NAKANISHI

OM-KK1027MA 000

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

BM-1680RA/BM-1580RA

取 扱 説 明 書 / OPERATION MANUAL

日本語 : P1 - P36 / English : P37 - P74

Thank you for purchasing the BM-1680RA / BM-1580RA motor spindle. This motor spindle is designed for small-diameter drilling and milling. An E3000i CONTROLLER, a motor cord, and an air line kit are required to operate this motor spindle. Read this operation manual and the manuals for the above-mentioned products carefully before use for proper and long-term operation. Keep this manual in an accessible place for future reference.

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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 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 **It is dangerous, so do not touch rotating parts while they are rotating.**
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 handle or remove this product until safety has been confirmed as described below.**
1) Before handling this product, confirm the safety of the entire machine to prevent injury and damage.
2) Before removing this product, confirm the machine is safe, shut off all power and air supplies, and then exhaust all residual compressed air from the system.
⑥ **When installing a tool, tighten the collet correctly and check again the collet and collet nut before use. Do not over-tighten the collet. This may cause damage to the motor spindle.**
⑦ **Do not use substandard tools, such as those that are unbalanced, bent, broken, chipped, or have excessive runout. Using such tools can cause the shank to fracture or bend, potentially resulting in injury. When using a tool for the first time, start it at a low speed and gradually increase the rotation while confirming it is operating safely.**
⑧ **Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.**

⚠ WARNING

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 to the internal components.**

② **Be sure to clean the collet and collet nut, 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.**

③ **When cleaning, stop motor rotation and remove dirt and debris with a brush or cloth. Also, never blow air into the dust proof cover area (refer to "6 - 3 Outside View"). This will cause debris to enter the bearings and cause malfunctions.**

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.**

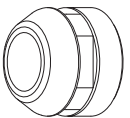
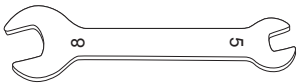
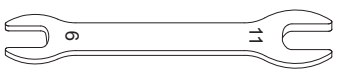
⚠ CAUTION

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 14. " TROUBLE SHOOTING ".**
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 5. 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 NSK NAKANISHI or an authorized service center.**
⑬ **When using this motor spindle for mass production, please purchase the another motor spindle as a spare in case of an emergency.**

2. PACKAGE CONTENTS

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 Package Contents List

Motor Spindle・・1 pc. 	Collet Nut (CHN-A)・・1 pc.* 	Wrench (8×5)・・1 pc. 
Wrench (9×11)・・1 pc. 	Operation Manual・・1 pc. 	Inspection Card・・1pc. 

* The collet nut is attached to the motor 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.
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 This is a straight-type motor spindle with a housing made from precision-ground, hardened stainless steel (SUS), available in body diameters of φ 16 mm and φ 15.875 mm. This allows for flexible layout within your machine.

② This motor spindle uses a high-speed, sensorless motor. As it is a brushless motor, the need for troublesome brush replacement is eliminated.

③ Two new models have been added to the lineup: motor spindles with a quick disconnect cord (BM-1680RA / BM-1580RA).

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	BM-1680RA / BM-1580RA
Max. Motor Speed	80,000 min^{-1}
Spindle Accuracy	Within 1 μm
Max. Output	115 W
Quick Disconnect Cord Length	0.5 m
Net Weight	140 g
Noise Level	Within 65 dB
IP Code	IP57
Motor Cord Type (Option)	EMCD-3000i-3M (3 m) / EMCD-3000i-5M (5 m) / EMCD-3000i-7M (7 m)

<Option>

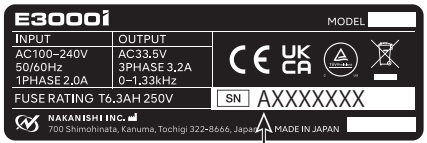
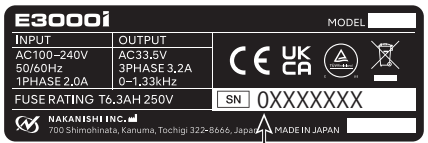
Collet (CHA- □□) *Note1	ϕ0.5–ϕ4.0 mm in 0.1 mm increments and ϕ2.35 mm, ϕ3.175 mm.
Motor Cord (EMCD-3000i- □ M) *Note2	Motor cord length: 3 m, 5 m and 7 m.(The Air Hose (ϕ4 mm) of the same length is attached.) For the E3000i CONTROLLER connection *Note3

*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.

