NAKANISHI

OM-KK1021MA 000

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

BM-3030RA

取扱説明書 / OPERATION MANUAL

日本語 : P1 - P19 / English : P21 - P39

Thank you for purchasing Motor Spindle BM-3030RA. This motor spindle designed for grinding, milling and small diameter drilling, etc.
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. Always keep this Operation Manual in a place where a user can referred to for reference at any time.

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 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.

(7) 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.

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

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

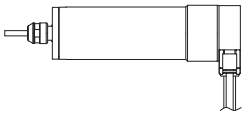
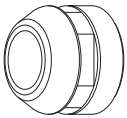
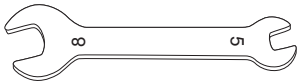
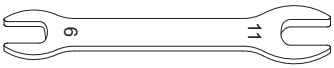
⚠ CAUTION

(1) Do not drop or hit this 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 ~ -0.01mm 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.
(6) Select suitable products for all applications. Do not exceed the capabilities of the motor spindle or tools.
(7) Carefully direct coolant spray to the tool. Do not spray directly on the motor spindle body.
(8) Stop working immediately when abnormal rotation or unusual vibration are observed. Afterwards, please check the content of section 15. " TROUBLESHOOTING ".
(9) Always check if the tool, collet or collet nut are damaged before and after operating.
(10) If the collet or collet nut show signs of wear or damage, replace them before a malfunction or additional damage occurs.
(11) 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.
(12) 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.
(13) 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.* 
Wrench (8 x 5)••1pc. 	Wrench (9 x11)••1pc. 
Operation Manual ••1set. 	Inspection Card••1pc. 

* The Collet Nut is attached to the Motor spindle.

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	BM-3030RA
Max. Motor Speed	30,000min^{-1}
Spindle Accuracy	Within 1μm
Max. Output	350W
Motor Cord Type (Option)	EMCD-3000i-3M (3m) / EMCD-3000i-5M (5m) / EMCD-3000i-7M (7m)
Quick Disconnect Cord Length	0.5m
Weight	474g
Noise Level	Within 65dB
IP Code	IP57

< Options >

Collet (CHA- □□) *Note1	φ0.5 - φ4.0mm in 0.1mm increments and φ2.35mm, φ3.175mm.
Motor Cord (EMCD-3000i-□M) *Note2	Motor Cord Length : 3m, 5m and 7m. (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

