クイックチェンジスピンドル / Quick Change Spindle

NRR3060-QC

取扱説明書 / OPERATION MANUAL

日本語 : P1 - P14 / English : P17 - P31

OM-K0628 003

Thank you for purchasing the Quick Change Spindle " NRR3060 - QC ". This Spindle is designed for grinding, small diameter drilling and milling, etc. The E3000 CONTROLLER and Air Line Kit, brushless motor 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 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 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.**

⚠ WARNING

⑥ 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 Ensure that the mounted the collet holder to the Spindle before rotate the Spindle.

⑩ When installing a tool in the collet holder, tighten the collet correctly then re-check the collet and collet nut before operating. Do not overtighten the collet. This may cause damage to the collet holder.

⑪ 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.

⑫ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.

⑬ 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 Make sure the inner face of the spindle and taper surfaces of the collet holder are clean (Clean them if debris is found.) mounting or before replacing the collet holder.
Ground particles or metal chips stuck to the surface will cause run-out or damage to the collet and spindle. Loss of concentricity will cause spindle damage due to the lack 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 When replacing the tool, make sure the tool shank, collet, collet nut, and inner face of the collet holder are clean. If ground particles or metal chips stick to the inside of the collet, damage to the collet holder or spindle can occur due to the loss of precision.

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.

⚠ CAUTION

⑦ **Select suitable products or tools for all applications. Do not exceed the capabilities of the Spindle 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 to the tool. Do not spray directly on the Spindle body and collet holder. If large amount spray directly on the Spindle and collet holder, it may cause excess load of the motor 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 " 13 TROUBLESHOOTING ".**

⑪ **Always check if the tool, collet, collet nut, connection hose and supply air hose for damaged before and after operating.**

⑫ **If the collet, collet nut or the collet holder show signs of wear or damage, replace them before a malfunction or additional damage occurs.**

⑬ **After installation, repair, initial operation, or long periods of non operation, please refer to section " 11 BREAK-IN PROCEDURE " detailed in Table. 2. When checking the Spindle, no vibration or unusual sound should be observed during rotation.**

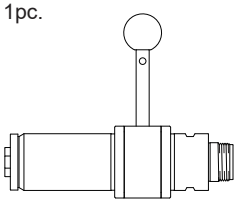
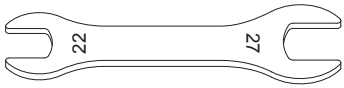
⑭ **Do not disassemble, modify or attempt to repair this Spindle. Additional damage will occur to the internal components. Service must be performed by NSK NAKANISHI or an authorized service center.**

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. 	Wrench (22 x 27)・・1pc. 
Inspection Card・・1pc. 	Operation Manual・・1set 

* The collet holder, collet and collet nut are sold separately.

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 Spindle features a lever type chucking system, which facilitates the replacement of the collet holder by lever rotation.
② The spindle housing is made from precision ground, hardened, stainless steel (SUS) with a mounting outside diameter of ϕ30mm.
③ There are 2 types of collet holders. Various sizes of mounting collets are available depending on the collet holder used (CHK 0.5mm - 6.35mm or CHA 0.5mm - 4.0mm).

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	NRR3060 - QC
Maximum Motor Rotation Speed	60,000min^{-1} (rpm)
Spindle Accuracy	Less than 1μm
Lever Rotation - Rotation Angle	90°
Applicable Motor *This Spindle can not use the reduction gear.	EM - 3060, EM - 3060J, EM - 3030J
Applicable Collet Holder	QC3 - A (For Collet CHA Type) QC3 - K (For Collet CHK Type)
Weight	570g
Noise Level at 1m distance	Less than 70dB (A)

	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 Holder	QC3 - A	QC3 - K
Collet	CHA - □□	CHK - □□
	φ0.5mm - φ4.0mm in 0.1mm increments and φ2.35mm, φ3.175mm	φ0.5mm - φ6.0mm in 0.1mm increments and φ2.35mm, φ3.175mm, φ4.76mm, φ6.35mm
Collet Nut	CHN - A	K - 265
Wrench	9 x 11, 8 x 5 (1pc. Each. Required)	12 x 14 (2 pcs. Required.)
Preset Adapter	QC3 - ADP	

