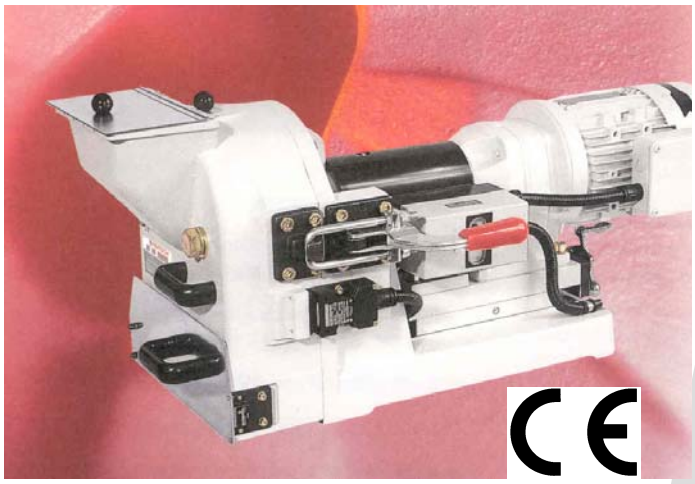
Operating Instructions

Laboratory Disk Mill

„pulverisette 13“



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Fritsch GmbH, Laborgerätebau has been certificated by the TÜV-Zertifizierungsgemeinschaft e.V. on november 21, 2003.

An audit certificated the accordance of the Fritsch GmbH to the DIN EN ISO 9001:2000.

The enclosed declaration of conformity calls the directives which the „pulverisette 13“ corresponds to. This permitts us to mark the instrument with the CE-Sign.

CE

Instrument number 13.10XX.00
Applies as of serial number 460

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Table of contents **page**

1 General Information / Introduction 1

1.1 Notes about Operating Instructions 1

1.2 Explanations of the signs at the instrument and in the operating instructions 2

1.3 Brief Description of the Instrument 3

1.3.1 Applications 3

1.3.2 Method of Operation 3

1.3.3 Drive Motor 4

1.4 Technical Data 5

2 Operating Safety 6

2.1 General Safety Instructions 6

2.2 Operators 7

2.3 Protective Equipment 7

2.4 Danger Points 7

2.5 Electrical Safety 8

3 Installation 9

3.1 Unpacking 9

3.2 Transport 9

3.3 Erection 9

3.4 Ambience conditions 10

3.5 Electrical Connection 10

3.5.1 Adapting the cutting mill to the available supply 10

3.6 Before Switching On for the First Time 10

3.7 Switching On for the First Time / Test for Correct Functioning 10

4 Working with the Cutting Mill 11

4.1 Grinding with zircon oxide grinding disks 11

4.2 Setting the Gap Width 11

4.3 Material Feed 12

4.4 Final Fineness 13

4.5 Dust Extraction 13

4.6 Comminuting of Coarse Material 14

5 Cleaning 14

6 Maintenance 15

6.1 Changing the gear oil of the motor 15

6.2 Exchanging the Grinding Disk 16

6.2.1 Exchanging the Fixed Grinding Disk 16

6.2.2 Exchanging the Rotating Disk 17

7 Warranty 18

8 Troubleshooting Checklist 19

9 Milling results examples 20

1 General Information / Introduction

1.1 Notes about Operating Instructions

- The copyright to these technical documents is the property of Fritsch GmbH, Manufacturers of Laboratory Instruments.
- These operating instructions are not to be reprinted or copied without the express approval of Fritsch GmbH.
- Please study these instructions carefully before attempting to operate the machine.
- All operators must be familiar with the contents of the operating instructions.
- Please observe all notes concerning your safety.
- The disk mill was designed with the user's safety in mind, however inherent risks cannot be excluded. Follow the advice in these instructions to avoid risks to users.
- The symbols in the right hand margin highlight the risks described in the text. Symbols are also to be found on the instrument warning users of possible risks.
  Warning symbols are surrounded by a triangle.
- These operating instructions do not constitute a complete technical description. They describe only the details required for safe operation and maintenance for usage under normal conditions.

