Micromotor for Laboratory Work

NSK

ULTIMATE 500

1,000~50,000 min^{-1}(rpm)

OPERATION MANUAL

OM-E0047E 001

⚠ IMPORTANT INSTRUCTIONS AND WARNING-Electric Devices

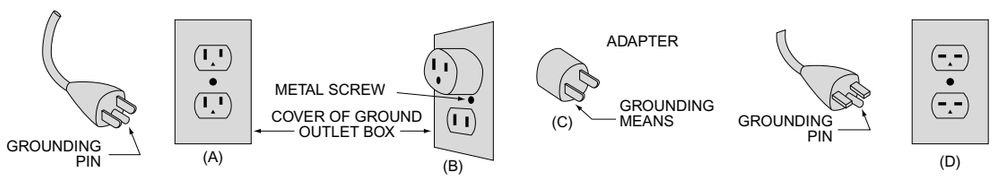
WARNING!

When using electric tools, basic safety precautions should always be followed to reduce the risk of fire, electrical shock and personal injury, including the following.
Read all these instructions before operating this product and save these instructions.

A. GROUNDING INSTRUCTIONS

1. In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This tool is equipped with an electric cord having an equipment-grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.
2. Do not modify the plug provided - if it will not fit the outlet, have the proper outlet installed by a qualified electrician.
3. Improper connection of the equipment-grounding conductor can result in a risk of electric shock. The conductor with insulation having an outer surface that is green with or without yellow stripes is the equipment-grounding conductor. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal.
4. Check with a qualified electrician or service personnel if the grounding instructions are not completely understood, or if in doubt as to whether the tool is properly grounded.
5. Use only 3-wire extension cords that have 3-prong grounding plugs and 3-pole receptacles that accept the tool's plug.
6. Repair or replace damaged or worn cord immediately.
7. This tool is intended for use on a circuit that has an outlet that looks like the one illustrated in Sketch A in Figure (below) (120V). The tool has a grounding plug that looks like the plug illustrated in Sketch A in Figure (below). A temporary adapter, which looks like the adapter illustrated in Sketches B and C, may be used to connect this plug to a 2-pole receptacle as shown in Sketch B if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician. The green-colored rigid ear, lug, and the like, extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box.

Grounding Method



8. USE PROPER EXTENSION CORD. Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table (below) shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gauge. The smaller the gauge number, the heavier the cord.

Minimum gauge for cord

Ampere Rating		Volts	Total length of cord			
		120V	7.5m (25ft.)	15m (50ft.)	30m (100ft.)	45m (150ft.)
		240V	15m (50ft.)	30m (100ft.)	60m (200ft.)	90m (300ft.)
More Than	Not More Than	Cord Number				
0	6		#18	#16	#16	#14
6	10		#18	#16	#14	#12
10	12		#16	#16	#14	#12
12	16		#14	#12	Not Recommended	

B. OTHER WARNING INSTRUCTIONS

1. For your own safety read instruction manual before operating tool.
2. Wear eye protection.
3. Replace cracked wheel immediately.
4. Always use guards and eye shields.
5. Do not overtighten wheel nut.
6. Use only flanges furnished with the grinder.
7. REMOVE ADJUSTING KEYS AND WRENCHES. From habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
8. KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.
9. DON'T USE IN DANGEROUS ENVIRONMENT. Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted.
10. Risk of injury due accidental starting. Do not use in an area where children may be present.
11. DON'T FORCE TOOL. It will do the job better and safer at the rate for which it was designed.
12. USE RIGHT TOOL. Don't force tool or attachment to do a job for which it was not designed.
13. WEAR PROPER APPAREL. Do not wear loose clothing, gloves, neckties, rings, bracelets, or other jewelry that might get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.
14. ALWAYS USE SAFETY GLASSES. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses. Also use face or dust mask if cutting operation is dusty.
15. SECURE WORK. Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate tool.
16. MAINTAIN TOOLS WITH CARE. Keep tools sharp and clean for best performance and to reduce the risk of injury to persons. Follow instructions for lubricating and changing accessories.
17. DISCONNECT TOOLS before servicing; when changing accessories, such as blades, bits, cutters, and like.
18. REDUCE THE RISK OF UNINTENTIONAL STARTING. Make sure switch is in off position before plugging in.
19. USE RECOMMENDED ACCESSORIES. Consult the owner's manual for recommended accessories. The use of improper accessories may cause risk of injury to persons.
20. NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF. Don't leave tool until it comes to a complete stop.
21. For recommended operating speed for various applications, please follow the instructions of bur manufacturers.
22. Use Accessories suitable for Max. 50,000min^{-1} (rpm).
23. The system functions normally in the environment where the temperature is at 0-40˚C, humidity at 10-85% RH, atmospheric pressure at 500-1060hPa, and no moisture condensation in the Unit. Use at outside of these limits may cause malfunction.
24. Store the system in the place where the temperature is at -10-60˚C, humidity at 10-85% RH, atmospheric pressure at 500-1060hPa, and the system is not subject to air with dust, sulfur, or salinity.

