

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

OM-K0628



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Thank you for purchasing the Quick Change Spindle NRR3060-QC. This spindle features easy replacement of the collet holder in the spindle by lever operation. This spindle is designed for grinding, small diameter drilling and milling, etc.. The <E3000 CONTROLLER>, <E3000 Series Brushless Motor>, and <Air Line Kit> are required to drive this spindle. Read these Operation Manuals carefully before installing and operating.

## 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
⚠ <b>WARNING</b>	<b>A safety hazard could result in bodily injury or damage to the device if the safety instructions are not properly followed.</b>
⚠ <b>CAUTION</b>	<b>A hazard that could result in light or moderate bodily injury or damage to the device if the safety instructions are not followed.</b>

### ⚠ **WARNING**

- ① The 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 or disconnect and touch the plug of power cord and plug of motor cord with wet hands. This may cause an electric shock.
- ⑤ Stop the motor prior to operating the lever. If lever operation is performed during spindle rotation, contact with internal components will damage the spindle.
- ⑥ Never operate or handle the spindle until you have thoroughly read the owner's manual and safe operation has been confirmed.
  - 1) To prevent injuries / damages, check the spindle, collet chuck, collet holder, and cutting tool for proper installation, before operating the spindle.
  - 2) Before disconnecting the spindle, always turn the control power off and turn the compressed air supply to the CONTROLLER off. Then it is safe to remove the spindle.
- ⑦ When mounting the collet holder on the spindle, make sure the lever is in LOCK position before rotating the spindle.
- ⑧ When installing a tool to the collet holder, tighten the collet chuck correctly then re-check the collet chuck and chuck nut before operating. Do not over-tighten the collet chuck. This may cause damage to the collet holder.
- ⑨ Do not use bent, broken, chipped, out of round or sub-standard tools as they may cause shatter or explode.  
Tools with fractures or a bent shank will cause injury to the operator. When using a new tool, rotate it at a low speed and increase speed gradually for safety.

- ⑩ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.
- ⑪ 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 the spindle, as shock can damage to the internal components.
- ② When replacing the collet holder, make sure the inner face of the spindle and taper surfaces of the collet holder are clean. (Clean them if debris is found.) Ground particles or metal chips stuck to the surface will cause run-out or damage to the collet chuck and spindle. Loss of concentricity will cause spindle damage due to the lack of precision.
- ③ When replacing the tool, make sure the tool shank, collet chuck, chuck nut, and inner face of the collet holder are clean. If ground particles or metal chips stick to the inside of the collet chuck, damage to the collet holder or spindle can occur due to the loss of precision.
- ④ When cleaning a spindle, stop the motor and remove debris with a soft brush or a cloth. Do not blow air into the dust proof cover area (refer to section 3 - 2 "Outside View") with compressed air as foreign particles or debris may get into the ball bearings.
- ⑤ When sizing the correct collet chuck size to the tool shank diameter, a tolerance of  $+0 \sim -0.01\text{mm}$  is strongly recommended. A tool shank within the  $+0 \sim -0.1\text{mm}$  range is mountable, however, this may cause poor concentricity and or insufficient tool shank gripping force.
- ⑥ Select suitable products or tools for all applications. Do not exceed the capabilities of the spindle or tools.
- ⑦ Carefully direct coolant spray to the tool. Do not spray directly on the collet holder and spindle body.
- ⑧ Stop working immediately when abnormal rotation or unusual vibrations are observed. If vibrations occur, please check the content of section 12 "TROUBLESHOOTING".
- ⑨ Always check if the tool, collet chuck or chuck nut are damaged before and after operating.
- ⑩ If the collet chuck, chuck nut or the collet holder 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 10. "BREAK-IN PROCEDURE" detailed in Table 1. When checking the spindle, no vibration or unusual sound should be observed during rotation.
- ⑫ Do not disassemble, modify or attempt to repair the spindle. Additional damage will occur to the internal components. Service must be performed by NSK NAKANISHI or an authorized service center.
- ⑬ When using the spindle for mass production, please purchase another spindle as a spare in case of emergency.