*Note3: Connect this product to a compatible controller (see Table 2). If it is connected to an incompatible controller, an “EL” error will be displayed on the indicator due to the controller’s error detection, and the motor will not rotate.

Table 2 Identifying the Compatible Controller

Identification Point	Compatible Controller	Incompatible Controller
Serial Number Initial on the Rating Plate	 Initial Letter: A–Z (excluding I, O, Q)	 Initial Letter: "0"

6 - 2 Compatibility

This product is compatible with the following safety standards.

- Safety standard in North America (UL,CSA) c UL us

UL1004-1	CSA C22.2 No.100

- EC Directive CE

Low Voltage Directive	IEC/EN60034-1

6 - 3 Outside View

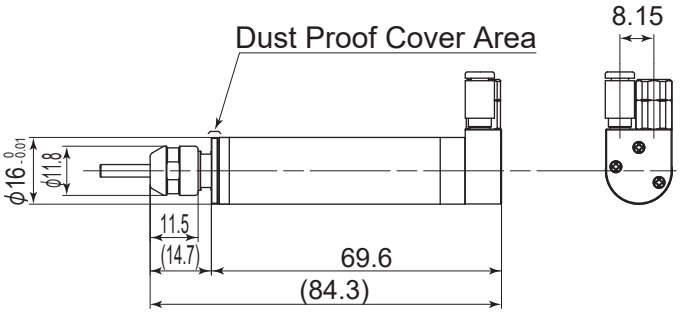


Fig. 1 BM-1680RA

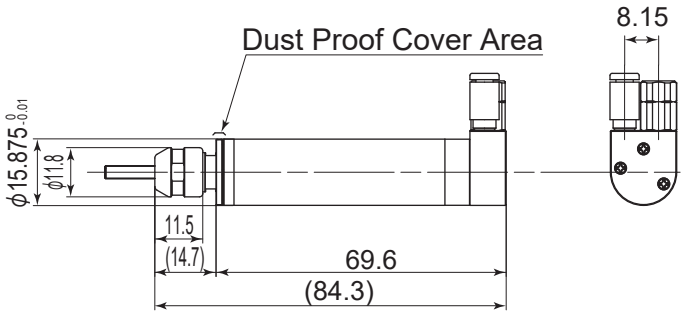


Fig. 2 BM-1580RA

6 - 4 Torque-Output Characteristics Graph

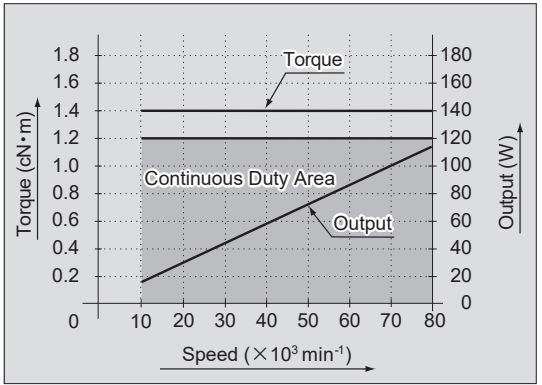


Fig. 3

Setting Range

- E3000i Controller: 10,000–80,000 min^{-1}
- E3000 Selector: 1,000–80,000 min^{-1}

Although the E3000 Selector allows settings between 1,000 and 10,000 min^{-1}, this range is outside the allowable operating range.
Do not use the product within this range.