6 - 2 Outside View

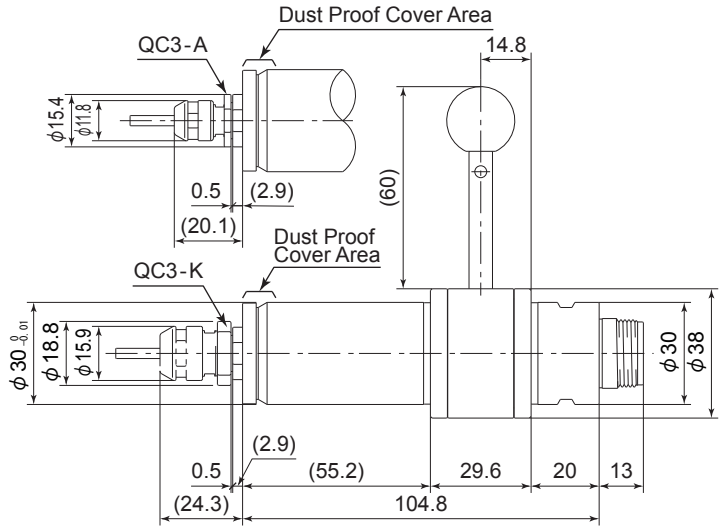


Fig. 1

7. CONNECTION OF THE SPINDLE TO THE MOTOR

⚠ CAUTION

- **Make sure your hands and all interlocking parts of the Spindle and brushless motor are clean before connecting the Spindle to the brushless motor. This is critical in preventing contaminants from entering the Spindle or brushless motor.**
- **When connecting the Spindle to the brushless motor, it is best to hold the brushless motor and Spindle in a vertical position. Carefully connect by threading the brushless motor on the Spindle and avoid mis-alignment, as this will cause damage to the brushless motor and or Spindle drive.**

Align the threads on the front end of the brushless motor and the rear end of the Spindle, then turn the Spindle clockwise. If the drive shaft of the brushless motor does not engage the drive dog on the Spindle smoothly, DO NOT FORCE THEM TO SEAT. Tighten the Spindle after rotating the Dust Proof Cover by hand to engage the drive shaft and the drive dog. Use the provided 27mm wrenches for final tightening of the Spindle to the brushless motor.

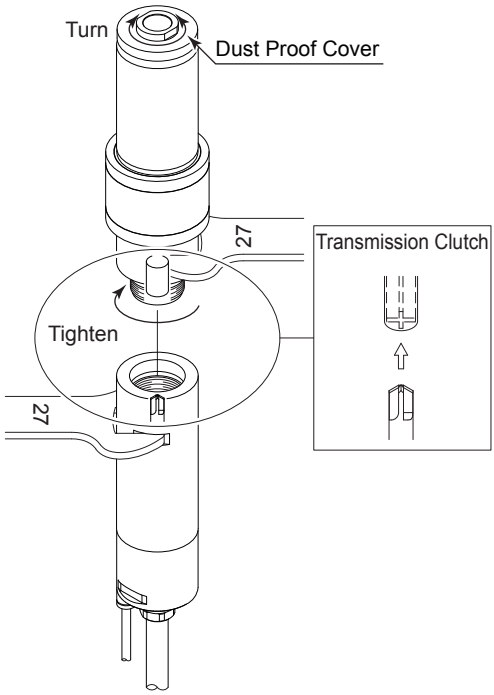


Fig. 2

8. CHANGING THE TOOL AND REPLACING THE COLLET

⚠ CAUTION

- **When installing the collet into the collet nut, be sure to fully engage the latch inside the collet nut to the groove on the collets outer diameter 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.**
- **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.**

RECOMMENDATION

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

8 - 1 How to replace collets using the provided wrenches

(1) Attach the collet to the collet nut. Be sure to fully engage the latch inside the collet nut to the groove on the collets outer circumference area (Fig. 3, Fig. 4) (Install the collet in the collet nut by positioning the collet in the collet nut and pressing down on flat surface (Fig. 5)).

(2) Attach the collet and collet nut to the collet holder and lightly finger tighten (Do not completely tighten until the end) (Fig. 6).

(3) Insert the tool into the collet and position the wrench on the collet holder.
Position the wrench on the collet nut, then tighten the collet nut by turning clockwise (Fig .7).

(4) When removing the tool, set the 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).

(5) When removing the collet, 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. 5).

