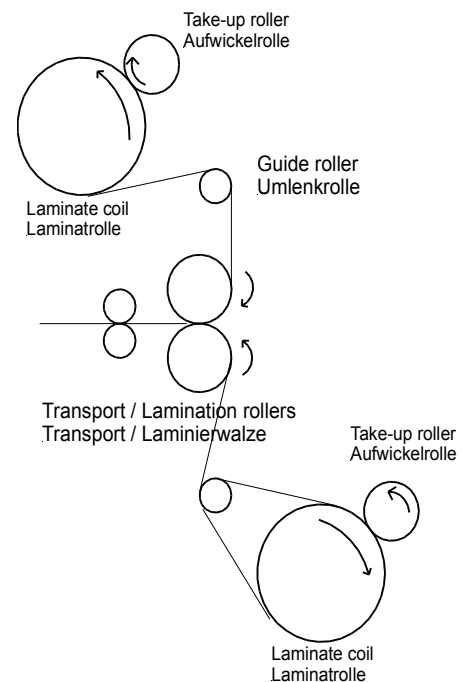
Turn the heating on and control that the heating rolls warm up and the actual temperature increases in the display. Caution! Danger of burns! You can adjust the target temperature by pressing the "C" key and then use the arrow keys to adjust the desired temperature. Press OK (the green "Enter" key) to leave the temperature setting and store the value.

Mount either tenting resist or solder mask on both laminate rolls according to the roller schematic.

For tenting resist set pressure to 1-2 and temperature to 105°C. For solder mask set pressure to 4-5 and temperature to 115°C.

Set transport speed to 0.5 m / min and perform a laminating test.

Turn off the laminator and let the rollers cool down.



roller schematic

Operating

General

The laminator has control switches on the upper left and right side of the housing. To the right you see the main supply switch, the drive switch "RUN" and the speed adjustment potentiometer (4). To the left there is the digital temperature control and the HEATER switch (5).

The transport and heater switches are illuminated when turned on.

The thermostat has an LCD display and four buttons (6).

Heating

If you turn on the main switch a welcome message with version number appears on the controller display. After some seconds the actual and the target temperature are displayed. You can switch the heating on and off with the red switch called "Heater". To adjust the temperature, press the red C button and use the arrow keys up and down to adjust the desired temperature. Then press the green Enter key. Thus the new set value is stored. A small "h" in the display indicates that the laminator is heating. If the "h" disappears, then the temperature is reached and the heating switches off. The current temperature is shown in the display.

Temperature setting proposals are about 105°C for photoresist and 115°C for solder mask. You must determine the best setting for your application. If the temperature is too low the resist will not stick to the copper, if it is too hot the material develops vapours that could irritate your nose and throat, and the resist could lose its sensitivity to light or could be otherwise damaged.

The speed setting depends on the thermal conductivity of the material you want to laminate. As a starting value for your own tests we recommend a setting of 0.5 m/min on the potentiometer scale. A too fast speed can show the same defects like a too low temperature setting. Vice versa a too slow speed shows the same defects as a too high temperature.

Inserting the laminate

The knob at the right side of the laminator serves for turning the lamination rollers by hand (7). This is necessary because one important principal of construction of the RLM laminators is that the transport rollers are separate from the lamination rollers. So the knob serves mainly for feeding the laminate until the transport rollers can grab it. You will need this knob only once each time you mount a new coil.

Pressure adjustment

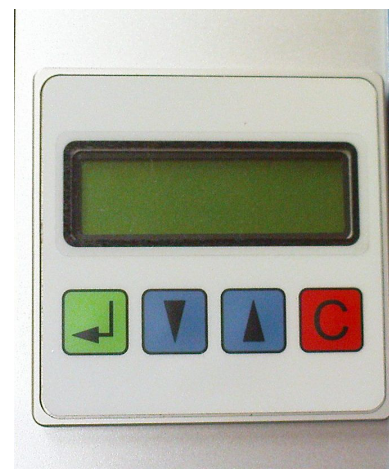
The knob on the lower right front is used to adjust the lamination pressure (8). This is important as the RLM laminators can be used for solder mask application as well. A scale to read out the setting



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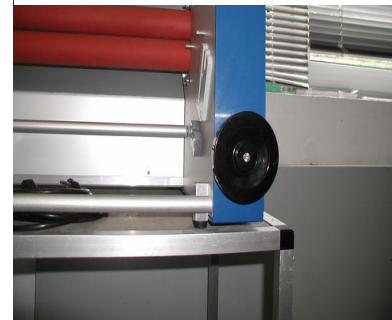
5



6



7



8

can be found on the outer right side of the unit, beneath the hand knob (8). In order to well press the mask into the profile between the copper traces, we recommend a setting of 4 to 5. Photoresist application is done at a setting of 1 to 2.

