NAKANISHI

OM-KK1032MA 000

E3000i モータスピンドル / E3000i Motor Spindle

BMF - 4230 - TSU

取扱説明書 / OPERATION MANUAL

日本語 : P1 - P15 / English : P17 - P32

Thank you for purchasing Motor Spindle BMF-4230-TSU. This motor spindle is designed for milling and small diameter drilling, etc. This spindle is compatible with the Standard Rotary Tool 3282-Y041 CNC precision automatic lathe from TSUGAMI that the customer is currently using, and it can be replaced and used interchangeably. An E3000i CONTROLLER, Motor Cord, and Air Line Kit are required to drive this motor spindle. Read this Operation Manual carefully before using. Also read the E3000i CONTROLLER and Air Line Kit Operation Manuals. For future reference, keep this Operation Manual accessible to all users.

CONTENTS

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 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 that 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 motor 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 motor spindle whenever the motor spindle is rotating.

④ Never connect, disconnect or touch the Power Cord Plug and Motor Cord Plug with wet hands. This may cause an electric shock.

⑤ Never operate or handle the motor spindle until you have thoroughly read the owner's manual and safe operation has been confirmed.

1) To prevent injuries / damages, check the motor spindle and cutting tool for proper installation, before operating the motor spindle.

2) Before disconnecting the motor spindle, always turn off the controller's power and compressed air supply to the CONTROLLER.

⑥ When installing the spindle, make sure that the fixed base is grounded to the machine tool in order to avoid the risk of an electric shock.

⑦ When installing a tool, tighten the collet correctly and double check the collet and collet nut before use. Do not over-tighten the collet. This may cause damage to the spindle.

⑧ Do not use bent, broken, chipped, deformed or sub-standard tools as they may shatter or explode. Tool with fractures or a bent shank may cause injury to the operator. When using a new tool, rotate it in a low speed and increase speed gradually for safety.

⑨ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.

⑩ Do not apply excessive force. This may cause tool slippage, tool damage, injury to the operator or loss of concentricity and precision.

⑪ Do not use grindstones. Grinding debris may enter the interior of the automatic lathe, causing malfunction and resulting in property damage.

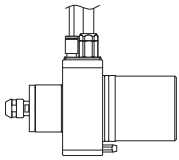
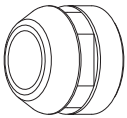
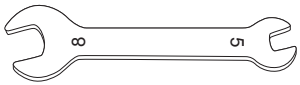
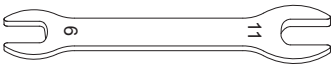
⚠ CAUTION

① Do not drop or hit this motor spindle, as shock can damage the internal components.
② Be sure to clean the collet and collet nut, the inside of the spindle before replacing the tool. If dust or metal chips stick to the inside of spindle or the collet, damage to the collet or spindle or compromise the spindle's precision.
③ When cleaning a motor spindle, stop the motor spindle and remove debris with a soft brush or a cloth. Do not blow air into the dust proof cover area (refer to section " 6 - 3 Outside view ") with compressed air as foreign particles or cutting debris may get into the ball bearings.
④ Always clean the tool shank before installing the tool in the spindle.
⑤ When sizing the correct collet size to the tool shank diameter, a tolerance of +0 – -0.01 mm is strongly recommended. A tool shank within the +0 – -0.1 mm range is mountable, however, this may cause poor concentricity and or insufficient tool shank gripping force.
⑥ Select suitable tools for all applications. Do not exceed the capabilities of the motor spindle or tools.
⑦ To prevent dust from entering while the machine is operating, do not stop the supply of cooling air from the motor. If the supply of cooling air is stopped while coolant and cutting oil is being supplied, the air purge will be lost and the coolant and cutting oil may enter the spindle and cause damage.
⑧ Carefully direct coolant spray to the tool. Do not spray directly on the motor spindle body. Large amounts of coolant sprayed directly on the motor spindle body may cause excess load of the motor spindle causing a loss of durability and longevity of the motor spindle.
⑨ Stop working immediately when abnormal rotation or unusual vibration are observed. Afterwards, please check the content of section " 14. TROUBLESHOOTING ".
⑩ Always check if the tool, collet or collet nut are damaged before and after operating.
⑪ Securely connect the cooling air hose to the Air Line Kit, the CONTROLLER and the motor spindle to avoid accidental disconnection during use.
⑫ If the collet or collet nut show signs of wear or damage, replace them before a malfunction or additional damage occurs.
⑬ When storing this product, wipe off any moisture, etc. that may have adhered to it. Failure to do so may cause rusting.
⑭ After installation, repair, initial operation, or long periods of non operation, please refer to section " 12. BREAK-IN PROCEDURE " detailed in Table 3. When checking the motor spindle, no vibration or unusual sound should be observed during rotation.
⑮ Do not disassemble, modify or attempt to repair this motor spindle. Additional damage will occur to the internal components. Service must be performed by NAKANISHI INC. or it's authorized service center.
⑯ When using this motor spindle for mass production, please purchase another motor spindle as a spare in case of an 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