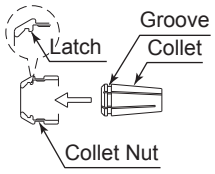


Fig. 3

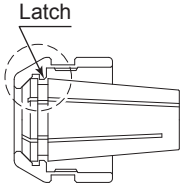


Fig. 4

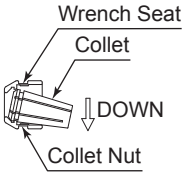


Fig. 5

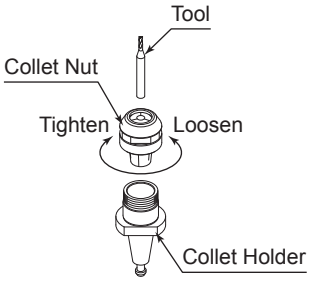


Fig. 6

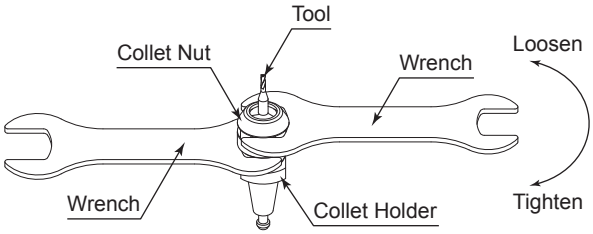


Fig. 7

8 - 2 Tool replacement using a preset adapter

(1) Affix the preset adapter to the tool holder (ϕ20mm) etc.
(2) Align the collet holder to the drive dog notch of the preset adapter, and insert the collet holder (Fig. 8).
(3) Attach the collet and collet nut to the collet holder, and lightly finger tighten (Do not tighten until the end) (Fig. 9).
(4) Insert the tool in to the collet and set the wrench on the collet holder. Set the wrench on the collet nut, and tighten the collet nut by turning clockwise (Fig.10).
(5) When removing the tool, set the 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).

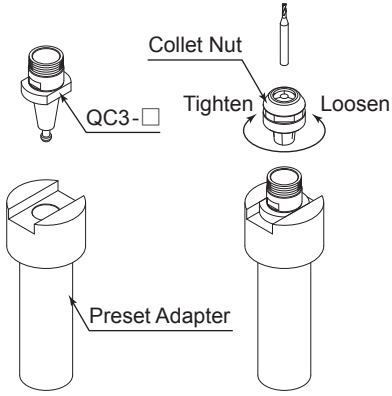


Fig. 8

Fig. 9

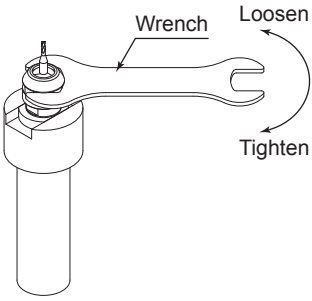


Fig. 10

9. REPLACING THE COLLET HOLDER

⚠ CAUTION

When replacing the collet holder, be sure to stop the motor. If the lever is operated while the motor is rotating, the Spindle will incur internal damage.

(1) Stop the motor rotation and confirm the rotation has stopped.
(2) Rotate the lever 90-Degrees to the OPEN position and remove the collet holder.
(3) Insert the new collet holder. Rotate the lever to LOCK position all the way until it snaps to tighten the collet holder.

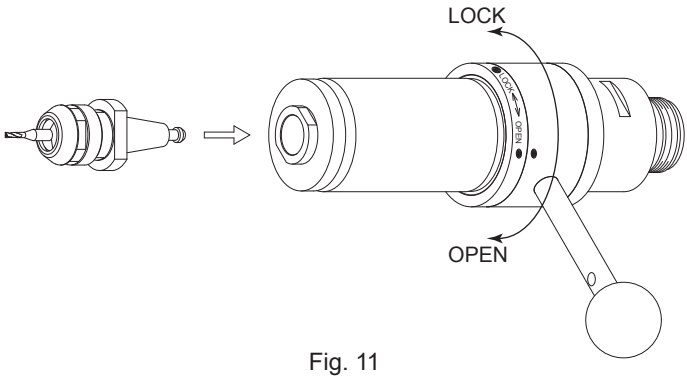


Fig. 11

(4) When installing the collet holder into the Spindle using an automatic tool changer (and other machines), set the collet holder a distance of 1.0 - 1.5mm from the face of the Spindle.

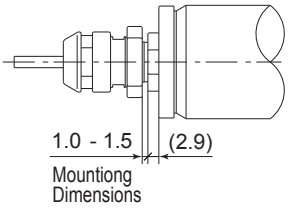


Fig. 12 Before Clamping

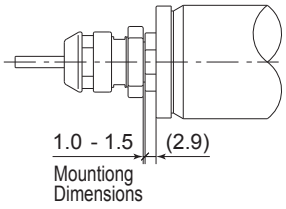


Fig. 13 After Clamping

* After installing the Collet Holder to the Spindle, the Collet Holder alignment can be checked utilizing a Laser Displacement Sensor as illustrated in Fig. 14.

