



## Operating manual

Version 1.0.3

### Grinding machine

○ **OPTI**grind®  
GU 15B Item no. 3101600

○ **OPTI**grind®  
GU 18B Item no. 3101605

○ **OPTI**grind®  
GU 20B Item no. 3101610  
3101615

○ **OPTI**grind®  
GU 25B Item no. 3101620





## Table of contents

<b>1</b>	<b>Safety</b>	
1.1	Safety instructions (warning notes).....	5
1.1.1	Classification of hazards .....	5
1.1.2	Other pictograms.....	6
1.2	Intended use.....	6
1.3	Reasonably foreseeable misuse.....	7
1.3.1	Avoiding misuse .....	7
1.4	Possible dangers caused by the grinding machine .....	8
1.5	Personnel qualification.....	9
1.5.1	Target group.....	9
1.6	User positions.....	10
1.7	Safety measures during operation.....	10
1.8	Safety devices .....	10
1.8.1	Spark-guard and support surface.....	10
1.9	Safety check .....	10
1.10	Personal protective equipment .....	11
1.11	For your own safety during operation .....	11
1.12	Disconnecting and securing the grinding machine .....	11
1.13	Emissions .....	11
1.14	Basic information on grinding wheels and cleaning brushes .....	12
<b>2</b>	<b>Technical specification</b>	
<b>3</b>	<b>Unpacking and connecting</b>	
3.1	Scope of delivery .....	13
3.2	Storage .....	13
3.3	Set-up and assembly .....	13
3.3.1	Installation site requirements .....	13
3.4	First commissioning .....	14
3.5	Dimensions .....	14
3.6	First commissioning .....	15
3.6.1	Power supply.....	15
3.6.2	Grinding machines with speed regulated drive .....	15
3.6.3	When the ELCB triggers .....	15
3.7	Operation .....	16
3.7.1	Suction connection of grinding wheel.....	16
3.7.2	Suction connection of cleaning brush .....	17
<b>4</b>	<b>Maintenance</b>	
4.1	Safety.....	17
4.1.1	Preparation.....	17
4.2	Inspection and maintenance.....	18
4.3	Replacing a sanding disc.....	18
4.4	Replacing the cleaning brush .....	18
4.5	Repair .....	19
<b>5</b>	<b>Appendix</b>	
5.1	Copyright .....	19
5.2	Liability claims/warranty.....	19
5.3	Advice for disposal / Options of reuse: .....	20
5.3.1	Decommissioning.....	20
5.3.2	Disposal of new device packaging .....	20
5.3.3	Disposal of electrical and electronic components .....	21
5.4	Disposal through municipal collection facilities.....	21
5.5	Product follow-up .....	21
5.6	Change information operating manual.....	21
5.7	Extraction unit GU1 with speed regulated grinding machines .....	22
5.8	Intended use .....	22
5.9	Reasonably foreseeable misuse.....	23
5.9.1	Avoiding misuse .....	23
5.9.2	Workplace limits .....	23
5.9.3	Residual risk.....	23
5.10	Commissioning .....	24
5.11	Electronics .....	24
5.12	Inspection deadlines .....	24
5.13	Operation of extraction unit.....	24
5.14	Description of functioning of the extraction system .....	24
5.15	Functional Description of the Electrical Connections.....	25
5.16	Fire and Explosion Prevention.....	26



## 6 Ersatzteile - Spare parts

6.1	Ersatzteilbestellung - Ordering spare parts .....	27
6.2	Hotline Ersatzteile - Spare parts Hotline .....	27
6.3	Service Hotline .....	27
6.4	Ersatzteilzeichnung - Spare parts drawing.....	28
6.5	Schaltplan Vario Schleifmaschinen - Wiring diagram Vario grinders - 400V .....	30
6.6	GU1 - mechanische Bauteile - mechanical components.....	31
6.7	GU1 -Elektrik - Electric - 230V .....	32
6.8	GU1 - Elektrik - Electric - 400V .....	33



## Preface

Dear customer,

Thank you very much for purchasing a product made by OPTIMUM.

OPTIMUM metal working machines offer a maximum of quality, technically optimum solutions and convince by an outstanding price performance ratio. Continuous enhancements and product innovations guarantee state-of-the-art products and safety at any time.

Before commissioning the machine please thoroughly read these operating instructions and get familiar with the machine. Please also make sure that all persons operating the machine have read and understood the operating instructions beforehand.

Keep these operating instructions in a safe place nearby the machine.

### Information

The operating instructions include indications for safety-relevant and proper installation, operation and maintenance of the machine. The continuous observance of all notes included in this manual guarantee the safety of persons and of the machine.

The manual determines the intended use of the machine and includes all necessary information for its economic operation as well as its long service life.

In the paragraph "Maintenance" all maintenance works and functional tests are described which the operator must perform in regular intervals.

The illustration and information included in the present manual can possibly deviate from the current state of construction of your machine. Being the manufacturer we are continuously seeking for improvements and renewal of the products. Therefore, changes might be performed without prior notice. The illustrations of the machine may be different from the illustrations in these instructions with regard to a few details. However, this does not have any influence on the operability of the machine.

Therefore, no claims may be derived from the indications and descriptions. Changes and errors are reserved!

Your suggestion with regard to these operating instructions are an important contribution to optimising our work which we offer to our customers. For any questions or suggestions for improvement, please do not hesitate to contact our service department.

**If you have any further questions after reading these operating instructions and you are not able to solve your problem with a help of these operating instructions, please contact your specialised dealer or directly the company OPTIMUM.**

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# 1 Safety

## Glossary of symbols

	provides further instructions
	calls on you to act
	listings

This part of the operating instructions

- explains the meaning and use of the warning notes included in these operating instructions,
- defines the intended use of the grinding machine,
- points out the dangers that might arise for you or others if these instructions are not observed,
- informs you about how to avoid dangers.

In addition to these operating instructions, please observe




- the applicable laws and regulations,
- the statutory provisions for accident prevention,
- the prohibition, warning and mandatory signs as well as the warning notes on the grinding machine.

**Always keep this documentation close to the grinding machine.**

## 1.1 Safety instructions (warning notes)

### 1.1.1 Classification of hazards

We classify the safety warnings into different categories. The table below gives an overview of the classification of symbols (ideogram) and the warning signs for each specific danger and its (possible) consequences.

Symbol	Alarm expression	Definition / consequence
	<b>DANGER!</b>	Impending danger that will cause serious injury or death to people.
	<b>WARNING!</b>	A danger that can cause serious injury or death.
	<b>CAUTION!</b>	A danger or unsafe procedure that can cause personal injury or damage to property.
	<b>ATTENTION!</b>	Situation that could cause damage to the grinding machine and product, as well as other types of damage. No risk of injury to persons.
	<b>INFORMATION</b>	Practical tips and other important or useful information and notes. No dangerous or harmful consequences for people or objects.



## 1.1.2 Other pictograms



Activation forbidden!



Warning: flammable substances!



Warning: suspended loads!



Warning: risk of stumbling!



Warning: tilting danger!



Warning: automatic start-up!



Warning: biological hazard!



Warning: injuries to hands!



Read the operating instruction before commissioning!



Pull out the mains plug!



Wear protective glasses!



Use face shield!



Wear safety shoes!



Wear a protective suit!



Use ear protection!



Protect the environment!



Prohibited: do not extract and ignition sources!

## 1.2 Intended use

### WARNING!

In the event of improper use, the grinding machine

- will endanger personnel,
- the grinding machine and other material property of the operating company will be endangered,
- the functionality of the grinding machine may be compromised.



The grinding machine is designed and manufactured exclusively for grinding and polishing metals using properly authorised grinding wheels, sanding belts or polishing wheels.

The grinding machine must be used exclusively for this purpose.

If the grinding machine is used in any way other than described above, modified without authorization of Optimum Maschinen Germany GmbH, then the grinding machine is being used improperly.



We will not be held liable for any damages resulting from any operation which is not in accordance with the intended use.

We expressly point out that the guarantee will expire, if any constructive, technical or procedural changes are not performed by the company Optimum Maschinen Germany GmbH. It is also part of the intended use that you

- the limits of performance of the grinding machine are observed,
- the operating manual is observed,
- the inspection and maintenance instructions are observed.

### WARNING!

**Severe injuries due to non-intended use.**

**It is forbidden to make any modifications or alternations to the operating parameters values of the grinding machine. They could pose an accident hazard to persons and cause damage to the grinding machine.**



### ATTENTION!

**If the grinding machine is not used as intended or if the safety directives or the operating instructions are ignored the liability of the manufacturer for any damages to personnel or objects resulting hereof is excluded and the claim under guarantee is becoming null and void!**



## 1.3 Reasonably foreseeable misuse

Any other use other than that specified under "Intended use" or any use beyond the described use shall be deemed as non-intended use and is not permissible.

Any other use has to be discussed with the manufacturer.

In order to avoid misuse, it is necessary to read and understand the operating instructions before first commissioning.

Operators must be qualified.

