

Operating instruction

Shape Sorter

Type : 3.0-e



The shape sorter are used to sort a batch of diamond or other grains of the same size range according to different shapes

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1 General

Please read this instruction before working with the device.

This operating and maintenance instruction contains useful hints for a safe and undisturbed operation of your **Shape-Sorter**.

2 Description

Hardware

The shape sorter is a system for sorting industrial diamonds and other materials. It consists of an oscillating table, oscillating storage reservoir, feeding system, and fifteen sorting boxes. The inclination and tilt as well as the amplitude of the table can be adjusted continuously. The surface of the table is made of aluminium. This system allows to sort into 15 different fractions.

Principle of operation

The operational principle is based on the different moving behaviour of particles on an inclined oscillating table. Using this system one can classify different shapes, as spheres, cubes, cuboctahedrons, broken particles, irregular shapes, platelets, etc.

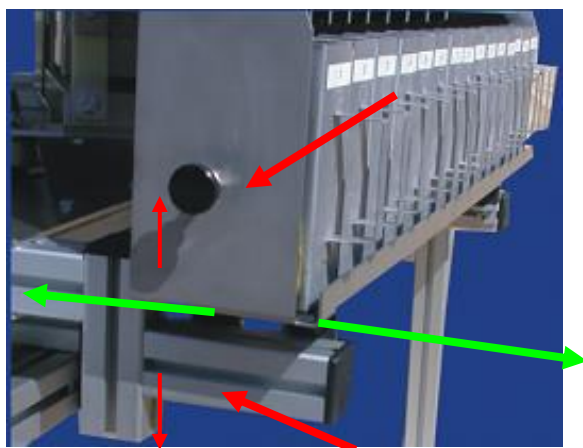
By oscillation, the diamonds move from the backside corner of the sorting tray towards the open edge with the collecting receptacles at the opposite edge.

The inclination of the sorting table causes the following effect:

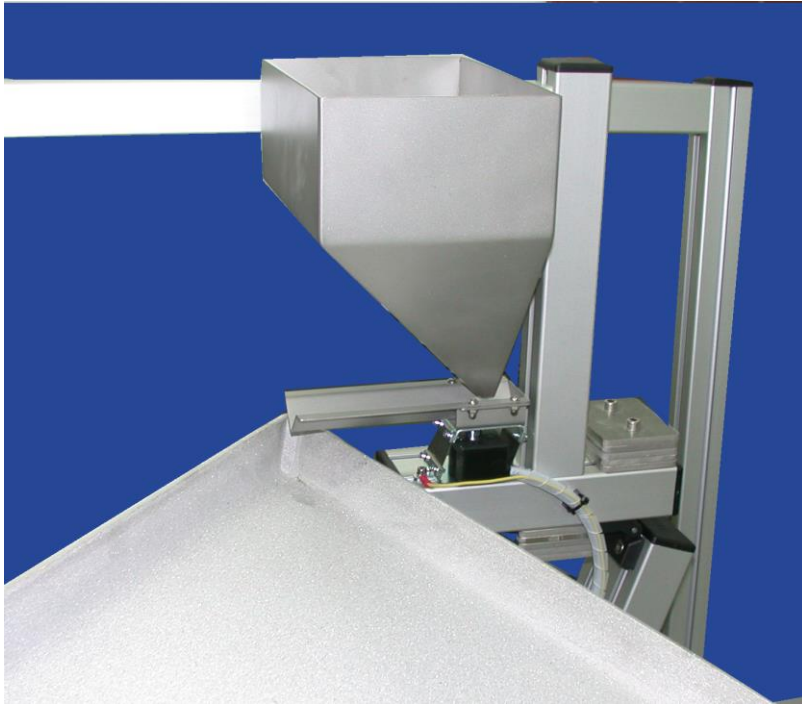
The blocky crystals approaching the shape of a ball roll down the incline and are collected at the lower boxes. The needle-like or irregular shaped crystals, which are not able to roll, move upwards by the oscillation and are collected in the upper boxes. The operating range of the shape sorting table can be adapted to the grain types to be sorted by adjusting the incline angle and amplitude of oscillation.

3 Main components

The Shape Sorter system consists of the following components:



Picture1: Adjusting the position of the collecting boxes



Picture 2 : Feeding system with storage funnel



Picture 1: Control Unit

4 Installation

General

Attention:

This device must be operated and maintained only by instructed persons.

Please start the system only after reading the manual and especially safety instructions.

Electrical connection

The shape sorter has only to connect with a correctly installed wall outlet with a protective grounding conductor (PE). Never change the protective action by a cable without a protective grounding conductor. Please produce by a proven expert an equivalent protection in accordance with the relevant installation regulations when power is supplied from power grids without earth connection.