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. 4)
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. 5)
At this time, make sure that the latches of the collet nut are properly seated in the groove of the collet. (Fig. 6)

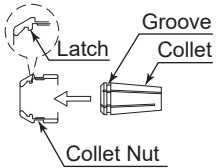


Fig. 4

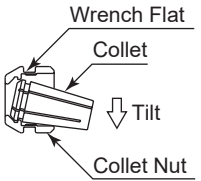


Fig. 5

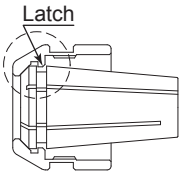


Fig. 6

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)."

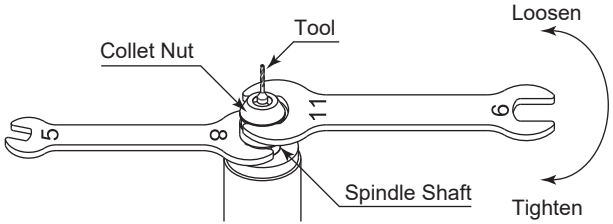


Fig. 7

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, causing difficulty 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.)
③ Clean the collet and collet nut, then insert the new tool and tighten the collet by turning clockwise. Do not over tighten.

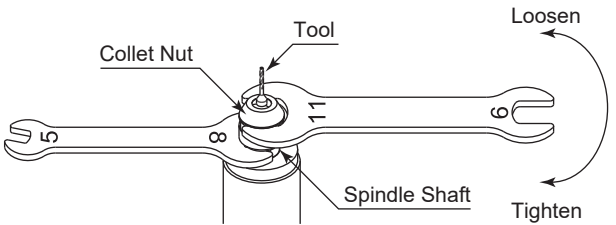


Fig. 8

9. REPLACING THE COLLET

⚠ CAUTION

When attaching the collet to the collet nut, ensure that the latch inside the collet nut is fully engaged in the groove on the collet. If the collet nut is tightened without the collet being properly engaged, the collet may get stuck inside the motor spindle and become impossible to remove.

① Remove the tool according to the section 8. "CHANGING THE TOOL" procedure above and remove collet nut assembly (Fig. 9).
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. 10).
③ To install the collet, hold the collet at a slight angle, and insert it into the collet nut (Fig. 11).
Press the collet in the collet nut by positioning the collet in the collet nut and pressing down on flat surface (Fig. 10).
Be sure to fully engage the latch inside the collet nut into the groove on the collet outer circumference area (Fig. 12).

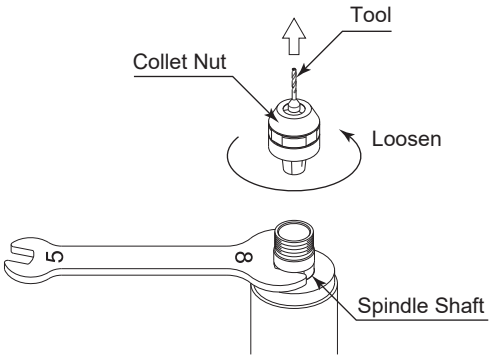


Fig. 9

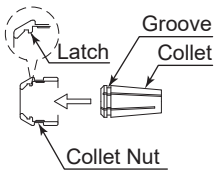


Fig. 11

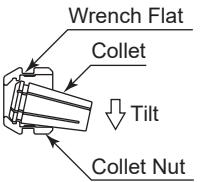


Fig. 10

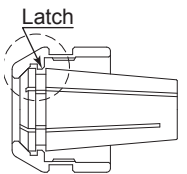


Fig. 12

10. CONNECTION OF MOTOR CORD AND AIR SUPPLY

10 - 1 Connecting the Motor Cord<EMCD-3000i- □ M>

⚠ CAUTION

- **Before connecting to the Motor Cord Plug, make sure the Main Power Switch on the CONTROLLER is turned OFF. If the Main Power Switch on the CONTROLLER is ON while connecting the Motor Cord Plug, damage may cause to the CONTROLLER.**
- **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 of the Motor Cord.