C. Important Instructions and Warning on ULTIMATE 500.

1. No lubrication is required to either motor or handpiece because ball bearings impregnated with grease in both motor and handpiece.
2. Activation of Circuit Breaker means too much load is applied to the motor beyond the capacity the motor takes. This circuit breaker is designed to protect the motor, but it is desired to perform the grinding work without activating the circuit breaker.
3. Never move Chuck Control Ring to the direction of LOOSEN while motor is running.
4. Care should be taken not to drop micromotor handpiece on floor or hard work surface in order to avoid damage caused by impact shock.

◆ Component Names

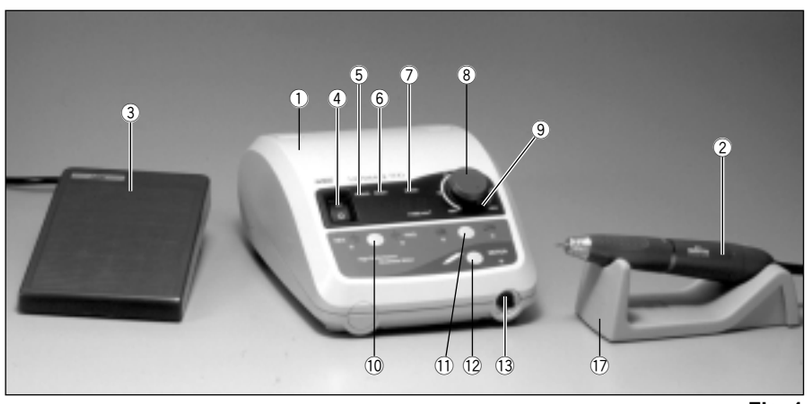


Fig. 1

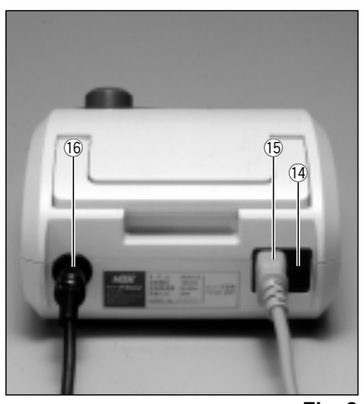


Fig. 2

① Control Unit
② Motor Handpiece
③ Foot Pedal (FC-40)
④ Power Switch
⑤ Power Lamp
⑥ Reset Lamp
⑦ Speed Display
⑧ Speed Control Knob
⑨ Speed Limit Release Button
⑩ Forward/Reverse Selector Switch
⑪ Hand/Foot Selector Switch
⑫ Motor Switch
⑬ Motor Connector
⑭ Inlet Box
⑮ Power Code
⑯ Foot Pedal Connector
⑰ Handpiece Stand

⚠ CAUTION

- **The lamp which lights at the upper right of the unit is to consume the power remaining in the condenser on the circuit board. It continues to be lit for about 5 minutes after the power is turned off, but this is not a failure. This lamp is also to call attention to electric shocks during repair, service, etc., which do not affect ordinary use. (Translucent blue type)**
- **If you touch the circuit board while this lamp is lit during repair or service, you may get an electric shock.**