Motor Spindle・・1pc. 	Collet Nut (CHN-A) ・・1pc. * The Collet Nut is attached to the Motor spindle. 
Wrench (8×5)・・1pc. 	Wrench (9×11)・・1pc. 
Hexagon socket bolt (for body mounting) (M5×30)・・4pcs. 	Operation Manual ・・1set. 
Inspection Card・・1pc. 	

3. WARRANTY

The company provides a limited warranty for our products. The company 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.
Business Hours	:	8:00 to 17:00 (CST) (closed Saturday, Sunday and Public Holidays)
U.S. Toll Free No.	:	+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)
Telephone No.	:	+81 289 64 3520
e-mail	:	webmaster-ie@nsk-nakanishi.co.jp

5. FEATURES

① The motor spindle housing is made of stainless steel (SUS) with a high hardness heat-treated and polished finish. Layout can be adjusted to fit the installation space when placing the motor spindle in a machine.
② This motor spindle uses a high-speed sensor less motor, eliminating the need for troublesome brush replacement.
③ This motor spindle adopts a Quick Disconnect Cord.

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	BMF-4230-TSU
Max. Motor Speed	30,000 min^{-1}
Spindle Accuracy	Within 1 μm
Max. Output	350 W
Quick Disconnect Cord Length	0.5 m
Weight	1,010 g
Noise level (at 1 m Distance)	60 dB (A) or less
IP Code	IP57 (when motor cooling air is supplied)
Compatible Rotary Tool	3282-Y041 (manufactured by TSUGAMI CORPORATION)
Applicable CNC Precision Automatic Lathes	Back tool post for TSUGAMI B026/32-Ⅲ, B038-Ⅲ, S205-Ⅱ/ S206-Ⅱ, etc.

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

< Options >

Collet (CHA- □□) *Note1	ϕ0.5 – ϕ4.0 mm in 0.1 mm increments and ϕ2.35 mm, ϕ3.175 mm.
Motor Cord (EMCD-3000i-□M) *Note2	Motor Cord Length : 3 m, 5 m and 7 m. (A hose of the same length is included.)

*Note1: Collet is sold separately. Please select the suitable collet size for your application.
*Note2: Motor Cord is sold separately. Please select the suitable motor cord length for your application.

6 - 2 Compatibility

The Motor Spindle is compatible with the following safety standards.