Attention: Set pressure to 0 every time you stop work, to avoid press marks on the rollers.

The positions 0 - 6 on the indicator scale (right hand side of the device) correspond approximately to the following values:

Scale position	Roller pressure	Application
0	approx. 4 kg	
1	approx. 6 kg	Tenting resist
2	approx. 8 kg	
3	approx. 10 kg	

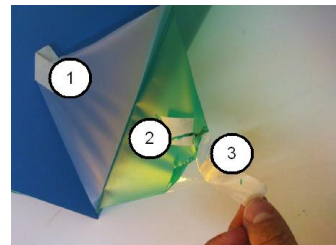
Scale position	Roller pressure	Application
4	approx. 12 kg	Solder mask
5	approx. 14 kg	
6	approx. 16 kg	

Mounting the laminate coils.

The following procedure is the same for photoresist and for solder mask laminate, but we assume you use only one type at a time on both the upper and lower coil.

Unpack the laminate rolls from their safelight boxes and mount them on the left flanges of the coil holders. See the roller schematic in order to have the right sense of coil rotation. Mount the right flanges and push them onto the coil as far as possible. The coils must not slip on the flanges. If the coils slip on the flanges, the separation foil might get between the heating rollers. Mount the coil holders back to the laminator and put the take-up rollers back in their place.

The laminate consists of three layers. These are the outer, strong and transparent polyester cover foil, the soft and sticky laminate layer itself and a thin, soft and mat plastic foil on the "inner" side of the compound. This thin foil prevents that the laminate sticks to itself when it is on the coil, but this foil must be removed before the laminate goes on the board. This separation foil will wind up on the take-up rollers.



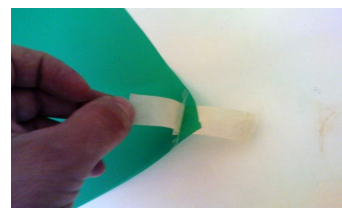
The picture on the right shows the three layers:

1 is the polyolefin-separation foil

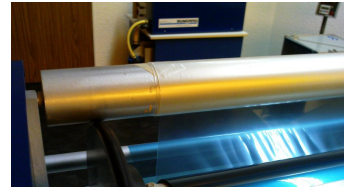
2 is the actual photo polymer

3 is the polyester-protection foil, that you normally remove before developing.

Pull the laminate off the lower coil for about 30 cm. Apply a piece of adhesive tape to the upper and lower end of the laminate compound and pull these "handles" to separate the thin separation foil from the laminate.



Put the take up roller back in its place on top of the laminate roller and fix the separation foil to the take up roller by adhesive tape. Repeat this procedure for the upper coil, with reference to the threading diagram (9). Make sure the take-up rollers are driven automatically by the rotation of the laminate coil.

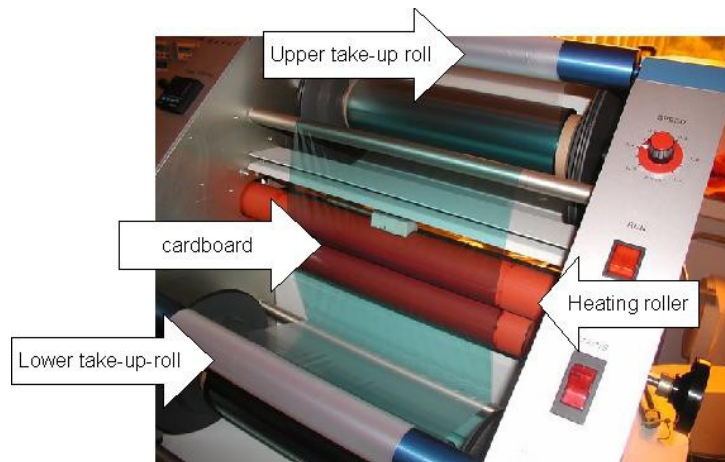


For the following step you will profit from two pieces of cardboard of approx. 300 x 300 size and 1 to 2 mm thickness.

Turn the laminator main supply on. Leave the heater and drive switch off.