◆ Set up of Control Unit

1. Mounting of Motor Handpiece

Insert the motor cord plug locator into Motor Connector ⑬ aligning it with the groove of the connector, and tighten the motor cord plug nut to fix. (Fig. 3)

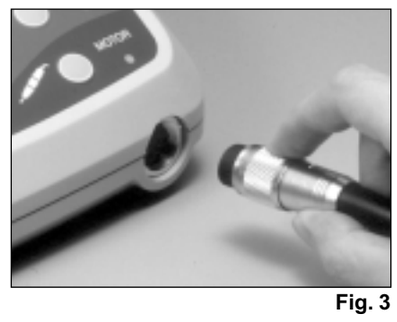


Fig. 3

2. Mounting of Foot Pedal

Insert the foot pedal cord plug locator into Foot Pedal Connector ⑯ aligning it with the groove of the connector. (Fig. 4)

* Connection of the foot pedal is not required if the unit is used by hand operation only.

Fig. 4

3. Connecting of Power Cord

Securely insert the plug of Power Cord ⑮ into Inlet Box ⑭ at the back of the unit aligning it with the configuration. (Fig. 5)

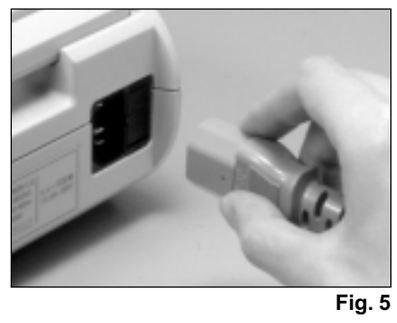


Fig. 5

◆ Operation Procedure

❶ Connect Power Cord ⑮ to a wall outlet.
❷ Make sure that Speed Control Knob ⑧ is at the lowest speed position.
❸ Turn Power Switch ④ ON (Green Power Lamp ⑤ will light).
❹ Select the rotation direction with Forward/Reverse Selector Switch ⑩. Each time this switch is pressed, the direction changes between FORWARD and REVERSE.
❺ Select the control method with Hand/Foot Selector Switch ⑪. Each time this switch is pressed, the method changes between the HAND and FOOT.

Operation – 1

Manual Operation

❻ Select HAND with Hand/Foot Selector Switch ⑪.
❼ Preset the rotation speed with Speed Control Knob ⑧ with checking the speed on the Speed Display ⑦.
❽ Press Motor Switch ⑫, and the motor will run.
❾ To stop the motor, press Motor Switch ⑫ again.

Operation – 2

Operation by Foot Pedal

❻ Select FOOT with Hand/Foot Selector Switch ⑪.
❼ Preset the maximum rotation speed with Speed Control Knob ⑧ with checking the speed on the Speed Display ⑦.
❽ Depress Foot Pedal ③, and the motor will run. The rotation speed can be variably controlled within the preset maximum rotation speed range according to the amount of depressing Foot Pedal ③.

※ **Auto speed mechanism**

To Fix the speed within the rotation speed range set by the volume, press Motor Switch ⑫ while the motor is running at the desired speed. The display lamp will flash and the rotation speed can be maintained even if Foot Pedal ③ is released. To cancel it, press Motor Switch ⑫ again or depress Foot Pedal ③ again.

◆ Speed Limit

For use of a small-diameter round bur or fisher bur at 40,000 min^{-1}(rpm) or more, pressing Speed Limit Release Button ⑨ and turning Speed Control Knob ⑧ allows setting of up to 50,000 min^{-1}(rpm).

⚠ CAUTION

Use of 40,000 min^{-1}(rpm) or more is allowable only when the bur manufacturer specifies the bur's acceptable rotation speed to be 40,000 min^{-1}(rpm) or more.

◆ Protective Circuit for Motor

When the motor is operated with a load exceeding the limit or the handpiece is in an unrotational condition, the circuit to protect the motor and unit works to stop the power supply to the motor, whereby red Reset Lamp ⑥ lights and an error code appears on Speed Display ⑦.