1.2 Explanations of the signs at the instrument and in the operating instructions

Attention! Warning against danger spot! Observe operating instructions!	
Attention! Mains voltage!	
Attention! Risk of explosion!	
Attention! Hot surface!	
Attention! Inflammable substances!	
Attention! Hazardous materials!	
Wear ear protectors!	
Wear eye shield!	
Do not walk under suspended load!	

1.3 Brief Description of the Instrument

1.3.1 Applications

The "pulverisette 13" is a laboratory disk mill used for batch or continuous fine grinding of soft to hard material samples (hardness grades up to 8 Mohs), e.g. in the fields of mining and metallurgy, rocks and soils, glass industry or pedology.

The maximum feed size is 20 mm edge length.

Depending on the set gap width, the final fineness attainable is approx. 5 mm (largest gap width) and approx. 0.1 mm (smallest gap width).

The throughput of the mill lies between 20 and 150 kg/hour, depending on the discharge gap setting, the bulk weight and the comminution behaviour of the sample.

1.3.2 Method of Operation

The material sample is comminuted in a dustproof grinding chamber containing two counteracting grinding disks with coarse toothing on the inside. One of these disks is driven by a powerful, slow-running gear motor.

The material to be ground is loaded into the centre of the motionless grinding disk through a closable hopper, emerging from the gap between the two disks after being comminuted by compression or shearing stress. The gap width determines the average grain size of the material; it can be adjusted and checked from outside.

In case of batch grinding, the material is collected in a vessel which has a dustproof connection to the mill.

The enclosed construction prevents dust from escaping. In addition, a dust extraction unit can be connected. Swing up the housing for cleaning; this renders the grinding chamber freely accessible.

1.3.3 Drive Motor

Drive is a 3 ~ 230 V / 400 V motor.

The drive motor is a 3-phase a.c. motor. Due to the strong reduction ratio of the drive the disk mill stops in a minimum of time after switching it off.

Direction of rotation of the drive motor

The 3-phase a.c. motor can rotate in either direction.

Refer to:

DIN VDE 0530, Part 8, "Terminal Markings and Direction of Rotation"

DIN VDE 0530, Part 7 / EN 60 934-7, "Abbreviations for Models"

Since the grinding disks are rotationally symmetric, it is possible to change the direction of rotation of the disk mill after the front cutting edges have become badly worn. You can extend the service life of the grinding disks in this manner.

Make this change in the direction of rotation by interchanging two supply conductors "L1, L2, L3" (or the supply leads "U1, U2, U3" in the socket outlet).

Only a trained specialist is permitted to change the direction of rotation.

1.4 Technical Data

Dimensions and weight

Dimension: 400 x 440 x 870 mm
(height x width x depth)

Weight: 140 kg (net weight)
170 kg (gross weight)

Noise level

The noise level is approx. 81dB (A).

Voltage	400V / 3~ 50Hz	230V / 3~ 60Hz
Current consumption	3,2A	5,6A
Power consumption	1,76 / 2,1 kW with high loading (significantly less in normal use).	1,9 kW with high loading (significantly less in normal use).

The device can be operated only at a three-phase network!

Transient overvoltages according to overvoltage category II allowed.

(See also section 3.5 Electrical Connection)

Electric fuses

- Thermal protection switch (motor protection switch); ready for operation again automatically after cooling down (a few minutes).

Material

- Feed particle size maximum 20 mm
- Feed amount maximum 1300 ml

Final fineness

The final fineness is between 0.2 mm and 12 mm.