・Safety standard in North America (UL,CSA)
UL1004-1
c US
CSA C22.2 No.100

・European Directive
Low Voltage Directive
CE
IEC/EN 60034-1

6 - 3 Outside View

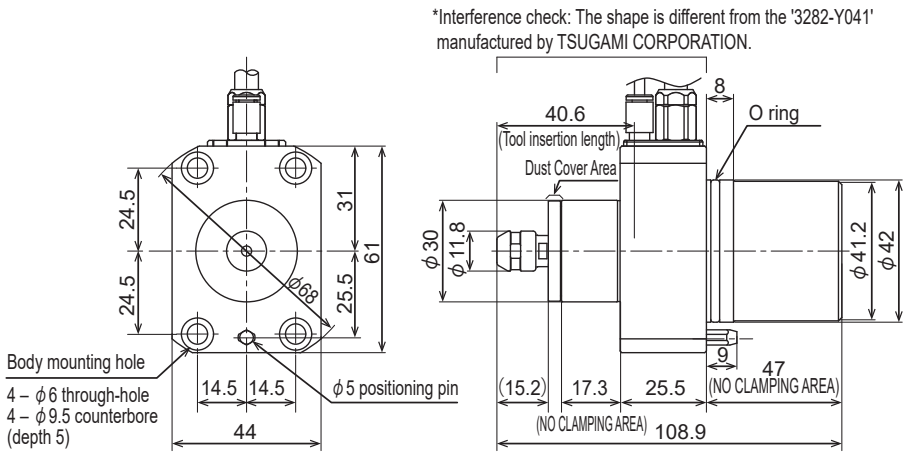


Fig. 1

6 - 4 Torque Characteristics

30,000 min^{-1}

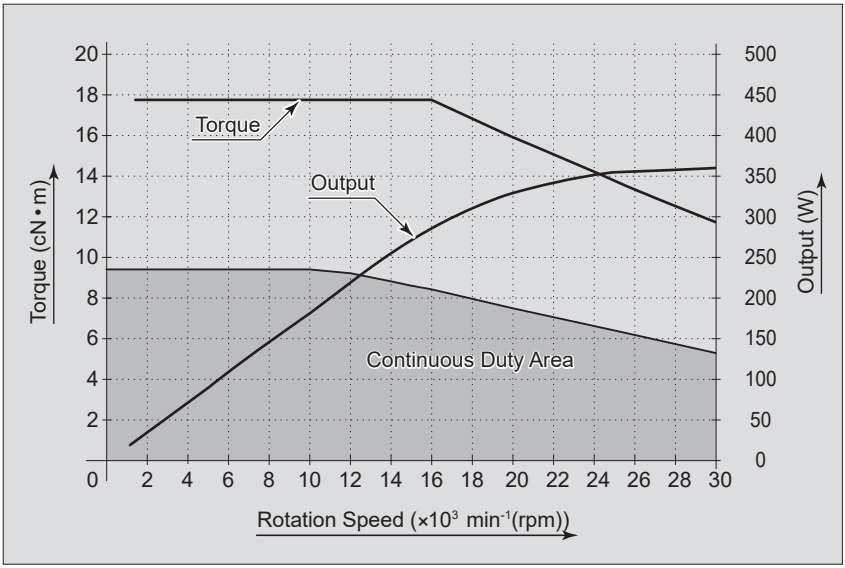


Fig. 2

7. INSTALLING THE COLLET AND TOOL

⚠ CAUTION

- **Be sure to clean the collet, the collet nut and the inside of the spindle before installing the collet or the tool. If dust or metal chips stick to the inside of the spindle or the collet, damage to the collet or spindle may occur to result in loss of precision.**
- **When installing the collet in the collet nut, make sure that the latches of the collet nut are properly seated in the groove of the collet. If the latches are not properly seated when you tighten the collet nut, the collet may become stuck inside the spindle.**
- **Never tighten the collet nut without inserting a tool in the collet. Excessively tightening the collet may damage the latches that hold the collet in the collet nut, making it difficult to remove the collet from the spindle.**
- **Keep the overhang length to a minimum when installing the tool. If the overhang length is too long, the tool may bend and cause injury.**

① Hold the collet nut in one hand, and install the collet. (Fig. 3)
If the collet is difficult to install, tilt the collet to one side when inserting it, so that the tabs can more easily be seated in the groove. (Fig. 3, Fig. 4)
At this time, make sure that the tabs of the collet nut are properly seated in the groove of the collet. (Fig. 5)