How to reset the protective circuit

During manual operation, it can be reset by pressing Motor Switch ⑫ again. During operation by foot pedal, depress Foot Pedal ③ back to stop, and the protective circuit will be reset.

◆ Memory Function

When the Power Switch ④ is turned on, the rotation direction and HAND/FOOT selections made when the main switch was last turned off are restored. Special attention should be given to the rotation direction.

◆ Error Code

When the motor is stopped due to some trouble such as a failure, overload, wire breakage or misuse, Speed Display ⑦ displays the error code for checking the status of the unit and understanding the cause of the trouble easily.

Error cord	Description	Cause
E 0	Self-check error	Abnormal internal memory Broken internal memory
E 1	Overcurrent detection error	Long-time use at a high load (overcurrent) Shorted cord (power line) Shorted motor winding
E 2	Overvoltage detection error	Severed cord (power line)
E 3	Motor sensor error	Faulty sensor (Hall IC) in the motor Disconnected motor cord Severed cord (signal line)
E 4	Unit overheat error	Temperature rise in the unit due to long-time use at a high load Unit placed under high temperature
E 5	Brake circuit error	Abnormal voltage generated in start / stop circuit Faulty start / stop circuit
E 6	Rotor lock error	Open chuck Faulty handpiece Faulty motor

For countermeasures against error displays, see the section on troubleshooting.

◆ Replacement of Fuse

Fuse is located in Inlet Box ⑭. Release ratchet clamp located on the top and bottom of the Inlet Box and pull it out to change the fuse (T3.15AL / 250V for 120V, T1.6AL / 250V for 230V). (Fig. 6)

✻ Fuse (for 120V): Order No. U195-152
Fuse (for 230V): Order No. U197-152

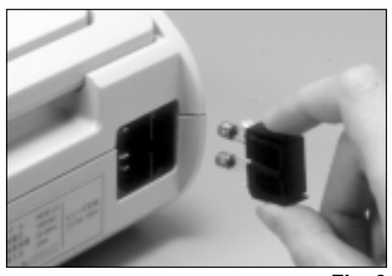


Fig. 6

⚠ CAUTION

Fuse is burned out when a short circuit occurs or when over-voltage is flowed into the primary current source. If the cause is uncertain, return the product to an authorized NSK's service shop for inspection.

◆ Maintenance Mode

The unit is provided with a maintenance mode to check the function of the switches, display, foot pedal, motor, etc. While pressing Hand/Foot Selector Switch ⑪ and Motor Switch ⑫ at the same time, turn on the Power Switch and keep pressing the button until beeps are made (for about 2 seconds). At this time, turning the volume from the minimum position in order displays "oP", "dP", "HL", "Pd" and "in", allowing the following checks. To release Maintenance Mode, turn Power Switch off and switch on again.

(1) [oP] : Switch check (operation check)

Press the switches on the panel, and the right and/or left lamps will light to check to see if the switches operate normally.

(2) [dP] : Display check

Press Forward/Reverse Selector Switch ⑩, and the lamps will light one by one to check to see if they operate normally. To cancel this check, press Forward/Reverse Selector Switch ⑩ again.

(3) [HL] : Motor signal check (Hall IC check)

Press Forward/Reverse Selector Switch ⑩, and Speed Display ⑦ will indicate one or two horizontal lines. Turn the motor slowly by hand, and this display will change to one line, two lines, one line, two lines, ... smoothly from the top to bottom or from the bottom to top. If any one of the three lines does not light, the sensor (Hall IC) in the motor is faulty or the cord is severed, therefore repair is needed. To cancel this check, press Forward/Reverse Selector Switch ⑩ again.

(4) [Pd] : Foot pedal check

Press Forward/Reverse Selector Switch ⑩, and Speed Display ⑦ will change. During normal time, Speed Display ⑦ changes in hexadecimals (0~9, A~F) according to the amount of depressing Foot Pedal ③ . Also, depressing the pedal slightly lights Reset Lamp ⑥, and depressing it fully extinguishes the lamp. If Speed Display ⑦ does not change smoothly or Reset Lamp ⑥ does not light properly, Foot Pedal ③ may be faulty. To cancel this check, press Forward/Reverse Selector Switch ⑩ again.