2 Operating Safety

2.1 General Safety Instructions

- Read the operating instructions carefully before use.
- The instrument can only to be used for the purpose described in section 1.3.1 Applications.
- We recommend that a safety logbook should be kept in which all work (service, repairs etc.) carried out on the machine should be entered.
- Use only original accessories and original spare parts. Failure to do so may call into question the performance of the instrument.
- Do not use damaged accessories.
- The operators must be familiar with the contents of the operating instructions.
  To this end, for example, the operating instructions must be kept with the instrument.
- Do not remove labels.
- Protective devices must not be made unserviceable or removed.
- Unauthorized modification of the instrument or any part thereof will result in the loss of the conformity to European directives which is asserted by Fritsch and the warranty.
- Wear ear protectors if the noise level is higher than 81dB(A).
- Wear eye shield!
- Behaviour at all times must be such as to strictly preclude any risc of accidents.
- Furthermore, the MAC values at place of work specified in the pertinent safety regulations must be adhered to. Where applicable, ventilation must be provided or the instrument must be operated under an exhaust hood.
- When oxidizable materials such as metals, organic materials, wood, coal, plastic, etc. are ground or sieved, the risk of spontaneous ignition (dust explosion) exists whenever the fine particles exceed a specific percentage. While such materials are being ground or sieved, it is therefore necessary to take special safety precautions (e.g. wet grinding or wet sieving) and the work must be supervised by a specialist.

- The instrument is not explosion-proof and is unsuitable to grind or sieve materials which are explosive, combustible or promote combustion.
- Do not run the disk mill unsupervised.

2.2 Operators

- No one other than authorized persons should operate the instrument and it must be serviced and repaired by trained specialists.
- No one suffering from medical problems or under the influence of medications, drugs, alcohol or overtiredness should be permitted to operate the instrument.

2.3 Protective Equipment

Protective equipment must be used as intended and must not be rendered disabled or dismantled.

All protective devices should be regularly checked for completeness and to ensure that they are functioning correctly. See also section 6 Maintenance.

The disk mill has an extensive safety system:

1. The feed hopper has a grid lock to prevent **interference.**
2. A protection switch monitors the grinding chamber during operation to make certain it is closed and prevents the disk mill from starting when it is open.
3. A second protection switch monitors the collecting vessel during operation to make certain it is closed and prevents the disk mill from starting when it is open.

⇒ The disk mill will not start if grinding chamber or collecting vessel is open.

Both switches meet the personal safety requirements

The protectective switches do not latch the hopper lid and collector.

If the lid is opened or the collector is removed, the motor will stop.

2.4 Danger Points

- Squeezing danger at the cover of the funnel!
- Squeezing danger at the toggle of the grinding chamber!

2.5 Electrical Safety

General

The disk mill is turned off and on by means of a **motor protection switch** matched to the mains voltage (as per nameplate).

⇒ **On turning the switch to Start (I):**

- The disk mill starts up.

⇒ **On turning the switch to Stop (0):**

- The mill will stop within seconds.
- Grinding chamber can be opened.
- Sample container can be taken.

Protection against Restarting

In case of line fault during the operation the undervoltage release switches off.

⇒ The mill will stop within seconds.

- Grinding chamber can be opened.
- Sample container can be taken out.

The mill does not restart when the supply returns.

⇒ The mill is secured against restarting.

⇒ On turning the switch to **Start (I)**, the motor is switched on and the mill takes up its function.

Overload Protection

In the event of overloading resp. of a defective motor or cable, a current protection switch will switch off (the rotary switch returns to the STOP (0) position).

Nach Beseitigen der Störung kann das Gerät wieder eingeschaltet werden.

3 Installation

3.1 Unpacking

- Remove the nails with which the hood is fastened on the transport pallet.
- Lift the hood off the transport pallet.
- Check that the items supplied correspond to your order before proceeding.

3.2 Transport

- Transport the machine on the transport pallet using a fork lift truck or hand fork lift truck.

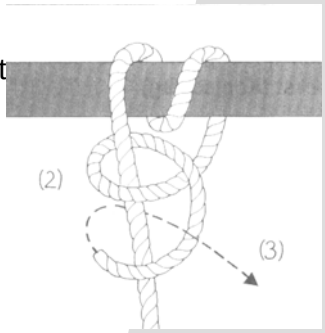
3.3 Erection

The disk mill is fixed on the pallet with 3 screws.