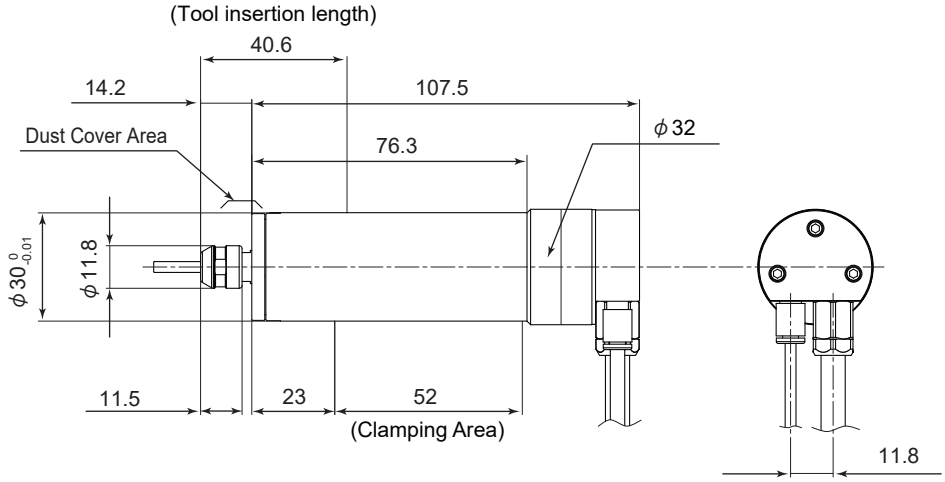


Fig. 1

6 - 4 Torque Characteristics

30,000min-1

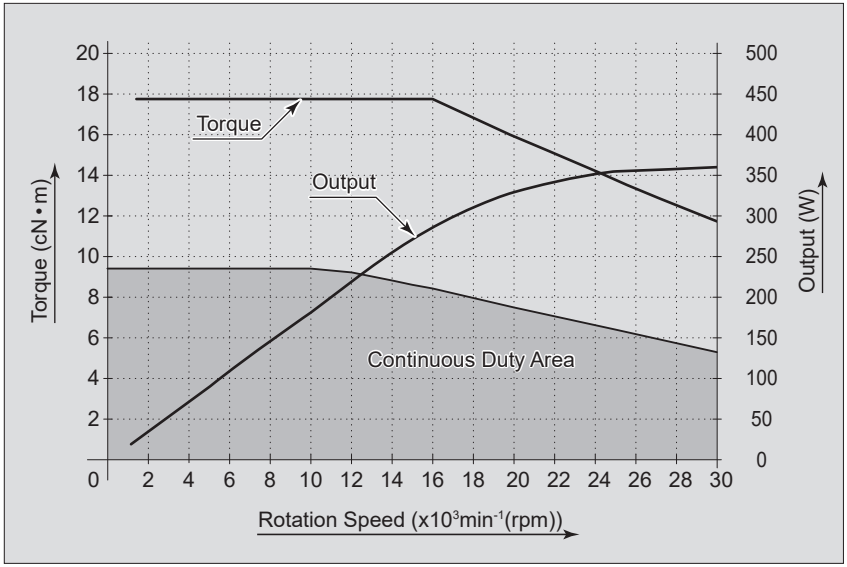


Fig. 2

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 latches can more easily be seated in the groove. (Fig. 4)
At this time, make sure that the latches of the collet nut are properly seated in the groove of the collet. (Fig. 5)

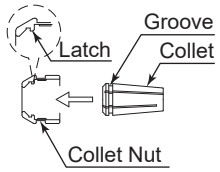


Fig. 3

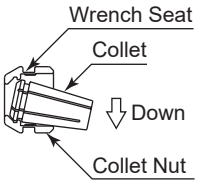


Fig. 4

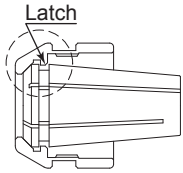


Fig. 5

(2) Insert the tool, place the provided 8mm wrench on the spindle shaft and place the provided 11mm wrench on the collet nut and turn clockwise to secure the tool.
"Recommended tightening torque: 6 N·m (when using CHA-3.0/3.175/4.0)."

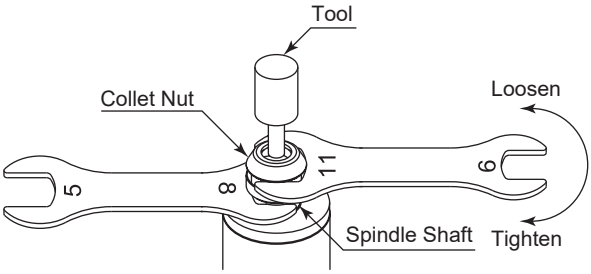


Fig. 6

8. CHANGING THE TOOL

⚠ WARNING

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.

(1) Set the provided 8mm wrench on the spindle.
(2) Place the provided 11mm 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.

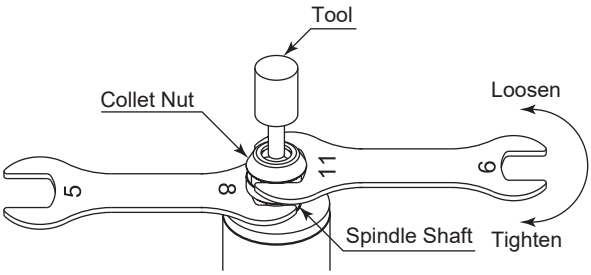


Fig. 7

9. REPLACING THE COLLET

⚠ CAUTION

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).
Be sure to fully engage the latch inside the collet nut into the groove on the collet outer circumference area (Fig. 11).