Let the top laminate hang loosely over the rollers. The protective foil faces to the heating rollers, the sticky photo polymer faces to the operator. Take the lower laminate and press it in proper alignment against the top laminate.

The laminate may not be sloppy or wrinkled. You will find the wrinkles on your board again. Now take a cardboard of 30 x 30 cm and 1 mm thickness. Push it against the laminate and further between the heating rollers (in opposite to a pcb a cardboard is soft and will not permanently deform the heating rollers).



10

Turn the hand wheel and thus promote the cardboard until you feel a firm resistance. This is the point where the board is due to enter between the transport rollers. The transport rollers can be seen from the back of the laminator. Set a speed of 0.5 on the scale and turn on the transport. Keep tension on the hand wheel until you feel that the transport rollers grab the cardboard.

Stop the transport before the cardboard disappears completely between the heating rollers. Check that upper and lower laminate run congruent. If necessary, loosen alternately the left and right upper flange, and move these rollers till the laminate aligns properly.

If the laminate shows wrinkles after having shifted the flanges, please insert the cardboard one more time to enable the laminate to level out.

The loaded laminate will look like in picture (10):

Finally, mount the inlet roller table: Lift it at its rear, insert the front end in the middle of the unit until it goes into the two lateral pins on the housing, and lower the rear end until this snaps onto the pins as well.

It is assumed that at the end of each job you leave a piece of cardboard between the lamination rollers. This serves to keep the lamination rollers clean from molten laminate.

Laminating

Now you can start operating the machine:

Turn the heaters on. Set the desired temperature and wait until the unit has heated up. Set the pressure and speed and start the transport. Let the cardboard leave the lamination rollers. Insert a PC board through the brushes of the inlet table and push it slightly until it is taken by the lamination rollers. If you do several PCBs at a time feed them one after the other with about 2 cm distance between them.

From the rear of the unit, cut the PCBs off one after the other using a sharp knife blade. Let the boards cool down before exposure.

The last sheet that you insert should always be the cardboard, with its end still between the lamination rollers. Turn the laminator off and let it cool down. If you have yellow safelight in the room you may leave the unit open. Otherwise you should cover the laminate coils from daylight.

Attention: Never cover a hot laminator!

Service and Maintenance

The laminator is almost maintenance free. It only needs cleaning, especially if there was laminate touching the lamination rollers. Use warm soapy water and a sponge to remove laminate rests from the roller surface. Never use hard or sharp tools. They could damage the silicone rubber.

There are no user serviceable parts inside the left and right blue coloured side compartments.

If once laminate should have wrapped around the transport rollers, you need to remove these side compartments to gain access to the drive sprockets.

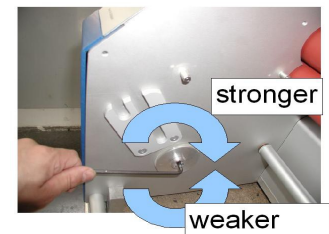
Reverse drive for transport

New starting from 2012: If the laminate has wrapped around the transport rollers, up to now the side walls had to be removed and the rollers taken out. From year 2012, the RLM 419p is equipped with a "Reverse drive for transport button". Thus, the laminate can be easily removed from the laminator. The Reverse drive for transport button should only be used for this purpose! Avoid power peaks! Set speed down to 0.4m/min before using the reverse transport switch. Do not quickly repeat switching on and off.



Adjusting the Roller Brake

If you happen to notice that the transport rolls do not transport the laminate but slip, one possible reason could be a too strong roller brake. You can easily adjust this brake with an 4-size Allen key at the lower and upper laminate roll. You might have to remove the left case in order to fix the inner brake disk when turning the Allen key screw. If you turn clockwise the brake impact will be stronger, if you turn counter-clockwise, the brake impact will be less.



At the rear of the laminator is a white steel cover. Behind this cover there is the pcb with the motor control. You have to check the fuse which is mounted to the pcb, if the laminator does not transport the boards any more. Only exchange the fuse with a fuse having the the same values and characteristics.