## 2. 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 30mm.
- ③ There are 2 types of collet holders. Various sizes of mounting collet chucks are available depending on the collet holder used. (CHK 0.5mm - 6.35mm or CHA 0.5mm - 4.0mm).

## 3. SPECIFICATIONS AND DIMENSIONS

### 3 - 1 Specifications

Model	NRR3060-QC
Allowable Motor Speed	Less than 60,000min <sup>-1</sup>
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 Chuck type : CHA) QC3 - K (For Collet Chuck type : CHK)
Weight	570g

Standard Accessories	
• Wrench (22 × 27) • • 1pc.	• Operation Manual • • 1set.

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

< Option >

Collet Holder	QC3 - A	QC3 - K
Collet Chuck	CHA - □□	CHK - □□
	φ0.5mm - 4.0mm in 0.1mm increments and φ2.35mm, φ3.175mm	φ0.5mm - 6.0mm in 0.1mm increments and φ2.35mm, φ3.175mm, φ6.35mm
Chuck Nut	CHN - A	K - 265
Wrench	9 × 11、8 × 5 (1pc. Required)	12 × 14 (2 pcs. Required.)
Preset Adapter	QC3 - ADP	

### 3 - 2 Outside View

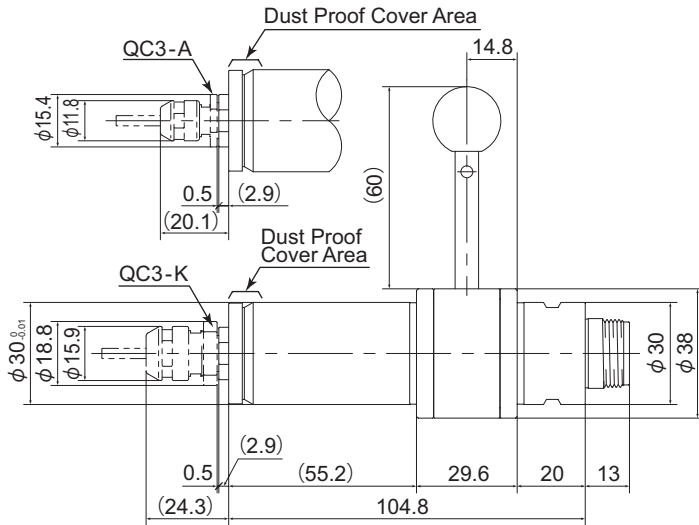


Fig. 1

## 4. CONNECTING TO THE MOTOR

### ! CAUTION

**Make sure your hands and all interlocking parts of the spindle and motor are clean before connecting the motor to the spindle. This is critical to prevent contaminants from entering the motor or spindle.**

Align the threads on the front end of the motor and the rear end of the spindle, and turn the spindle clockwise. If the drive shaft of the motor does not engage the drive dog on the spindle, the spindle could not be turned. **DO NOT FORCE.** Turn the spindle back a few threads, rotate the end of the spindle shaft by hand to engage the drive shaft and the drive dog. Use the provided 27mm wrenches for final tightening of the spindle to the motor.

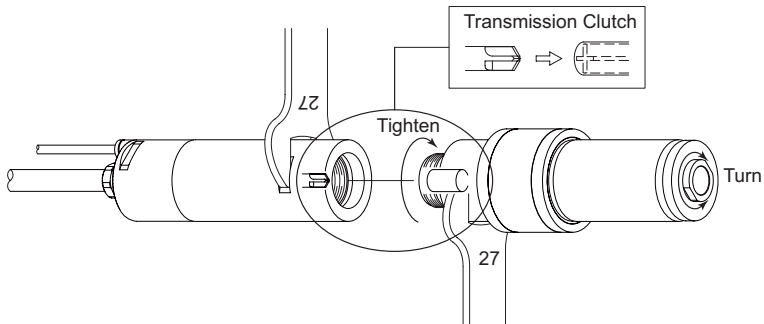


Fig. 2

## 5. CHANGING THE TOOL AND REPLACING THE COLLET CHUCK ■

### ⚠ CAUTION

Do not tighten the collet chuck without inserting a tool or dummy bur, as this will damage the collet chuck, spindle or chuck nut, causing difficulty removing the collet chuck.