Power supply: 230 V/ 50Hz ,4 A

Location

To ensure proper operation of the shape sorter please choose the location so that the following environmental conditions are fulfilled:

- Temperature: +18 ... +30 °C
- Permissible relative humidity: 45to 60 %,
- Place the sorting table at a solid, low vibration and horizontal surface
- Free from excessive changes of temperature and humidity
- Sufficient room in front of and over the system

The equipment has four rotary feet for levelling uneven areas and highs.

Do not use the device for extended periods of high humidity. Avoid condensing humidity on the device.

Let very cold systems at first acclimate at room temperature (about +20°C)-disconnected from the mains supply.

5 Handling of the control unit

At the front panel of the control unit are the following elements (see Fig 4):

1. feed control
2. sorting control
3. switch for inclination x-axis
4. switch for inclination y-axis
5. display x-axis angle
6. display y-axis angle



Fig. 5: Control unit

sorting angle:

switch "y axis"

The sorting angle determines the distribution and the situation of the particles on the deck. This configuration can be influenced by a change of the intensity of the vibration.

small sorting angle

and/or strong vibration brings the particle current towards the upper edge of the deck.

great sorting angle

and/or weak vibration brings the particle current towards the lower edge of the deck.

forward angle:

switch "x axis"

The x-axis determines at which speed the diamonds run over the deck. (dwell time)

small forward angle :

The productivity is too low.

large forward angle :

The diamonds don't have any time to orientate themselves on the deck. Only a narrow part of the deck is covered with diamonds. The sorting effect is insufficient.

Attention !:

Larger and heavier particles require a smaller forward angle than smaller, lightweight particles.

intensity of the vibration: Regulator "sort"

The vibration intensity influences the position of the particle current at constant sorting angle on the deck. The required intensity of the vibration is dependent on the grain size of the particles.

Attention !:

Small particles (for example 325/400 mesh) require a high intensity of the vibration to make them move on the deck. Therefore a big sorting angle must be adjusted simultaneously so that the diamonds can spread out on the deck and don't run on the upper edge of the deck only.

diamond supply:

Regulator "feed"

The feeding rate has to be adjusted so that a continuous material supply is ensured. The particles density should be low enough to allow for free movement of the single particles.

6 Typical sorting problems

Some bad particles in a good mixture:

The sorting angle must be big so that the majority of the good crystals can run in the lower area of the deck.

Some good crystals in a bad mixture:

By a little sorting angle one achieves that only the best crystals can remain on the lower edge of the deck and the rest of the mixture into the upper collecting boxes is transported.

Other significant influential factors

Particle size within the goods to sort:

The particle size has to be sorted within a batch has to be in the same range, as specificity from FEBA or ANSI (US-mesh) classification. If the particle size too different then will take place on the sorting deck a "sieving" because smaller particle with a constant density are lightweight and will be transported to the top of the deck by the oscillation energy regardless of their form.

Climate of the room:

Temperature and humidity can influence the sorting result strongly. The parameters must remain constant while processing one batch.

Mains frequency:

Power frequency and voltage fluctuations have no effect on the sorting result.

7 Operation

Before starting the sorting procedure the surface of the sorting table has to be cleaned by means of a clean tissue and alcohol and dried afterwards.

Attention: Please pay attention that the surface is free of diamonds at cleaning!



The grains to be sorted are filled into the charging funnel and fed onto the table by a vibrating chute. The feeding rate and the parameters of the table, i.e. the 2 angles of inclination of the table, are set to give an even distribution of grains from the left to the right margin of the table. The vibration amplitude of the table is kept constant for all sorting procedures. Good, blocky shaped grains with smooth faces migrate to the lower, right-hand side; irregular, angular, fractured and sliver shaped crystals with rough surfaces migrate to the upper, left-hand side of the table. The grains are collected in a row of collecting boxes at the front edge of the table, according to their distribution on the table surface: blocky grains in the right-hand side boxes, irregular grains in the left-hand side boxes.

The grain fractions in the boxes are checked under the optical microscope. For the objective check of these parameters, we recommend the automatic particle analyser from our range of **Dialnspect** products. That is the best solution for your size and shape analysis of abrasives.

If the separation is not sufficient, the sorting procedure is repeated with selected fractions. The table parameters are again adjusted to give a well spread distribution on the table and an improved separation of crystal shapes. The grain fractions shall finally be equivalent in shape to reference samples.

Special separation procedures may be applied, if only one edge of the spectrum of grain shapes shall be separated from the main mass, e.g. if only irregular, angular particles shall be sorted out. In this case the inclination of the sorting table is set very steep. Only the irregular shaped crystals migrate upwards on the table surface and separate from the bulk volume of grains. The main portion of grains moves along the low right-hand side of the table and is collected in the right-hand side boxes. The fraction of irregular grains is collected in the boxes of the right-hand side and eventually of the centre. The cut point of sorting can be determined by checking the grain shape of each box.

By an opposite sorting procedure only extreme blocky crystal grains can be sorted out. In this case, the inclination of the sorting table is set very flat. The bulk volume of grains then moves to the right and only the fraction of very blocky crystal grains keep to the left-hand side of the table, where it can be collected.