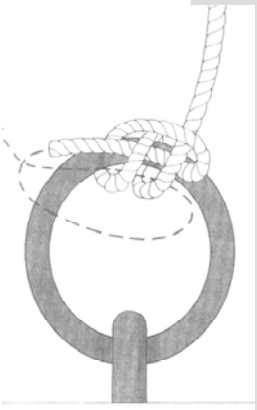
Unscrew the screws with a 17 mm open-end wrench.

Attention weight: Laboratory Disk Mill = 140 Kg! To carry the disk mill you need 3 support people.

1. Fasten a sturdy rope on a 20 mm iron rod, so that the rope could not slip.



2. Fasten the rope on the eye hook of the disk mill.



With the help of the iron rod 2 support people carry the disk mill;

the third one prevent it from swinging during transport.

The disk mill must be placed on a flat, stable base. It can be bolted to this base or a base plate (pallet or the like).

3.4 Ambience conditions

- Use the instrument only inside.
- The air must not contain any electrical conductive dust.
- The ambient temperature must be between 5 and 40°C.
- Height up to 2000m M.S.L.
- Maximum relative humidity of air 80% temperature up to 31°C, linear decreasing down to 50% relative humidity of air at 40°C
- Contamination level 2 (IEC 664)

3.5 Electrical Connection

Before making the connection, compare the voltage and current values shown on the nameplate with the values of the mains supply to which the machine is to be connected.

(See section 1.4 Technical Data)

3.5.1 Adapting the cutting mill to the available supply

Changing the required supply voltage from 230 to 400 volts and or changing the connecting cable mayonly be carried out by a trained electrician.

3.6 Before Switching On for the First Time

A set of grinding disks is already fitted to all disk mills supplied to the customer. The mill is therefore ready for operation once the electrical connection has been made.

Please check wheter the grinding disks are fixed correctly. **Smallest gap width 0.1 mm** (see section 4.2 Setting the Gap Width).

Grinding disk mustn´t touch them selves!

Instrument is only to be operated with assembled and fixed grinding disks.

3.7 Switching On for the First Time / Test for Correct Functioning

Switch on the machine only when all the work described in section 3 Installation has been done.

Switching on: turning the switch to “Start” **(1)**

Switching off: turning the switch to “Stop” **(0)**

4 Working with the Cutting Mill

4.1 Grinding with zircon oxide grinding disks

A few working instructions are to be followed while working with zircon oxide grinding disks:

1. Push the grinding chamber down only to the extent that the grinding disks do not touch each other whille in operation. The local heating immediately leads to tension fissures around the circumference. These fissures occur in a very short span of time and are easy to spot.
2. Local heating can also occur, if you feed in so much material that a layer of material is constantly being ground in the grinding chamber o the outer edge of the grinding disk. This leads to tension fissures or even to the breakage around the circumference of the grinding disk.
3. The hardness of the zircon oxide grinding disk lies at MOHS 8.5 (HV1350). No hard sample material may be ground as this could lead to the breaking of the outer edges of the grinding disks.
   The breaking of the edges can also occur in case of sample materials with Moh's hardness of 6 or 7. (The grinding grinding disks have a progressive break geometry. Rough grinding takes place in the inner area and fine grinding in the outer area of the grinding disk. The load is maximum in the are of fine grinding. Very hard sample materials can lead to the described breakage.)
4. The adhesive with which the fastening pins of the grinding disk are glued in has a temperature resistance up to 80°C. For this reason, the grinding disks should not be heated above 80°C because its secure position within the mount would no longer be guaranteed.

Caution!!!

Fritsch GmbH ensures that only our in-house, top quality zircon oxide grinding disks are permissible.

Used grinding discs that are corroded, broken or completely crushed around the circumference cannot be recognised as a claim.