### RECOMMENDATION

Please minimize the tool overhang from the collet chuck to maintain high accuracy.

#### 5 - 1 How to replace collets chuck using the provided wrenches

- ① Attach the chuck to chuck nut, and be sure to fully engage the latch inside the chuck nut to the groove on the collet chucks outer circumference area. (Fig. 3, Fig. 4) (Install the collet chuck in the chuck nut by positioning the collet chuck in the chuck nut and pressing down on flat surface. (Fig. 5))
- ② Attach the collet chuck and chuck nut to the collet holder and lightly finger tighten. (Do not completely tighten until the end.) (Fig. 6)
- ③ Insert the tool in to the collet chuck and position the wrench on the collet holder. Position the wrench on the chuck nut, then tighten the chuck nut by turning clockwise. (Fig. 7)
- ④ When removing the tool, set the wrench on the chuck nut and turn it counterclockwise to loosen the collet chuck and remove the tool. (The first turn will loosen the chuck nut, but the tool will not release and turning will become stiff. Keep turning through the stiffness and the collet chuck will open.)
- ⑤ When removing the collet chuck, the collet chuck and chuck nut are secured by a groove in the collet chuck and a flange in the chuck nut. To remove the collet chuck hold the chuck nut in one hand and push diagonally down on the collet chuck. The collet chuck should be released. (Fig. 5).

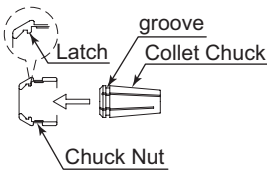


Fig. 3

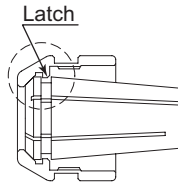


Fig. 4

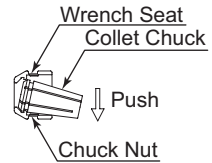


Fig. 5

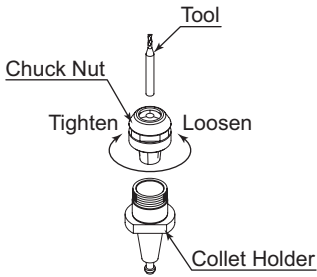


Fig. 6

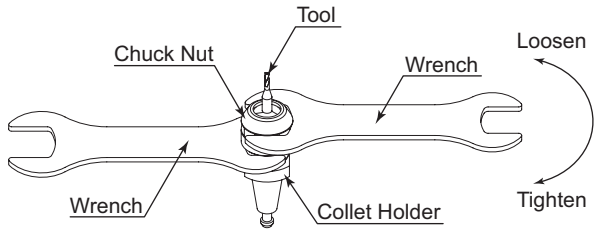


Fig. 7

## 5 - 2 Tool replacement using a preset adapter

- ① Affix the preset adapter to the tool holder ( $\phi 20\text{mm}$ ) 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 chuck and chuck 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 chuck and set the wrench on the collet holder. Set the wrench on the chuck nut, and tighten the chuck nut by turning clockwise. (Fig. 10)

