Apparatus for Analyzing Nodularity of Sheroidal Graphite Cast Iron

Type : CGA

Operation Manual
Specification
Drawings

NAKAYAMA Co., Ltd.

Safety symbol marks

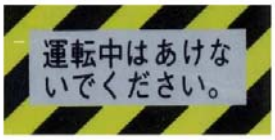
The following symbol marks are used in this manual to indicate important safety items.

Mark	Meaning
	A misoperation may lead to dangerous situation directly causing death or serious illness.
	A misoperation may lead to dangerous situation with a possibility of death or serious illness.
	A misoperation may lead to dangerous situation causing injury of medium degree of damage to this apparatus.
!	This is for an item including words such as “danger” or “warning”

Note: Some of the items with “WARNING” may also result in serious situation depending on condition. Care must always be taken.

Warning marks on the apparatus

Danger labels or warning labels are stuck on the apparatus wherever necessary. Pay attention to the following labels and take utmost care.



Safety Items!

- The following types of work should be done by persons with specific knowledge and skill: transportation, installation, wiring, operation, handling, maintenance, and inspection.
- Do not operate this apparatus in an environment containing flammable or explosive gas or vapor. It is very dangerous to do so.
- Do not open the door of the control box while electricity is on. It may cause electric shock.
- Do not move, connect, or check the apparatus while electricity is on. Do such work only after switching off.
- Condensers may still be charged immediately after switching off. Work such as wiring or checking should be started only after voltage is tested after switching off.
- Ground should be securely connected before switching on to prevent electric shock.
- Do not enter under the apparatus while being lifted, otherwise injury by dropping may happen.

- Do not open covers of the apparatus while operating, otherwise you may be caught or get electric shock.
- Do not cut or remove ground connections either inside or outside the apparatus, otherwise the apparatus may be in a dangerous state for the operator.

- At the beginning, installation, restoration, leveling, and electric wiring should be done according to this manual. After that, do the necessary checking before switching on.
- Before switching on, voltage of the source should be checked if it matches the nominal design voltage of the apparatus.
- It is recommended to install an emergency outside current breaker of the electricity supplied to the apparatus. Changing or replacing of breakers either inside or outside the apparatus should be done only after current is shut off.
- When safety parts such as grounding wire or fuse are suspected to be defective, do not operate the apparatus. Check before operation
- Be careful of dropping or falling while transporting the apparatus.
- When lifting the apparatus, check the weight and use lifting devices with sufficient strength. Operate the lifting device in a proper manner.
- Before switching on the apparatus, check if the covers are closed, positioning is correct, and the surrounding is set in a safe state
- Do not handle switches with a wet hand or with gloves put on.
- Do not use oil and grease other than those specified or similar products.
- Keep checking and cleaning the apparatus.

Specification

Outline

The function of this apparatus is automatic specimen preparation and measurement of nodularity of cast iron. An iron specimen is first manually rough polished to remove burrs on the section for examination, and positioned in the apparatus for four-step automatic polishing and image analysis to produce nodularity data according to the new JIS standard.

Features of the apparatus

(1) Precise nodularity measurement by image analysis not affected by human sense.
(2) Quick and safe specimen preparation by automation.
(3) Dry polishing with a built-in dust collector to minimize dust exhaust. Compact machine design completely covered in a chamber for easy and free installation.

Functions and main specifications

Using conditions

(1)	Environment	place of installation in room
		Surrounding temperature 10 to 40 degree C
(2)	Efficiency	apprx. 100 specimens in a day

Specimen

(1)	Shape	cylinder (edge of the section for examination should be rounded)
	Size	20 or 30 mm in diameter
		50±10 mm in length
(2)	Material	cast iron

Measurement

(1)	System	image analysis
(2)	Standard	based on new JIS (G5502-2001)
(3)	Time of measurement	Within five minutes

Apparatus specifications

Specimen handling

(1)	Horizontal move	(X axis)
	drive	robo-sylinder (ball-screw by a pulse motor)
	ball screw size	10 mm in diameter
	moving speed	max. 230 mm/sec
	stroke	600 mm
	motor	pulse motor
(2)	Vertical move (Z axis)	
	Drive	air cylinder with a guide
	Stroke	60mm
	Cylinder size	16 mm in diameter
(3)	chuck	
	type	air driven chuck with three jaws
	jaw stroke	16 mm radially
	chuck jaw	changed depending on specimen size
	chuck force	58N(5.9kg) at air press. 0.4 MPa

Polisher

(1) Type dry wheel polishing

(2) Wheel specifications

	process	wheel name
1st step	rough grind	rough grindstone
2nd step	rough polish	rough polish stone
3rd step	medium polish	medium polish stone
4th step	finish	finishing disk

Wheel size 100mm in diameter

removal one-touch attach-removal using a center cap

(3) Feed speed max. 50 mm/sec

(4) Polish pressure max.80 N (8.1kg, at air press. (0.4 MPa)

(5) Pressuring vertical cylinder press. by chucks

(6) Press. control electro-air regulator

(7) Motor 0.75 kW

(8) Drive system flat gear (m=1)
speed reduction for each step

Cover and safety measures

(1) Cover type complete closing cover
front cover with an upper opening
a vinyl door at right (for specimen)

(2) Maintenance wheel change through the front door
(polish BOX door)
specimen in-and-out through right side door
dust collection through the front control panel door
electricity through the front door

(3) Noise reduction noise sources are contained inside the cover. 85db or less

(4) Safety measure automatic stop of all actions at door opening
(upper door and specimen door)

Analysis

(1) Analysis method image analysis of images taken by CCD camera

(2) Measuring points ten points on one specimen

(3) Moving measure position X-Y position control
X axis (right-left); specimen moved
Y axis (back-forth); camera moved
(by adjusting screw)
2mm for 20mm specimen, 3mm for 30mm specimen
(fixed at shipment to one of the two)

Control

(1)	Control board	fixed in the apparatus
(2)	Control panel display	fixed at the upper part of the board liquid crystal display
(3)	Displayed items	(a) rotation speed of polishing (b) polishing time (c) polishing speed (d) polishing pressure
(4)	Controller	microcomputer

Dust collector

(1)	Location	contained in the apparatus
(2)	Collector type	formed cassette filter
(3)	Capacity	air volume 4.0 ㎥ /min static pressure 125 mmH_2O
(4)	Motor	200W
(5)	Intake size	70mm in diameter
(6)	Duct size	75mm in diameter
(7)	Dust bucket size	2.0L
(8)	Operation	operated simultaneously with the polisher

