

NRR-3060

OPERATION MANUAL

Thank you for purchasing the Lever Type Spindle "NRR - 3060". This Spindle has a simple lever operated collet. No wrenches are required for tool changing. This Spindle is designed for cutting PC boards. The E3000 CONTROLLER, Brushless Motor, and Air Line Kit are required to drive this Spindle. Read this and all the associated component Operation Manuals carefully before use. Always keep this Operation Manual in a place where a user can refer to for reference at any time.

1. CAUTIONS FOR HANDLING AND OPERATION

- Read these warnings and cautions carefully and only use in the manner intended.
- These warnings and cautions are intended to avoid potential hazards that could result in personal injury to the operator or damage to the device. These are classified as follows in accordance with the seriousness of the risk.

Class	Degree of Risk
WARNING	A safety hazard could result in bodily injury or damage to the device if the safety instructions are not properly followed.
CAUTION	A hazard that could result in light or moderate bodily injury or damage to the device if the safety instructions are not followed.

WARNING

- ① This Spindle is not a hand tool. It is designed to be used on CNC machines or special purpose machines.
- ② Do not touch the cutting tool while it is running. It is very dangerous.
- ③ Wear safety glasses, dust mask, and use a protective cover around the Spindle whenever the Spindle is rotating.
- ④ Never connect, disconnect or touch the Power Cord Plug or Motor Cord Plug with wet hands. This may cause an electric shock.
- ⑤ Never operate or handle the Spindle and brushless motor until you have thoroughly read the Operation Manuals and safe operation has been confirmed.
 - 1) To prevent injuries / damages, check the Spindle, brushless motor and cutting tool for proper installation, before operating the Spindle and brushless motor.
 - 2) Before disconnecting the Spindle and brushless motor, always turn the control power off and turn the compressed air supply to the CONTROLLER off. Then it is safe to remove the Spindle and brushless motor.
- ⑥ When installing a Spindle to a fixed base, make sure the fixed base is grounded in order to avoid the risk of an electric shock.
- ⑦ Stop the brushless motor prior to operating the lever. If lever operation is performed during spindle rotation, contact with internal components will damage the spindle.
- ⑧ Make sure that lever position is LOCK before rotating with mounting cutting tool.
- ⑨ When installing a tool, tighten the collet correctly and check again the collet before use. Do not over-tighten the collet. This may cause damage to the spindle.
- ⑩ Do not use bent, broken, chipped, out of round or sub-standard tools, as this may cause them to shatter or explode. Tools with fractures or a bent shank will cause injury to the operator. When using a new tool, rotate it in a low speed and increase speed gradually for safety.
- ⑪ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.
- ⑫ Do not apply excessive force. This may cause tool slippage, tool damage, injury to the operator or loss of concentricity and precision.

CAUTION

- ① Do not drop or hit this Spindle, as shock can damage to the internal components.
- ② Do not connect this Spindle to the reduction gear. This may cause collet breakage by overload.
- ③ Be sure to clean the collet, the inside of the spindle before replacing the tool. If ground particles or metal chips stick to the inside of spindle or the collet, damage to the collet or spindle can occur due to the loss of precision.
- ④ When cleaning a Spindle, stop the brushless motor and remove debris with a soft brush or a cloth. Do not blow air into the dust proof cover area (refer to section " 6 - 2 Outside View ") with compressed air as foreign particles or cutting debris may get into the ball bearing.
- ⑤ Always clean the tool shank before installing the tool in the spindle.
- ⑥ When sizing the correct collet size to the tool shank diameter, a tolerance of +0 ~ - 0.01mm is strongly recommended.

A tool shank within the +0 ~ - 0.1mm range is mountable, however, this may cause poor concentricity and or insufficient tool shank gripping force.
- ⑦ Select suitable products or tools for all applications. Do not exceed the capabilities of the Spindle or tools.
- ⑧ Do not stop the supplied cooling air to the brushless motor during operation of the machine. Removing the air pressure from the brushless motor causes a loss of purging, allowing the Spindle to ingest coolant and debris. This will cause damage to the Spindle.
- ⑨ Carefully direct coolant spray directly on the tool. Do not spray directly on the Spindle body. If large amount spray directly on the Spindle, it may cause excess load of the Spindle rotation with loss of durability to the Spindle.
- ⑩ Stop working immediately when abnormal rotation or unusual vibration are observed. Immediately, please check the content of section " 14. TROUBLESHOOTING ".
- ⑪ Always check if the tool, collet are damaged before and after operating.
- ⑫ If the collet show signs of wear or damage, replace it before a malfunction or additional damage occurs.
- ⑬ After installation, repair, initial operation, or long periods of non operation, please refer to section " 13. BREAK-IN PROCEDURE " detailed in Table. 2. When checking the Spindle, no vibration or unusual sound should be observed during rotation.