Spare part list

680161		Aluminium Aufnahmeachse + 2 Jumbhalter für	RLM 419p dryfilm-resist holder set of right and left PVC piece plus hexagon axis	
680162		Absaughaube f. RLM 419 P, ohne Ventilator	extraction hood for RLM 419p, without ventilator,	
680165		Heizwalze für Laminator RLM 419p, rot	heater/roller for RLM 419p laminator	
680166		Zugwalze für Laminator RLM 419p, schwarz	pull roller for RLM 419p laminator, black	
680167		Sechsteckige Laminataufnahmeachse für RLM	Hexagon axis for RLM 419p laminat fixation,	
680168		Auslauftisch Laminator RLM 419p	rear table for RLM 419p laminator	
6000		Einlauftisch Laminator RLM 419p	Front table for RLM 419p laminator	
680170		Gelblicht- UV-Filterfolie, Breite 1,2m, Zuschnitt von	UV-filter foil, yellow, cut from roll, width 1,2m, price	
680171		Gelblicht- UV-Filterhülle für Leuchtstoffröhren,	UV-filter sleeve, yellow, 1,2m length:	
680175		Entschäumer für Entwickler und Strippanlagen	anti-foam-agent for developing and stripping units	
680165 REP		Reparatur: Heizwalze für Laminator RLM 419p, rot	repair of heater/roller for RLM 419p laminator	

6000	LM571911	Platine Motorsteuerung für RLM 419p	Pcb motor control	
6000				
		Bronzelager	Brass bearing	
		Halterung für Kohlebürste	Holder for coal brush	
		Kappe f. Kohlenbürstenhalter	Cap for brush holder	
		Kohlebürste	Brush and Spring Assembly	
		Isolierscheibe	Washer non-metallic	
		Federscheibe	Spring Wavy Washer	
	LM517842	Solid State relais	Solid State relais	
	LM571840	Temp.controller bis 2011	Temp.controller till 2011	
	LM571841	Temp.sensor (Thermoelement) bis 2011	Temp.sensor (Thermoelement) till 2011	
	LM571601	O-Ringe Transport	O-rings transport	
	LM571602	O-Ringe Jumbo	O-rings Jumbo	
699304		Schalter beleuchtet f.RLM	Switch illuminated	
			Main switch with relay	
			Power cord with plug	
60000		Anti-Statik-Bürste	Anti static brush	
60000		Anschlag für Einlauftisch	Parallel stop for inlet table	
60000		Vorspannungsfeder für die Heizwalzen	Spring for heat rollers	
60000		Seitenwand rechts mit Öffnung Druckverstellung	Side wall with opening pressure adjustment	
60000		Seitenwand links	Side wall left	

Guarantee

All machines are submitted before distribution to examination on function and continuous operation firmness. On the machine we grant a work warranty of 12 months to our customers starting from purchase date on accuracy in material and processing. We warrant at our choice by exchange of incorrect parts or by repair of the machine in our house. Old parts change into our possession.

Disclaimer of Warranty

Bungard GmbH & Co. KG reserves the right to change or enhance its machines or machine specifications according to its judgement, if necessary. Bungard cannot be held responsible to implement aforesaid changes into machines sold already.

Bungard products and services are liable to the current prices and conditions, which are subject to change.

The instructions and definitions in this document are also subject to change and mark no assurance on the part of Bungard.

This manual contains informations of the Bungard Compacta and is the translated English version.

Please regard the "Sales terms and delivery conditions". These are available after fulfilment of the contract. We don't furnish a guarantee or warranty in cause of damages at material or hurts of people because of

Incorrect use of the machine

Wrong setup, installing and operating of the machine or incapable service

Use of the machine with defective safety equipment

Non-observance of the service manual in regard to transport, stocking, setup, installation and service of the machine

Unlicensed modifications at the machine

Incorrect or incomplete repairs

Destructive force effect at the machine in cause of foreign objects or external use of force

Use of non-original spare parts

normal wear parts.

We cannot accept subsequent claims from damage or destruction of work pieces worked on in the machine, because we have no knowledge or control over the operating conditions at your site. This is valid in a general manner also for requirements from damage to articles, buildings and persons as well as the environment.

We do not warrant that the function of the machine will meet the customer's requirements or that the operation of the machine will to this regard be error free.

In no event will we be liable to the customer for any incidental, consequential, or indirect damages of any kind, including loss of profit and prosecution for environmental pollution, even if we could have been aware of the possibility of such damages.

All information was arranged with great care. We reserve ourselves however mistake and technical changes without previous announcement.

Running the machine in corroding, humid, dusty, extremely hot or explosive atmosphere happens at the operator's own risk and responsibility.

We explicitly exclude any warranty for damages resulting from running the machine in in corroding, humid, dusty, extremely hot or explosive atmosphere.

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