### 1.3.1 Avoiding misuse

- The distance between the contact surface and the grinding wheel must not exceed 2mm. However, the distance may be greater if the grinding process and the material used require this for security reasons.
- Cleaning brushes may be used only on the grinding machine GU15B, GU18B, GU20B and GU25B.
- Grinding wheels must not be installed in places that are designed for cleaning brushes.

We expressly point out that the guarantee will expire, if any constructive, technical or procedural changes are not performed by the company Optimum Maschinen Germany GmbH.

### WARNING!

**Risk of injury caused by flying workpieces.**

Ensure the gap between the grinding wheel and bearing surface is as small as possible and readjust the support surface immediately if the distance is too big.

If the support surface can no longer be adjusted, the grinding wheel must be replaced.



### INFORMATION

Grinding machines with frequency converter for regulating the speed are built according to the standard DIN EN -3 class C2.







## WARNING!

This machines are not intended for use in residential facilities where the power is supplied via a public low voltage supply system. In these areas, it may be difficult to guarantee electromagnetic compatibility due to conducted and emitted interference.



### Overview of the EMC categories:

#### Categorie C1

- required limit values Class B Group 1 according to EN 55011

#### Categorie C2

- Required limit values class A Group 1 according to EN 55011, Installation by EMC experts and warning: "This is a product of category C2 according to EN 61800-3. This product may cause radio interference in a residential area. In this case, it may be necessary for the operator to take appropriate action."

#### Categorie C3

- Required limit values class A group 2 according to EN 55011, whereby these limit values are below those of class A group 1, plus warning: "This type is not suitable for connection to a public low-voltage network supplying residential buildings. When connecting to a public low voltage network, radio frequency interference is expected."

<b>Speed regulated grinding machines</b>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Categorie	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>
Environment	Residential area Business area Industrial area		Industrial area	
Voltage / Current	< 1000 V			> 1000 V
EMC knowledge	no requirement	Installation and commissioning by an EMC expert		

## 1.4 Possible dangers caused by the grinding machine

The grinding machine was built using state-of-the-art technology. Nevertheless, there is a residual risk, as the grinding machine operates with

- high speeds,
- rotating parts,
- one grinding wheel (emission of sparks),
- one cleaning brush,
- electrical voltage and currents.

We have used design and safety engineering to minimize the health risk to personnel resulting from these hazards.

If the grinding machine is used and maintained by personnel who are not duly qualified, there may be a risk resulting from its incorrect or unsuitable maintenance.

## INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- and strictly follow these operating instructions.

Always disconnect the grinding machine from the electrical power supply before performing cleaning or maintenance tasks.








## WARNING!

The grinding machine may only be used with fully functional safety devices.

Disconnect the grinding machine immediately, whenever you detect a failure in the safety devices or when they are not fitted!

All additional devices installed by the operator must be equipped with the stipulated safety devices. This is your responsibility as the operator!  Safety devices on page 10



## 1.5 Personnel qualification

### 1.5.1 Target group

This manual is addressed to

- the operating companies,
- the operators,
- the maintenance personnel.

Consequently, the warning notes refer both to the use of the grinding machine and to its maintenance.

Always disconnect the grinding machine from the electrical power supply. This will prevent it from being used by unauthorized persons.

The qualifications of the personnel for the different tasks are mentioned below:

#### Operator

The user must have been instructed by the operator about the assigned tasks and possible risks in case of improper behaviour. The user may only carry out tasks that exceed normal operation if this is stated in these instructions and the operator has explicitly entrusted him with the task.

#### Qualified electrician

With professional training, knowledge and experience as well as knowledge of respective standards and regulations, qualified electricians are able to perform work on the electrical system and recognise and avoid any possible dangers.

Qualified electricians have been specially trained for the working environment, in which they are working and know the relevant standards and regulations.

#### Qualified personnel

Due to their professional training, knowledge and experience as well as knowledge of relevant regulations, qualified personnel are able to perform the assigned tasks and to independently recognise and avoid any possible dangers.

#### Instructed person

Instructed persons were instructed by the operating company regarding the assigned tasks and any possible risks of improper behaviour.

## INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- and strictly follow these operating instructions.

In the event of improper use

- there may be a risk to personnel,
- the grinding machine and other property and
- the functionality of the grinding machine may be compromised.





## 1.6 User positions

The user position is in front of the grinding machine.

## 1.7 Safety measures during operation

### CAUTION!

**Danger due to inhaling dust and mist that are hazardous to health.**

Depending on the materials to be machined and the agents used, dusts and mists can arise that are detrimental to health.

Ensure that the harmful dust and mist generated are safely sucked off at the point of origin and routed away from the working area or filtered.



## 1.8 Safety devices

The grinding machine must only be operated with fully functional safety devices.

Stop the grinding machine immediately if there is a failure on the safety device or becomes ineffective.

It is your responsibility!

If a safety device has been activated or has failed, the grinding machine must only be used if

- the cause of the fault has been eliminated,
- you have verified that there is no danger to personnel or objects.

### WARNING!

**If you bypass, remove or override a safety device in any other way, you are endangering yourself and other persons working with the grinding machine. The possible consequences are:**

- injuries due to components or workpieces flying off at high speed,
- contact with rotating parts,
- fatal electrocution.



The grinding machine features the following safety devices:

- A spark protection on each grinding wheel.
- A protective guard with shaft cover on the grinding wheel.
- A support surface for the workpiece.
- A brush guard.

### WARNING!

**Although the isolating safety devices provided and delivered with the machine are designed to reduce the risks of workpieces being ejected or parts of tools or workpieces breaking off, they cannot eliminate these risks completely. Always work carefully and observe the limit values of the grinding process.**



### 1.8.1 Spark-guard and support surface

Adjust the guard to the correct height before you start working. To do so, slacken the clamping screw, set the required height and re-tighten the clamping screw. Observe the correct distance to the grinding wheel.

## 1.9 Safety check

Check the grinding machine regularly.

Check all safety devices

- before starting work,
- once a week (with the machine in operation) and



- after all maintenance and repair work.

## 1.10 Personal protective equipment

For certain work personal protective equipment is required.

- Protect your face and your eyes: Wear a safety helmet with facial protection when performing work where your face and eyes are exposed to hazards. Wear protective gloves when handling pieces with sharp edges.
- Use safety shoes when you assemble, disassemble or transport heavy components, or transport the grinding machine.
- Use ear protection if the noise level (emission) in the workplace exceeds 80 dB (A).
- Before starting work make sure that the required personal protective equipment is available at the work place.
- When working with the cleaning brush, also wear a face shield and, if necessary, a leather apron.



### CAUTION!

**Dirty or contaminated personnel protective equipment can cause illness. It must be cleaned after each use and at least once a week.**

## 1.11 For your own safety during operation

### WARNING!

**Before switching the grinding machine on, make sure that there is no risk of personal injury or damage to property.**

Avoid any unsafe work methods:

- The instructions mentioned in these operating instructions have to be strictly observed during assembly, operation, maintenance and repair.
- Use protective glasses!
- Do not work on the grinding machine, if your concentration is reduced, for example, because you are taking medication.
- Stay on the grinding machine until the working spindle has come to a complete standstill.
- Use the specified personal protective equipment. Ensure you wear close-fitting clothing and, if necessary, a hairnet.
- Make sure that your operation does not create a safety hazard.



## 1.12 Disconnecting and securing the grinding machine

Disconnect the mains plug before starting maintenance and repairs.



## 1.13 Emissions

The generation of noise emitted by the grinding machine is 70 to 80 dB(A). If the grinding machine is installed in an area where various machines are in operation, the noise exposure (immission) on the operator of the grinding machine at the working place may exceed 80 dB(A).

### INFORMATION

This numerical value was measured on a new machine under the operating conditions specified by the manufacturer. The noise behaviour of the machine might change depending on the age and wear of the machine.

Furthermore, the noise emission also depends on production engineering factors, e.g. speed, material and clamping conditions.





## INFORMATION

The specified numerical value represents the emission level and does not necessarily a safe working level. Though there is a dependency between the degree of the noise emission and the degree of the noise disturbance it is not possible to use it reliably to determine if further precaution measures are required or not. The following factors influence the actual degree of the noise exposure of the operator:



- Characteristics of the working area, e.g. size or damping behaviour,
- other noise sources, e.g. the number of machines,
- other processes taking place in proximity and the period of time, during which the operator is exposed to the noise.

Furthermore, it is possible that the admissible exposure level might be different from country to country due to national regulations. This information about the noise emission should, however, allow the operator of the machine to more easily evaluate the hazards and risks.

## CAUTION!

**Depending on the overall noise exposure and the basic threshold values, machine operators must wear appropriate hearing protectors. We generally recommend the use of noise and ear protection.**



### 1.14 Basic information on grinding wheels and cleaning brushes

- Various shortcomings during installation and operation can lead to the bursting of grinding wheels.
- Ordinary grinding wheels are generally not designed to withstand a greater lateral load.
- The tapping off cutting debris from the grinding wheel always leads to damage of the grinding wheel.
- Grinding wheels which have an imbalance can burst more easily.
- An unbalance of a grinding wheel cannot be completely removed by truing with a diamond dresser.
- Incorrectly stored grinding wheels can burst immediately after switching on, or individual small fragments can fly away like a bullet.
- Single needles of a cleaning brush can fly away.