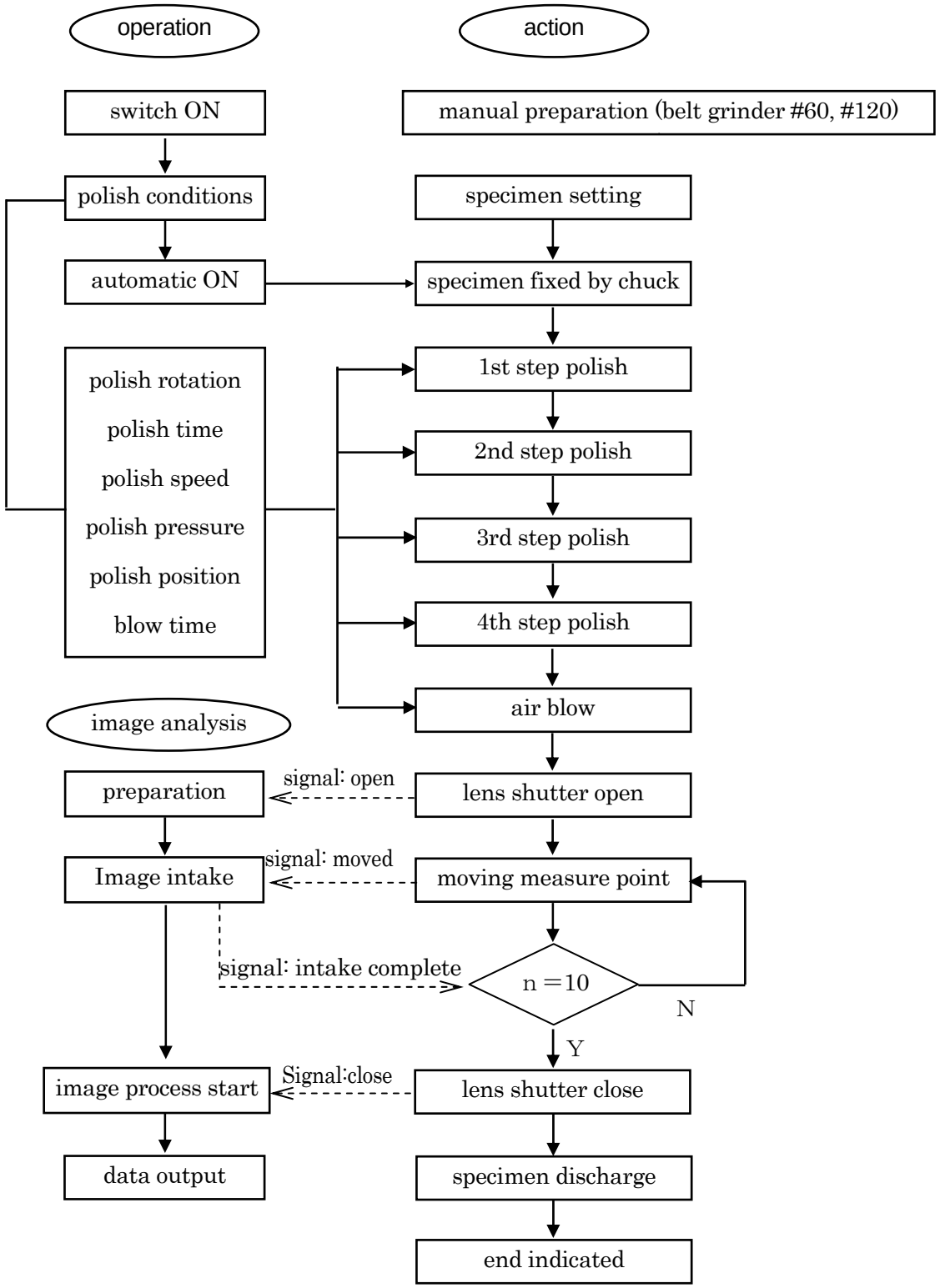
Others

(1)	Apparatus size	900(W)×600(D)×1408(H) in mm
(2)	Apparatus weight	400 kg

Utility and others

(1)	Electricity source	AC 3-phase 200/220V 50/60Hz	
	in apparatus	power part	AC 3-phase 200/220V 50/60Hz AC single-phase 100V 50/60Hz
		control part	AC single-phase 100V 50/60Hz
		magnetic valve	DC24V
		total capacity	6kVA
(2)	Air pressure	0.4 MPa (4kg/cm^2) or higher, dry air	
(3)	Color	5Y7/1	

Action Flow


operation
action
switch ON
manual preparation (belt grinder #60, #120)
polish conditions
specimen setting
automatic ON
specimen fixed by chuck
polish rotation
polish time
polish speed
polish pressure
polish position
blow time
1st step polish
2nd step polish
3rd step polish
4th step polish
air blow
image analysis
preparation
signal: open
lens shutter open
Image intake
signal: moved
moving measure point
signal: intake complete
n =10
N
Y
image process start
Signal:close
lens shutter close
data output
specimen discharge
end indicated

Guarantee

Period of guarantee is one year starting from acceptance of the apparatus. When acceptance is delayed due to some defects in the apparatus, the period starts from the time of start of substantial usage. Any troubles caused by our design or manufacturing occurring during the guarantee period will be quickly repaired or changed at our responsibility. This excludes the following cases:

(1) Troubles caused by misoperations.

(2) Troubles caused by usage different from described in the contract.

(3) Troubles of an apparatus that was altered by the user.

(4) Troubles caused by natural disasters.

C. Installing the apparatus

* When moving the apparatus, use lifting devices with sufficient strength and without defects. Damage during transportation can be highly dangerous. Pay full attention to the position of the center of gravity, because the whole shaper is quite irregular.
* Do not enter under the apparatus while lifting. Do not put your hand under the apparatus. It is very dangerous to do so.
* When connecting to the source power, be sure to shut off the source electricity. Electric shock can be dangerous.

* In test operation, be careful of sudden move of the apparatus. Do not touch or come near moving parts, otherwise you may be caught by the machine.

* Before switching on, recheck wiring and loose screws.
* Even for test operation, covers should be closed before start.
•

Installation

1.Location

(1) The apparatus should be installed on a flat concrete basement.

(2) When such machines as high frequency generators, spark machining, arc welders are in the neighborhood of the apparatus and electric power is supplied from the same board as this apparatus, sometimes, though rarely, erroneous action may occur. This should be avoided.

2.Transportation

When wire rope is used in transportation, pay full attention to the position of the center of gravity, because the apparatus shape is irregular.

3.Checking the apparatus

For the purpose of safe shipment and transportation, some parts may be fixed for security. Free movement without interference of all moving parts should be checked before switching on.

Initial Installation

(1)Line connection

① The control board is at a low position at the right hand side of the apparatus.