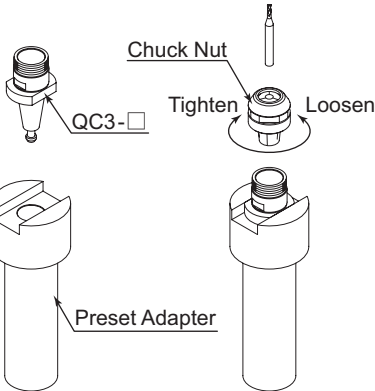


Fig. 8

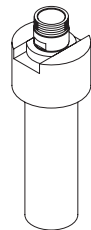


Fig. 9

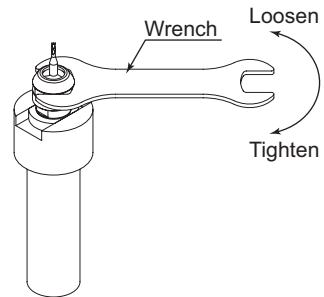


Fig. 10

## 6. REPLACING THE COLLET HOLDER

### ⚠ CAUTION

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

- ① Stop the spindle 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.

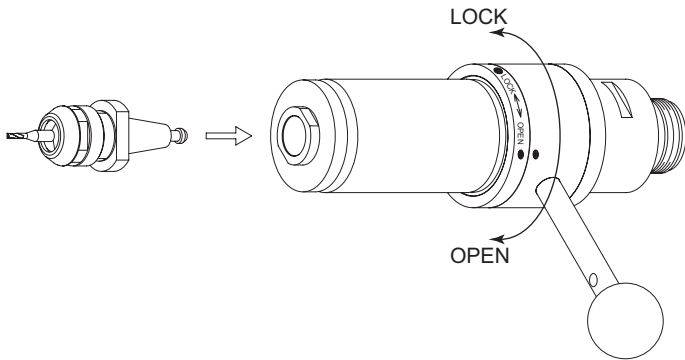


Fig. 11

- 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.

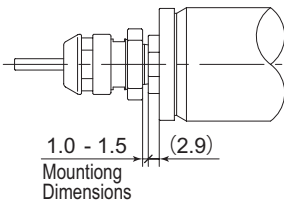


Fig. 12 Before Clamping

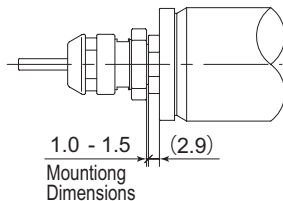


Fig. 13 After Clamping



## 7. INSTALLATION OF THE MOTOR AND SPINDLE

### ⚠ WARNING

Whenever connecting a spindle to an electric motor, or when installing a spindle to a fixed base, ensure that 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 mounting within clamping area etched on the spindle. If the spindle is installed incorrectly, this will cause and damage to the spindle.
- Cautions when tightening the securing bolt  
Do not over tighten the bolt. This may cause damage to 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 spindle is tight before using.

① When mounting a spindle, refer to the Clamping Area etched on the spindle (Fig. 14).

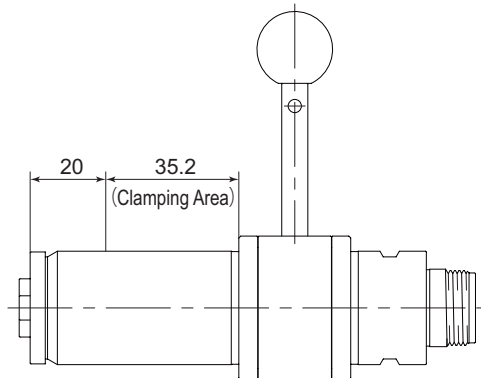


Fig. 14

- ② The installation shown in Fig. 15 "How to install using a split type holder" is the recommended installation method. Refer to ③ "How to fabricate a Split Type Holder" section. If this is not possible, install as shown in Fig. 16.