## 2 Technical specification

	GU15B	GU18B	GU20B	GU25B
Electrical connection	230V ~50Hz (60Hz)		230V ~50Hz (60Hz) 3x 400V ~50Hz (60Hz)	3x 400V ~50Hz (60Hz)
Motor power	450W		600W	1.5 KW
Speed [ min <sup>-1</sup> ]	2850			
Grinding wheel [mm]	Ø 150 x 20	Ø 175 x 25	Ø 200 x 30	Ø 250 x 40
Cleaning brush [mm]	Ø 150 x 20	Ø 175 x 25	Ø 200 x 25	Ø 250 x 30
Circumferential speed, [m/s]	22	26	30	37
Speed regulated (Vario) grinding speed,[m/s]	30 to 5			37 to 6
Extraction socket	Ø34 - 35			
Machine weight [kg]	10.7	12.3	18.5	32.5

GUB\_GB.fm



Shaft diameter Grinding wheel [mm]	Ø16	Ø32	Ø32	Ø32
Shaft diameter Cleaning brush [mm]	Ø16	Ø32	Ø32	Ø32

### 3 Unpacking and connecting

The grinding machine is delivered pre-assembled.

#### 3.1 Scope of delivery

Check the grinding machine immediately after delivery for transport damage, missing parts and loose locking bolts. Compare the scope of delivery with the delivery note. Grinding wheels and polishing wheels are available in specialist shops or from our main catalogue.

#### 3.2 Storage

##### ATTENTION!

**Incorrect and improper storage might result in damage or destruction of electrical and mechanical machine components.**

**Store packed and unpacked parts only under the intended environmental conditions. Follow the instructions and information on the transport box.**

Consult Optimum Maschinen Germany GmbH if the machine and accessories are stored for more than three months or are stored under different environmental conditions than those specified here.



#### 3.3 Set-up and assembly

##### 3.3.1 Installation site requirements

Organise the working area around the grinding machine according to the local safety regulations.

##### WARNING!

**The grinding machine must be firmly connected to the substructure.**



##### INFORMATION

In order to achieve high levels of functionality and machining accuracy, as well as a long service life of the machine, the set-up location should meet certain criteria.

The following points should be noted:

- The device must only be installed and operated in a dry and well-ventilated place.
- Avoid places close to machines which cause chips or dust.
- The installation site must be vibration-free, i.e. located away from presses, planing machines, etc.
- The foundation must be suitable for the grinding machine. Also make sure that the floor has sufficient load bearing capacity and is level.
- The floor must be prepared in such a way as to ensure that, if any coolant is used, it cannot penetrate the floor.
- Protruding parts - such as the dog, handles, etc. - must be secured, where necessary, by means of on-site measures so that persons are not endangered.
- Provide enough space for set-up and operating personnel and material transport.
- Also bear in mind accessibility for installation and maintenance works.





- Ensure adequate lighting is available (minimum value: 500 Lux, measured at the tool tip). In the event of a lower level of lighting, additional illumination must be provided, e.g. by means of a separate workplace light.
- The power plug of the grinding machine must be readily accessible.

## CAUTION!

Arrange the machine's connection cable in such a way that it will not cause a tripping hazard.

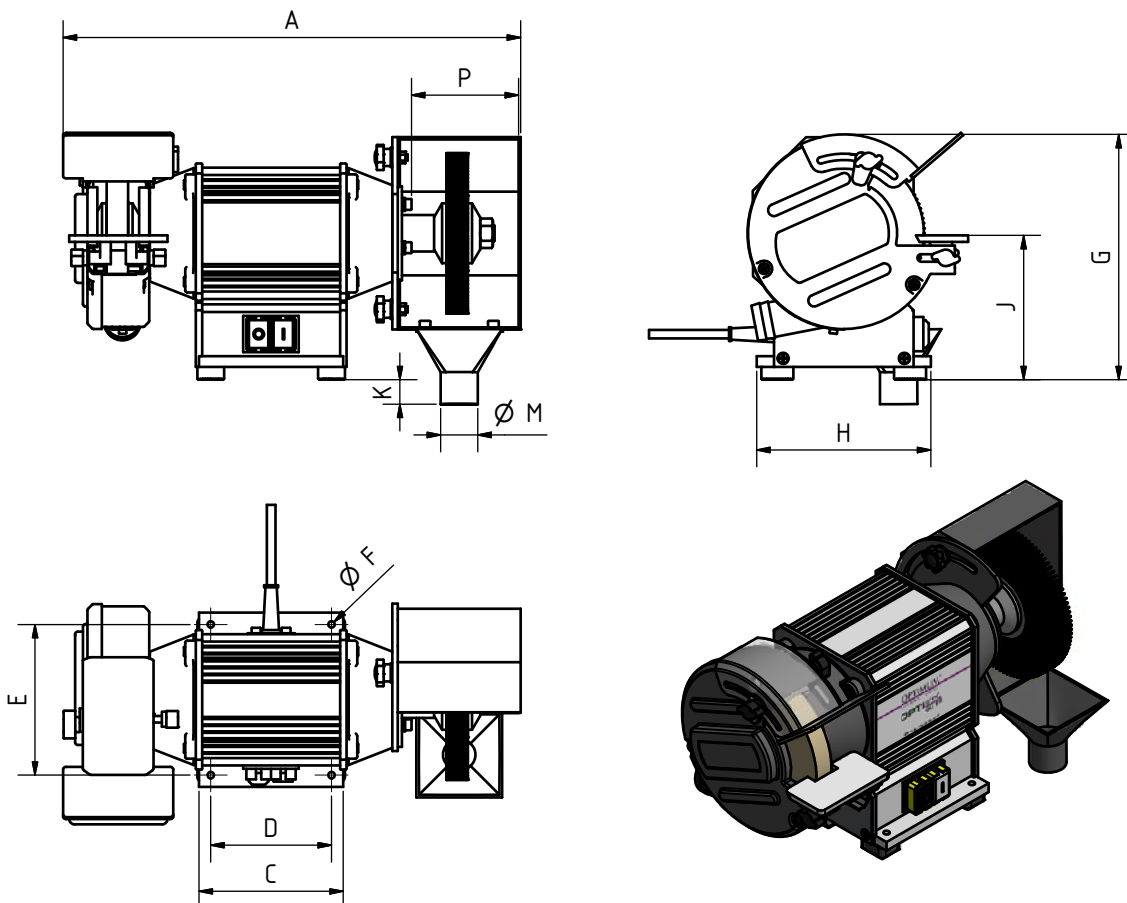


### 3.4 First commissioning

For first commissioning, the grinding wheels must be trued with a dressing stone to ensure the true running of the grinding wheels.

Grinding wheels made from compound abrasives have a natural imbalance as a result of the pressing process during the manufacturing process. Compound grinding wheels have a higher or lower density in some areas. This natural imbalance cannot be removed with a dressing stone, however, the imbalance of the machine can be reduced by turning the grinding wheel, e.g. by 180° on the grinding wheel shaft.

### 3.5 Dimensions



Img.3-1: GU15B | GU18B | GU20B | GU25B

[mm]	GU15B	GU18B	GU20B	GU25B
A	428	428	517	526



C	135	135	160	240
D	113	113	138	201
E	141	141	148	148
F	6	6	6	9
G	229.5	243.5	281.5	319
H	163	163	170	212
J	135	135	160	170
K	23	36	24	39
M	35	35	35	35
P	100	100	135	138

### 3.6 First commissioning

#### ATTENTION!

Before commissioning the machine, all bolts, fastenings and protections must be checked and retightened as necessary!



#### WARNING!

The use of unsuitable grinding wheels, sanding belts and polishing wheels constitute a safety hazard. Use only grinding wheels, sanding belts and polishing wheels that withstand the speed requirements and possible loads.



#### WARNING!

First commissioned of the grinding machine by inexperienced personnel constitute a risk to personnel and equipment.



We do not accept any liability for damages caused by incorrectly performed commissioning.

Personnel qualification on page 9

#### 3.6.1 Power supply

- Connect the electrical supply cable.
- Check the fusing (fuse) of your electrical supply.

#### 3.6.2 Grinding machines with speed regulated drive

Please check that the type of current, voltage and protection fuse correspond to the values specified. A protective earth ground wire connection must be available. Mains fuse 16A. Due to the design, the leakage current is greater than 3,5 mA. We ask for due attention while executing machine tests within the framework of industrial safety guidelines.

Since a direct current may be caused by the frequency converter in the protective earthing conductor, if an upstream residual current device (ELCB / RCD) is required in the network, the following guidelines must be followed:

To avoid an operating fault, you need an AC/DC-sensitive ELCB. Be absolutely sure which leakage current security is necessary for dangerous body currents, as regulated in DIN VDE 0100 part 410, at your mains connection.



#### 3.6.3 When the ELCB triggers

- Pulse current - sensitive ELCB type A  
ELCB type A independent of rated voltage, for triggering when changing fault currents and pulsing DC fault currents.