CAUTION

- ⑭ Do not disassemble, modify or attempt to repair this Spindle. Additional damage will occur to the internal components. Service must be performed by NSK NAKANISHI or an authorized service center.
- ⑮ When using this Spindle for mass production, please consider the purchase of an additional Spindle to be used as a back-up in case of emergency.

2. BASIC PACKAGE

When opening the package, check if it includes all items listed in " Table. 1 Packing List Contents ". In the event of any shortage, please contact either NAKANISHI (see the " 4. CONTACT US " section) or your local dealer.

Table. 1 Packing List Contents

Spindle • • 1pc. 	Collet ϕ 3.175mm (CHB - 3.175) or ϕ 4.0mm (CHB - 4.0) • • 1pc.* (For U.S. market ϕ 3.175mm (CHB - 3.175)) 	Wrench (22 x 27) • • 1pc.
Wrench (6.1 x 8) • • 2pcs. 	Inspection Card • • 1pc. 	Operation Manual • • 1set

*The collet is attached to the Spindle.

3. WARRANTY

We provide a limited warranty for our products. We will repair or replace the products if the cause of failure is due to the following manufactures defects. Please contact us or your local distributor for details.

- ① Defect in manufacturing.
- ② Any shortage of components in the package.
- ③ Where damaged components are found when initially opening the package.
(This shall not apply if the damage was caused by the negligence of a customer.)

4. CONTACT US

For your safety and convenience when purchasing our products, we welcome your questions. If you have any questions about operation, maintenance and repair of the product, please contact us.

Contact Us

- For U.S. Market

Company Name

: **NSK America Corp.**

Industrial Div.
: 8:00 to 17:00 (CST)
(closed Saturday, Sunday and Public Holidays)

: +1 800 585 4675

Telephone No. : +1 847 843 7664

Fax No. : +1 847 843 7622

Website : www.nskamericacorp.com

- For Other Markets

Company Name

: **NAKANISHI INC.**

Business Hours : 8:00 to 17:00 (JST)
(closed Saturday, Sunday and Public Holidays)

: +81 289 64 3520

Telephone No. : webmaster-ie@nsk-nakanishi.co.jp

e-mail

5. FEATURES

- ① The Spindle housing is made from precision ground, hardened, stainless steel (SUS) with a mounting outside diameter of ϕ 26.8mm.
- ② Various sizes of collets are available CHB - 2.0mm, 3.0mm, 3.175mm and 4.0mm. Standard collet is CHB - 3.175mm or CHB - 4.0mm (For U.S. market CHB - 3.175mm).
- ③ This spindle features a lever type chucking system, which facilitates the replacement of the tool by lever rotation.

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	NRR - 3060
Maximum Motor Rotation Speed	60,000min ⁻¹ (rpm)
Applicable Motor *This Spindle can not use the reduction gear.	EM- 3060, EM - 3060J, EM - 3030J
Milling Capacity *Note 1 (Cutting or Milling PC boards with an end mill)	End Mill Size : Less than ϕ 1.0mm Work : PC board (ex. Glass Epoxy Resin) Thickness : Less than 1.6mm f : Less than 5,000mm / min
Weight	350g
Noise Level at 1m distance	Less than 70dB (A)

*Note 1 : You may need to lower feed rate (mm / min) depending on the shape of tools being used or the thickness of work. Always check the milling condition before working.