4.2 Setting the Gap Width

The gap width between the two grinding disks is set by simply adjusting the crank with scale (1 graduation mark = 0.02 mm) which is located under the drive motor. You can check the setting through a view gap (see illustration) or measure the gap with a feeler gauge. You can also change the gap width while the mill is running.

It is to be made certain, that you turn the gap from a larger to a smaller distance with the crank, if you do it the other way, the gap grows 0,1mm during grinding over for instance and you get an inaccurate grinding result.

The minimum gap width as delivered is limited to 0.1 mm. On the rear left of the sliding table is a stop screw with lock nut that limits the forward movement of the sliding table. This prevents the grinding disks from accidentally touching each other.

If the grinding disks have been worn down over time, the minimum configurable gap becomes larger than 0.1 mm and the stop screw must be readjusted. To do this, take off the cap, remove the lock nut with a 13 mm fork spanner and turn the stop screw somewhat back with a 4 mm hexagon socket screw key (see pictures on the right side).

Then set the minimum gap of 0.1 mm with the feeler gauge and crank. When finished, turn the stop screw back forward again up to the stop until hand-tight and secure it with the lock nut.

Material which is difficult to grind should be preground in an initial pass using a large gap width and then achieve the desired fineness in a second pass using the minimum gap. Follow the same procedure if you have no data regarding the grindability of the material at hand.

4.3 Material Feed

Caution!!

Turn the mill on before pouring material into the hopper.

Feed relatively large pieces of material max. corner length 20 mm into the hopper one at a time and then close the cover immediately afterwards.

Do not add any more material until the grinding noise has decreased considerably.

The amount of material put into the hopper must be no more than will allow the cover to be closed during grinding.

Determine the maximum amount to add on the basis of the grindability of the material. Determine the comminution process for each new material (grinding noise) and determine the optimum amount to be added.

Caution!!

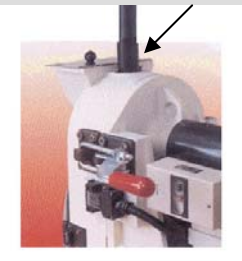
The grinding disk intake and the housing are made up of cast iron with nodular graphite. This cast steel is not rust free. When grinding moist or wet sample material (e.g. slurry), you need to dry the rear side of the grinding disks, the inside of the grinding disk intake and all the parts of the housing that come in contact with the sample, after grinding. Not doing so may lead to corrosion.

4.4 Final Fineness

The final fineness achievable depends on the gap width selected (about 0.1mm to 5 mm). The gap width determines only one dimension of the individual particles in the ground material. For example, material which breaks up into lamellar structures may be longer in one direction than another when comminuted. Even for these types of materials, however, the proportion of material where one dimension is longer is normally considerably reduced following a second pass.

4.5 Dust Extraction

After the end of the grinding process, you can extract the dust created during grinding if you install the dust extraction connector (Order no.: 13.1390.00) on the window used to check the gap setting. Press this adapter onto the two collar screws and lock it in place by turning it slightly. You can insert a commercially available suction hose from a vacuum cleaner into the top opening.



Caution!!

Never switch on the vacuum cleaner during the grinding process, because the sample will be extracted too.

4.6 Comminuting of Coarse Material

Coarse material (up to 65 or 95 mm edge length) can be comminuted to the fineness of the disk mill in one pass by combining it with laboratory jaw crusher "pulverisette 1" type 1 or type 2.

Install the jaw crusher over the disk mill in a mounting rack (order no. 43.5100.00). The preground material from the jaw breaker slides down a special chute directly into the hopper of the disk mill.

5 Cleaning

To clean the grinding chamber, open the housing. Use a brush or a suction unit to clean. If necessary, you may also use a liquid cleaner (alcohol, naphtha), but watch for the beginning of rust development. Be very certain to dry out the cutting mill completely.

Hazardous materials!

Caution when using combustible or poisonous materials! Risk of poisoning and fire!

When using cleaning materials which are combustible or detrimental to health, it is imperative that you observe the pertinent safety regulations (MAC values) and, if necessary, clean the disk mill in a ventilated safety zone.

