NAKANISHI

Spindle

NR - 601

OPERATION MANUAL

Thank you for purchasing Spindle " NR - 601". This product is designed for use with AM - 600R, AM - 600RA air motors. This Spindle is designed for grinding, small diameter drilling and milling, etc. The air motor and Air Line Kit (with lubricator) are rquired 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 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 operate or handle the air motor and Spindle until you have thoroughly read the Operation Manuals and safe operation has been confirmed.
1) To prevent injuries / damages, check the air motor, Spindle and cutting tool for proper installation, before operating the air motor and Spindle.
2) Before disconnecting the air motor and Spindle, always turn the control power off and turn the compressed air supply off. Then it is safe to remove the air motor and Spindle.
⑤ When installing a tool, tighten the collet chuck correctly and check again the collet chuck before use. Do not over-tighten the collet chuck. This may cause damage to the Spindle.
⑥ 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.
⑦ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.
⑧ Do not apply excessive force. This may cause tool slippage, tool damage, injury to the operator or loss of concentricity and precision.

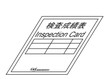
⚠ CAUTION

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 Be sure to clean the collet chuck, the inside of the Spindle before replacing the tool. If ground particles or metal chips stick to the inside of spindle or the collet chuck, damage to the collet chuck or Spindle can occur due to the loss of precision.
④ When cleaning a Spindle, stop the air 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 Always clean the tool shank before installing the tool in the Spindle.
⑥ When sizing the correct collet chuck 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.
⑦ Select suitable products or tools for all applications. Do not exceed the capabilities of the Spindle or tools.
⑧ Do not stop the supply cooling air for motor during operation of the machine. Removing the air pressure from the Spindle causes a loss of purging, allowing the Spindle to ingest coolant. This will cause damage to the Spindle.
⑨ Carefully direct coolant spray to the tool. Do not spray directly on the Spindle body. If large amount splay directly on the Spindle, 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 " 12. TROUBLESHOOTING ".
⑪ Always check if the tool, collet chuck are damaged before and after operating.
⑫ If the collet chuck show signs of wear or damage, replace it before a malfunction or additional damage occurs.
⑬ After installation, repair, initial operation, or long periods of non operation, please carry out break -in as follow. Start rotating slowly and over a short period of 15 - 20minutes, increase speed gradually until allowable maximum speed.
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 Contents List ".
In the event of any shortage, please contact either us (see the " 4. CONTACT US " section) or your dealer.

Table. 1 Packing Contents list

Spindle・・1pc. 	Collet Chuck φ3.0mm (CHM - 3.0) or φ3.175mm (CHM - 3.175)・・1pc.* (For U.S. market φ3.175mm (CHM - 3.175)) 	Wrench (7 x 5.1)・・1pc. 
Wrench (6 x 4.5), (20 x 24) ・・1pc. Each. 	Inspection Card・・1pc. 	Operation Manual・・1set. 

* The collet chuck 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 the details.

① Defect in manufacturing.
② Any shortage in the package.
③ Where it is found any damage has occurred when opening the package.
(This shall not apply if the damage was caused by the negligence of a customer)

4. CONTACT US

For safe use / purchase of 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 φ22.8mm.
② Special arbors are available for small drill chucks, metal saws and grindstones.

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	NR - 601
Maximum Motor Rotation Speed	58,000min^{-1} (rpm) (Using AM - 600R)
Appropriate Motor *This Spindle can not use the reduction gear.	AM - 600R, AM - 600RA
Weight	208g
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 Chuck (CHM - □□)	φ1.0mm, φ1.6mm, φ2.0mm, φ2.35mm, φ3.0mm, φ3.175mm
Grindstone Axis (AGM - 01)	For grinding wheel with ID of φ5mm.

6 - 2 Outside View

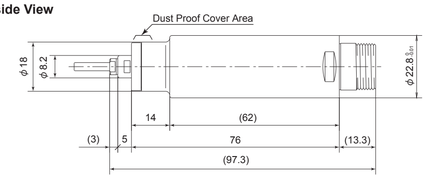


Fig. 1

7. CONNECTION OF THE SPINDLE TO THE MOTOR

⚠ CAUTION

Make sure your hands and all interlocking parts of the Spindle and air motor are clean before connecting the air motor to the Spindle. This is critical in preventing contaminants from entering the air motor or Spindle.