② Connect a line of AC 3-phase 200/220V to R,S, and T terminals on the input side of the circuit breaker, which is at the back of the right hand side of the apparatus.

(2)Checking before switching on electricity.

① Checking wiring and piping.

Check if wiring and piping are correctly set.

②Checking the line and voltage.

Although the apparatus is made to match the customer's power source at shipment, you are urged further to confirm if the source voltage matches the machine specification.

③Screw tightening.

Although all the screws are tightened at shipment, they may have been loosened by vibration during transportation. Check them before switching on.

(3)Checking the machine parts.

For the purpose of safe shipment and transportation, some parts may be fixed for security. Free movement without interference of all moving parts should be checked before switching on.

(4)Connection of compressed air.

Compressed air pipe should be connected to the proper place.

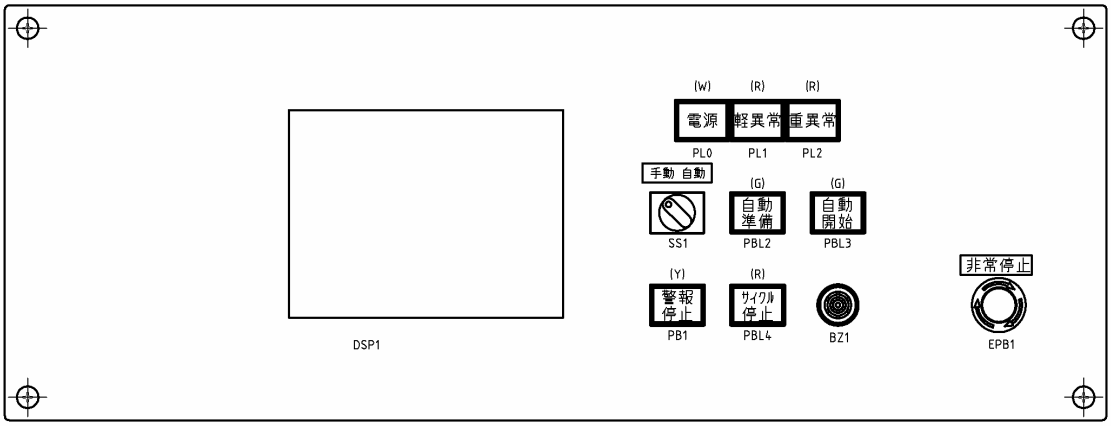
Air should be dry and clean and pressure should be at or above the specification, otherwise power shortage or some troubles may occur.

Refer to the item No.6 of "D Operation" for handling of air combination that controls supplied air.

(5)Checking after switching on.

Switch on and check the rotation direction of the main motor. The proper direction is indicated by a mark.

Control Board



(1) Signal lamp

a. power	Lights while power is on.
b. minor hazard	hazard, but restart not necessary.
c. major hazard	hazard that needs restart.

(2) Select switch

a. manual/auto	selection of operation mode. Manual： for manual operation Auto： for automatic operation

(3) Push buttons

a. emergency stop	Immediate stop of the apparatus.
b. Auto preparation	Automatic preparation starts. The lamp blinks during automatic preparation. The lamp stays on when preparation completes.
c. Auto.operation start	Automatic operation starts as set beforehand. Lamp is on during automatic operation.
d. Buzzer stop	Hazard buzzer stops.
e. Cycle stop	Automatic operation is interrupted.

Steps in Normal Automatic Operation

(1) Turn on the main circuit breaker to light the “power” lamp.
(2) After some initial automatic actions, menu is displayed.
(3) Turn the select switch to “auto”, select the “auto” on the display and then push “auto prep.” button.

When automatic preparation is complete and all parts are in stand by, “auto prep.” light changes from blinking to lighting.
Note: At a restart after a long stop or in a cold weather, the main rotation shaft is slow to accelerate. Warning run is recommended in such a case.
(4) Place a specimen on the specimen stand.
(5) Push “auto start” button. The apparatus performs polishing of 1st step through 4th step, air blowing, and the specimen is transferred for imaging. Ten images are taken in collaboration with the personal computer and then the specimen returns to the specimen stand. The operation steps.

Note: There are three modes of automatic operation. “Auto” performs polishing and imaging. Others are “Polish only” and “No polish (Image only)”.

Specimen Setting

To set a specimen, open the specimen door and place the specimen with its polish surface down in the shallow cavity on the specimen stand. After the end of operation, open the door and take the specimen out. Be careful in touching a specimen, as it may be hot after polishing and cause burn on hand (See photo 1).

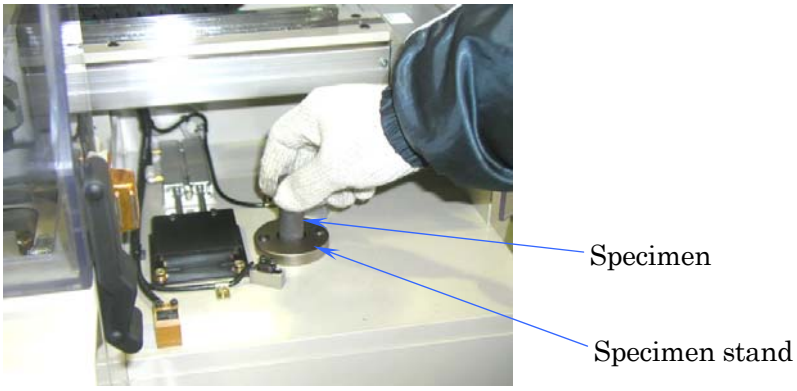


Photo1 Specimen setting

Handling of Air Combination

The apparatus uses air for movement and a set of air combination, consisting of an air filter, a regulator, and a three port valve for air release, is installed (See Fig.1). Its handling is explained below.

(1) Compressed air source

WARNING 警告

1. Use clean air. Compressed air, containing chemicals, organic solvent based oil, corrosive gas, should be avoided, otherwise damage or operation troubles may be caused.
2. If air contains excessive drain water, operation troubles may be caused. Air dryer or after-cooler should be inserted upstream of the air combination.

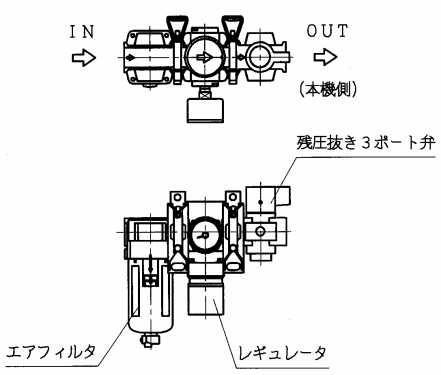


Fig.1. Air Combination

(2) Environment of use

WARNING 警告

Do not use the apparatus in the following environment.