6 Maintenance

Disconnect mains connector before starting any work.

Disconnect mains connector and secure instrument against being turned on again accidentally!

When maintenance work is being performed, this should be indicated with a warning sign.

Functional part	Function / Form	Assay	Maintenance interval
Safety switch 1 (Activity caused by closing the grinding chamber)	Prevents starting	Grinding chamber open: Mill doesn't run. Attention!!! If the switch is defect, the grinding diks start to run. Don´t grip into the running mill.	Check switch before each use (replace if defective).
Safety switch 2 (Activity caused by closing the product container)	Prevents starting	Product container not slid: Mill doesn't run. Attention!!! If the switch is defect, the grinding diks start to run. Don´t grip into the running mill.	Check switch before each use (replace if defective).
Gap width grinding disk	Breaking function	Distanz checked	Before each use.
Roller bearing	Lubrication	Bearing clearance	Grease after app. 3-4 month with rolling bearing grease.

6.1 Changing the gear oil of the motor

The gearbox of the motor has already been filled with low-viscosity grease at the factory.

A screw-in filling plug in the gearbox makes it possible to check the level.

The grease must be changed after approx. 5,000 hours of operation. To do so, let the motor run for at least 1 hour (to warm the grease), drain the grease and then pour in new grease.

Low-viscosity grease category O (international designation: NL GI 00)

Order no. 85.0100.00

6.2 Exchanging the Grinding Disk

The grinding disks are subject to natural wear and will have to be exchanged after protracted use. If you discover while inspecting or cleaning that the disks are worn, there is no need to exchange them at once. Simply change the rotation direction of of the driving motor: The crushing edges on the backside of the disks are brought into action now. However, you should order new replacement disks now if they are not already available.

Changing the rotation direction of the driving motor, see section 1.3.3 Drive Motor.

6.2.1 Exchanging the Fixed Grinding Disk

Loosen the fastening bolts with a 30mm fork-wrench, before opening the grinding chamber. Then undo the fastening bolts completely - but hold the grinding disk securely with one hand in the process. Afterwards you can remove the grinding disk.

The new disk is installed by reversing the procedure above.

Caution!!!!

Clean the intake and rear side of the disk thoroughly before using the new disk. It is especially important while using hard and rough ZrO2 disks and and WC+Co disks so that the disks fit free of voltage and parallel against each other.

Even while pulling out the screws, it is important for the pulling speed not to be too high (see table) and to be the same for both the screws.

The ZrO2 grinding disks are included with supporting rubber disks, which are placed under the steel supporting disks. The nuts are then pulled out, until the supporting rubber disks press under the supporting steel disk. (picture 1) In A pulling out speed of 20-30Nm is thus ensured.

picture 1

Material	*max. driving torque (Nm)*	*Density g/cm³*	*Abrasion resistance*	*Material to be crushed*	*Order no.*
Hardened steel casting 11-12% Cr	**390**	7,9	good	hard, brittle sample	13.1100.09
Maganese steel 12-13% Mn	**200**	7,9-8	good	hard, brittle sample	13.1120.23
Hardmetal tungsten carbide 90,3% WC + 9,5% Co	**200**	14,8	very good	hard, abrasive sample	13.2000.08
Zirconium oxide 92,5% ZrO2	**100**	5,9	extremely good	abrasive, medium-hard sample for iron-free grinding	13.2100.27

6.2.2 Exchanging the Rotating Disk

On the rear right of the sliding table is a stop screw with lock nut that limits the forward movement of the sliding table. This prevents the grinding disks from accidentally touching each other.

To do this, take off the cap, loosen the lock nut with a 13 mm fork spanner and turn the stop screw far back with a 4 mm hexagon socket screw key (see pictures on the right side).

