NAKANISHI

Spindle

NR-3060S

OPERATION MANUAL

Thank you for purchasing spindle NR-3060S. This spindle designed for grinding, small diameter drilling and milling, etc. The E3000 <Control Unit>, <Bluishless Motor>, <Air Line Kit (AL-0201)> or <Air Motor>, <Air Line Kit (AL-0304 or AL-951)> 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.

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 **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, 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 spindle until you have thoroughly read the owner's manual and safe operation has been confirmed.**
1) To prevent injuries / damages, check the spindle 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 control unit off. Then it is safe to remove the spindle.
⑥ **When installing a tool, tighten the collet correctly and check again the collet and collet nut before use. Do not overtighten the collet. This may cause damage to the spindle.**
⑦ **Do not use bent, broken, chipped, out of round or sub-standard tools as they may cause shatter or explode. Tool 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.**
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.**

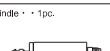
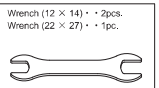
⚠ CAUTION

① **Do not drop or hit the 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 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 6 - 2 " Outside view ") with compressed air as foreign particles or cutting debris may get into the ball bearing.**
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 or tools for all applications. Do not exceed the capabilities of the spindle or tools.**
⑦ **Carefully direct coolant spray directly on the tool. Do not spray directly on the spindle and collet nut. Large amounts of coolant sprayed directly on the spindle may cause excess load of the spindle causing a loss of durability and longevity of the spindle.**
⑧ **Stop working immediately when abnormal rotation or unusual vibrations are observed. If vibrations occur, please check the content of section 13 " 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 11. " 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. 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. 	Collet Nut (K-265)・・1pc.*	Wrench (12 × 14)・・2pcs. Wrench (22 × 27)・・1pc. 
Operation Manual・・1set.	Inspection Card・・1pc.	

* The collet nut is attached to the 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 The spindle housing is made from precision ground, hardened, stainless steel (SUS) with an outside diameter of ϕ30mm.
② The spindle utilizes ceramic bearing for 60,000min⁻¹.
③ Various sizes of collets are available CHK 0.5mm - 6.35mm. Standard collet is CHK 3.0mm or CHK 3.175mm. (For U.S. market CHK 3.175mm.)

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	NR-3060S		
Allowable Motor Speed	60,000min⁻¹ (Continuous use : Less than 50,000min⁻¹)		
Spindle Accuracy	Within 1μm		
Weight	260g		
	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 (CHK- □□)*Note 1	ϕ0.5mm～ϕ6.0mm in 0.1mm increments and ϕ2.35mm, ϕ3.175mm, ϕ6.35mm
Collet Nut	K-265

*Note 1 : Collet is sold separately. Please select the suitable collet size for your application.

6 - 2 Outside View

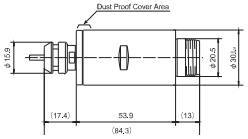


Fig. 1

7. CONNECTION 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 cutting tool by hand to engage the drive shaft and the drive dog, and make the final turns with provided 27mm wrench. (Fig. 2)

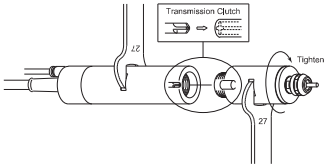


Fig. 2

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.

RECOMMENDATION

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

① Set the provided 12mm wrench on the spindle.
② Place the provided 14mm 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.

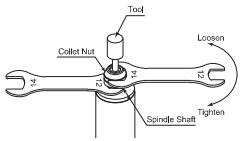


Fig. 3

9. REPLACING THE COLLET

① Remove the tool according to the section 8. " CHANGING THE TOOL " procedure above and remove collet nut assembly. (Fig. 4)
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. 5)
③ Install the new collet in the collet nut by positioning the collet in the collet nut and pressing down on a flat surface. (Fig. 5)

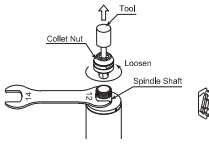


Fig. 4

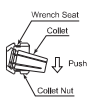


Fig. 5

10. INSTALLATION OF THE SPINDLE

⚠ WARNING

In case of using the electric motor, 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 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 of the Split Type Holder.**
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. 6)

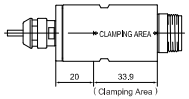


Fig. 6

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

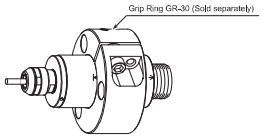


Fig. 7

② When installing a spindle to the holder, recommended installation method is shown Fig 8. Refer to " ③ How to fabricate the Split Type Holder. If this is not possible, install as shown in Fig. 9.

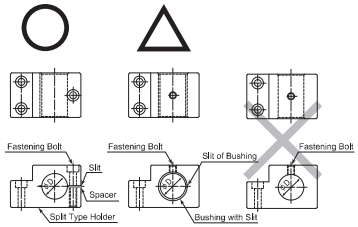


Fig. 8 Fig. 9 Fig. 10

⚠ CAUTION

Do not allow set screws to come directly in contact with the spindle body as shown in Fig. 10, 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. 11)

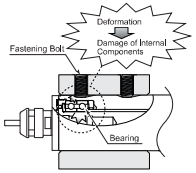


Fig. 11

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 the Split Type Holder so that the inside diameter of the Split Type Holder is ϕ30 with its tolerans 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 twist the Screw for Removal, and broaden the Slit Area.

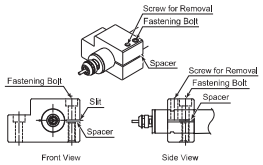


Fig. 12

⚠ CAUTION

- **How to confirm the tightening standard of the holder by the clamp meter (In case of use a electric motor)**
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 100V / 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 overtighten 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 spindles 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 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.

Steps	1	2	3	4	5
Rotation Speed (min⁻¹)	15,000	30,000	40,000	50,000	60,000
Rotation Time (min)	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.

12. 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.

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

① The proper surface speed for general grindstones is 10 - 30 m/s.
② Do not exceed 13mm of overhang for mounted grindstones as shown in Fig. 13. 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 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 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⁻¹)
20	N x 0.5
25	N x 0.3
50	N x 0.1

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

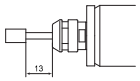


Fig. 13

13. 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.)
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.)
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.	
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 cutting tool is bent.	Change the cutting 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.
	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 spindle.
	The ball bearings are worn.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

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.

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