(5) [in] : Initializing function

Press Forward/Reverse Selector Switch ⑩, and beeps will be made and rotation direction, HAND/FOOT and other settings will return to the factory set condition.

Rotation direction : FWD (forward)
HAND/FOOT : HAND
Vacuum-coupled mode : OFF

◆ Vacuum-coupled Mode

On some dental tables with vacuum dust collector, the motor may be used while being coupled with a dust collector. When such a dust collector * is used, power consumption of ULTIMATE 500 can be regulated so that the vacuum-coupled function can work. If you need coupling with a vacuum dust collector, select the mode as follows :

How to select the mode

While pressing Forward/Reverse Selector Switch ⑩, turn on Power Switch ④, and the mode can be selected.
A long beep indicates vacuum-coupled mode and 2 short beeps indicate non-coupled (energy-saving) mode.
Each time the switch selection is made, the mode changes between vacuum-coupled mode and non-coupled mode.

※ A currently known dust collector is KAVO EWL-560.

◆ Handling of Motor and Handpiece

1. Insertion or Removal of Bur

The chuck is opened by turning the Bur Lock Ring to an open position. The chuck is loosened and the bur can be removed. By turning the ring in the LOCK direction, the chuck is closed and the bur can be mounted. At this time, turn the ring until it clicks. (Fig. 7)

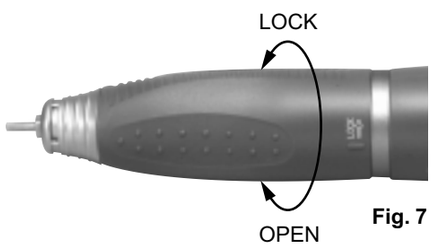


Fig. 7

2 . Cleaning and Replacement of Chuck

(1) Removal of Chuck

To remove the chuck, open the ring and turn the chuck counterclockwise with the provided spanner wrench. (Fig. 8)

※ If a bur having a large diameter of a cutting part is used under a high torque, the chuck may rotate in the close direction and the bur may be stuck and cannot be removed. In this case, align the nose's slit and spindle's spanner position (flat part), and apply an L spanner to fix the spindle. Open the ring and turn the chuck counterclockwise with the provided spanner wrench to remove it. (Fig. 9)

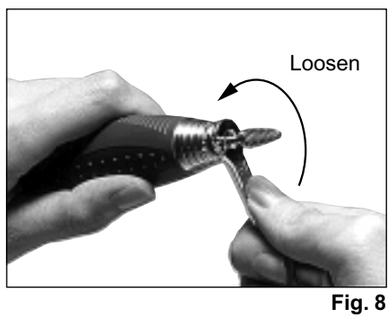


Fig. 8

(2) Cleaning of Chuck

Remove and clean the chuck as frequently as possible in the ultrasonic cleaner. Clean at least once a week.

⚠ CAUTION

Neglecting to clean the chuck for a long time is very dangerous because wax, gypsum, etc., accumulate in the chuck and the bur is caught insecurely, causing runout.

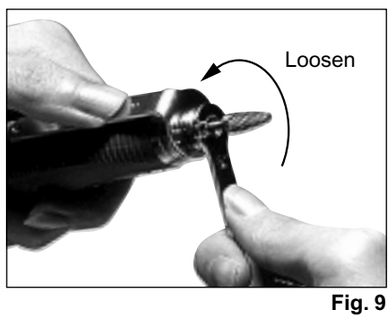


Fig. 9

(3) Insertion of Chuck

Thinly apply oil before insertion.
Open the ring, insert the dummy bur or the bur in use into the chuck, and turn the chuck clockwise by hand until it stops. Then, lock the ring, and the chuck could hold the bur securely. (Fig. 10)