- AC/DC - sensitive ELCB type B  
ELCBs of series type B also accept the detection of smooth AC fault currents as well as the detection of fault current shapes of type A; they are therefore suitable for all the circuits mentioned. ELCBs of this series therefore detect all types of fault current according to the triggering characteristic B, i.e. both smooth DC fault currents and also all AC fault currents of all frequencies and mixed frequencies up to 1 MHz are detected and switched off reliably in the event of a fault. 
- Alternating current - sensitive ELCBs of type AC (only alternating current) are unsuitable for frequency converters. Alternating current - sensitive ELCBs of type AC are not customarily used and are no longer permitted in Germany. 

## 3.7 Operation


- ➔ Before you start grinding, check that the workpiece is free of oil, grease and paint residues to prevent smudging or soiling of the grinding wheels.
- ➔ Check the condition of the grinding wheels. If the grinding wheels are dirty or muddied, they must be roughened or replaced.
- ➔ If necessary, clean the workpiece with the cleaning brush first.

The workpiece support can be adjusted for certain grinding operations. Loosen the clamping screw to adjust the workpiece support.

- ➔ Note that this adjustment results in a reduced potential load absorption of the workpiece support.
- ➔ The distance between the grinding wheel and workpiece support must be as low as possible.
- ➔ Only put slight pressure on the workpiece.
- ➔ Check the state of the grinding wheel. If it is dirty, it must be scraped clean or replaced.
- ➔ Grinding wheels must be disposed of in an environmentally friendly manner.

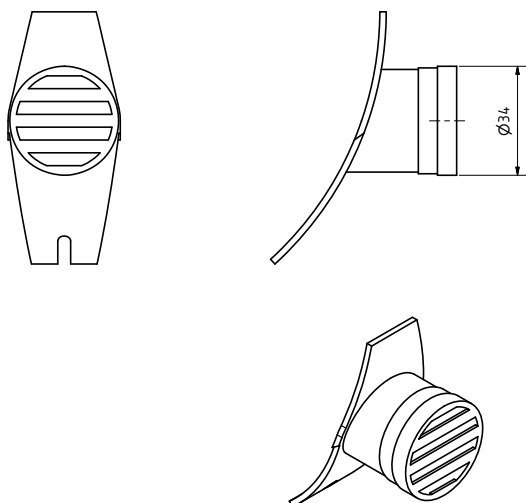
### INFORMATION

With speed-controlled grinding machines in conjunction with a suction unit, it is possible that the suction unit does not switch on at too low a speed when work starts.

 Operation of extraction unit on page 24

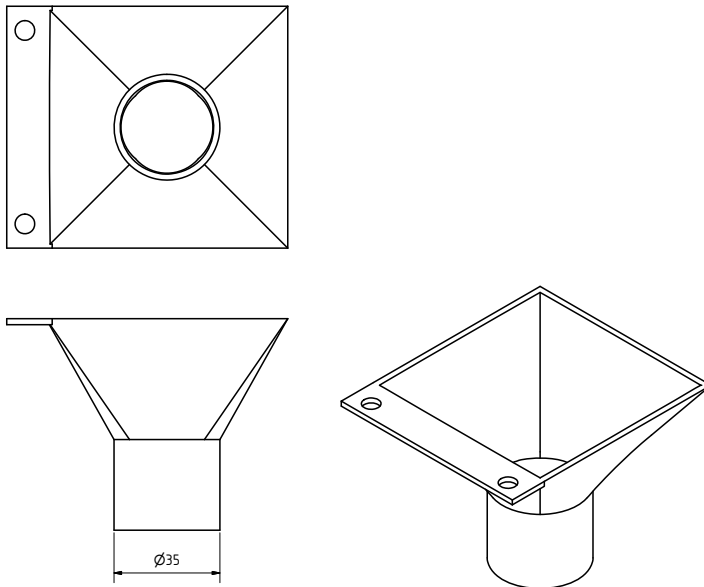


### 3.7.1 Suction connection of grinding wheel





## 3.7.2 Suction connection of cleaning brush



## 4 Maintenance

In this chapter you will find important information about

- Inspection
- Maintenance
- Repair

of the grinding machine.

### ATTENTION!

**Properly performed regular maintenance is an essential prerequisite for**

- **operational safety,**
- **failure-free operation,**
- **a long working life of the grinding machine and**
- **the quality of the products which you manufacture.**

Installations and equipment from other manufacturers must also be in good order and condition.



### 4.1 Safety

#### WARNING!

**The consequences of incorrect maintenance and repair work may include:**

- **extremely serious injuries to those working on the grinding machine and**
- **damage to the grinding machine.**

**Maintenance and repair work on the grinding machine must be carried out by qualified technical personnel only.**



#### 4.1.1 Preparation

##### WARNING!

**Only work on the grinding machine if it has been disconnected from the power supply.**





## 4.2 Inspection and maintenance

### INFORMATION

The bearing is lifetime-lubricated. It is not necessary to lubricate it again.

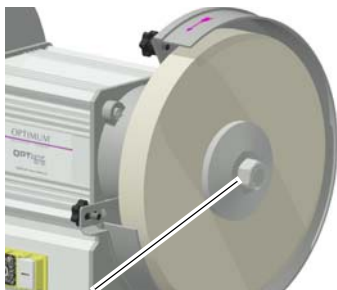
### WARNING!

**Grinding wheels must be replaced, if there is an excessive distance between the external diameter of the grinding wheel and the completely readjusted workpiece support.**

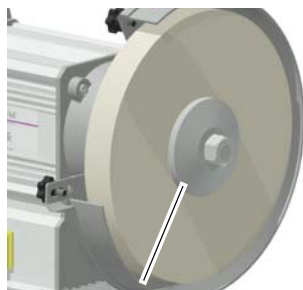


## 4.3 Replacing a sanding disc

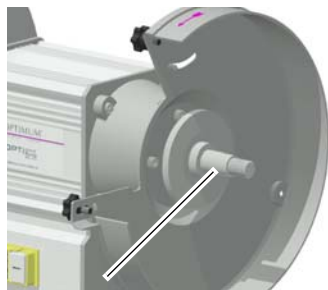
- Disassemble the protective cover of the grinding wheel.
- Loosen the shaft nut.
- Hold the grinding wheel tight to loosen the nut. Make sure you use the correct direction to loosen the nut.
- Pull off the grinding wheel and the retaining washer from the shaft by hand.
- Check the new grinding wheel for visible damage prior to assembly.



Shaft nut



Retaining washer



Drive shaft



Thrust washer

## 4.4 Replacing the cleaning brush

- Disconnect the device from the mains.
- Secure the grinding machine against unauthorized switching on.
- Unscrew the nut on the cleaning brush, (right-hand thread).
- Pull the cleaning brush off the driving shaft.
- Mount the new cleaning brush. Make sure that the tool fixture is correctly seated.
- Check the orientation in the centric run by manually turning the cleaning brush.
- Fasten the nut using an open-jaw spanner.
- Carry out a trial run.



## 4.5 Repair

Optimum Maschinen Germany GmbH accepts no liability nor does it guarantee against damage and operating malfunctions resulting from failure to observe these operating instructions.

Use only perfect and suitable tools, only original spare parts or serial parts expressly approved by Optimum Maschinen Germany GmbH for repairs.

## 5 Appendix

### 5.1 Copyright

This document is protected by copyright. All derived rights are reserved, especially those of translation, re-printing, use of figures, broadcast, reproduction by photo-mechanical or similar means and recording in data processing systems, either partial or total.

Subject to technical changes without notice.

### 5.2 Liability claims/warranty

Besides the legal liability claims for defects of the customer towards the seller, the manufacturer of the product, OPTIMUM GmbH, Robert-Pfleger-Straße 26, D-96103 Hallstadt, does not grant any further warranties unless they are listed below or were promised as part of a single contractual provision.

- Liability or warranty claims are processed at OPTIMUM GmbH's discretion either directly or through one of its dealers.  
Any defective products or components of such products will either be repaired or replaced by components which are free from defects. Title to replaced products or components is transferred to OPTIMUM Maschinen Germany GmbH.
- The automatically generated original proof of purchase which shows the date of purchase, the type of machine and the serial number, if applicable, is the precondition in order to assert liability or warranty claims. If the original proof of purchase is not presented, we are not able to perform any services.
- Defects resulting from the following circumstances are excluded from liability and warranty claims:
  - Using the product beyond the technical options and proper use, in particular due to overstraining of the machine.
  - Any defects arising by one's own fault due to faulty operations or if the operating manual is disregarded.
  - Inattentive or incorrect handling and use of improper equipment
  - Unauthorized modifications and repairs
  - Insufficient installation and safeguarding of the machine
  - Disregarding the installation requirements and conditions of use
  - atmospheric discharges, overvoltage and lightning strokes as well as chemical influences
- Neither are the following items covered by liability or warranty claims:
  - Wearing parts and components which are subject to normal and intended wear, such as V-belts, ball bearings, lighting, filters, seals, etc.
  - Non reproducible software errors
- Any services, which OPTIMUM GmbH or one of its agents performs in order to fulfil any additional warranty are neither an acceptance of the defects nor an acceptance of its obligation to compensate. These services neither delay nor interrupt the warranty period.
- The court of jurisdiction for legal disputes between businessmen is Bamberg.
- If any of the aforementioned agreements is totally or partially inoperative and/or invalid, a provision which nearest approaches the intent of the guarantor and remains within the framework of the limits of liability and warranty which are specified by this contract is deemed agreed.