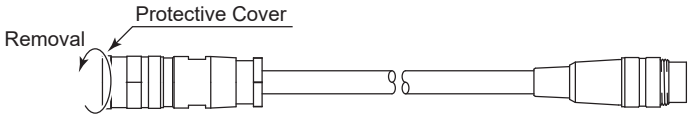


Fig. 13

② Ensure Alignment pin upward. Carefully insert the Alignment pin into the Alignment hole and push straight into the motor connector of the Motor Cord Side.

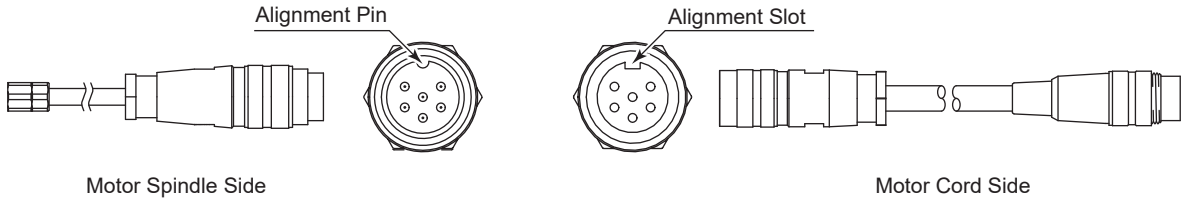


Fig. 14

③ Tighten the Coupling Nut.

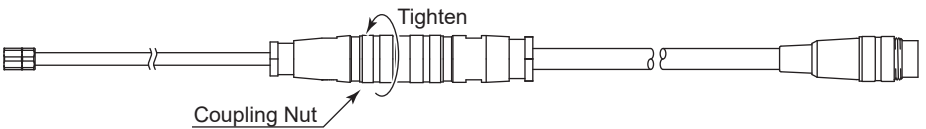


Fig. 15

④ While pushing the collar on the air hose joint, remove the plug.

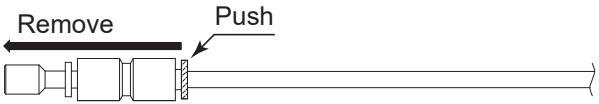


Fig. 16

⑤ Insert the air hose into the joint on the motor spindle side.

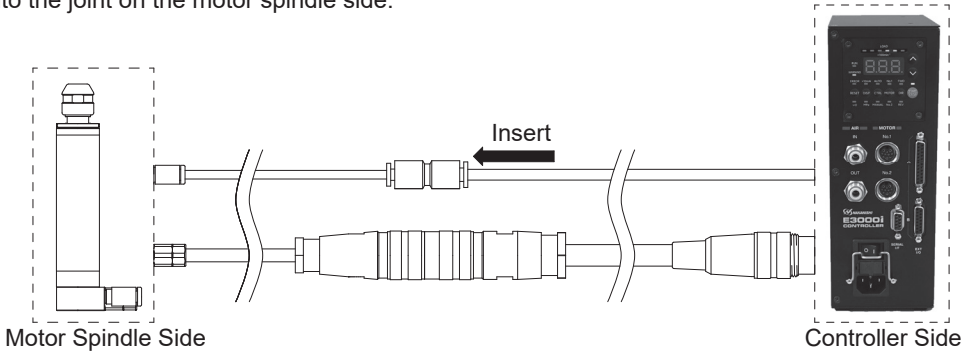


Fig. 17

10 - 2 Air Supply

The air pressure requirement varies with the number of the motor connections and the length of the hose (quick disconnect cord and motor cord). Verify the number of spindles and cable length before setting the pressure according to Table 3.

⚠ CAUTION

- **"Hose Length" is the total length, consisting of the hose for the quick disconnect cord and the hose for the motor cord. Refer to Fig. 18 and Table 3 to set the air supply pressure that corresponds to the 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. (Common for all motor spindle models.)**

Table 3

Total Hose Length (m) *Note 4		3.5	5.5	7.5
When one motor spindle is connected	Air Pressure (MPa)	0.25	0.30	0.35
When two motor spindles are connected				

*Note 4: "Hose Length" indicates total hose length consisting of the Quick Disconnect Hose and the Motor Cord Hose. See Fig.18 to see how to calculate "Hose Length".