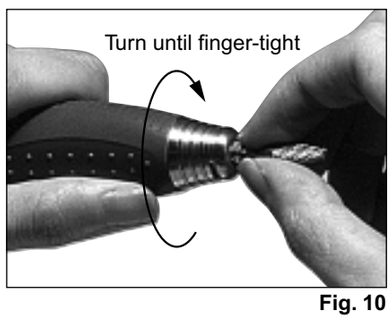


Fig. 10

3. Disconnecting and Connecting of Motor Cord to Motor

Remove the cord nut at the rear end of the motor, and the motor cord connector can be pulled out. For connection, align the connector pin and the hole in the motor cord connector, and insert the connector straight until it stops. Then, tighten the cord nut.

※ When inserting the connector, do not turn or twist it.

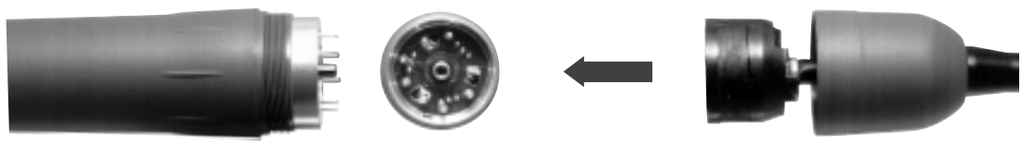


Fig. 11

4. Disconnecting Handpiece from Motor

The handpiece and motor are screwed at the midpoint. Firmly grasp the motor outer case and the handpiece outer case and turn it counterclockwise to disconnect. (Fig. 12)
When connecting the motor and handpiece, pay attention to the following CAUTION.

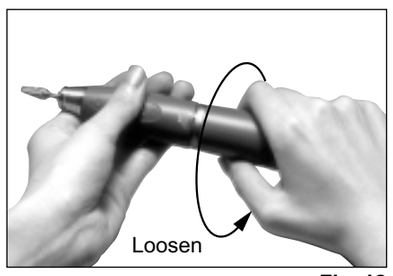


Fig. 12

⚠ CAUTION

When connecting the handpiece to the motor, turn the handpiece clockwise and tighten firmly. If the clutch is not engaged properly, the handpiece cannot be tightened completely. In such case, Do Not Force. Loosen the handpiece and turn the bur briefly to re-position the drive dog. Re-connect the handpiece and tighten securely. (Fig. 13)

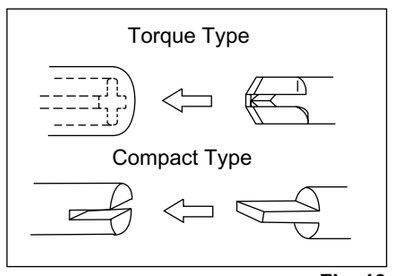


Fig. 13

◆ Handpiece Stand

At the bottom of the handpiece stand, tools necessary for handpiece maintenance and a spare chuck (optional) can be mounted. (Fig. 14)

Fig. 14

◆ Handpiece Holder

The handpiece holder that can be mounted on the right side of the control unit will widen a your effective work area. Insert the holder into the slot and fasten the screw. Adjust the holder angle to your best position. (Fig. 15)

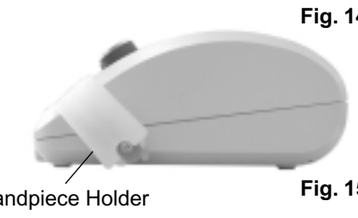


Fig. 15

◆ Specification

Control Unit

Model	NE95-LG (Light Gray)
	NE95-SB (Translucent Blue)
Power Supply	AC 120/230 V 50/60Hz
Rated Power Output	30W
Weight	2.6kg
Dimensions	W172 x D230 x H94mm

Foot Pedal

Model	FC-40
Weight	660g

Handpiece Stand

Model	Z095-201
Weight	120g

Motor Handpiece

(1) Torque Type

Model	UM50T
Speed	1,000~50,000min^{-1}(rpm)
Output	250W (Peak Power)
Max.Torque	8.7 N•cm
Weight	230g (Exclude Motorcord)
Dimensions	L164 x ø29mm
Cord Length	1.2m

(2) Compact Type

Model	UM50C
Speed	1,000~50,000min^{-1}(rpm)
Output	140W (Peak Power)
Max.Torque	6 N•cm
Weight	185g (Exclude Motorcord)
Dimensions	L148 x ø27mm
Cord Length	1.2m

◆ Troubleshooting

Please check the following points before sending back instruments for repair.