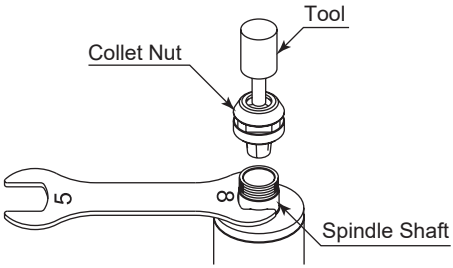


Fig. 8

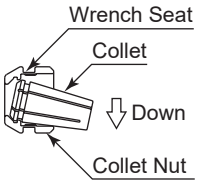


Fig. 9

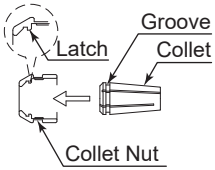


Fig. 10

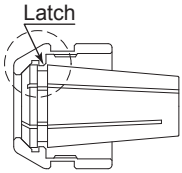


Fig. 11

10. CONNECTION OF MOTOR CORD AND AIR SUPPLY

10 - 1 Connection of the Motor Cord

⚠ WARNING

- **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.

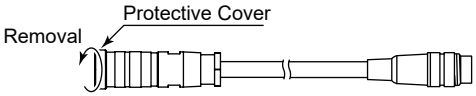


Fig. 12

(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.

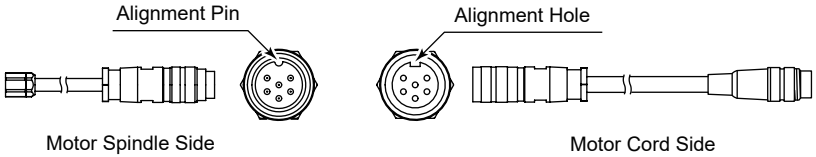


Fig. 13

(3) Tighten the Coupling Nut.

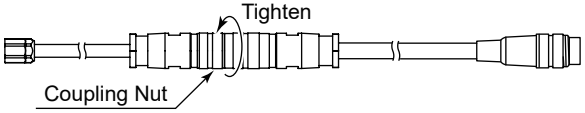


Fig. 14

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

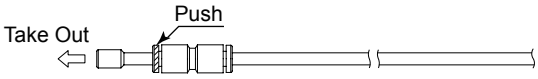


Fig. 15

(5) Insert the provided air hose.

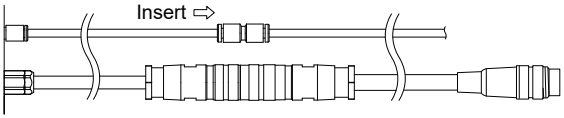


Fig. 16

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 Quick Disconnect Hose and Air Hose. 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 1, 2		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 1: "Hose Length" indicates total hose length consisting of the Quick Disconnect Hose and the Air Hose. See Fig.17 to see how to calculate "Hose Length".

*Note 2: 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.

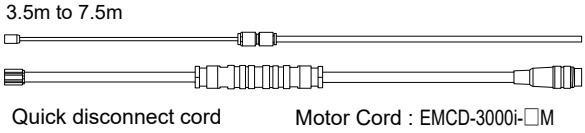


Fig. 17

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.**
- **When mounting the motor spindle, be sure to clamp within clamping area etched on the spindle. If the motor spindle is installed incorrectly, this will damage the motor spindle.**
- **Precautions when tightening the securing bolt on the Split Type Holder.**
  Do not over tighten the bolts. This may compromise the motor spindle's precision.
  Tighten the bolts until the spindle body can not be turned by hand within the fixture.
  Strong tightening is not necessary or recommended.
  Apply work load and confirm that the motor spindle is firmly mounted before using.

(1) When mounting a motor spindle, refer to the Clamping Area etched on the motor spindle. (Fig. 18)

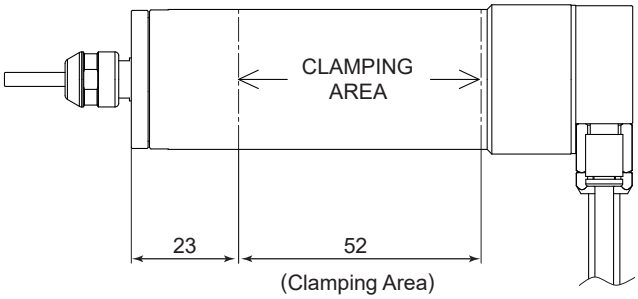


Fig. 18

* When installing a motor spindle, the use of "Grip Ring GR-30 (sold separately (Fig. 19))" is recommended. If the Grip Ring GR-30 cannot be used due to the restriction of dimension and space, install as shown in (2) below.