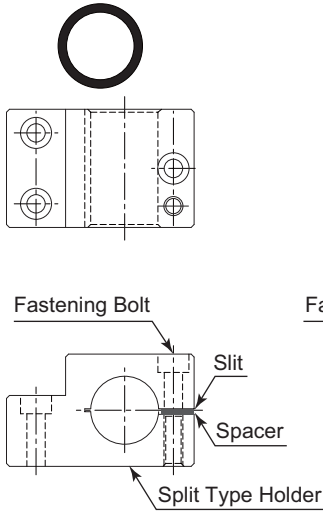


Fig. 15

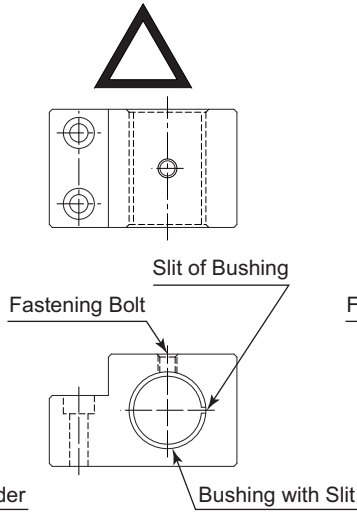


Fig. 16

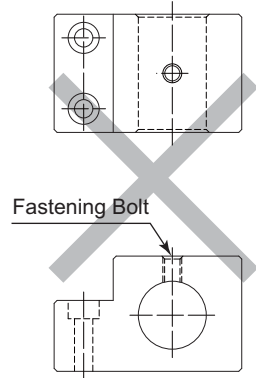


Fig. 17

**! CAUTION**

**Do not allow set screws to come directly in contact with the spindle body as shown in Fig. 17, as this will result in damage to the spindle housing and internal its components.**

**When installing, never clamp directly over the spindle bearings, as this will result in bearing damage. (Refer to Fig. 18)**

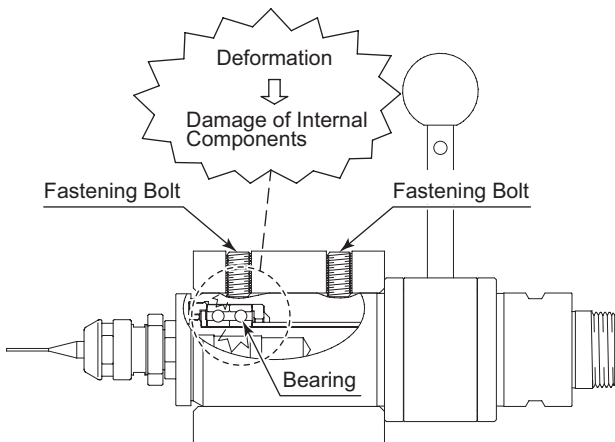


Fig. 18

③ How to fabricate a Split Type Holder

- (1) Semi finish (bore) the inside diameter of the Split Type Holder.
- (2) Cut a slit in the holder. (Approximately 2mm wide)
- (3) Tighten the Removal Screw (Set Screw) and widen the Slit Area.
- (4) Insert a spacer (ex t = 2mm) into the Slit Area.
- (5) Loosen the Removal Screw and tighten the fastening bolt with the specified torque.
- (6) Finish the Bore of the Split Type Holder so that the inside diameter of the Split Holder is  $\phi 30 \begin{smallmatrix} -0.01 \\ -0.015 \end{smallmatrix}$  with its roundness and concentricity of less than 5 $\mu$ m.
- (7) When inserting the spindle, loosen the Fastening Bolts and tighten the Removal Screw, widening the Slit Area.

