NAKANISHI

Speed-Increasing Spindle
NGS-3140-CTZ01

OPERATION MANUAL

Thank you for purchasing the Speed-Increasing Spindle "NGS-3140-CTZ01". This spindle is compatible with the standard rotary tool GSC1310 manufactured by Citizen Machinery currently in use. Replacing the GSC1310 with this product enables an increase of the rotation speed. Read this operation manual carefully before use for proper and long-term operation of the product. Keep this manual in an accessible place for future reference.

1. CAUTIONS FOR HANDLING AND OPERATION

■ Read these warnings and cautions carefully and only use the product 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 product must be installed on the designated CNC lathe.**
② **It is dangerous, so do not touch rotating parts while they are rotating.**
③ **For safety, use protective covers, safety glasses, and dust masks while rotating.**
④ **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.**
⑤ **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.**
⑥ **Use tools within the allowable rotation speed range. Using tools at rotation speeds exceeding the allowable range may cause injury and property damage due to tool breakage.**
⑦ **Do not apply extreme loads (excessive cutting depth, feed rate) during machining. Extreme loads may cause injury and property damage due to tool breakage.**

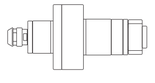
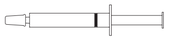
⚠ CAUTION

① **Do not drop or strike this product. This can cause rotation problems, heat generation, housing deformation, and other malfunctions.**
② **When replacing tools, be sure to clean the inside of the spindle, collet, and collet nut. If grinding powder or cutting chips adhere to them, this may damage the spindle, collet, and collet nut, or cause runout.**
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 - 2 Outside View"). This will cause debris to enter the bearings and cause malfunctions.**
④ **Always clean the tool shank before installing it in the spindle. Debris in the collet will cause runout and other malfunctions.**
⑤ **For tool shank diameter, a tolerance of +0 to -0.01 mm relative to the collet nominal diameter is strongly recommended. Tool shanks within the +0 to -0.1 mm tolerance range can be mounted; however, this may result in runout and/or insufficient gripping force.**
⑥ **Select appropriate products and tools suitable for your work. Also, perform work under appropriate machining conditions.**
⑦ **Direct cutting fluid to the cutting edge during machining, and avoid contact with the spindle body as much as possible.**
⑧ **If irregular rotation or abnormal vibrations occur during operation, stop work immediately and inspect the equipment (refer to "13 TROUBLESHOOTING").**
⑨ **As part of daily start-up and shut-down inspections, check tools, collets, and collet nuts for damage or wear.**
⑩ **Collets and collet nuts are consumable parts. Replace the collet or collet nut when runout increases or damage occurs.**
⑪ **When using this product again after extended periods of non-use, perform break-in operation according to "9 BREAK-IN PROCEDURE". Also, confirm there are no abnormal sounds or abnormal heating before use.**
⑫ **Do not disassemble or modify this product. If disassembled or modified, performance cannot be guaranteed thereafter. Also, repair service may be refused.**
⑬ **When using this product in mass production equipment, always prepare a spare spindle in case of unexpected failure.**

2. PACKAGE CONTENTS

After opening the package, confirm that all items listed in "Table 1 Package Contents List" are included. If any package contents are missing, please contact "4. CONTACT US" or your purchasing dealer.

Table 1 Package Contents List

Spindle・・1 pc.	Collet Nut (K-265)・・1 pc.*	Wrench (12 × 14)・・2 pcs.
		
Hexagon Socket Bolt (M5 × 30)・・4 pcs.	Grease Dispenser・・1 pc.	Grease Nipple・・1 pc.
		
Operation Manual・・1 pc.	Inspection Card・・1 pc.	

* The collet nut is attached to the spindle.

3. WARRANTY

We do not provide a warranty for our products; however, we will provide product replacement or free repair in the following cases (1)–(3). Please contact "4. CONTACT US" or your purchasing dealer.

(1) Manufacturing defects by our company.
(2) Shortage of package contents.
(3) Product damage found when opening the package.
(However, product replacement and free repair do not apply if the package was dropped due to customer negligence.)