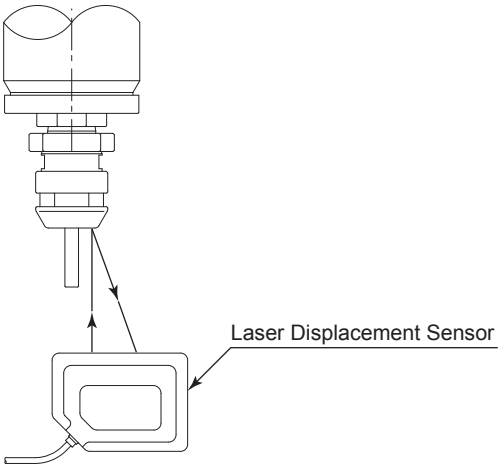


Fig. 14

10. 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.

(1) When mounting a Spindle, refer to the Clamping Area etched on the Spindle (Fig. 15).

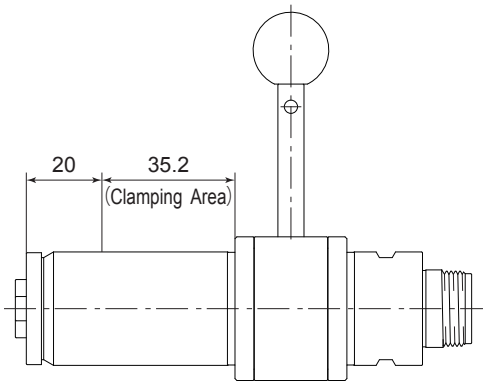


Fig. 15

(2) When installing a Spindle to the holder, recommended installation method is shown Fig. 16. Refer to " (3) How to fabricate the Split Type Holder ". If this is not possible, install as shown in Fig. 17.

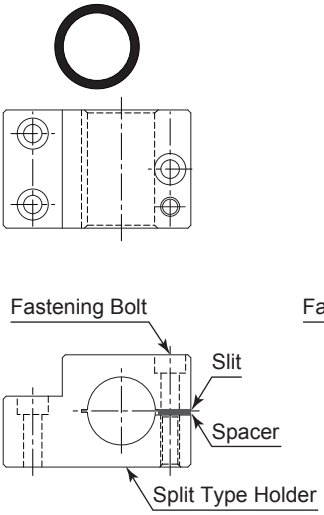


Fig. 16

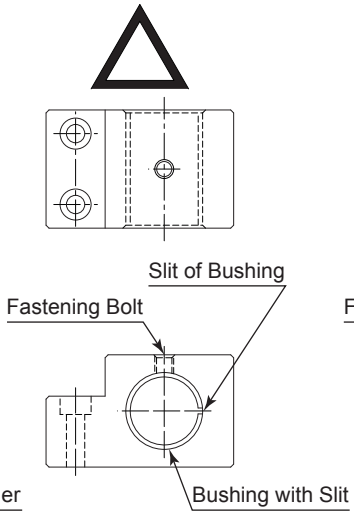


Fig. 17

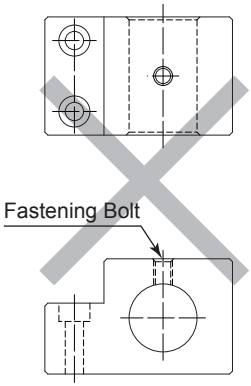


Fig. 18

⚠ CAUTION

Do not allow set screws to come directly in contact with the Spindle body as shown in Fig. 18, 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. 19).

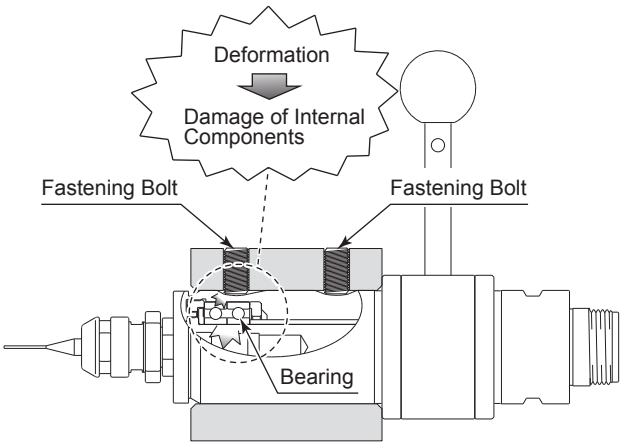


Fig. 19

(3) How to fabricate the Split Type Holder.