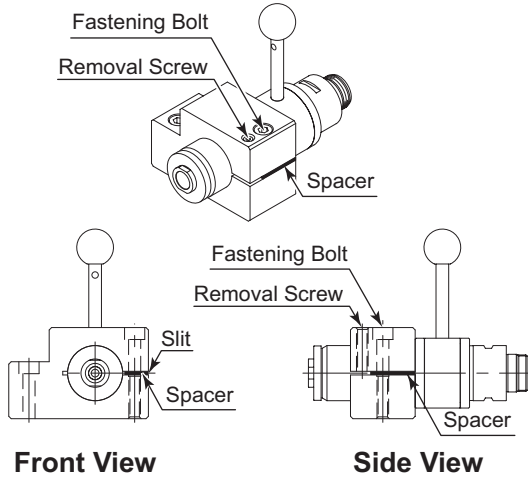


Fig. 19

**⚠ CAUTION**

**HOW TO CONFIRM THE CORRECT SPINDLE TIGHTNESS USING THE CONTROLS TIGHTNESS METER**

- Measure the current value (mA x10) at the CONTROLLER of the spindle in a no load state (not clamped) at maximum rotation speed. Record the mA x10 reading. Fasten the spindle in the split type holder so that the increase in the no-load current value (during rotation at the maximum rotation speed) with the spindle tightened in place is a maximum 20mA (for type 100V / 120V) / 10mA (for type 200V / 230V) or less, compared to the no-load current value that was recorded. 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 motor spindle is installed. NAKANISHI offers motor spindles with a wide variety of capabilities and specifications.

Please carefully check the motor spindle's specifications against the requirements of your equipment and verify suitability and safety of the Holder prior to initial use.

## 8. BREAK-IN PROCEDURE

During transportation, storage or installation the grease inside the bearings will settle. If the spindle is suddenly runs 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 1.

Table 1.

Step	1	2	3	4	5
Rotation Speed ( $\text{min}^{-1}$ )	15,000	30,000	40,000	50,000	60,000
Rotation Time ( $\text{min}^{-1}$ )	15	10	10	10	10
Items to Check	No Abnormal Noises	Spindle Housing no hotter than 20°C. If hotter than 20°C stop for at least 20 minutes, check installation and restart Break-In procedure.			Spindle Housing less than 20°C.

## 9. CAUTIONS IN USING GRINDSTONES AND CUTTING 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 manufacturers recommendations.

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

- ① The proper surface speed for general grindstones is 600 - 1,800m / min.
- ② Do not exceed 13mm of overhang for mounted grindstones as shown in Fig. 20. If the overhang must exceed 13mm, reduce the motor speed in accordance with Table 2.
- 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 chuck clean. If contaminants are left in the collet chuck or chuck nut, excessive run-out will cause damage to the tool and or spindle.
- ⑧ Do not strike or disassemble the 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 2. Overhang and Speed

Overhang (mm)	Max. Speed (min <sup>-1</sup> )
20	N x 0.5
25	N x 0.3
50	N x 0.1

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

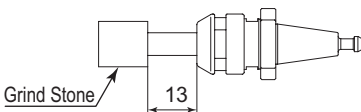


Fig. 20

## 10. TROUBLESHOOTING

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.)
	Lever position is OPEN.	Set the lever to LOCK position.
Overheating during rotation.	Cutting debris has contaminated the ball bearing, and the ball bearings are damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The lever is not set to LOCK position.	Replace parts. (Return to NAKANISHI dealer service.)
Abnormal vibration or noise during rotation.	Using bent tool.	Replace the cutting tool.
	Cutting debris has contaminated the ball bearings.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The ball bearings are worn.	
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 chuck or chuck nut are not correctly installed.	Check and clean the collet chuck and chuck nut. And, tighten the collet chuck accurately again.
	The collet chuck and the chuck nut are worn.	Replace the collet chuck and the chuck nut.
High run-out.	The cutting tool is bent.	Change the cutting tool.
	Chuck nut is not correctly installed.	Secure the collet chuck and the chuck nut correctly.
	The collet chuck or collet holder are worn.	Replace the collet chuck or collet holder.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)

Trouble	Cause	Inspection / Corrective Action
High run-out.	Contaminants inside the collet chuck, chuck nut and collet holder or the spindle.	Clean the collet chuck, chuck nut and collet holder or the spindle.
	The ball bearings are worn.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

※仕様及び形状等は予告なく変更する場合がありますので、ご了承ください。

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※Specifications may be changed without notice.

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