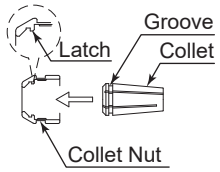


Fig. 3

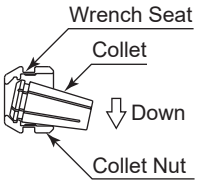


Fig. 4

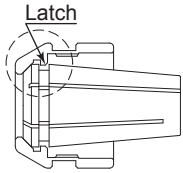


Fig. 5

② Insert the tool into the collet, and attach the tool and the collet nut to the spindle shaft.(Fig. 6)
③ Place the provided 8 mm wrench on the wrench groove of the spindle shaft and hold it in place.
④ Place the provided 11 mm wrench on the collet nut and turn the collet nut clockwise to secure the tool.『Reference tightening torque: 6 N・m（CHA-3.0/3.175/4.0 use）』

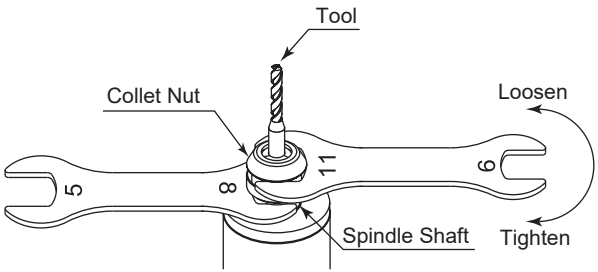


Fig. 6

⑤ Check the runout of the tool. If runout is excessive, using 5 μm or more as a guideline, loosen the collet and rotate it 90°. Then refasten the tool.

8. CHANGING THE TOOL

⚠ CAUTION

- **Do not tighten the collet without inserting a tool or dummy bur as this will damage the collet, spindle or collet nut, to cause difficulty when removing the collet.**
- **Keep the overhang length to a minimum when installing the tool. If the overhang length is too long, the tool may bend and cause injury.**

① Set the provided 8 mm wrench on the spindle.
② Place the provided 11 mm wrench on the collet nut and turn it counterclockwise to loosen the collet and remove the tool. (The first turn will loosen the collet nut, but the tool will not release and turning will become stiff. Keep turning through the stiffness and the collet will open. The turning may not become stiff.)
③ Clean the collet and collet nut, then insert the new tool and tighten the collet by turning clockwise. Do not over tighten.
④ Check the runout of the tool. If runout is excessive, using 5 µm or more as a guideline, loosen the collet and rotate it 90˚. Then refasten the tool.

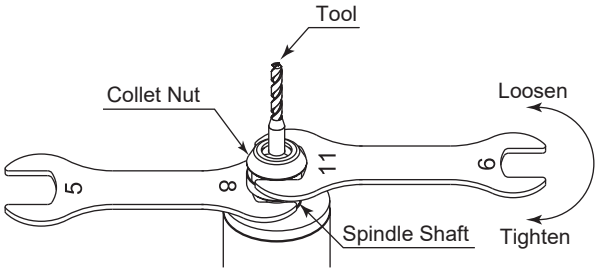


Fig. 7

9. REPLACING THE COLLET

⚠ CAUTION

- **The collet and collet nut are consumable parts and will wear out with use. Replace the collet or collet nut if collet force decreases or there are signs of wear or scratches.**
- **When installing the collet in the collet nut, make sure to fully engage the latch inside the collet nut to the groove on the collet outer circumference area. In addition, remember that if the collet is attached without being engaged with the latch of the collet nut, the collet cannot be removed and this may cause damage to the collet or the spindle.**

① Remove the tool according to the section "8. CHANGING THE TOOL" procedure above and remove collet nut assembly (Fig. 8).