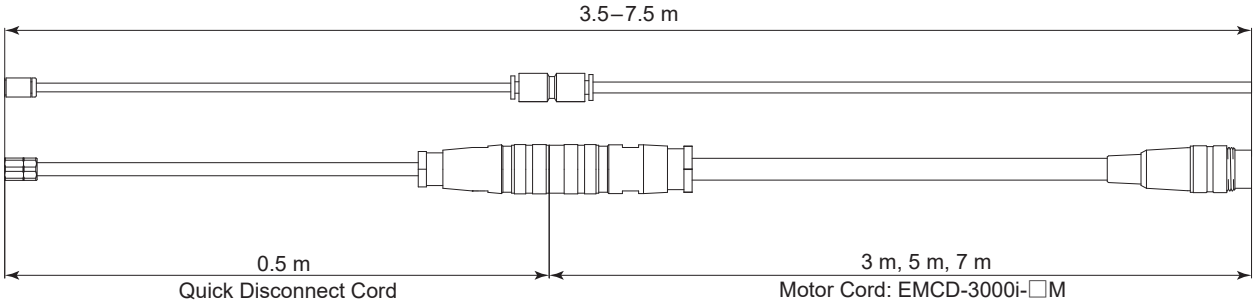


Fig. 18

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 cause shock to the spindle. This may cause damage to internal components and result in malfunctions.**

⚠ CAUTION

- **When mounting the motor spindle, be sure to mounting within clamping area etched on the spindle. If the motor spindle is installed incorrectly, this will cause and damage to the motor spindle.**
- **Cautions when tightening the securing bolt of the Split Type Holder.**
  Do not over tighten the bolt. This may cause damage to motor spindle's precision. Tighten the bolt until the spindle body can not be turned by hand within the fixture. Extreme tightening is not necessary or recommended.
  Apply working force and check that the motor spindle is tight before using.

① When mounting a motor spindle, refer to the Clamping Area etched on the motor spindle.

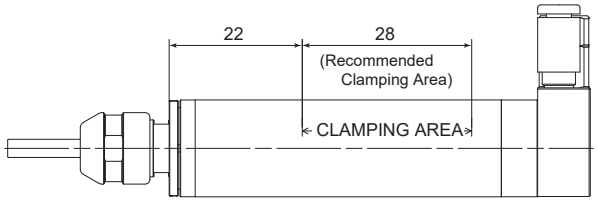


Fig. 19

② When mounting the motor spindle into a holder, the method shown in Fig. 20 is recommended. For manufacturing instructions, refer to " ③ How to fabricate the split type holder". If the method in Fig. 20 cannot be used, mount it using the method in Fig. 21 or Fig. 22. When using the method in Fig. 22, refer to Fig. 24.

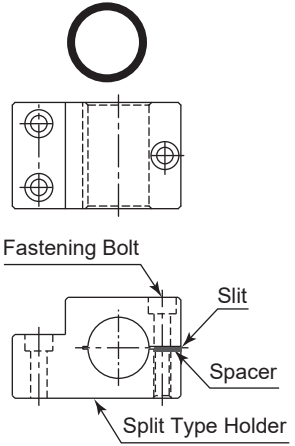


Fig. 20

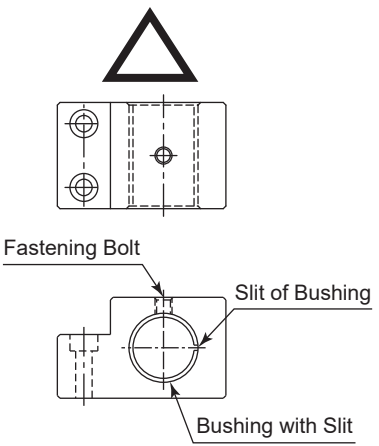


Fig. 21

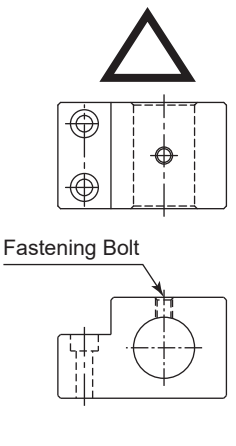


Fig. 22

⚠ CAUTION

Do not mount directly with the fastening bolts outside the recommended clamping area. This can cause the spindle's housing to deform, leading to rotation failure and heat generation (see Fig. 23).