① Rough bore the inside diameter of the Split Type Holder.
② Cut a slit. (Ex. Slit 2mm) wide.
③ Tighten the Screw for Removal and Force Open the Slit Area.
④ Insert a spacer (Ex. thickness = 2mm) into the Slit Area.
⑤ Loosen the Screw for Removal, and tighten the fastening bolt with its specified torque.
⑥ Finish the Split Type Holder so that the inside diameter of the Split Type Holder is ϕ30 with its tolerance range from − 0.01mm to − 0.015mm, and its roundness and cylindricity of less than 5μm.
⑦ When inserting the Spindle loosen the Fastening Bolt, and tighten the Screw for Removal, widening the Slit Area.

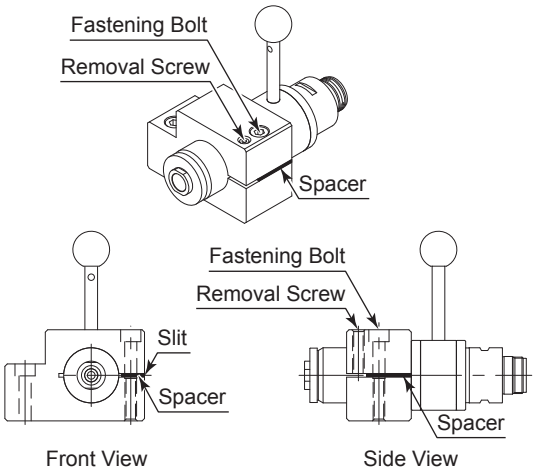


Fig. 20

⚠ CAUTION

- **How to confirm the tightening standard of the holder by the clamp meter 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.

11. 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)	15,000	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.

12. CAUTIONS WHEN USING GRINDSTONES AND TOOLS

⚠ 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 manufacturer's recommendations.

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

(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. 21. If the overhang must exceed 13mm, reduce the motor speed in accordance with Table. 3.
(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 cutting tools within the allowable recommended speed of the cutting tools. Use of a cutting tool outside of the allowable speed of the cutting tools could cause damage to the Spindle and injury to the operator.
(7) Keep the cutting tool shank and collet clean. If contaminants are left in the collet or collet nut, excessive run-out will cause damage to the cutting tool and or Spindle.

(8) When replacing the tool, make sure the tool shank, collet, collet nut, and inner face of the collet holder are clean. If ground particles or metal chips stick to the inside of the collet, damage to the collet holder or Spindle can occur due to the loss of precision.

(9) Do not strike or disassemble the Spindle.

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

Table. 3 Overhang and Speed

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

*N = Max. Operating Speed with 13mm overhang.

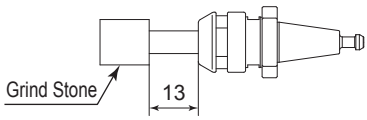


Fig. 21

13. 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.)
	Lever position is OPEN.	Set the lever to the LOCK position.
Overheating during rotation.	Cutting debris has contaminated the ball bearings, and the ball bearings are damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The lever is not set to the LOCK position.	Replace parts. (Return to NAKANISHI dealer service.)
Abnormal vibration or noise during rotation.	The tool shank is bent.	Replace the tool.
	Cutting debris has contaminated the ball bearing.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The spindle ball bearings have been damaged.	
Collet holder slippage.	The collet holder is worn.	Replace the collet holder.
	The internal components of the spindle are worn or damaged.	Replace the internal components of the Spindle. (Return to NAKANISHI dealer service.)
Tool slippage.	Collet or collet nut are not correctly installed.	Check and clean the collet and collet nut. Reinstall the collet and collet nut.
	The collet and the collet nut are worn.	Replace the collet and collet nut.

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

Refer to brushless motor and E3000 CONTROLLER Operation Manuals.

14. 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.

株式会社ナカニシ www.nakanishi-inc.com
〒322-8666 栃木県鹿沼市下日向700
TEL: 0289-64-3380 FAX: 0289-62-5636

NAKANISHI INC. www.nakanishi-inc.com
700 Shimohinata, Kanuma, Tochigi 322-8666, Japan

NSK America Corp. www.nskamericacorp.com
1800 Global Parkway, Hoffman Estates, IL 60192, USA

NSK Europe GmbH EC REP
Elly-Beinhorn-Strasse 8, 65760 Eschborn, Germany

NSK United Kingdom Ltd. UK Responsible Person
Office 4, Gateway 1000, Arlington Business Park, Whittle Way, Stevenage, SG1 2FP, UK

2022-09-06 CACC0907 002H