② The collet and collet nut are secured by a groove in the collet and a flange in the collet nut. To remove the collet hold the collet nut in one hand and push diagonally down on the collet. The collet should be released (Fig. 9).

③ To install the collet, hold the collet at a slight angle, and insert it into the collet nut (Fig. 10). Press the collet in the collet nut by positioning the collet in the collet nut and pressing down on flat surface (Fig. 9,Fig. 10).
Be sure to fully engage the latch inside the collet nut into the groove on the collet outer circumference area (Fig. 11).

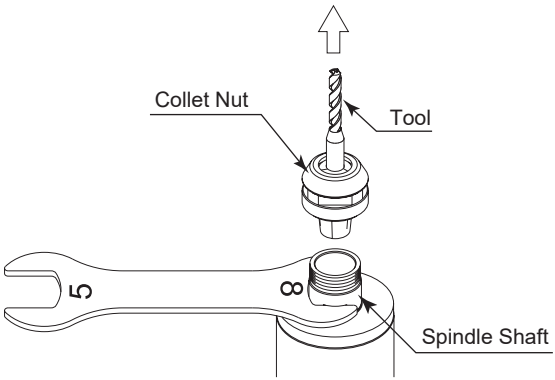


Fig. 8

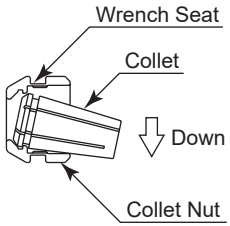


Fig. 9

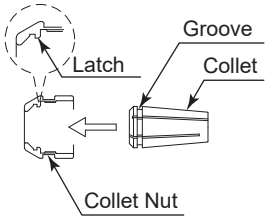


Fig. 10

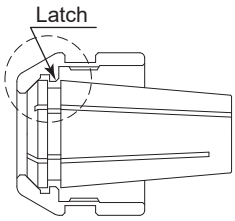


Fig. 11

10. CONNECTION OF MOTOR CORD AND AIR SUPPLY

10 - 1 Connection of the Motor Cord

⚠ CAUTION

- **Before connecting the Motor Cord Plug, make sure the Main Power Switch on the CONTROLLER is turned OFF. It may lead to damaging the controller if the Main Power Switch on the CONTROLLER is ON while connecting the Motor Cord Plug.**
- **Install the connector cover (protective cap etc.) to prevent damage or contamination to the Motor Cord Plug when not in use.**

① Remove the Protective Cover found on the Motor Cord.

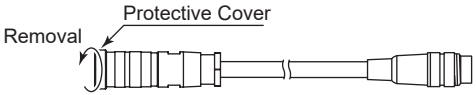


Fig. 12

② Ensure the Alignment pin is pointing upwards. Carefully insert the Alignment pin into the Alignment hole and push straight into the connector of the Motor Cord Side.

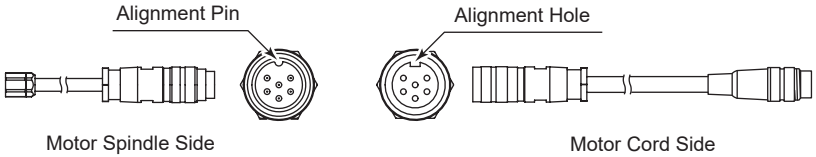


Fig. 13

③ Tighten the Coupling Nut.

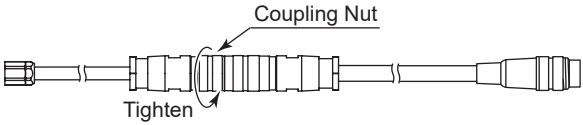


Fig. 14

④ Remove the protective air inlet by pushing in the quick disconnect cover.

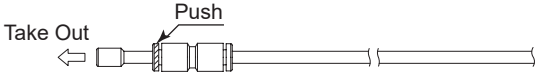


Fig. 15

⑤ Insert the provided air hose.