〈**Control Unit and Motor**〉

Trouble		Cause/Check	Remedy
Pilot Lamp does not light.		The power plug is disconnected.	Insert the power plug correctly.
		The fuse is blown.	Replace it with a specified fuse. If the reason the fuse has blown is unknown, ask for an inspection.
		Power Switch is faulty.	Ask for repair.
The motor and handpiece do not run, or Reset Lamp lights.	Foot Pedal dose not work.	The connection of the foot pedal cord plug is loose.	Connect the foot pedal cord plug correctly.
		Hand/Foot Selector Switch is set by HAND.	Set Hand/Foot Selector Switch to FOOT.
		Check to see if the foot pedal operates normally in maintenance mode (4) “Pd” : Foot pedal check.	If the foot pedal dose not operate normally, ask for repair of the foot pedal or replace it with a new one.
	Error code E0 appears.	Turn on the power again.	If the same error code appears, ask for repair of the unit.
	Error code E1 appears.	Turn on the power again.	If it operates normally, the error display is temporarily due to overload, which is not a problem.
		If you have two or more units, replace the motor and the motor cord and check the operation.	If it operates normally after replacing the motor and the motor cord, the motor and/or the motor cord may be shorted. Ask for repair of the motor and/or the motor cord. If the same error code still appears after replacing, ask for repair of the unit.
	Error code E2 appears.	The motor cord is disconnected.	Connect the motor cord correctly.
		If you have two or more units, replace the motor and the motor cord and check the operation.	If it operates normally after replacing the motor and the motor cord, the motor and/or the motor cord may be severed. Ask for repair of the motor and/or the motor cord. If the same error code still appears after replacing, ask for repair of the unit.
	Error code E3 appears.	The motor cord is disconnected.	Connect the motor cord correctly.
		Check to see if it operates normally in maintenance mode (3) “HL” : Motor signal check.	If any problem is found during a check, the motor cord may be severed or the sensor in the motor may be faulty. Ask for repair.
	Error code E4 appears.	Vacuum-coupled Mode is on, while the dust collector is not used.	Make the Vacuum-coupled Mode to be off. See Vacuum-coupled Mode section in the manual.
		After stopping to cool it down place for about 10 minutes, check the operation again.	If it operates normally, there is no problem. Check the operating environment, storage location, etc., for high temperature. If the same error code appears frequently, ask for repair of the unit.
	Error code E5 appears.	Turn on the power again, and repeat starting and stopping several times.	If it operates normally, there is no problem. If the same error code appears, ask for repair of the unit.
	Error code E6 appears.	The chuck is open.	Lock the chuck.
		Check to see if the tip can be lightly rotated by hand.	If the rotation is abnormal, ask for repair of the motor and handpiece.
The rotation speed does not rise.		The maximum rotation speed for operation by foot pedal should be set with the Speed Control Knob.	Set the maximum rotation speed with the Speed Control Knob.

〈**Handpiece**〉

Trouble	Cause	Remedy
The handpiece does not run with the chuck tightened.	Entry of foreign matter in the ball bearings or seizure.	Send it to your dealer. Ask for repair.
Heat is generated during rotation.	Entry of foreign matter in the ball bearings, causing wear of the bearings.	Same as the above.
Vibration or noise occurs during rotation.	Same as the above.	Same as the above.
	A bent bur is used.	Replace the bur.
Runout of the bur is heavy.	Dust may be stuck in the chuck or spindle.	Clean the inside of the chuck and spindle.
	The chuck is worn.	Replace the chuck.
	The ball bearings are worn.	Send it to your dealer.
The bur comes out.	The chuck is loose.	Tighten the chuck securely. (See ◆Handling of Motor and Handpiece.)

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