## 5.3 Advice for disposal / Options of reuse:

Please dispose of your equipment in an environmentally friendly manner, by not placing waste in the environment but in a professional manner.

Please do not simply throw away the packaging and later the disused machine, but dispose of both in accordance with the guidelines laid down by your city council/local authority or by an authorised disposal company.

### 5.3.1 Decommissioning

#### CAUTION!

**Immediately decommission used machines in order to avoid later misuse and endangering of the environment or of persons.**

- **Unplug the power cord.**
- **Cut the connection cable.**
- **Remove all operating materials from the used device which are harmful to the environment.**
- **If applicable remove batteries and accumulators.**
- **Disassemble the machine if required into easy-to-handle and reusable assemblies and component parts.**
- **Dispose of machine components and operating fluids using the intended disposal methods.**



### 5.3.2 Disposal of new device packaging

All used packaging materials and packaging aids from the machine are recyclable and generally need to be supplied to the material reuse.

The packaging wood can be supplied to the disposal or the reuse.

Any packaging components made of cardboard box can be chopped up and supplied to the waste paper collection.

The films are made of polyethylene (PE) and the cushion parts are made of polystyrene (PS). These materials can be reused after reconditioning if they are passed to a collection station or to the appropriate waste management enterprise.

Only forward the packaging materials correctly sorted to allow direct reuse.

#### INFORMATION

Please take care in your interest and in the interest of the environment that all component parts of the machine are only disposed of in the intended and admitted way.

Please note that the electrical devices comprise a variety of reusable materials as well as environmentally hazardous components. Please ensure that these components are disposed of separately and professionally. In case of doubt, please contact your municipal waste management. If appropriate, call on the help of a specialist waste disposal company for the treatment of the material.





### 5.3.3 Disposal of electrical and electronic components

Please make sure that the electrical components are disposed of professionally and according to the statutory provisions.

The device is composed of electrical and electronic components and must not be disposed of as household waste. According to the European Directive 2015/863/EU regarding electrical and electronic used devices and the implementation of national legislation, used power tools and electrical machines need to be collected separately and supplied to an environmentally friendly recycling centre.

As the machine operator, you should obtain information regarding the authorised collection or disposal system which applies for your company.

Please make sure that the electrical components are disposed of professionally and according to the legal regulations. Please only throw depleted batteries in the collection boxes in shops or at municipal waste management companies.



### 5.4 Disposal through municipal collection facilities

Disposal of used electrical and electronic components (Applicable in the countries of the European Union and other European countries with a separate collecting system for those devices).

The sign on the product or on its packing indicates that the product must not be handled as common household waste, but that it needs to be disposed of at a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the public health. Incorrect disposal constitutes a risk to the environment and public health. Recycling of material will help reduce the consumption of raw materials. For further information about the recycling of this product, please consult your District Office, municipal waste collection station or the shop where you have purchased the product.



### 5.5 Product follow-up

We are required to perform a follow-up service for our products which extends beyond shipment.

We would be grateful if you could send us the following information:

- Modified settings
- Any experiences with the grinding machine which might be important for other users
- Recurring failures of the grinding machine.

### 5.6 Change information operating manual

Chapter	Short summary	new version number
2 ; Spare parts	Shaft diameter cleaning brush GUB15	1.0.1
All	GU1 + Vario drive	1.0.2
1.3.1	The distance between the contact surface and the grinding wheel must not exceed 2mm.	1.0.3



## 5.7 Extraction unit GU1 with speed regulated grinding machines

The extraction unit GU1 is suitable for dust class L.

## 5.8 Intended use

### WARNING!

In the event of improper use, the extraction unit

- will endanger personnel,
- the extraction unit and other property of the operating company and
- the functionality of the extraction unit may be compromised.



The extraction with blower and cyclone separator has been designed and built for the extraction of air pollutant substances on manually operated machines for tools with geometrically non-determined blade.

It is forbidden to use the extraction unit when machining with non-water-soluble or water-soluble cooling lubricants. The device is not suitable for the extraction of mixtures of combustible dusts with fluids.

The extraction unit must only be installed and operated in a dry and well-ventilated areas.

The defined conditions of use and performance data must not be changed.

The extraction unit must neither be renovated nor modified in any other way.

### Dust category L

(Low risk according to the definition of standard EN 60335-2-69). According to the EN standard, the extraction unit is approved for dust category L and thus, for the extraction of dry, non-combustible and dust hazardous to health with occupational exposure limit values (German AGW) of  $> 1\text{mg}/\text{m}^3$ . The clean air is emitted back to the location.

### Dust category M

(Medium risk according to the definition of standard EN 60335-2-69). The extraction unit is suitable for the extraction of dry, non-flammable dust hazardous to health where the occupational exposure limit value is higher than  $0.1\text{mg}/\text{m}^3$ .

### Dust category H

(High risk according to the definition of standard EN 60335-2-69). The extraction unit is suitable for the extraction of dry, non-flammable dust hazardous to health for all occupational exposure limit values as well as for non-flammable dust with carcinogenic substances. The clean air is emitted back to the location.

### Use in dust areas with potentially explosive atmosphere (Type 22)

Safety-related, extraction units with the supplement "Type 22" are suitable for extracting flammable, dry non-electrically conductive dusts in Zone 22. Exceptions are dusts with extremely low minimum ignition energy ( $\text{MIE} < 1\text{mJ}$ ). Use with these dusts requires a case-related safety assessment and, where applicable, further measures.

Safety-related, the extraction unit is not suitable for extracting potentially explosive substances in line with §1 Explosives Act. Do not extract hot gases, ignition sources of any type, sparks generated mechanically or electrostatically charged materials.

If the extraction unit is used other than as specified above, without the permission of the company Optimum Maschinen Germany GmbH, the machine is no longer used properly.

We will not be held liable for any damages resulting from any operation which is not in accordance with the intended use.

We expressly point out that the guarantee will expire, if any constructive, technical or procedural changes are not performed by the company Optimum Maschinen Germany GmbH. It is also part of the intended use that you





- observe the limits of the extraction unit,
- the assembly instruction is observed,
- the inspection and maintenance instructions are observed.

## CAUTION!

**Extremely severe injuries due to non-intended use.**

**Conversions and modifications of the operating values of the extraction unit are forbidden. They could pose an accident hazard to persons and cause damage to the extraction unit.**



## 5.9 Reasonably foreseeable misuse

Any use other than that specified under "Intended use" or any use beyond that described will be deemed non-intended use and is not permissible.

Any other use must be discussed with the manufacturer.

### 5.9.1 Avoiding misuse

When commissioning the extraction unit, the efficiency must be checked. This includes a check of the device parameters and the measurement of the hazardous substance pollution of air at the work place. For particulate hazardous substances, the inspection of the device must be repeated annually. For pure gaseous substances, the Ordinance on Hazardous Substances requires an inspection every three years.

The extraction unit may only be operated using electrically conductive extraction hose and accessories.

### 5.9.2 Workplace limits

During activities on material-removing machines, amongst others, the general dust limit value with regard to release of aluminium, aluminium hydroxide, aluminium oxide (except for aluminium oxide fumes), iron (II) oxide, iron (II) oxide, graphite and magnesium oxide (except for magnesium oxide fumes) must be considered according to TRGS 900. The limit value for the alveolar fraction is 3 mg/m<sup>3</sup> and for the inhalable fraction, 10 mg/m<sup>3</sup>.

If there is a possibility that potentially toxic, highly toxic, carcinogenic, mutagenic or reprotoxic substances are released, further protective measures are necessary according to §10 of the German Ordinance on Hazardous Substances (Gefahrstoffverordnung, GefStoffV). In event of reprotoxic substances, the maternity protection and parental leave ordinance (German MuSchEltZV) must be observed.

Further requirements and information for ventilation of work places can also be found in the

- German Occupational Safety Act,
- Factory Safety Act,
- ninth ordinance for the Device Safety Act (machine ordinance - 9 GSGV),
- Ordinance on working premises

as well as

- other national health and safety regulations, accident prevention regulations and generally accepted rules of engineering.

### 5.9.3 Residual risk

When observing the operating instructions and the work processes listed therein, as well as when observing the applicable safety guidelines by the operating personnel, it is assumed that in normal operation that the extraction unit cannot pose a risk.

However, when extracting different substances it cannot be ruled out that these substances cannot lead to an unforeseeable chemical reaction between each other.

- If potentially explosive dusts are extracted, no ignition sources may be sucked in.



## 5.10 Commissioning

During the connection of several hoses at the extraction ports, it must be ensured that a leakage resistance of  $10^6$  Ohm is not exceeded.

The three-phase electrical connection must be equipped with a neutral conductor.

## 5.11 Electronics

Have the extraction unit checked at regular intervals. Immediately eliminate all defects such as loose connections, defective wires, etc.