	Temperature	Humidity	Atmospheric Pressure
Operation Environment	0 - 40°C	MAX.75% (No condensation)	800 - 1,060hPa
Transportation and Storage Environment	-10 - 50°C	10 - 85%	500 - 1,060hPa

<Option>

Collet (CHB- □□) ϕ 2.0mm, ϕ 3.0mm, ϕ 3.175mm, ϕ 4.0mm

6 - 2 Outside View

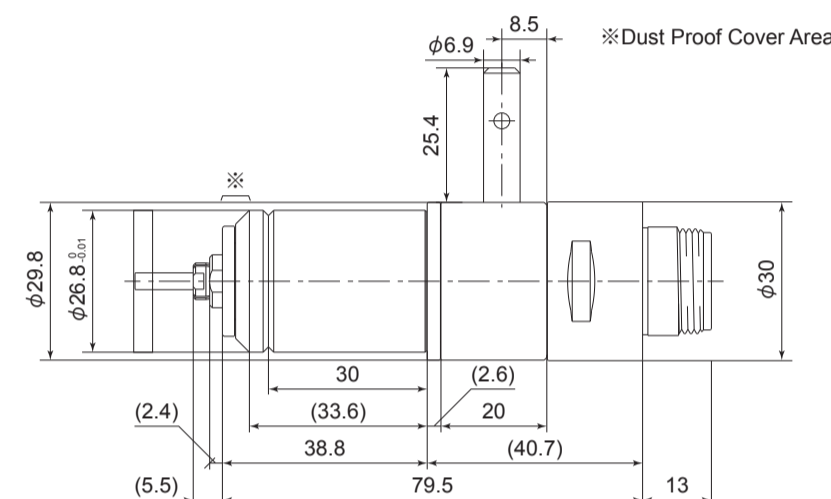


Fig. 1

7. CONNECTION OF THE SPINDLE TO THE MOTOR

CAUTION

Make sure your hands and all interlocking parts of the brushless moto and Spindle are clean before connecting the Spindle to the brushless motor. This is critical in preventing contaminants from entering the Spindle or brushless motor.

Align the thread on the front end of the brushless motor and the rear of the Spindle, and turn the Spindle clockwise. If the drive shaft of the brushless motor does not engage properly to the drive dog on the Spindle, it may only turn approximately two threads before stopping. DO NOT FORCE THEM TOGETHER. Loosen the Spindle from the brushless motor, rotate the Spindle shaft by hand then re-try. The drive shaft and the drive dog must be fully engaged. When fully engaged, secure the brushless motor and Spindle using the provided 27mm wrench (Fig. 2).

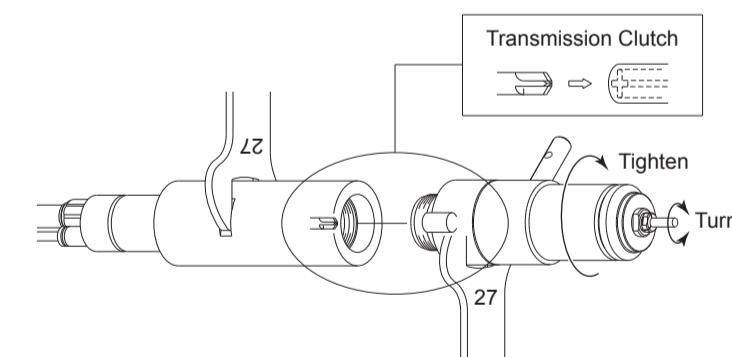


Fig. 2

8. CHANGING THE TOOL

⚠ WARNING

Always stop the brushless motor before operating the collet release lever.

⚠ CAUTION

Do not tighten the collet without inserting a tool or dummy bur as this will result in damage to the collet.

RECOMMENDATION

Please set the cutting tools to minimize the overhang amount. 13mm is the maximum amount of overhang to maintain high accuracy and safety.

- Stop the motor and check that the motor is not rotating before replacement.
- Turn the Lever counter-clockwise to loosen the collet and to remove the tool.
- Insert the replacement tool into the collet. Turn the Lever clockwise all the way until it snaps to tighten the collet.

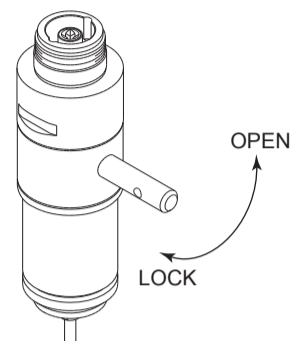


Fig. 3

9. REPLACING THE COLLET

- Turn the Lever counterclockwise.
- Place the 8mm wrench on the spindle shaft to be fastened.
- Place the 6.1mm wrench on the collet and turn it counter-clockwise to loosen the collet. And remove the collet from the spindle shaft together with the tool.
- Remove the tool from the collet.
- Insert the replacement collet and turn it clockwise to tighten.
- Tighten lightly with the 8mm and 6.1mm wrenches.
- Turn the Lever clockwise to close.