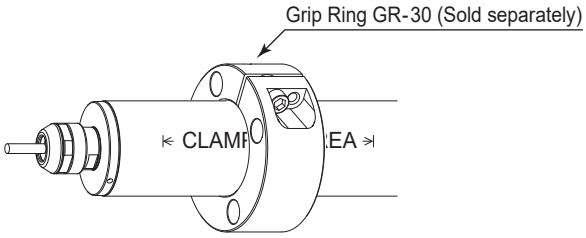


Fig. 19

(2) When installing a motor spindle to a holder, recommended installation method is shown in Fig. 20. Refer to " (3) How to fabricate the Split Type Holder " If this is not possible and install as shown in Fig. 21 using the Controllers X10mA function to avoid crushing the motor spindle.

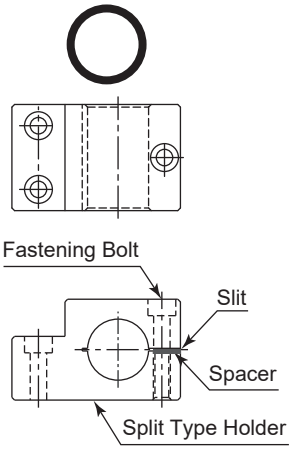


Fig. 20

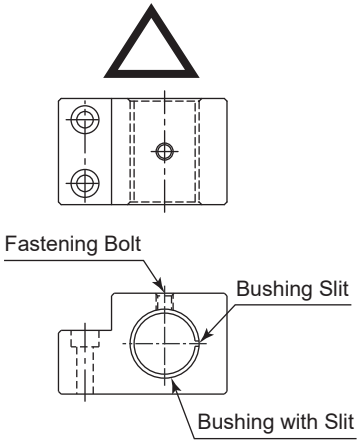


Fig. 21

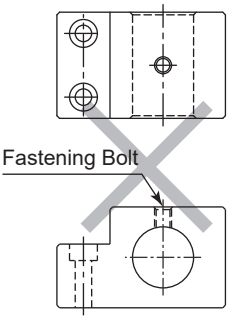


Fig. 22

⚠ CAUTION

Do not allow fastening bolts come directly in contact with the spindle body as shown in Fig. 22, 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. 23).

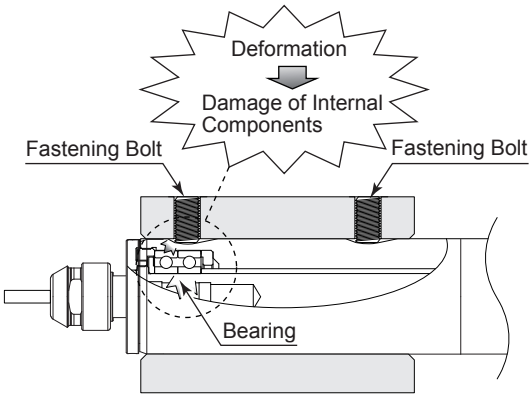


Fig. 23

(3) How to fabricate the Split Type Holder

1) Roughly process (carve) the inside diameter of the Split Type Holder.
2) Cut a slit. (Ex. Slit 2mm)
3) Tighten the Screw for Removal and widen the Slit Area.
4) Insert spacer (ex t = 2mm) into the Slit Area.
5) Loosen the Screw for Removal, and tighten the Fastening Bolt at the specified torque.
6) Finish machining the Split Type Holder so that the inside diameter of the Split Type Holder matches the motor spindle's outside diameter (30mm).
   The tolerance range for the holder is -0.01mm to -0.015mm and a roundness and cylindricity of less than 5μm.
7) When inserting the motor spindle, loosen the Fastening Bolt and tighten the Screw for Removal, and widen the Slit Area.