A second person must be present during work on live components to disconnect the power in the event of an emergency. Disconnect the extraction unit immediately if there is a malfunction in the power supply!

Comply with the required inspection intervals in accordance with the factory safety directive, operating equipment inspection.

The operator of the extraction unit must ensure that the electrical systems and operating equipment are inspected with regards to their proper condition, namely,

- by a qualified electrician or under the supervision and direction of a qualified electrician, prior to initial commissioning and after modifications or repairs, prior to recommissioning
- and at set intervals.

The intervals must be set so that foreseeable defects can be detected in a timely manner, when they occur.

The relevant electro-technical rules must be followed during the inspection.

No check is required before first commissioning, if the manufacturer or installer has confirmed to the operator that the electrical system and operating materials have been procured in accordance with the stipulations of the accident prevention regulations.

Permanently installed electrical systems and operating materials are considered constantly monitored if they are continually serviced by qualified electricians and inspected by means of measurements during operation (e.g. monitoring the insulation resistance).

## 5.12 Inspection deadlines

Define and document the inspection deadlines for the extraction unit in accordance with § 3 of the Factory Safety Act and perform an operational risk analysis in accordance with § 6 of the Work Safety Act. Use the test intervals specified in the inspection and maintenance as reference value.

Ambient air, hazardous substance pollution

- annually, local measurements for particulate hazardous substances.
- every 3 years, local measurements for pure gaseous substances.

## 5.13 Operation of extraction unit

### INFORMATION

The blower in the GU1 only switches on in conjunction with inverter drive (Vario grinding machines) if the speed is first set to high speed when the grinding machine is switched on in order to exceed the 0.5 A detection signal for switching on the blower.



## 5.14 Description of functioning of the extraction system

In the machine substructure is situated a fan that generates an underpressure. The negative pressure produced draws in the ambient air. The air volume from the extraction connections is guided via a cyclone separator that extracts the fine dust particles from the extracted air and deposits them in a collection tank. The exhaust air cleaned is guided back to the outside via a filter.



## 5.15 Functional Description of the Electrical Connections

The 230V protection contact sockets situated on the rear are used to connect the equipment and machines.

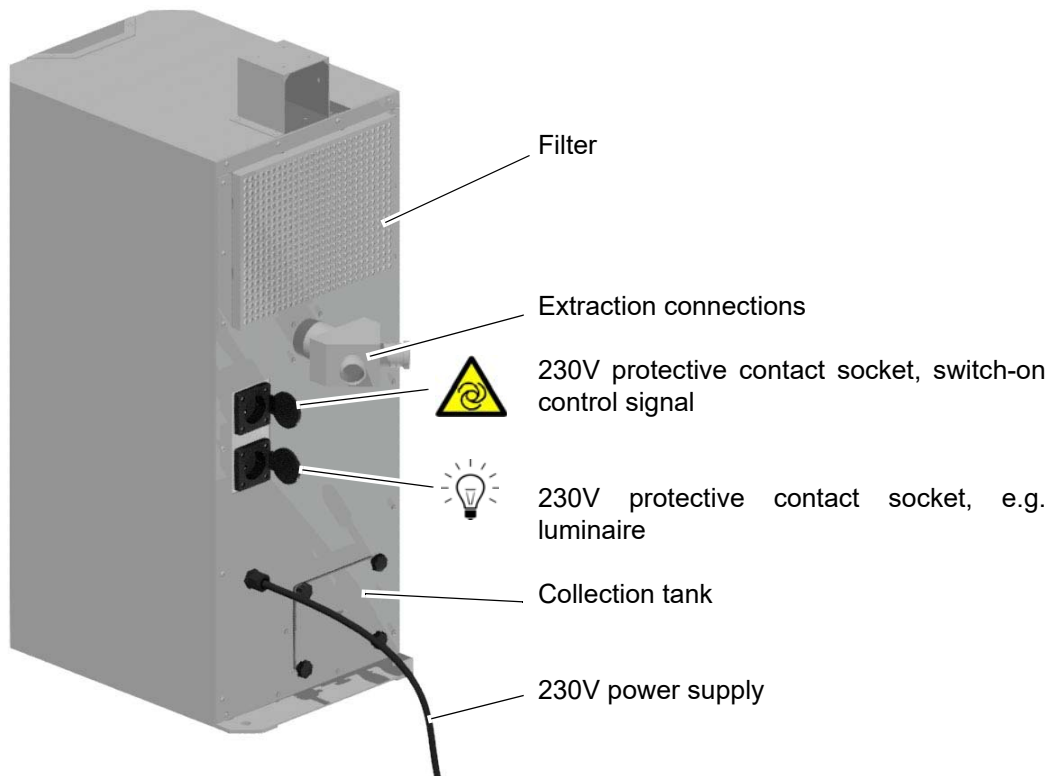
- The maximum possible total current consumption on the protective contact sockets is 10A for GU1 with 230V mains connection.
- The maximum possible total current consumption on the protective contact sockets is 16A for GU1 with 400V mains connection.

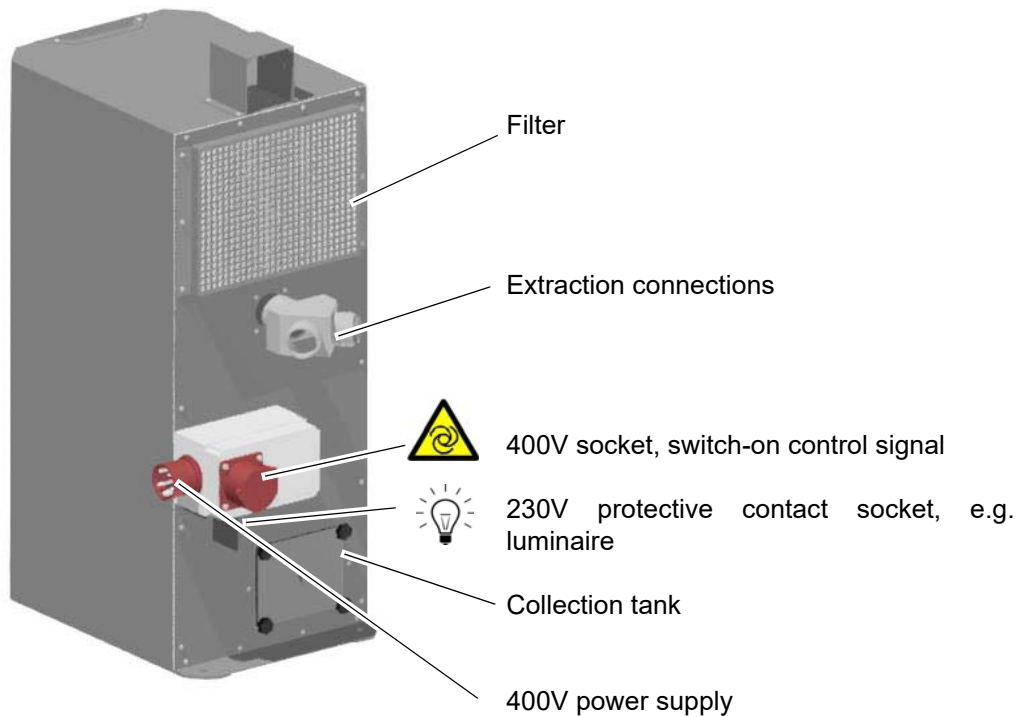
A socket is used as a detection signal for switching on the fan in the machine substructure. The blower fan start with a short delay as soon as the machine connected there is switched on. The blower fan switch off as soon as machine or device connected to the socket is switched off.



### INFORMATION

The blower on the GU1 with 400V supply voltage will only switch on if the possibly used extension cable or the 400V socket for connecting the GU1 is also 5-pin, i.e. including neutral conductor.





## 5.16 Fire and Explosion Prevention

Flammable material dust is considered as potentially explosive from a particle size smaller than 500 µm.

Swirled up deposited flammable dust may lead to a potentially explosive atmosphere in tool machines and separator units. This must be observed in particular with light alloy metal dusts such as aluminium and magnesium.

The resulting dusts are combustible and explosive when stirred up in air and can release hydrogen gas with slurries that occur and thus form oxyhydrogen gas.

The machine substructure GU1 is not designed to remove an explosive atmosphere in the working area of the complete machine.