1. since polycarbonate and nylon are used in the apparatus, environments containing synthetic oil, thinner, acetone, alcohol, ethylene chlorides and other organic solutions, sulfuric acid, nitric acid and other chemicals, machining oil, kerosene, gasoline, or screw locking oil should be avoided. Places with a possibility of contamination by such materials should also be avoided.
2. Please with possible vibration or shock should be avoided.
3. Direct sunlight should be avoided by protection covering or other means.
4. Radiation heat from the surrounding, if any, should be prevented by covering.

(3) Regulator pressure (See Fig.2)

WARNING 警告

1. Adjust air pressure by observing pressure meters of both the p
   Do not turn handles exceeding the necessary limits: otherwise damaged.

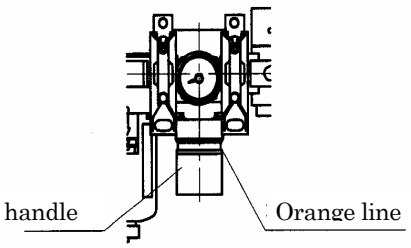


Fig.2

CAUTION 注意

2. Unlock the pressure handle before adjusting pressure and lock the handle after adjustment. If the steps are mistaken, the handle may be damaged or the secondary pressure may not be stable. The handle is unlocked by pulling it, which can be confirmed by the “orange line” at the lower part of the handle. The handle if locked by pushing it back. If not smooth, try to turn the handle slightly and push. Locking is confirmed as the “orange line” disappears.
3. Right turn of the pressure handle, as looked from below, is for raising the secondary pressure, and left turn is for lowering pressure.

4. Confirm the primary pressure. The secondary pressure should be kept below 85% of the primary pressure, otherwise the secondary pressure may become unstable.

(4) Element change of air filter

Before element change, confirm that no pressure is left in the case.

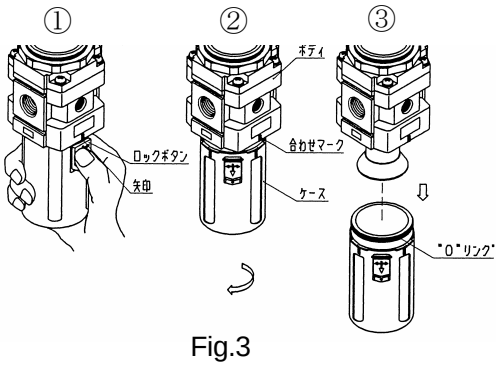


Fig.3

1. Detaching the case (See Fig.3)

a) Lightly grasp the case and pull down the lock button with your thumb.

b) When an arrow appears, push up the case lightly while still keeping down the lock button and turn to left (or right) by 45 degree until the matching mark on the case comes to the mark on the body.

c) Release the lock button and lower the case vertically in slow motion until the case is detached.

2. Detaching the element (See Fig.4).

Push the baffle upwards and turn left by 15 degree to detach the part as shown in the Figure.

Use the specified type of element for change. If other types or other sizes are used, proper performance becomes impossible and damages may be caused.

When attaching and element, match the groove in the valve guide and the extrusion on the baffle, and push the baffle upwards and turn right by 15 degree.

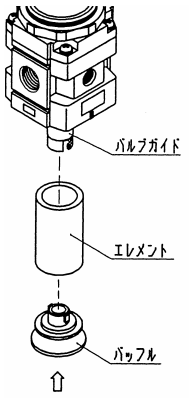


Fig.4

3. Attaching a case (See Fig.5)

a) Confirm that the "O" ring of the case is free from dust.
Match the mark on the case to the mark on the body and push the case (No need for touching the lock button when attaching).

b) Turn the case in the reverse direction as when detaching until the arrow disappears with a clicking sound. Try to turn left, or right to confirm it can not turn. If it can turn, restart from the beginning of attaching process.

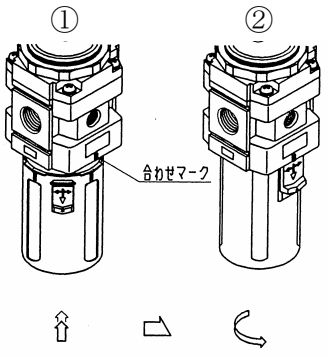


Fig.5

(5) Three port valve for pressure exhaust

Before maintenance checking, be sure to use this valve to shut off air supply and to exhaust remaining compressed air.

1. ”Supply position”(See Fig.6)
   When the pipe and the lever are in parallel as in Fig.6, letter “SUP.” can be seen from the window below the lever. In this lever position, air is supplied from the primary side to the apparatus.
   By turning the lever 90 degree clockwise, the position becomes “Exhaust”.
2. ”Exhaust” position (See Fig.7).
   When the pipe and the lever are at right angle as in Fig.7, letter”EXH.” can be seen in the window below the lever. In this lever position, the primary air supply is shut off and the remaining compressed air in the apparatus is exhausted.
   By turning the lever 90 degree counterclockwise, the position becomes “Supply”.

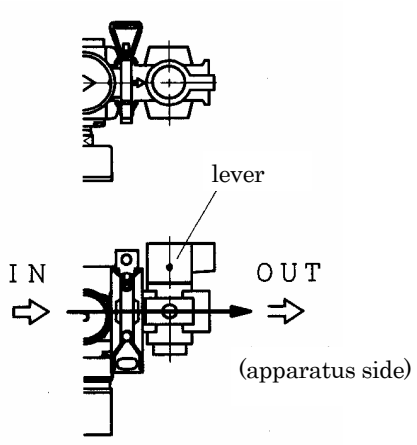


Fig.6

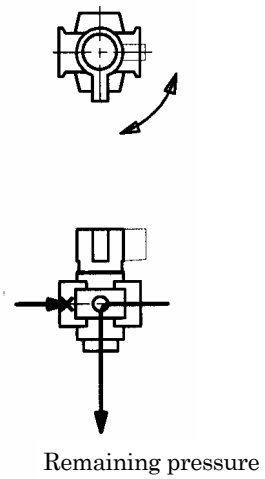


Fig.7

E. Maintenance and checking

Notes for caution

1. In maintenance during running, never touch rotation parts such as shafts and moving parts, otherwise you may be caught and injury may happen.
2. Maintenance and checking of moving parts such as polishing stone should be performed after the apparatus is stopped.
3. When checking after stop, confirm that the apparatus is in complete stop and electricity is shut off and air pressure supply is stopped.
4. Checking of control board should be done after shutting off electricity to prevent electrifying.
5. Polishing stones may still be rotating sometime after the emergency stop button is pressed. Do checking after confirming complete stop.