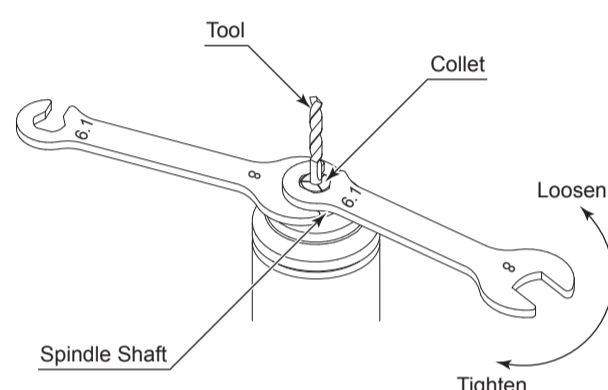


Fig. 4

10. ADJUSTMENT OF " TOOL MOUNTING DEPTH "

Please make the stopper by your own to adjust " Tool Mounting Depth ". Utilize the screw M2 x 0.4 l 3 in the spindle in consideration for " Dimension ϕA " to fit tool shank diameter and the required adjust length (L) refer to Fig. 5.

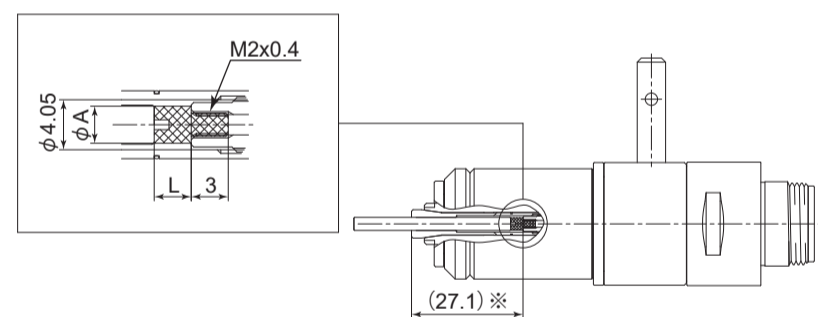


Fig. 5

Note: The depth to the stopper mounting position is a reference dimension. If you need an accurate depth, check the actual measurement.

11. INSTALLATION OF DUST COLLECTOR

⚠ CAUTION

Do not over tighten the screw. This may cause damage to the spindle's precision.

- Align the screw of dust collector with V-shaped groove.
- Tighten the screw (cup point screw or truncated cone point screw) with less than 50cN · m.

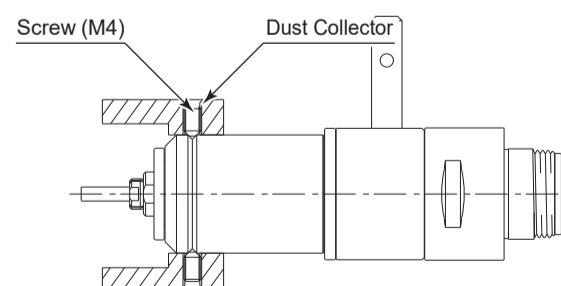


Fig. 6

12. INSTALLATION OF THE SPINDLE

⚠ WARNING

When installing a Spindle to a fixed base, make sure the fixed base is grounded in order to avoid the risk of an electric shock.

⚠ CAUTION

- When installing a Spindle, do not hit, drop or cause shock to the Spindle. This may cause damage to internal components and result in malfunctions.
- When mounting the Spindle, be sure to secure within Clamping Area etched on the Spindle O.D. If the Spindle is installed incorrectly, damage to the internal components is possible.
- Cautions when tightening the securing bolts on to a Split Type Holder
Do not over-tighten the bolt. This will cause damage to Spindle's precision.
Tighten the bolt until the Spindle body can not be rotated by hand within the fixture.
Extreme tightening is not necessary or recommended.
Apply working force and check that the Spindle is tight before using.

- When mounting a Spindle, refer to the Clamping Area etched on the Spindle (Fig. 7).