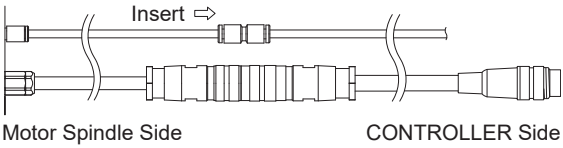


Fig. 16

10 - 2 Air Supply

The air pressure requirement varies with the number of the motor connections and the total length of the hose. Verify the number of spindles and air hose length before setting the pressure according to Table 2.

⚠ CAUTION

- **"Hose Length" indicates total hose length consisting of the Air Hose supplied with the Motor Spindle and the Air Hose supplied with each Motor Cord. See Fig. 17 and Table 2 to see how to calculate "Hose Length".**
- **When connecting the two motor spindles to the Controller, use the air hose branching joint provided (" Y " Type) provided with the CONTROLLER. Insert the branching joint into the Air Out quick disconnect on the CONTROLLER.**

Table. 2

Total Hose Length (m)* Note 3, 4		3.5	5.5	7.5
One E3000i Motor Spindle is connected to the Control Unit.	Air Pressure (MPa)	0.20	0.25	0.30
Two E3000i Motor Spindles are connected to the Control Unit.		0.30	0.35	0.40

*Note 3: "Hose Length" indicates total hose length consisting of the Air Hose supplied with the Motor Spindle and the Air Hose supplied with each Motor Cord. See Fig.17 to see how to calculate "Hose Length".

*Note 4: When connecting a device other than the E3000i Motor Spindle to the E3000i Controller, refer to the "Air Pressure Settings" described in the E3000i Controller Operation Manual.

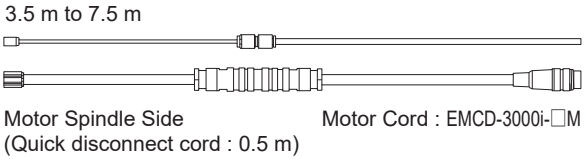


Fig. 17

11. INSTALLATION OF THE MOTOR SPINDLE

⚠ WARNING

When installing a motor 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 motor spindle, do not hit, drop or apply shock to the spindle. This may cause damage to internal components and result in malfunctions.**
- **Never fasten a sleeve directly onto the spindle body housing (diameter ϕ 30, ϕ 41.2, ϕ 42 mm) section when installing the spindle.**

This motor spindle can be installed, without fastening a sleeve over the main housing section. This is designed to eliminate deformation and damage to the motor spindle when performing the installation.

① Insert the ϕ42 mm spindle body housing section into the machine tool holder with the ϕ5 positioning pin facing downward. (Installation on the upper station is recommended.)

② Secure the motor spindle through the four mounting holes using the supplied hexagon socket bolts. (M5 × 30) (Fig. 18)

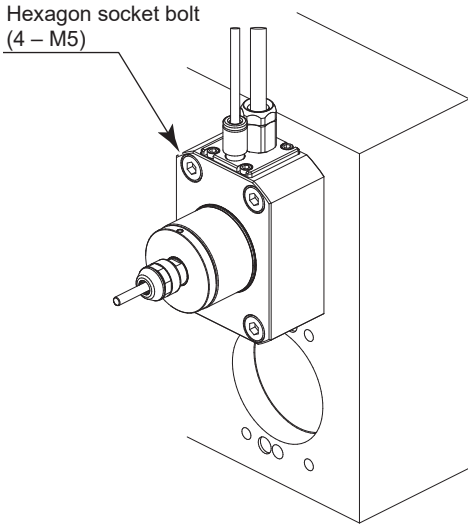


Fig. 18

12. BREAK-IN PROCEDURE

During transportation, storage or installation, the grease inside the bearings will settle. If the spindle is suddenly run at high-speed, excessive heat will cause bearing damage. After installation, repair, initial operation or long periods of non operation, please follow the break-in procedure detailed in Table 3.