Then open the grinding chamber and fold up the safety shield. With the crank, turn the rotating disk forward until the cover of the coupling lies against the housing. This creates enough space behind the rotating screw to loosen the fastening screws of the disk with a 30 mm fork spanner and unscrew them entirely. The grinding disk must be held fixed while doing so to prevent it from falling out. Then you can remove the grinding disk from its guide.

After installing the new grinding disk, the stop screw on the carriage must be readjusted. To do this, set the minimum gap of 0.1 mm with the feeler gauge and crank. When finished, turn the stop screw back forward again up to the stop until hand-tight and secure it with the lock nut.

Caution!!!!

Clean the intake and rear side of the disk thoroughly before using the new disk. It is especially important while using hard and rough ZrO2 disks and and WC+Co disks so that the disks fit free of voltage and parallel against each other.

Even while pulling out the screws, it is important for the pulling speed not to be too high (see table) and to be the same for both the screws.

The ZrO2 grinding disks are included with supporting rubber disks, which are placed under the steel supporting disks. The nuts are then pulled out, until the supporting rubber disks press under the supporting steel disk. (picture 2) In A pulling out speed of 20-30Nm is thus ensured.

picture 2

Material	max. driving torque (Nm)	Density g/cm³	Abrasion resistance	Material to be crushed	Order no.
Hardened steel casting 11-12% Cr	390	7,9	good	hard, brittle sample	13.1110.09
Maganese steel 12-13% Mn	200	7,9-8	good	hard, brittle sample	13.1130.23
Hardmetal tungsten carbide 90,3% WC + 9,5% Co	200	14,8	very good	hard, abrasive sample	13.2010.08
Zirconium oxide 92,5% ZrO2	100	5,9	extremely good	abrasive, medium-hard sample for iron-free grinding	13.2110.27

7 Warranty

The warranty card accompanying this instrument must be returned to the manufacturer, duly filled out, in order for the warranty to become effective.

The option of online registration is available. For further information, please refer to your warranty card or visit our Homepage http://www.fritsch.de

We, Fritsch GmbH, Germany, our application technology laboratory and our agent in your country will gladly provide advice and assistance with this instrument.

Always include the serial number shown on the nameplate with any queries.

Fritsch GmbH does not provide any warranty on the grinding disks. Claims after the first use cannot be recognised.

8 Troubleshooting Checklist

Functional error	Possible cause	Corrective measure
Mill fails to start	No power connected	Insert plug
	Safety switch 1 open	Lock the grinding chamber correctly
	Safety switch 2 open	Slide product container correctly
Disk does not turn	Gap width 0	Set the gap width; see section 4.2 Setting the Gap Width.
Mill stops during operation	Motor overheated	Allow mill to cool
	Overload, Motor protection switch actuated	Allow mill to cool, clear of material, reduce material feed rate
	Grinding chamber overfilled, Deadlock of too great/hard material.	Open and empty the grinding chamber
Poor milling result	Grinding disk worn-out	Change rotational direction or renew grinding disk. See section 6.2 Exchanging the Grinding Disk.
Material escapes	Sealing soils or faulty	Clean or replace the seals

9 Milling results examples

- feed particle size 20 mm
- feed quantity 1 kg
- material graded from hard to medium hard

Material to be ground	Grinding time (mm)	Disk gap setting (mm)	Grain size analysis (µm) 90%<	Grain size analysis (µm) 50%<	Through put kg/h
Basalt	2,1	1,0		600	28
	3,5	0,1	220	60	17
Clinker	1,5	1,0		800	36
	10,0	0,1	220	60	6
Slate	1,4	1,0		1500	45
	2,2	0,1	300	90	27
Hard coal	3,5	1,0		800	17
	13,5	0,1	250	100	4
Coke	5,3	1,0		400	11
	9,0	0,1	400	200	5
Limestone	2,0	1,0	1000	420	30
	6,3	0,1	210	100	10
Thomas meal	1,3	1,0	1000	350	45
	2,3	0,5	350	150	26
Pumice stone	1,7	1,0	1100	450	35
	5,0	0,1	150	30	12