1. After the end of checking, be sure to replace safety covers before restarting, otherwise you may be caught or injury may happen.
2. When an abnormal hazard occurs, never restart the apparatus until the cause of the hazard has been found and countermeasures have been taken.

1. Some parts of the apparatus such as motor surface can be heated to high temperature during running and may still be hot even after stop running. Be careful of burning at checking.
2. In the beginning of a maintenance and checking, first clean the apparatus, otherwise dust on and in the apparatus may be transferred into the apparatus causing troubles.
3. Repair, overhaul, and assembling should be done by specialists, otherwise electrifying, injury, or fire may happen.

Items of Regular Maintenance Checking

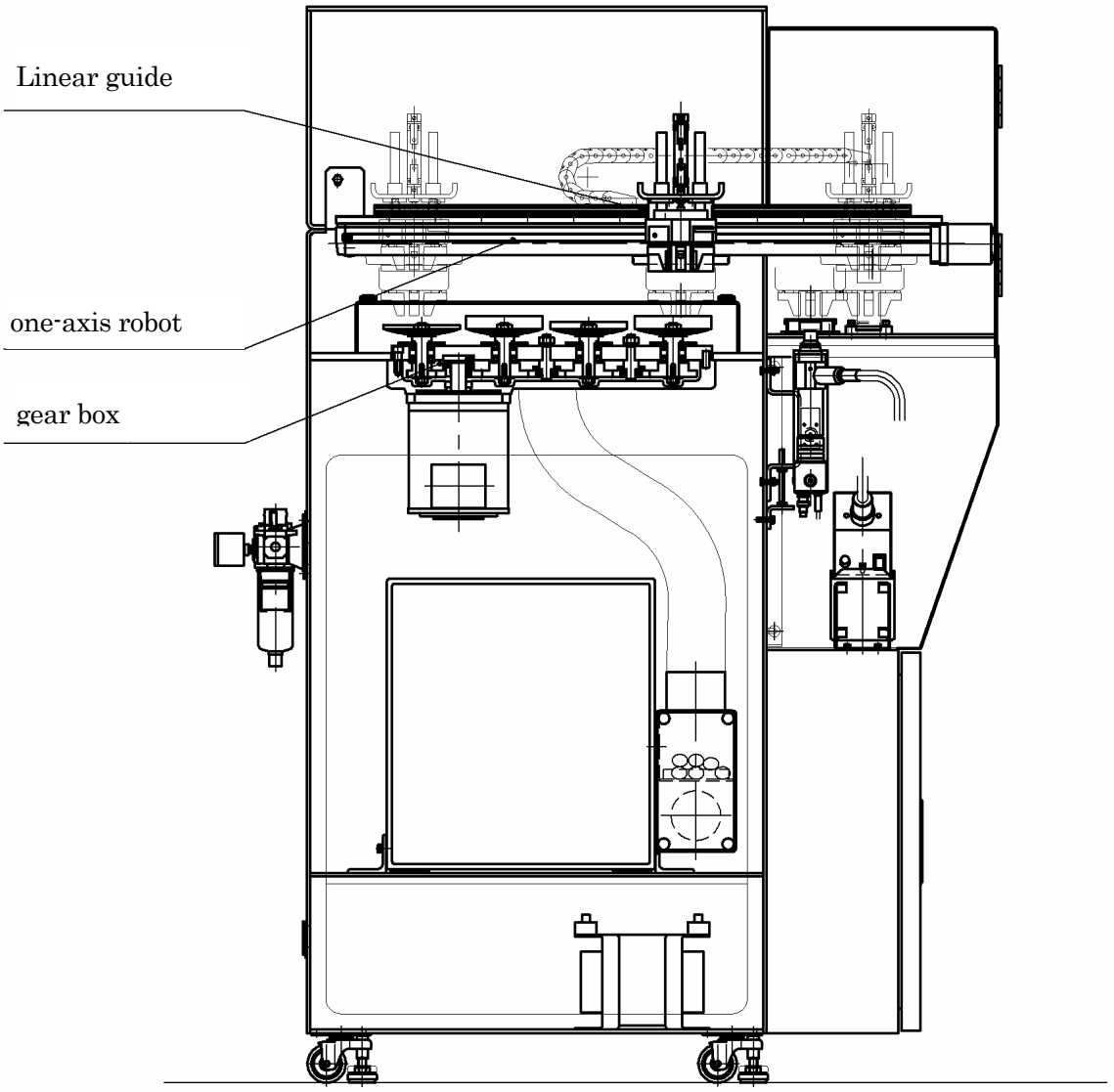
period	checking items	contents	actions
daily	air pressure	lowered pressure	check the source
		air piping leak	fix pipes
		air cleaner sludge pile up	clean the drain
	machine inside	polish dust pile up	clean dust
	blank running	abnormal noise	repair
		polisher motor noise	change bearing
	polishing	chipping, crack, breaking	change wheel
	wheel	deformation, breaking	change cap
	center cap	leak from main shaft	repair
	grease leak		
weekly	chucking jaw	wear of jaw	change jaw
	sliding parts	wear or play	change part

* When opening the upper cover for maintenance, push it open to the end. If it is left at an intermediate position without reaching the end, it may close unexpectedly, because the stopper can not function at such a position.
* Excess pile up of dust in the polisher cover may lower dust collecting efficiency and may lead to stain or wear of parts. Daily cleaning is recommended.
* As to maintenance of the main motor and robot, refer to the manual of respective machine.

Standard Practice of Oil and Grease

	place	no.	period	recomm.brand	quantity	method
grease	1. linear guide	1	yearly	Albania No.1,2 (Showa Shell)	appro-priate	manual grease pump
	2. robot slider ball screw	1		Albania No.2 (Showa Shell)		see robot manual
	3. gear box	1		Molyb-denum grease		remove old grease fill new one

* Use the recommended brands of grease.
* Remove dirt at and around grease feed holes before greasing.
* Wipe off excess grease after greasing.



Changing and Use of Wheel Stones

(1) Pay full attention to safety and put on all the required protective wear.
(2) Wheel change should be done by persons designated through skill test.
(3) Before wheel change, be sure to push emergency switch, confirm full stop, and shut off the power source.
(4) Before attaching a new wheel, make sure it has no flaw like cracking.
(5) Clean the attaching surface to assure nothing is caught between the wheel and the center cap.
(6) After attaching a new wheel, blank running of at least three minutes is recommended.
(7) Before everyday use, blank running of at least one minute is recommended.

Storing of Wheel Stones

(1) Give full consideration against high humidity and sudden temperature change during storing.
(2) Avoid shocks such as dropping or collision.
(3) Wheels should not be piled. No heavy things should be placed on wheels.