## 6 Ersatzteile - Spare parts

### 6.1 Ersatzteilbestellung - Ordering spare parts

Bitte geben Sie folgendes an - Please indicate the following :

- Seriennummer - *Serial No.*
- Maschinenbezeichnung - *Machines name*
- Herstellungsdatum - *Date of manufacture*
- Artikelnummer - *Article no.*

Die Artikelnummer befindet sich in der Ersatzteilliste. *The article no. is located in the spare parts list.* Die Seriennummer befindet sich am Typschild. *The serial no. is on the rating plate.*

### 6.2 Hotline Ersatzteile - Spare parts Hotline



+49 (0) 951-96555 -118  
ersatzteile@stuermer-maschinen.de



### 6.3 Service Hotline



+49 (0) 951-96555 -100  
service@stuermer-maschinen.de



## 6.4 Ersatzteilzeichnung - Spare parts drawing

A



6-1: Ersatzteilzeichnung - Spare parts drawing

GUB\_parts.fm



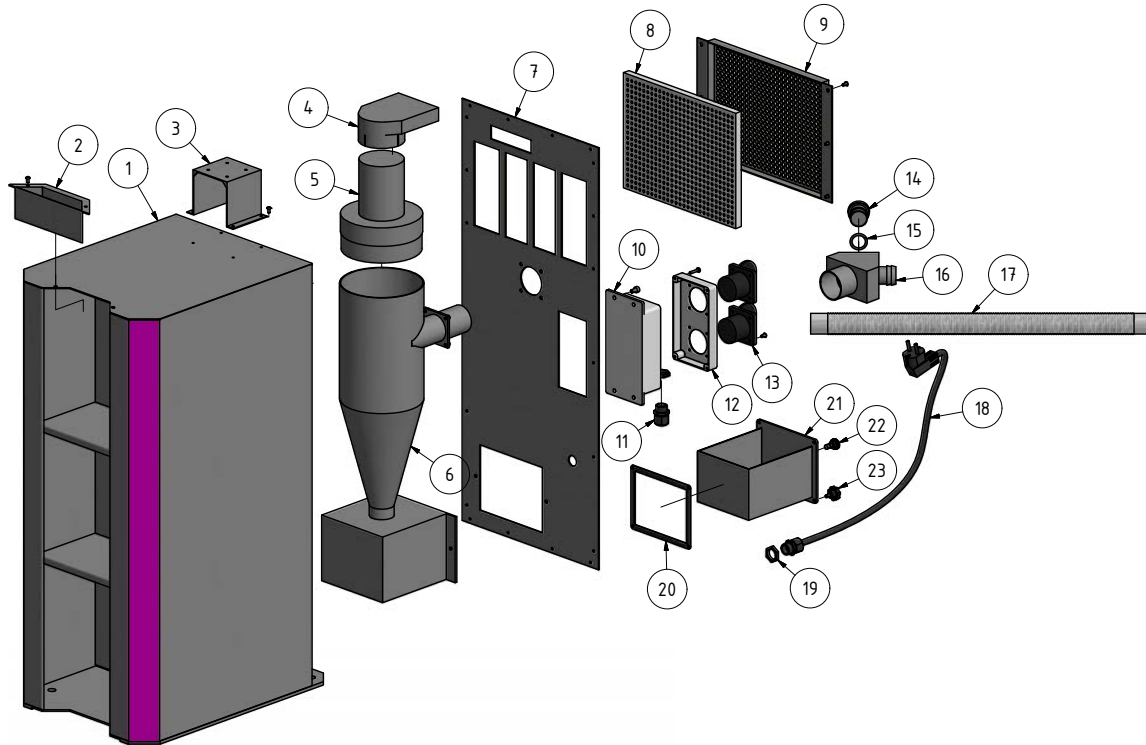
GU15B   GU18B   GU20B   GU25B								
Pos.	Bezeichnung	Description	Menge Qty.	Größe Size	Artikelnummer			
					Item no.			
					GU 15B	GU 18B	GU20B	GU25B
1	Klemmschraube	Clamping screw	4	M6x12	0310150501			
2	Abdeckung links	Cover left	1		0310150502	0310151002	0310151502	0310152502
3	Schutz	Cover	1		0310150503	0310151003	0310151503	0310152503
4	Sechskantmutter links	Hexagon nut left	1	links/left	0310150504			
5	Flansch	Flange	4		0310150505	0310151005		0310152505
6	Platte links	Plate left	1		0310150506		0310151506	0310152506
7	Werkstückauflage	Workpiece support	1		0310150507		0310151507	0310152507
9	Abdeckung links	Cpver left	1		0310150509	0310151009	0310151509	0310152509
10	Führungsplatte links	Guide plate left	1		0310150510	0310151010	0310151510	0310152510
11	Lagerflansch	Bearing flange	2		0310150511	0310150511	0310151511	0310152511
12	Anschlusstecker	Conection plug	1	230V	-	-	-	-
12	Anschlusstecker	Conection plug	1	400V	-	-	-	-
13	Rotor	Rotor	1	230V	0310150513		0310151513	-
13	Rotor	Rotor	1	400V	-	-	-	0310158013
14	Abdeckung links	Cover left	1		0310150514		0310151514	
15	Kugellager	Ball bearing	2	6203-2Z	0406203R			-
15	Kugellager	Ball bearing	2	6004-2Z	-	-	-	0406004R
16	Gehäuse+Stator	Housing+Stator	1	230V	0310150516		0310151516	-
16	Gehäuse+Stator	Housing+Stator	1	400V	-	-	0310152016	0310158016
17	Ein-Aus-Schalter	On-Off Button	1	230V	04640700023			-
17	Ein-Aus-Schalter	On-Off Button	1	400V	-	-	0310152017	
18	Platte	Plate	1		0310150518		0310151518	-
19	Gummifuss	Rubber foot	4		0310150519			0310152519
20	Kondensator	Capacitor	1	8µF	0310150520		-	-
20	Kondensator	Capacitor	1	10µF	-	-	0380023	0380023
23	Sechskantmutter rechts	Hexagon nut right	1	rechts/left	0310150523			
26	Grundplatte	Base plate	1		-	-	-	0310152526
28	Absaugstutzen	Connecting piece	1		0310150528			0310130335
29	Federscheibe	Spring washer	2		0310150529			0310152529
30	Schraube	Screw	4	M6x15	-	-	-	-
31	Schraube	Screw	3		0310150531		0310151531	0310152531
32	Schraube	Screw	6		0310150532			-
32	Schraube	Screw	8		-	-	-	0310152532
33	Schraube	Screw	8	M5x15	-	-	-	-
34	Schraube	Screw	4	M5x15	-	-	-	-
34	Schraube	Screw	4	M6x20	-	-	-	-
35	Senkkopfschraube	Screw	4	M5x7	0310150535			
36	Distanzhülse	Sleeve	1		-	-	-	0310152536
37	Scheibenschutz	Disc safety	2		0310150537	0310151037	0310151537	0310152537
38	Halteplatte	Holding Ring	1		0310160038	0310160538	0310161038	0310162038
39	Abdeckung	Cover	1		0310160039	0310160539	0310161039	0310162039
40	Trichter	Glory	1		0310160040	0310160540	0310161040	0310162040
41	Flansch	Flange	1		0310160041	0310160541	0310161041	0310162041
42	Reinigungsbürste	Cleaning brush	1	150x20x16	3107425	-	-	-
42	Reinigungsbürste	Cleaning brush	1	175x20x32	-	3107430	-	-
42	Reinigungsbürste	Cleaning brush	1	200x25x32	-	-	3107435	-
42	Reinigungsbürste	Cleaning brush	1	250x30x32	-	-	-	3107440