8 Short instruction

You can recognize

What is the reason?



sorting angle to big
and / or intensity of the vibration to weak.



sorting angle to small
and/or intensity of the vibration to strong



forward angle to big



forward angle to small
and/or intensity of the vibration to weak (app. 0)



all adjustments are perfect

Operation	Process parameter and Remarks
1 Setting atmospheric conditions	45...60% r.H. and 20...25°C (constant)
2 Cleaning sorting table and collecting boxes	isopropyl alcohol
3 Setting table parameters	acc. to grain size and grain type
4 Filling diamond into funnel	max. mass depending on grain size
5 Switch the control unit ON	
6 Setting the table parameter	<p>x-axis 0...15°</p> <p>Switch inclination x-axis :</p> <p>up for more inclination down for less inclination</p> <p>y-axis 0...15°</p> <p>Switch inclination y-axis:</p> <p>up for more inclination down for less inclination</p> <p><i>acc. to grain size and type</i></p>
7 Feeding diamond grains by vibrating chute	regulator feed control :(at the Knob 0...100) right for more depending on grain size and type
8 Adjusting the vibration of the oscillating tray	regulator sorting control : (at the knob 0...100) right for more
9 Adjusting sorting parameters (see step 6 and 8)	even distribution of grains on table
10 Checking grain fractions	visual inspection under optical stereo microscope or DialInspect
11 <i>Repeating sorting procedure with selected fractions and adjusted parameters</i>	<i>to improve sorting</i>

9 Maintenance- Cleaning

Keep the machine clean, especially the material bunker, the collection boxes. All the metallic surfaces can be cleaned with alcohol.

Attention: Please pay attention that the surface is free of diamonds before cleaning so that the surface cannot be damaged!

The vibratory drives are wear-free and require no maintenance. The conveyor rail and the deck can show signs of wear after a prolonged use. Those parts must be replaced when the sort process would be substantially affected. The control unit is also wear-free and requires no maintenance.

Turn off the machine before cleaning always at the main switch.

10 Operating errors

Replace defective fuses with ones of the specified type and rating.



11 Safety instruction

Please study, understand and follow all instructions in this instruction manual before operating! Also observe all safety and accident prevention regulations. Please require strict compliance with clearly defined safety precautions and rules of conduct.

Usage according to regulations

The Shape Sorter may only be used for commercial purposes for compliant sorting of industrial diamonds and similar materials.

Personnel requirements

It is the responsibility of the operator to ensure that only qualified personnel perform the installation and maintenance of the system.

Persons who operate the shape sorter have to be instructed by qualified personnel and have to read the manual.

All persons who operate the shape sorter or working within the vicinity of the system, will be advised of the safety instructions and procedures for emergencies.

Operator's obligations

The operator has to identify the additional risks, which can arise on site, and create a risk analysis for the nearby area.

Risk of human injury

Danger of crushing

Danger of crushing to hands and fingers in the area of the machine frame and all moving parts. In case of danger, the angular motors can be stopped with the **main switch "OFF/AUS"**



Danger from electric current

Non-compliance can result in personal injury, death, or damages to materials. Disconnect the supply voltage before assembly/ disassembly and replacing fuses from the power supply. Protective conductor connections need to be checked periodically for proper functioning.



Correct reaction in dangerous situations

Abnormal function of the system

Please stop immediately the system by danger of personal injury. Please stop by the main switch **"OFF/AUS" on the control unit.**



12 Technical data

Power supply	:	230 V, 50/60 Hz, 4 A
Protection class	:	IP 22
Length	:	950 mm
Height	:	1500 mm
Width	:	900 mm
Weight	:	approx. 85 kg

Vibration Control Unit

Controller

feed control

max adjustment limit (U)	:	0...100 (Umax)
Vibrating frequency(F)	:	75,0Hz

sorting control

max adjustment limit(U)	:	0...100 (Umax)
Vibrating frequency (F)	:	approx. 50 Hz (device-dependent working frequency)
Acceleration MAX	:	4,1 g (DISPLAY 100)

max. inclination and tilt

X - axis	:	15°
Y - axis	:	15°

available sorting table with different surface

Type 0	:	D46 ... D 76
Type 1	:	D91 ... D 126
Type 2	:	D151 ... D 251
Type 3	:	D301 ... D 601
Type 4	:	from D 601

Yield	:	app.. 800 ct./h (30/40 mesh) app. 500 ct./h (40/50 mesh) app. 100 ct./h (325/400 mesh)
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edge width	:	800 mm
surface	:	Aluminium
storage funnel volume	:	approx. 3,5 l
sorting boxes	:	
number	:	15
volume	:	approx. 500ml

feed and sort control	:	0...100 %
display x and y-axis	:	0,0...15°,0 (accuracy absolute 0,2°(max))
atmospheric conditions	:	45...60% r.H. 20...25°C
Cleaning	:	with isopropyl alcohol sorting table and collecting boxes

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13 Personal notes

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