Method of Changing Wheel Stones

Four steps of polishing are automatically performed in this apparatus. A Wheel stone of each step, when worn, should be changed following the procedure described below. The center cap system is adopted in this apparatus that enables one-touch change.

(1) Confirm that rotation of the shaft has been stopped.
* Although this apparatus is equipped with interlocking that prohibits rotation when the cover of the polishers is open, pushing of the emergency button and breaking of the main power are required before wheel change.
(2) Loosen the left and right soft latches that lock the upper cover, and push open the cover to its extreme. Leaving it at an intermediate position is dangerous, because it could close unexpectedly.
(3) Loosen the left and right snap locks that fix the polisher cover, and open the polisher cover towards you.
(4) while holding the nut for the wheel with a cap wrench, rotate the wheel counterclockwise with your hand until it stops. When stopped, the wheel can be lifted up and removed from the center cap. If the nut is found loose at this point, tighten it by referring to the next item.
(5) Before attaching a new wheel, clean the attaching face of the center cap and the surroundings. If the center cap is found to have damage or deformation, change it by referring to the next item. Some kinds of wheels such as urethane wheel may have wavy face by some fluctuation in the manufacturing process. If the polishing face is wavy, polishing may not be properly performed because of poor contact with the specimen. Therefore, wavy wheels should be made flat before attaching to the apparatus by rubbing it on a sandpaper of, for instance, #180 size placed on a flat steel block.

(6) Insert a new stone, watching the jaw direction so that the stone fits the attaching face of the center cap. Rotate the stone clockwise until stopped by the stopper, while holding the nut with a cap wrench.

(7) Close the polisher cover and upper cover, and test rotate the polisher shaft with your hand.

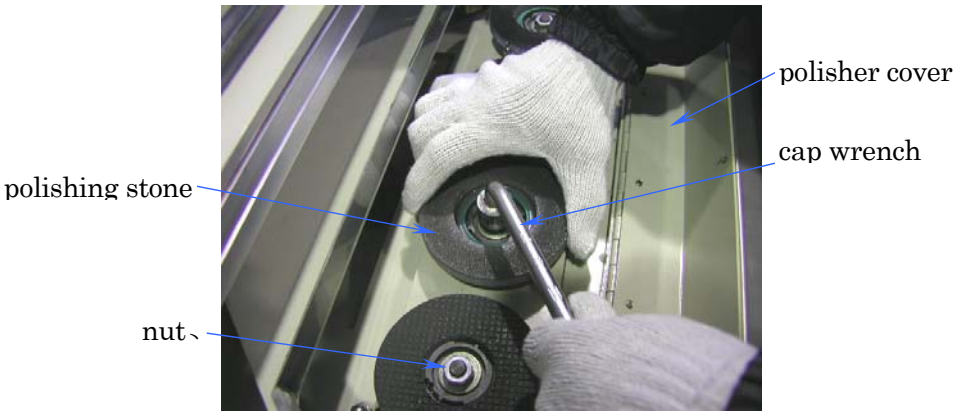


Photo2. Changing a wheel stone

Changing Center Cap

Normal stone change can be done just by removing the stone from the center cap. If the center cap is damaged or deformed, however, the center cap should be changed as described below before changing the stone. If a damaged center cap is left unchanged, there is a danger of stone coming off while polishing. Damaged center cap should be changed as early as possible.

(1) As explained in item 6. polishing stone change, confirm that the shaft has stopped, and then open the upper cover and polisher cover.

(2) Hold the shaft by applying a flat wrench to a fitting below the center cap and then loosen the nut that fastens the center cap using a cap wrench. The screw is clockwise to fasten.

(3) After removing the nut and washer, the center cap can be removed. Then clean the shaft and the surroundings.

(4) Attach a new center cap in reverse steps as when removing. Fasten the nut using a flat wrench and a cap wrench.

(5) Attach a polishing stone as explained earlier, and check by test running.

Photo3. Changing a center cap

Changing Chucking Jaws and Specimen Stand

Change chucking jaws or specimen stand in the following steps, when chucking jaws are worn or when specimen diameter is to be changed.

Before, changing, move the chuck position, if necessary. Push the emergency button before changing. Jaw change is done with air being supplied, and hence, utmost care is needed not to be caught.

Changing chucking jaws

Two types of jaws are prepared for two specimen sizes, respectively: 20mm and 30mm in diameter. Select the one matching your specimen size.

(1) Move the chuck by hand to the position of the specimen stand, and push the emergency button. Push the alarm stop button to stop alarm sound.

(2) Loosen two screws (M4 cap screw)that fasten the chuck jaw and remove the jaw. Do the same with three jaws. Beware that, as jaws are set downward, they tend to fall when loosening screws.

(3) Attach a new jaw by fitting the male part of the jaw to the female part on the chuck and fastening by screws. All the three chucks should be changed together.

(4) After changing jaws, test by hand if a specimen is held properly without being inclined or off-center.

(5) When jaw size was changed, confirm that the closing sensor functions properly when the chuck is closed. The closing sensor is found at the right of the chuck when looked from the front.

If the sensor does not react or reaction is not stable, adjust the position of the sensor.

The specimen stand must also be changed to match the specimen size referring to the following item.

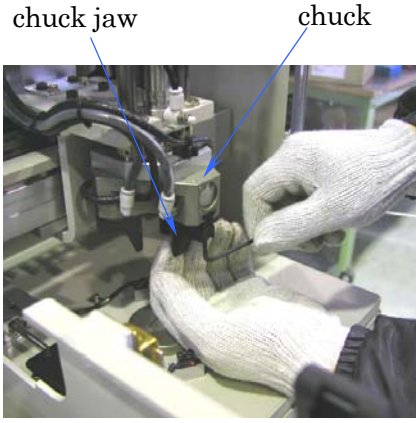


Photo4. Changing chuck jaws

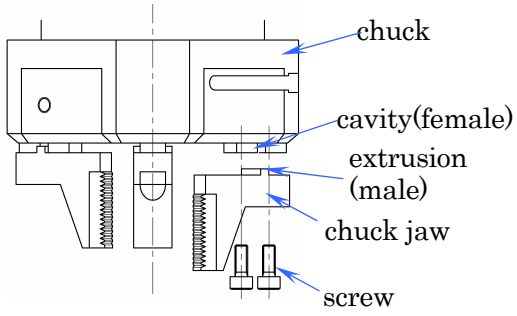


Fig.8

Changing Specimen Stand

When specimen size is to be changed, change the chuck jaws as explained above, and at the same time, change the specimen stand to match the new specimen size.