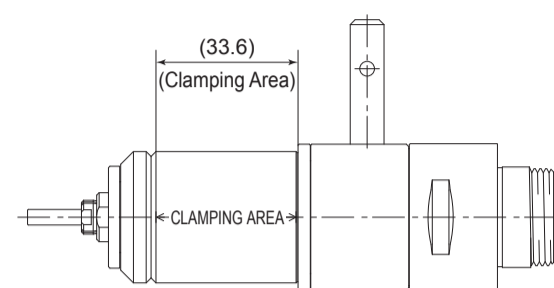


Fig. 7

- When installing a Spindle to the holder, recommended installation method is shown Fig. 8. Refer to " ③ How to fabricate the Split Type Holder ". If this is not possible, install as shown in Fig. 9.

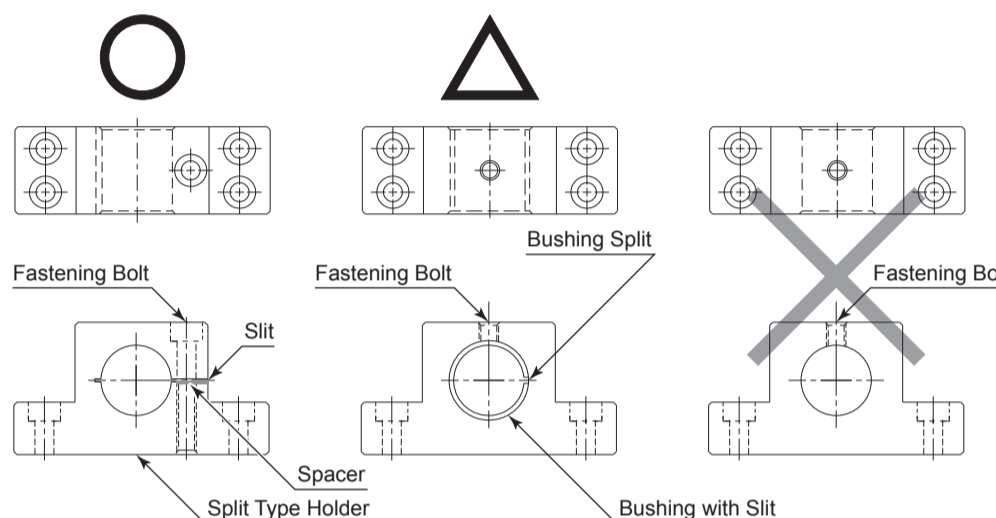


Fig. 8

Fig. 9

Fig. 10

⚠ CAUTION

Do not allow set screws to come directly in contact with the Spindle body as shown in Fig. 10, as this will result in damage to the Spindle housing and internal components.
When installing, never clamp directly over the bearings, as this will result in bearing damage (Refer to Fig. 11).

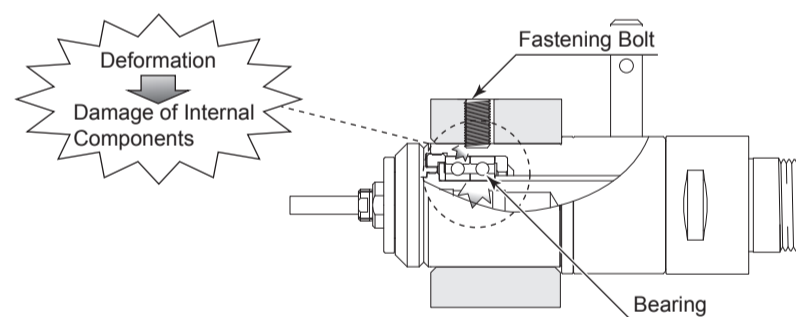


Fig. 11

- How to fabricate the Split Type Holder
 - Rough bore the inside diameter of the Split Type Holder.
 - Cut a slit (Ex. Slit 2mm) wide.
 - Tighten the Screw for Removal and Force Open the Slit Area.
 - Insert a spacer (Ex. thickness = 2mm) into the Slit Area.
 - Loosen the Screw for Removal, and tighten the fastening bolt with its specified torque.
 - Finish the Split Type Holder so that the inside diameter of the Split Type Holder is $\phi 26.8$ with its tolerance range from - 0.01mm to - 0.015mm, and its roundness and cylindricity of less than 5 μ m.
 - When inserting the Spindle loosen the Fastening Bolt, and tighten the Screw for Removal, widening the Slit Area.