Table. 3

Steps	1	2	3	4
Rotation Speed (min^{-1})	5,000	10,000	20,000	30,000
Rotation time (min)	15	10	10	10
Items to check	No Abnormal Noises	The spindle housing temperature increase during the break-in process should not exceed 20 degrees C (36 degrees F) above ambient temperature. Should the motor spindle exceed this limit, rest the motor 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 motor spindle for proper installation.		The spindle housing temperature increase during the break-in process should not exceed 20 degrees C (36 degrees F) above ambient temperature.

13. CAUTIONS WHEN USING CUTTING TOOLS

⚠ CAUTION

Refer to the following formula for the maximum spindle motor speed when using a drill or an end mill.

$$\text{Motor speed (min}^{-1}\text{)} = \frac{1{,}000 \times \text{Cutting speed (m/min)}}{3.14 \times \text{Cutting drill diameter (mm)}}$$

① The spindle RPM depends on the tool diameter and the workpiece material.
② Please follow the manufacturer's recommended rotational speed. Applying tools outside of manufacturer's maximum recommended rotational speed may cause damage to the spindle or injury to the operator.
③ For improved machining accuracy, keep the overhang length to a minimum when installing the tool.
④ When increasing the cutting tool overhang, reduce the motor speed. (Table. 4, Table. 5)
⑤ Keep the cutting tool shank and collet clean. Any contamination in the collet or collet nut will cause excessive runout and will therefore cause damage to the cutting tool and or spindle.
⑥ Use after checking for runout.
⑦ Do not strike or drop the spindle.

Table. 4 Relationship Between Drill Overhang Length and RPM

Overhang Length (mm)	Max RPM
Drill diameter×10	100% of the RPM
Drill diameter×20	70% of the RPM
Drill diameter×20 or more	50% or less of the RPM

Table. 5 Relationship Between End Mill Overhang Length and RPM

Overhang Length (mm)	Max RPM
Shank diameter×5	100% of the RPM
Shank diameter×10	50% of the RPM
Shank diameter×10 or more	30% or less of the RPM

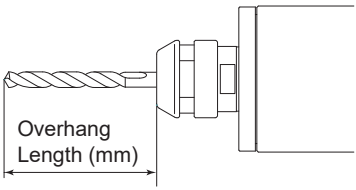


Fig. 19

14. TROUBLE SHOOTING

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

Trouble	Cause	Inspection / Corrective Action
Spindle does not rotate or rotate smoothly	The ball bearings are damaged	Replace the ball bearings. (Return to NAKANISHI dealer for service.)
	Motor is damaged	Replace the motor. (Return to NAKANISHI dealer for service.)
Overheating during rotation	Cutting debris has contaminated the ball bearings, and the ball bearings is damaged	Replace the ball bearings. (Return to NAKANISHI dealer for service.)
	Low air pressure	Check air hose connection and air pressure.
Abnormal vibration or noise during rotation	The tool's shank is bent	Replace the tool.
	Cutting debris has contaminated the ball bearings	Replace the ball bearings. (Return to NAKANISHI dealer for service.)
	The ball bearings are worn	
Tool slippage	Collet or collet nut are not correctly installed	Check and clean the collet and collet nut. And, tighten the collet accurately again.
	The collet and the collet nut are worn	Replace the collet and collet nut.
High run-out	The tool's shank is bent	Replace the tool.
	Collet nut is not correctly installed	Secure the collet and the collet nut correctly.
	The collet and the collet nut are worn	Replace the collet and the collet nut.
	The inner side of the spindle is worn	Replace the spindle shaft. (Return to NAKANISHI dealer for service.)
	Contamination inside the collet and the collet nut or the spindle	Clean the collet, collet nut and the inside of the spindle.
	The ball bearings are worn	Replace the ball bearings. (Return to NAKANISHI dealer for service.)

Please also refer to the E3000i CONTROLLER operation manual.

15. DISPOSAL OF THE MOTOR SPINDLE

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

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