(1) Push the emergency button. Stop alarm sound by pushing the alarm stop button. Position of the chuck does not matter as long as it does not interfere with your work.
(2) Loosen two screws fastening the stand and remove the stand.
(3) Attach a new stand matching the specimen size, and fasten with screws.
(4) Place a specimen by hand and check if it sits roughly at the center of the cavity on the stand. If it is off the center, loosen screws and adjust the stand position. If centering can not be achieved by such adjustment, change the setting of stand position by referring to Chapter D item 5-7 of management menu on centering of camera and others.

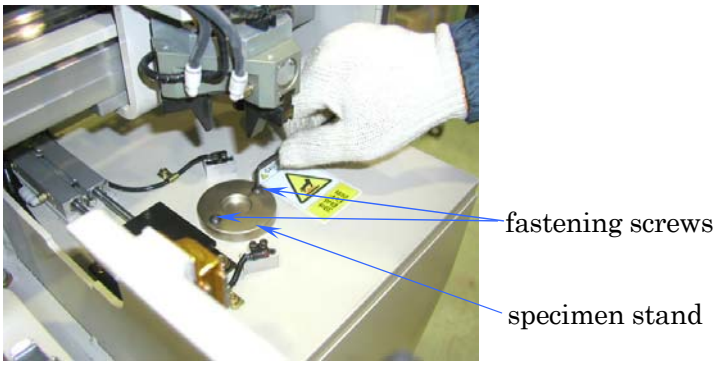


Photo 5. Changing specimen stand

Adjustment of camera

Adjustment of Y-axis stroke and focus of CCD camera for image analysis will be explained below.
As the adjustment is done with electricity and air pressure being supplied, utmost care is required not to be caught by machine.

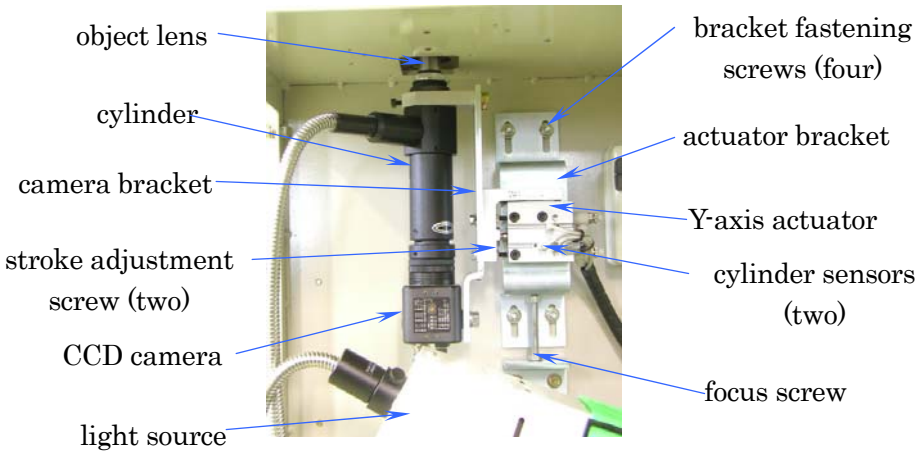


Photo 6. Inside camera chamber

Y-axis stroke adjustment

Y-axis stroke is adjusted on shipment to 2mm for specimen size 20 mm dia. and 3mm for 30mm dia., respectively. When fine adjustment is needed, or when stroke is to be changed, follow the steps explained below.

(1) Loosen four screws and remove the camera chamber cover. Be careful not to drop the cover when all the screws are loosened.

(2) Y-axis stroke is adjusted with the two screws that fasten the cylinder and CCD camera bracket to the Y-axis actuator (air cylinder). Loosen the nut that fasten the screws, and adjust the stroke by turning the adjusting screw with a hexagon wrench. Adjustment is possible only to the back direction of the cylinder and the range of adjustment is 5 mm maximum.

(3) After adjusting the Y-axis stroke, check if the sensor on the cylinder functions properly in both in and out directions. In cases where the both lamps light at the same time, or both do not light, adjust the sensor position. In particular, when the stroke is made less than 2 mm, the both sensors may possibly light at the same time. In such a case, widen the stroke until the two sensors light separately.

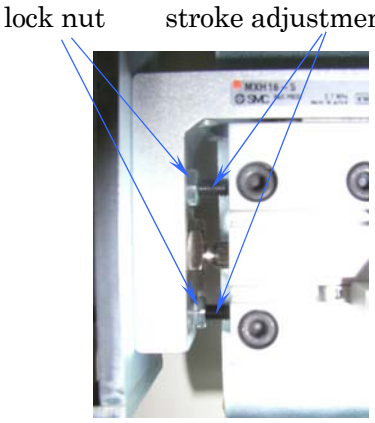


Photo7. Stroke adjustment parts

(4) After completing adjustment of stroke and sensors, adjust the camera focus as explained below.

9-2 Focus adjustment

If image is out of focus after stroke adjustment or object lens change, adjust focus as explained below.

(1) Remove the camera chamber cover as in stroke adjustment.

(2) Set the monitor screen to “manual-specimen in and out” and “manual-imaging”, and hold a specimen with the chuck and move to the front of one of the five positions for imaging st that an image can be seen on the monitor.

(3) The focus adjusting screw is located on the under-side of the bracket for the Y-axis actuator. Loosen the screws that fasten the bracket and adjust the focus by using the adjusting screw until the image on the screen is properly focused.

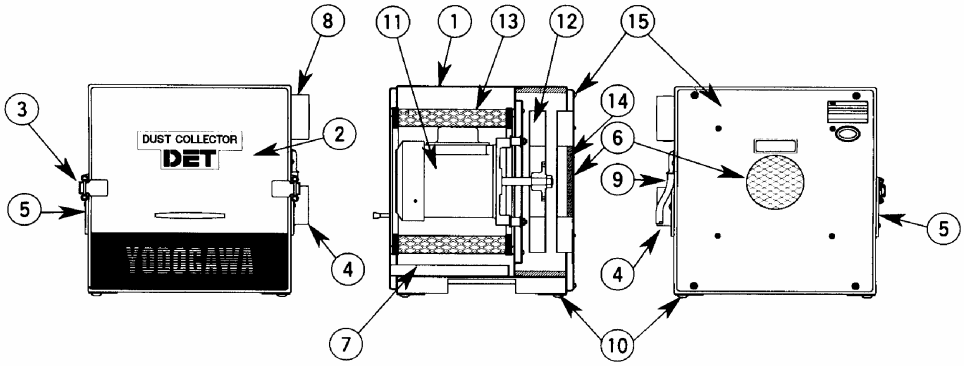
(4) Try to move the specimen backward. Image should still be focused. But if the image is found very much out of focus, it suggests that the camera has moved along a wrong line, because the Y-axis actuator has not been set properly. Then move the specimen back to forward, and do focus adjustment after adjusting the Y-axis actuator.