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 By installing this spindle in place of the standard rotary tool mounted on a CNC lathe, it is possible to output a rotation speed 4.3 times faster than the machine's command rotation speed.
② The spindle housing is made of stainless steel (SUS) with high-hardness heat treatment and polished finish.
③ The spindle utilizes a planetary gear system.
④ A wide range of collet sizes are available.

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specifications

Model	NGS-3140-CTZ01
Allowable Motor Speed	43,000 min^{-1} (Machine command value: 10,000 min^{-1})
Spindle Accuracy	Within 1 μm
Net Weight	582 g

Compatible Rotary Tool: GSC1310 (manufactured by Citizen Machinery)
Applicable CNC Lathes: A20, D25, L20, L32, M32, etc.

	Temperature	Humidity	Atmospheric Pressure
Operation Environment	0–40 ° C	MAX.75 % (No condensation)	800–1,060 hPa
Transportation and Storage Environment	-10–50 ° C	10–85 %	500–1,060 hPa

< Option >

Collet (CHK- □□)*Note 1	ϕ0.5–ϕ6.0 mm in 0.1 mm increments and ϕ2.35 mm, ϕ3.175 mm, ϕ6.35 mm
Collet Nut	K-265

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

6 - 2 Outside View

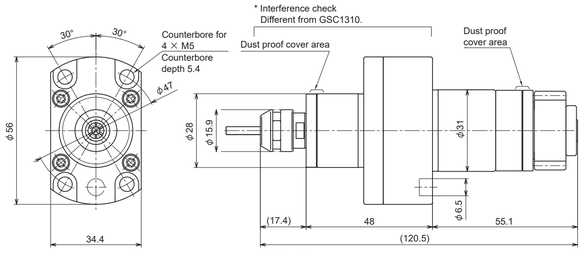


Fig. 1

7. CHANGING THE TOOL

⚠ CAUTION

Do not tighten the collet nut without inserting a tool. Excessive collet compression may cause the collet claws to disengage from the collet nut internally. If this occurs, the collet may remain stuck in the spindle even when the collet nut is loosened.

RECOMMENDATION

To maintain high machining accuracy, install tools with minimal overhang. The maximum allowable overhang is 13 mm to maintain high accuracy and safety.

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

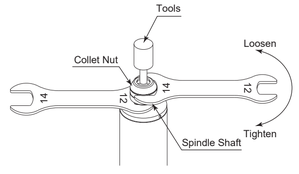


Fig. 2

8. 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.

① Insert the spindle's main housing area into the holder (guide hole), aligned with the positioning pin on the machine.
② Secure the spindle through the 4 counter-sunk holes on the flange using bolts.

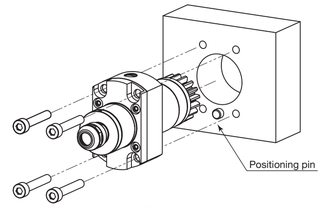


Fig. 3

9. 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

	Procedure A				Procedure B	
Steps	1	2	3	4	5	6
Input-Side Rotation Speed (min^{-1}) (Machine Command Value)	1,500	3,000	4,500	6,000	7,500	9,000
Output-Side Rotation Speed (min^{-1}) (Spindle Rotation Speed)	6,500	13,000	19,500	26,000	32,300	38,700
Rotation Time (min)	15	10	10	15	10	15
Important Notes	Ensure no irregular noise or vibration occurs. The spindle housing may rise in temperature by about 30 °C. If the input-side rotation speed of the installed machine is up to 6,000 min^{-1}, perform only procedure A. If the input-side rotation speed of the installed machine exceeds 6,000 min^{-1}, perform procedure B after completing procedure A.					

10. CAUTIONS WHEN USING DRILLS OR END MILLS

⚠ CAUTION

Refer to the following formula for the maximum spindle rotation speed when using a drill or an end mill.