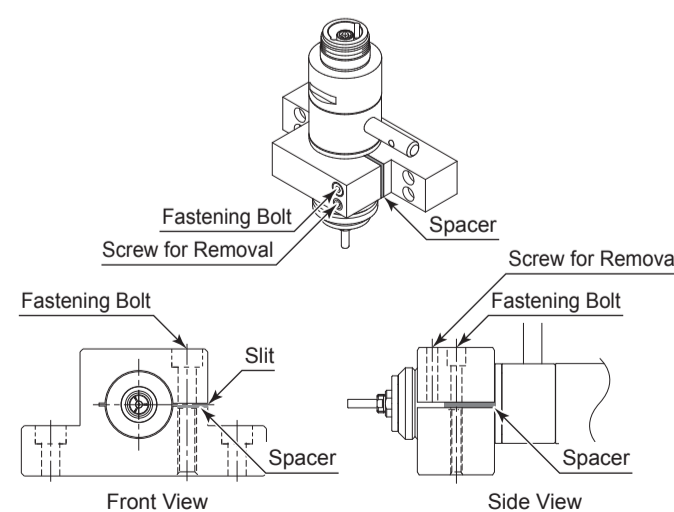


Fig. 12

⚠ CAUTION

- How to confirm the correct tightening or clamping of the Spindles in the holder
Measure the current value of the CONTROLLER's power cord by the clamp meter.
Fasten the holder so that the increase in the no-load current value (during rotation at the maximum rotation speed) with the Spindle fastened is 20mA (for type 120V) / 10mA (for type 200V / 230V) or less, compared to the no-load current value (during rotation at the maximum rotation speed) without fastening the Spindle. Do not over-tighten the Fastening Bolt. It may damage Spindle's precision and shorten the life of the bearings.
- The final responsibility for ensuring holder's safety for use in a given application is left to the designer of the equipment in which NAKANISHI's Spindle is installed.
NAKANISHI offers Spindle with a wide variety of capabilities and specifications.
Please carefully check the Spindle's specifications against the requirements of your equipment and verify suitability and safety of the Holder prior to initial use.

13. BREAK-IN PROCEDURE

During transportation, storage or installation, the grease inside the bearings will settle. If the Spindle is suddenly run at high-speed, the grease will be ejected from the bearings, causing excessive heat that will cause bearing damage.

After installation, repair, initial operation, or long periods of non operation, please follow the break-in procedure detailed in Table. 2.

Table. 2

Steps	1	2	3	4	5
Rotation Speed (min ⁻¹) (rpm)	1,500	30,000	40,000	50,000	60,000
Rotation Time (min)	15	10	10	10	10
Items to Check	No Abnormal Noises	The Spindle housing temperature during the break-in process should not exceed 20 degrees C (36 degrees F) above ambient temperature. Should the Spindle exceed this limit, rest the Spindle for at least 20 minutes and re-start the break in procedure from the beginning. If the housing temperature rises again and exceeds 20 degrees C (36 degrees F) above ambient temperature, check the Spindle and motor for proper installation.			The Spindle housing temperature during the break-in process should not exceed 20 degrees C (36 degrees F) above ambient temperature.

14. TROUBLESHOOTING

If a problem or concern occur, please check the following items prior to consulting your dealer.

Trouble	Cause	Inspection / Corrective Action
Spindle does not rotate or rotate smoothly.	The spindle ball bearings have been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The motor has been damaged.	Replace the motor. (Return to NAKANISHI dealer service.)
Overheating during rotation.	Lever position is OPEN.	Set the lever to the LOCK position.
	Cutting debris has contaminated the ball bearings, and the ball bearings are damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
Abnormal vibration or noise during rotation.	The lever is not set to the LOCK position.	Replace parts. (Return to NAKANISHI dealer service.)
	The tool shank is bent.	Replace the tool.
Tool slippage.	Cutting debris has contaminated the ball bearing.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The spindle ball bearings have been damaged.	
High run-out.	collet is not correctly installed.	Check and clean the collet. Reinstall the collet.
	The collet is worn.	Replace the collet.
	The tool is bent.	Change the tool.
	Collet is not correctly installed.	Secure the collet correctly.
	The collet is worn.	Replace the collet.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)
	Contaminants inside the collet or the spindle.	Clean the collet and the inside of the taper and spindle.
	The spindle ball bearings have been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

Refer to the brushless motor and the E3000 CONTROLLER Operation Manuals.

15. DISPOSAL OF THE SPINDLE

When disposal of a Spindle is necessary, follow the instructions from your local government agency for proper disposal of industrial components.



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