## 6.6 GU1 - mechanische Bauteile - mechanical components

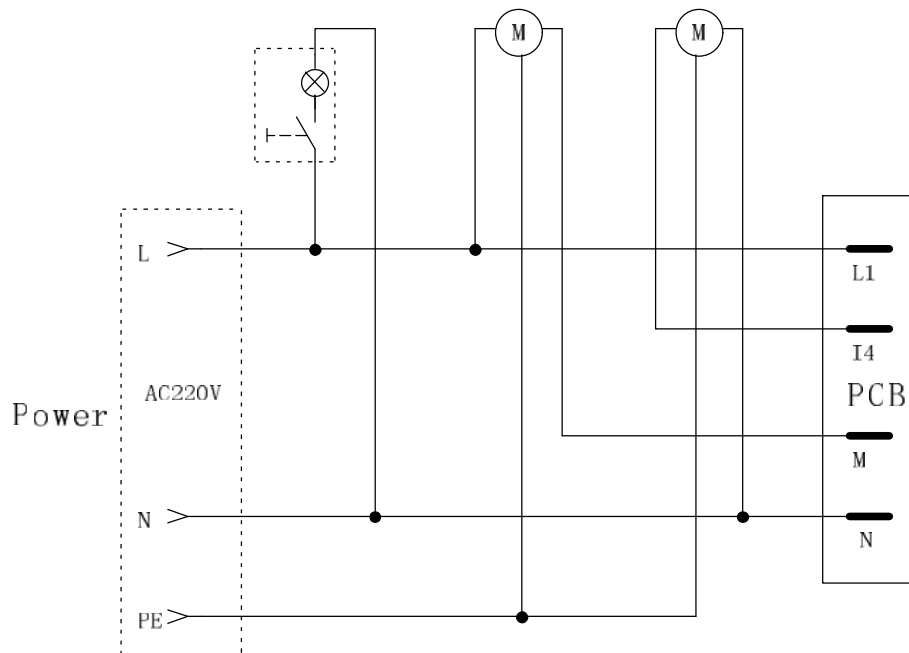
A



GU1					
Pos.	Bezeichnung	Description	Menge Qty.	Größe Size	Artikelnummer Item no.
Pos. 1	Unterbau GU1	Substructure GU1	1		0310711101
Pos. 2	Kühlbehälter GU1	Cooling tank GU1	1		0310711102
Pos. 3	Halter GU1	Holder GU1	1		0310711103
Pos. 4	Anschluss GU1	Plug GU1	1		0310711104
Pos. 5	Motor GU1	Motor GU1	1		0310711105
Pos. 6	Zyklon GU1	Cyclone GU1	1		0310711106
Pos. 7	Rückwand GU1	Back board GU1	1		0310711107
Pos. 8	Filter GU1	Filter GU1	1		0310711108
Pos. 9	Abdeckung GU1	Cover GU1	1		0310711109
Pos. 10	Gehäuse GU1	Housing GU1	1		0310711110
Pos. 11	Zugentlastung GU1	Strain relief GU1	1		0310711111
Pos. 12	Abdeckung GU1	Cover GU1	1		0310711112
Pos. 13	Steckdose GU1	Socket-outlet GU1	2	230V for 230V GU1 supply	0310711113
	Steckdose GU1	Socket-outlet GU1	1	400V for 400V GU1 supply	03107111131
Pos. 14	Stopfen GU1	Plug GU1	1		0310711114
Pos. 15	O-Ring GU1	O-Ring GU1	1		0310711115
Pos. 16	Verteiler GU1	Manifold GU1	1		0310711116
Pos. 17	flexibles Absaugrohr (Optional) GU1	flexibel suction tube (option) GU1	1		0310711117
Pos. 18	Anschlussstecker GU1	Plug cable GU1	1	230V	0310711118-1
	Anschlussstecker GU1 GU1	Plug cable GU1		400V	0310711118-2
Pos. 19	Klemmmutter GU1	Clamping nut GU1	1		0310711119
Pos. 20	Dichtung GU1	Seal GU1	1		0310711120
Pos. 21	Staubbehälter GU1	Particles tank GU1	1		0310711121
Pos. 22	Rändelschraube GU1	Knurled screw GU1	1		0310711122

## 6.7 GU1 -Elektrik - Electric - 230V

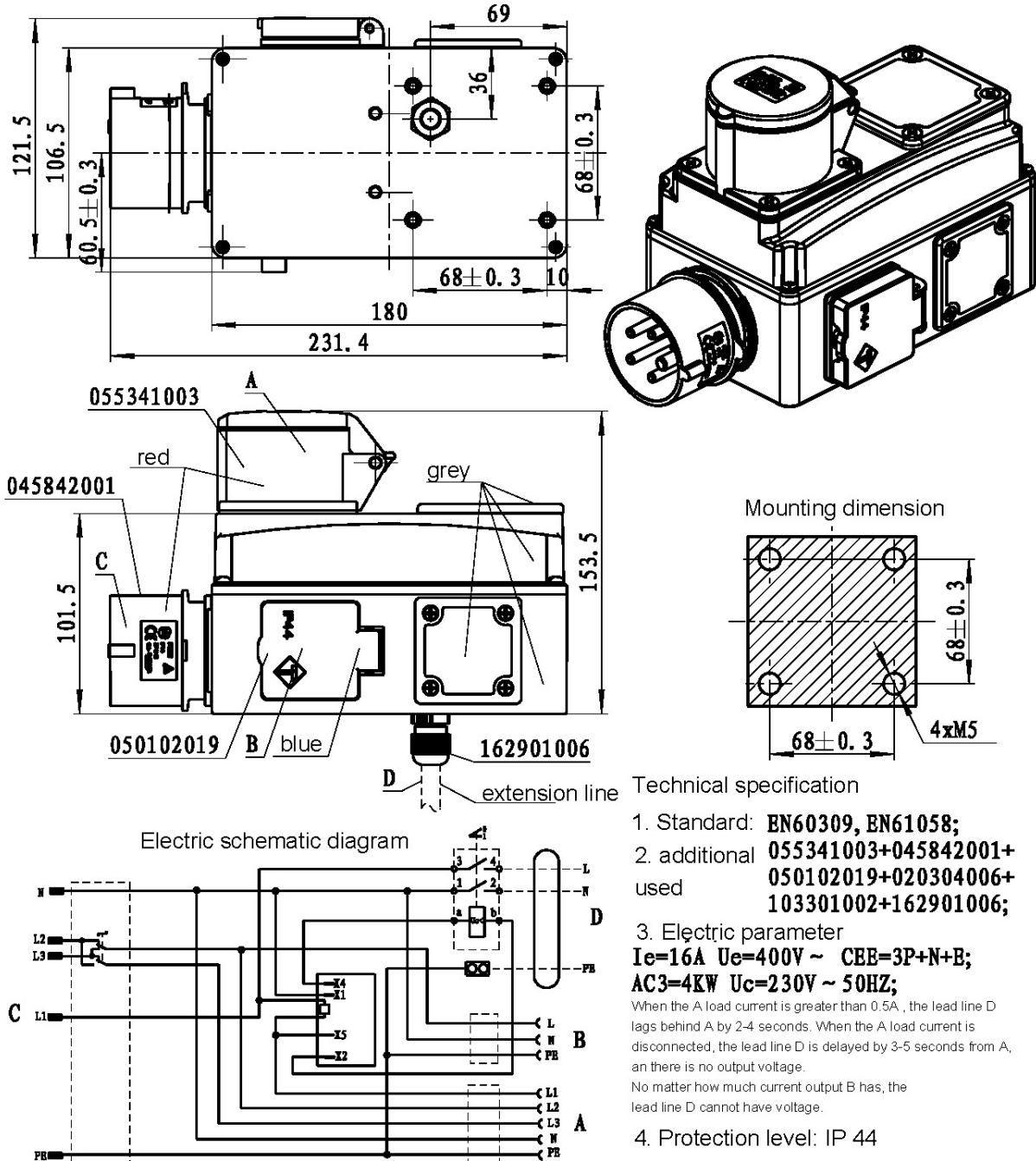
B



## 6.8 GU1 - Elektrik - Electric - 400V

### Schaltplan Stromverteiler - Wiring diagram power distribution

C



### Anschlüsse - Connections

- A - Anschluss Schleifmaschine - *Grinding machine connection* - CEE 400V 16A
- B - 230V Schutzkontaktsteckdose - *230 V socket with earthing-contact*
- C - Versorgungsanschluss Absaugung - *Supply connection for extraction unit* - CEE 400V 16A
- D - Versorgungsanschluss Gebläse - *Supply connection for blower*



## EC Declaration of Conformity

in accordance with the Machinery Directive 2006/42/EC Annex II 1.A

**The manufacturer / distributor:** Optimum Maschinen Germany GmbH  
Dr.-Robert-Pfleger-Str. 26  
D - 96103 Hallstadt

**hereby declares that the following product**

**Product designation:** Grinding machine

**Type designation:** GU15B | GU18B | GU20B | GU25B

Grinding machine for private persons as well as for craft and industrial plants which meets all the relevant provisions of the above mentioned Directive 2006/42/EC as well as the other directives applied (below) including their amendments in force at the time of declaration.

The following other EU Directives have been applied: EMC Directive 2014/30/EC ; Restriction of the use of certain hazardous substances in electrical and electronic equipment 2015/863/EU

The safety objective meet the requirement of EC Directive 2006/42/EC.

**The following harmonized standards were applied:**

EN 61029-2-4 Safety of transportable motor-operated electric tools - Part 2-4: Particular requirements for bench grinders

EN 50370-1 Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 1: Emission

EN 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

EN ISO 13849 - Safety of machinery - Safety-related parts of control systems

EN ISO 12100 Safety of machinery - General principles for design - Risk assessment and risk reduction

Person responsible for the document: Kilian Stürmer

Phone: +49 (0) 951 96555 - 800

Address: Dr.-Robert-Pfleger-Str. 26  
D - 96103 Hallstadt

Kilian Stürmer  
(CEO, General manager)

Hallstadt, 2023-03-20



## EC - Declaration of Conformity

according to Machinery directive 2006/42/EC, Annex II A

**The manufacturer / distributor** Optimum Maschinen Germany GmbH  
Dr. Robert-Pfleger-Str. 26  
D - 96103 Hallstadt

hereby declares that the following product

**Product designation:** GU15B | GU18B | GU20B | GU25B  
with extraction unit GU1 and speed regulated drive

fulfils all the relevant provisions of the directive specified above and the additionally applied directives (in the following) - including the changes which applied at the time of the declaration.

### Description:

Speed regulated grinding machine with extraction unit GU1 for craft and industrial plants which meets all the relevant provisions of the above mentioned Directive 2006/42/EC as well as the other directives applied (below) including their amendments in force at the time of declaration.

### The following additional EU Directives have been applied:

EMC Directive 2014/30/EU ; Restriction of the use of certain hazardous substances in electrical and electronic equipment 2015/863/EU

### The following harmonized standards were applied:

EN 61029-2-4 Safety of transportable motor-operated electric tools - Part 2-4: Particular requirements for bench grinders

EN 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

EN 50370-1 Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 1: Emission

EN 50370-2 Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 2: Immunity

EN 55011 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement - class A

EN 61000-3-2 Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)

EN 61000-3-3 Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection

EN ISO 13849 Safety of machinery - Safety-related parts of control systems

EN ISO 12100 Safety of machinery - General principles for design - Risk assessment and risk reduction

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