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

① Cutting speed varies depending on the tool and workpiece material. Use the conditions recommended by the tool manufacturer.
② Use drills, end mills, etc. at the manufacturer's recommended rotation speed. Using at rotation speeds exceeding the recommended range may cause tool breakage.
③ To maintain high machining accuracy, install tools with minimal overhang. This will increase rigidity and accuracy while decreasing deflection and minimizing tool breakage.
④ When increasing the overhang, reduce the rotation speed. (See Table 3, Table 4)
⑤ Clean the tool shank before installation. Debris in the collet may cause runout.
⑥ Do not apply excessive impact to the spindle.

Table 3 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

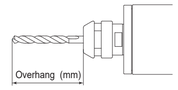


Fig. 4

Table 4 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

11. CAUTIONS WHEN USING GRINDSTONES

⚠ CAUTION

Maximum surface speed is specified for each grindstone. Using the following formula, never exceed the maximum surface speed for safety.

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

① The proper surface speed for general grindstones is 10–30 m/s. Grinding within this range is recommended.
② Install mounted grindstones with overhang of 13 mm or less (See Fig. 5).
③ To maintain high machining accuracy, install tools with minimal overhang.
④ When increasing the overhang, reduce the rotation speed (See Table 5).
⑤ Dress the grindstone before use whenever possible.
⑥ Do not use grindstones with excessive runout, scratches, cracks, or other defects.
⑦ For grinding, limit each cut to 0.01 mm or less. After each cut, reciprocate several times before making the next cut.
⑧ Clean the tool shank before installation. Debris in the collet may cause runout.
⑨ Do not apply excessive impact to the spindle.

Table 5 Relationship between grindstone overhang and rotation speed

Overhang (mm)	Max. Rotation Speed (min^{-1})
20	N × 0.5
25	N × 0.3
50	N × 0.1

* N = Maximum rotation speed at 13 mm overhang

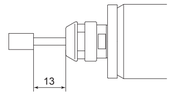


Fig. 5

12. GREASE INJECTION

⚠ CAUTION

・Be sure to use our specified grease. Other types of grease may cause damage to the spindle.
・Be sure to stop the spindle rotation before removing the plug screw on the side of the spindle. Grease may spray out due to backflow.

To improve the durability of the gear parts, apply grease every 200 hours using the following method.
Grease injection prevents friction of the parts assembled inside as well as heat generation. This maintenance must be performed without fail.

12 - 1 Grease Injection

① Stop the spindle from rotating.
② Use a flathead screwdriver to remove the plug screw marked "GREASE" on the side of the spindle. (Fig. 6).

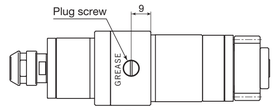


Fig. 6

③ Mount the grease nipple on the top of the provided dispenser. Then attach the grease nipple to the threaded hole from step ②.

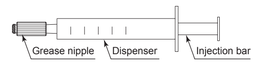


Fig. 7

④ Inject approx. 0.1 ml (1 increment) of grease.

⚠ CAUTION

Excessive grease will generate stirring heat. Be sure to follow the specified injection amount.

⑤ Remove the grease nipple and, finally, install the plug screw.
* Be sure to operate with the plug screw installed.

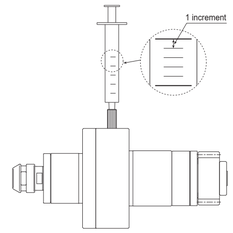


Fig. 8

12 - 2 After Grease Injection

⚠ CAUTION

After grease injection, stirring heat will be generated by the grease. Start with low-speed rotation and gradually increase the speed, then perform break-in procedure before starting operation.

* Grease is available for purchase as a standard accessory. Please purchase our specified grease dispenser or grease (See Table 6).

Table 6

Product	Description		Code No.
	Grease for reducer	(2.5 mL)	1547
		(10 mL)	1550
		(100 mL)	1549
	Plug screw		7939

13. TROUBLESHOOTING

If a problem or concern occurs, please check the following prior to consulting your dealer.

Trouble	Cause	Corrective Action
Poor or no spindle rotation	The spindle ball bearings have been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The spindle gears have been damaged.	Replace the inner gears. (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.)
Tool slippage	Collet and collet nut are loose.	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 runout	The tool is bent.	Change the 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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