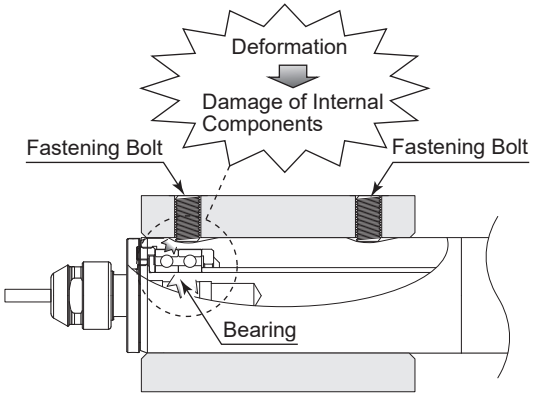


Fig. 23

⚠ CAUTION

Ensure the outer diameter of the fastening bolt is completely within the 28 mm CLAMPING AREA.
***Align the bolt using its outer diameter as the reference, not its center line.**

- **M5: 0.7 N·m**
- **M6: 1.0 N·m**

***Do not exceed the recommended torque. Overtightening can cause the motor spindle to deform, making it impossible to remove from the holder.**

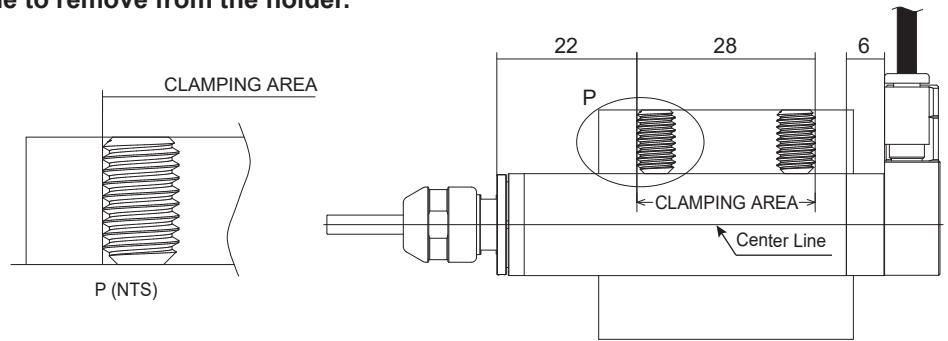


Fig. 24

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) Twist the Screw for Removal and Broaden the Slit Area.

(4) Insert spacer (ex t = 2mm) into the Slit Area.

(5) Loosen the Screw for Removal, and tighten the Fastening Bolt with the specified torque.

(6) Finish machining the Split Type Holder so that the inside diameter of the Split Type Holder is motor spindle's outside diameter (Refer to Table 4).
The correct 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 twist the Screw for Removal, and broaden the Slit Area.