Align the thread on the front end of the air motor and the rear of the Spindle, and turn the Spindle clockwise. If the drive shaft of the air motor does not engage properly to the drive dog on the Spindle, it may only turn aprroximately two threads before stopping.
DO NOT FORCE THEM TOGETHER. Loosen the Spindle from the air motor, rotate the spindle shaft by hand then re-try. The drive shaft and the drive dog must be fully engaged. When fully engaged, secure the air motor and Spindle using the provided 20mm wrench (Fig. 2).

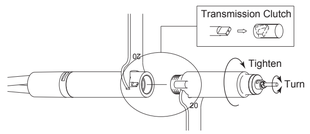


Fig. 2

8. CHANGING THE TOOL

⚠ CAUTION

Do not tighten the collet chuck without inserting a tool or dummy bur as this will result in damage to the collet chuck.

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 7mm wrench on the Spindle.
② Place the provided 4.5mm wrench on the chuck and turn it counterclockwise to loosen the collet chuck and remove the tool.
③ Clean the collet chuck, then insert the new tool and tighten the collet chuck by turning clockwise. Do not over-tighten.

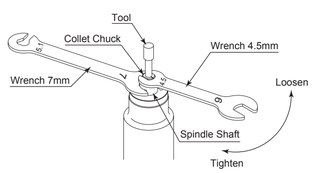


Fig. 3

9. REPLACING THE COLLET CHUCK

① Remove the tool according to the section " 8. CHANGING THE TOOL " procedure above (Fig. 3).
② Place the provided 7mm wrench on the spindle shaft, and turn the top of the collet chuck counterclockwise to remove the collet chuck (Fig. 4).
③ Install the new collet chuck into the Spindle by turning it clockwise.

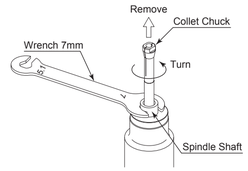


Fig. 4

10. INSTALLATION OF THE SPINDLE

⚠ 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. 5).

② When installing a Spindle to the holder, recommended installation method is shown Fig 6. Refer to " ③ How to fabricate the Split Type Holder ". If this is not possible, install as shown in Fig. 7.

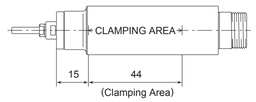


Fig. 5

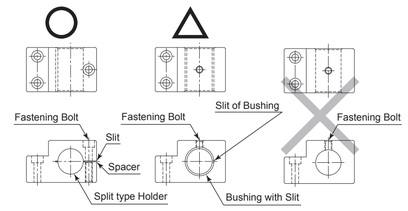


Fig. 6 Fig. 7 Fig. 8

⚠ CAUTION

Do not allow set screws to come directly in contact with the Spindle body as shown in Fig. 8, 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. 9)

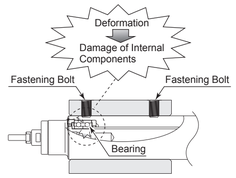


Fig. 9

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 the specified torque.
(6) Finish the Split Type Holder so that the inside diameter of the Split Type Holder is φ22.8 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 twist the Screw for Removal, and widen the Slit Area.

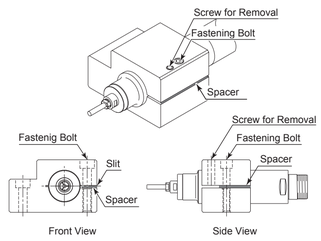


Fig. 10

⚠ CAUTION

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. 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. 11. 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 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 chuck clean. If contaminants are left in the collet chuck or chuck nut, excessive run-out will cause damage to the cutting tool and or Spindle.
⑧ Do not strike or disassemble the Spindle.
⑨ Please set the cutting 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}) (rpm)
20	N x 0.5
25	N x 0.3
50	N x 0.1

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

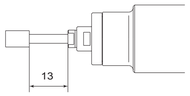


Fig. 11

12. 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 spindles 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.)
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.)
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 spindles ball bearings have been damaged.	
Tool slippage.	Collet chuck is not correctly installed.	Check and clean the collet chuck. Reinstall the collet chuck.
	The collet chuck is worn.	Replace the collet chuck.
High run-out.	The tool is bent.	Change the tool.
	Collet chuck is not correctly installed.	Secure the collet chuck correctly.
	The collet chuck is worn.	Replace the collet chuck.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)
	Contaminants inside the collet chuck or the spindle.	Clean the collet chuck and the inside of the taper and spindle.
	The spindle ball bearings has been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

Refer to the air motor Operation Manual.

13. 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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