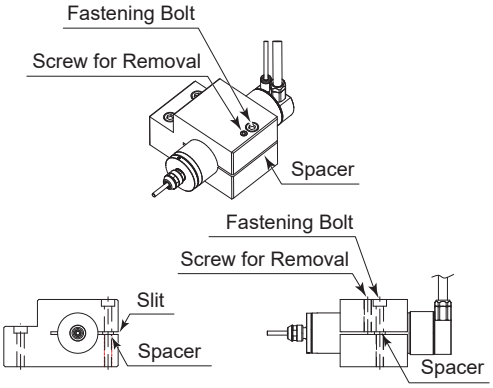


Fig. 24

⚠ CAUTION

Due to the wide variety of dimensions and materials of the holders to be manufactured, the suitability of the manufactured holders should be determined by the system designer or specifier after analysis and testing as necessary. The responsibility for ensuring the suitability of the holder, the desired characteristics of the motor spindle, and safety rests with the person who determines the suitability of the system.

(4) Motor current value display function and tightening when clamping

1) Motor current value display function
The Control Unit has a function that displays load on the motor spindle in current (x10mA). (Refer to "PARTS NAMES" of the E3000i CONTROLLER Operation Manual). This function allows you to confirm the working load / clamping level when clamping the Motor Spindle in fixtures.

2) Clamping the Motor Spindle
Adjust the clamping pressure level using the motor current value display. Run the motor spindle at any speed and note the current level while the motor spindle is not secured in any manner. Insert the motor spindle into the fixture and carefully and slowly tighten. The clamped current value should never be more than +1 (+10mA) of the current load reading before clamping.

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.

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

(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) Do not strike or drop the spindle.

Table. 4 Relationship Between Drill Overhang Length and RPM

Overhang Length (mm)	Max RPM
Drill diameter x 10	100 % of the RPM
Drill diameter x 20	70 % of the RPM
Drill diameter x 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 x 5	100 % of the RPM
Shank diameter x 10	50 % of the RPM
Shank diameter x 10 or more	30 % or less of the RPM

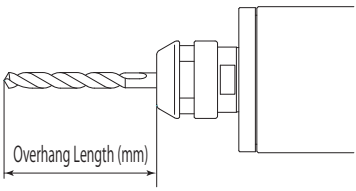


Fig. 25

14. CAUTIONS WHEN USING GRINDSTONES

⚠ CAUTION

The maximum surface speed or rpm is always specified for a grindstone. Do not exceed the maximum speed with reference to the calculating chart below. Always follow the grindstone manufacturers' recommendations.

$$\text{Surface Speed (m / s)} = \frac{3.14 \times \text{Diameter (mm)} \times \text{rotation speed (min}^{-1}\text{)}}{1{,}000 \times 60}$$

(1) The proper surface speed for general grindstones is 10-30m / s.
(2) Do not exceed 13mm of overhang for mounted grindstones as shown in Fig. 26. If the overhang must exceed 13mm, reduce the motor speed in accordance with table 6.
(3) Dress the grindstone prior to use.
(4) Do not use cutting tools with bent or broken shanks, cracks or excessive run-out.
(5) For grinding, the maximum depth of cut should not exceed 0.01mm radially or axially. Reciprocate the tool several times after each pass to eliminate tool pressure.
(6) Always operate tools within the allowable recommended speed of the tools. Use of a tool outside of the allowable speed of the tools could cause damage to the spindle and injury to the operator.
(7) Keep the tool shank and collet clean. If contaminants are left in the collet or collet nut, excessive run-out will cause damage to the tool and or spindle.
(8) Do not strike or disassemble the motor spindle.
(9) Please set the tools to minimize the overhang amount. 13mm is the maximum amount of overhang to maintain high accuracy and safety.

Table. 6 Overhang and Speed

Overhang (mm)	Max. Speed (min^{-1})
20	N x 0.5
25	N x 0.3
50	N x 0.1

N = Max. Operating Speed with 13mm overhang.

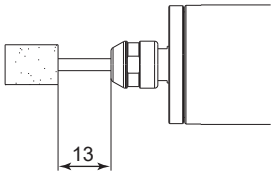


Fig. 26

15. 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.)

16. 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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