(5) After confirming the focus in the back position, do fine focusing by using the adjusting screw that was used in the stroke adjustment.

(6) Do fine focusing in the back position, and again do fine focus adjustment in the front position. Focusing is complete if image is properly focused in both the front and back positions with the locking nut and bracket screws fastened tightly. Return the camera chamber cover to the original position.

Handling of dust collector

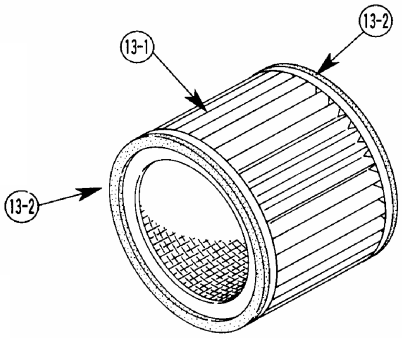
Polishing dust is collected by the dust collector installed behind the door below the control board. Its handling is explained below.



No.	part name	No.	part name
1	casing	9	power code
2	front door	10	feet
3	snap lock	11	motor
4	intake hole	12	fan
5	blind cover	13	cassette filter
6	exhaust hole	14	back filter
7	dust bucket	15	back door
8	operation switch		

Filter unit part name

part No.	Part name	necessary No.
13-1	cassette filter	1
13-2	Filter packing	2



CAUTION 注意

Before use:

Check the following items before use.

(1) Confirm that fire-extinguishing stone is contained in a BOX attached at the intake hole<4>. If there is no stone, spark may stick to the cassette filter, which can catch fire.

(2) Confirm that the front door is completely closed. If left open or not completely closed, aspiration force may be reduced and trouble may occur in the fan motor.

(3) Confirm that the operation switch is on.

Photo 8. Duct collector

Conditions of dust

The following should not be allowed into the dust collector.
(1) Sticky or corrosive materials.
(2) Flammable things like cigarette buts or matchstick.
(3) Flammable materials like gasoline, thinner, benzene, or kerosene.
(4) Powders of potential powder explosion such as aluminum, magnesium, titanium, or epoxy.

Checking the fire extinguishing stone BOX and dust collector.

Always open and check the above tow after use. Flammable dust such as fibrous dust should be removed to prevent possible fire.
To check the dust collector, loosen the left and right snap locks and open the front cover. To check the fire extinguishing stone BOX, remove the four screws on the front of the BOX and remove the cover and packing.

Photo 9. Checking dust collector

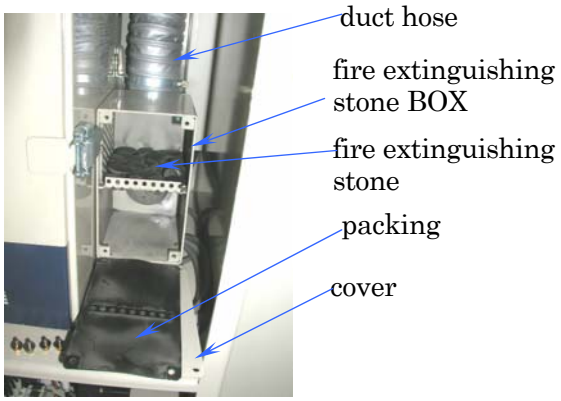
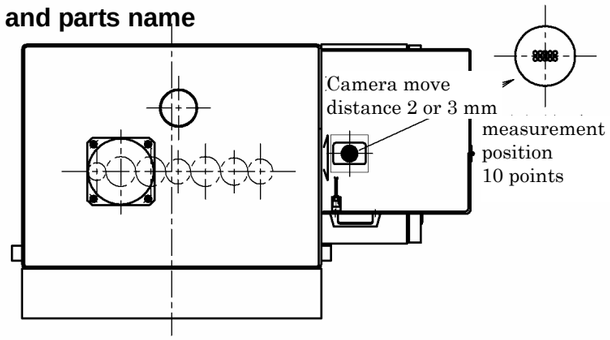
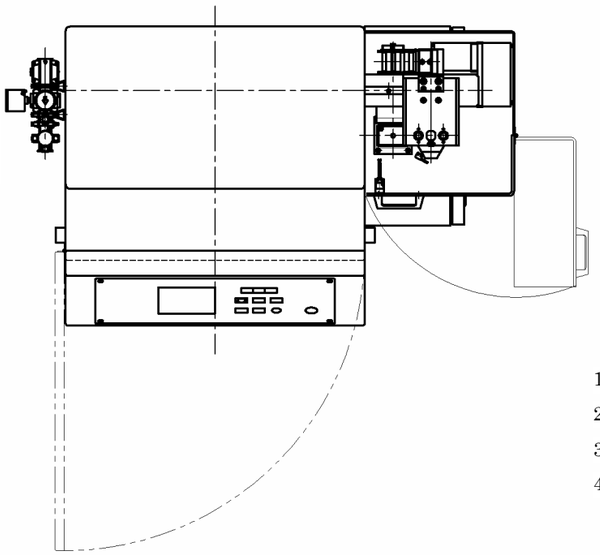


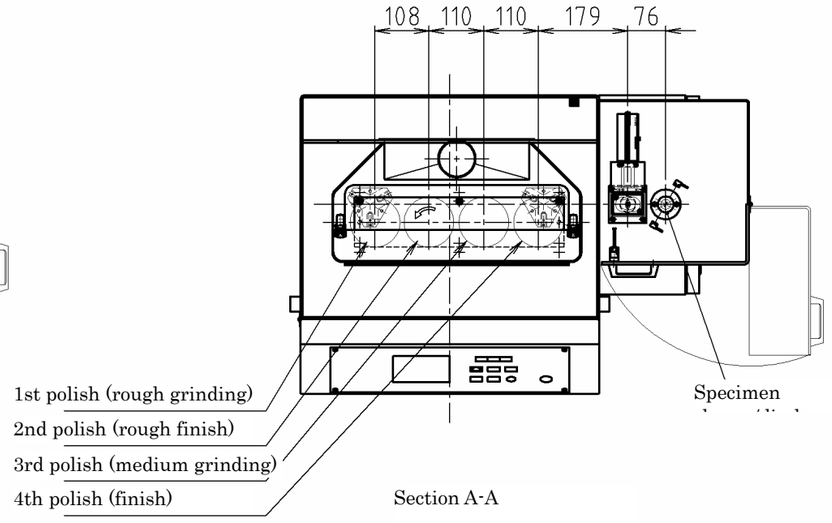
Photo 10.
Checking fire extinguishing stone Box

Constitution and parts name



Section B-B





Section A-A