Table 4

Model	BM-1680RA	BM-1580RA
ϕD	ϕ16	ϕ15.875

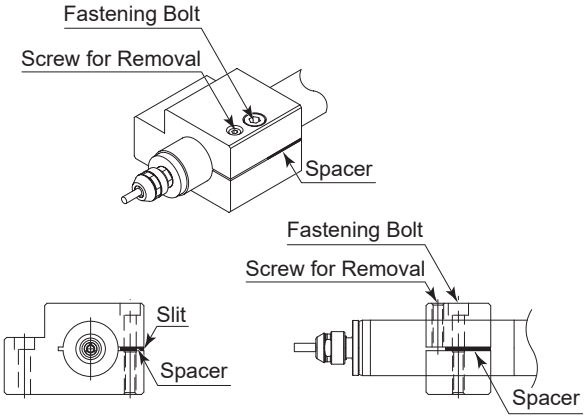


Fig. 25

⚠ CAUTION

Due to the wide variety of dimensions and materials used in holder fabrication, the final determination of a holder's suitability must be made by the system designer or specifier, based on necessary analysis and testing. Responsibility for the holder's suitability, for ensuring the motor spindle achieves its intended performance, and for guaranteeing overall system safety rests entirely with the party who makes this determination. Therefore, please conduct a thorough evaluation of these factors before manufacturing the holder.

④ Motor current display and adjusting the clamping pressure

(1) Motor current display

The Control Unit has a function that displays load on the motor spindle in current (×10mA). (Refer to Control Panel Details ⑱ of the E3000i CONTROLLER Operation Manual). This display allows you to confirm the load / clamping level when fixing the Motor Spindle in fixtures.

(2) Clamping the Motor Spindle

Adjust the clamping pressure level using the motor current 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 Display should never be more than +1 (+10mA) of the current load reading before clamping. This is a very important step when installing the E3000i Motor Spindle.

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 5.

Table 5

Steps	1	2	3	4	5	6
Rotation Speed (min^{-1})	15,000	30,000	40,000	50,000	60,000	80,000
Rotation time (min)	15	10	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 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 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 rotation speed when using a drill or an end mill.

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

① The spindle rotation speed depends on the tool diameter and the workpiece material.
② Please follow the manufacturer's recommended feeds and speeds. Applying tools outside of manufacturer's maximum recommended rotational speed may cause damage to the spindle or injury to the operator.
③ In order to maintain tolerance and safety, set cutting tools inside the collet maximizing the contact with the cutting tool shank and reducing excess and unnecessary cutting tool overhang. This will increase rigidity and accuracy while decreasing deflection and minimizing tool breakage.
④ When increasing the cutting tool overhang, reduce the motor speed.
⑤ Clean the tool shank before attaching it. Debris in the collet may cause runout.
⑥ Do not strike, drop or disassemble the spindle.

Table 6 Relationship Between Drill Overhang and Rotation Speed

Overhang (mm)	Max. Rotation Speed
Drill diameter × 10 times	100% of the rotation speed
Drill diameter × 20 times	70% of the rotation speed
Drill diameter × 20 times or more	50% or less of the rotation speed

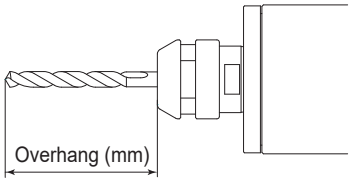


Fig. 26

Table 7 Relationship Between End Mill Overhang and Rotation Speed

Overhang (mm)	Max. Rotation Speed
Shank diameter × 5 times	100% of the rotation speed
Shank diameter × 10 times	50% of the rotation speed
Shank diameter × 10 times or more	30% or less of the rotation speed

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 run	The ball bearings are damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	Motor is broken.	Replace the motor. (Return to NAKANISHI dealer service.)
Overheating during rotation	Cutting debris has contaminated the ball bearing, and the ball bearing is damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	Low air pressure.	Check air hose connection and air pressure.
Abnormal vibration or noise during rotation	Using bent tool.	Replace the tool.
	Cutting debris has contaminated the ball bearing.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The ball bearings are worn.	

Trouble	Cause	Inspection / Corrective Action
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 the collet nut.
High run-out	The tool is bent.	Change the tool.
	Collet nut is not correctly installed.	Secure the collet and the collet nut correctly.
	Wear or scratches on collet and collet nut	Replace the collet and the collet nut.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)
	Contaminants inside the collet and the collet nut or the spindle.	Clean the collet, collet nut and the inside of the taper and spindle.
	The ball bearings are worn.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

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 electrical components .

取扱説明書のダウンロード ▶
Download operation manual

ウェブサイト ▶
Our website

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