

## E800 AIR BEARING SPINDLE

# NRA-5080

## OPERATION MANUAL

OM-K0291E Rev.A

Thank you for purchasing the air bearing spindle, NRA-5080. NRA-5080 is an air bearing spindle designed for use with 80,000min<sup>-1</sup> E800 System. It perfectly fits to internal grinding of small bore that requires micro precision grinding. The motor, the air line kit, and the control unit are required to drive this spindle. Read this and E800 operation manuals carefully before use.

### 1 Safety Cautions and Warning Indicators

- Read these cautions carefully and correctly use the device.
- Safety cautions are intended to avoid potential hazards that could result in personal injuries or damages to the device. They are classified as follows in accordance with the seriousness of the risk.

Class	Degree of Risk
⚠ Warning	Existence of a hazard that could result in bodily injury or damage of the device, if the safety instructions are not followed.
⚠ Caution	Possibility of a hazard that could result in light or middle degree of bodily injury or damage of device, if the safety instructions are not followed.

#### ⚠ Warning

- ① This air bearing spindle(NRA-5080) is not designed as a hand tool. Install it on your machine tool or special purpose machine.
- ② Do not touch the spindle during rotation, for motor speed is very high.
- ③ Wear safety glasses or dust mask, and use a protective cover for your working.

#### ⚠ Caution

- ① Use the spindle after running at its free speed for 10-20 minutes. Frictional heat caused by air would cause the spindle temperature to rise +25°C above room temperature. Therefore idling stabilizes spindle accuracy.
- ② Be sure to keep supplying air to the air bearing spindle even if it is not being used. Cutting oil could insert in the spindle.
- ③ Do not drop, hit, or subject to excessive shock. The shock can damage or overheat internal components.
- ④ Check that the cutting tool is securely tightened before each use.
- ⑤ Keep the collet chuck always clean. The debris and dirt inside of the spindle could damage the collet chuck and the spindle, or result in poor tool concentricity.
- ⑥ Always drain the moisture condensation from the air filter to prevent it from rusting the spindle interior and causing failure.

### 2 Features

- ① The outside housing,  $\phi$  50.0mm, is made of precision ground stainless steel (SUS-416).
- ② The air bearing supports and floats the rotating member.
- ③ Do not supply lubricating oil to the spindle. Air bearing does not wear during rotation.
- ④ It is designed for use with 80,000 min<sup>-1</sup> spindles.
- ⑤ This is best for internal grinding of small holes that require micro precision processing.

### 3 Dimensions and Specifications

Max. Motor Speed	80,000 min <sup>-1</sup>
Spindle Accuracy	Within 1 $\mu$ m
Air Pressure	0.5 MPa (5 kgf/cm <sup>2</sup> )
Air Consumption	38 Nl/min (Air Bearing Spindle at air pressure of 0.5 MPa)
Weight	960 g
Standard Collet Chuck	$\phi$ 3.0 mm ( $\phi$ 3,175(1/8") for USA market)

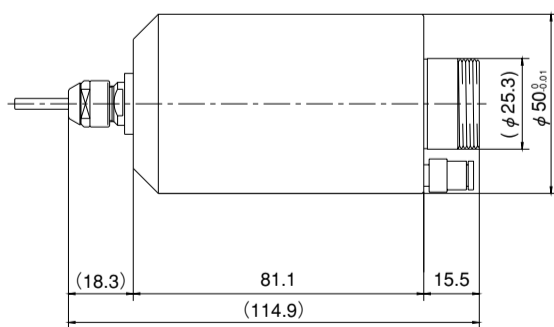


Fig. 1

#### <Options>

Collet Chuck (CHA-□□).....  $\phi$  0.5mm~ $\phi$  4.0mm in 0.1mm increments  
and  $\phi$  2.35mm,  $\phi$  3.175mm

Collet Cap..... K-263

#### Standard Accessories

- Collet Chuck  $\phi$  3.0mm (mounted on the spindle) 1 pc.
- Collet Cap K-263 (mounted on the spindle) 1 pc.
- Spanner (10X10) 2 pcs.
- Bar Wrench 1 pc.
- Reducer ( $\phi$  6/ $\phi$  4 Fitting)
- Operation Manual
- Air Hose  $\phi$  4mm

#### Required tools

- Air Line Kit AL-982  
Required to supply air to both the control unit and the spindle.
- Control Unit
- Motor EM-801, EM-805 (Motor cord with quick disconnect in the middle)

### 4 Connecting to Motor (EM-801 or EM-805)

Align the drive shaft of the motor and the drive dog of the spindle (NRA-5080) and turn clockwise. If the drive shaft does not engage the drive dog, do not force them to turn. It would break the motor. Turn the spindle back a few threads, rotate the tool by hand to engage the drive shaft and the drive dog. Make the final turns with the bar wrench provided. (Fig. 2)

#### ⚠ Caution

Clean the hands and the connecting parts, before connecting the spindle to the motor, to prevent entry of debris into the motor and spindle.

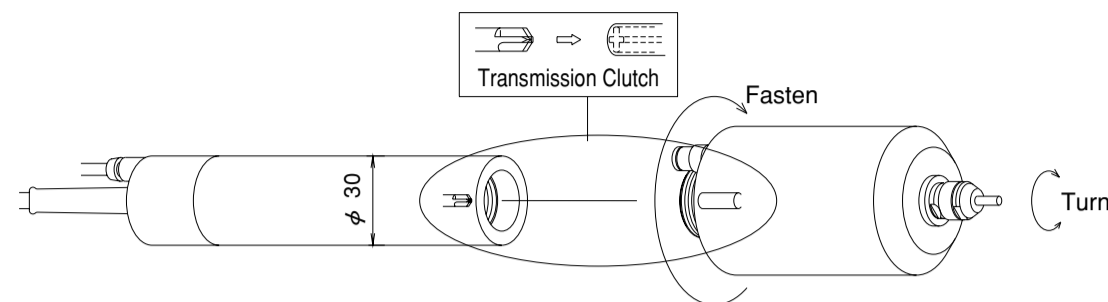


Fig. 2

### 5 Replacing Tools

Change tool(grinders with shaft) as follows. (Fig. 3)

- ① Set the 10mm spanner on the spindle.
- ② Place the 10mm spanner on the collet cap and turn it counterclockwise to loosen the collet chuck, and pull out the tool. (The first turn will loosen the collet cap. Further turning will bring resistance, but keep turning it overcoming resistance. And the chuck will open.)
- ③ Insert a new tool and fasten the collet chuck clockwise.

#### ⚠ Caution

To tighten the collet cap, always insert a tool in the collet chuck. When tightened without a tool in the collet chuck, the chuck is excessively compressed, and the chuck and the collet cap pins could disengage. When they disengage, the collet chuck could remain inside the spindle and could not be pulled out.

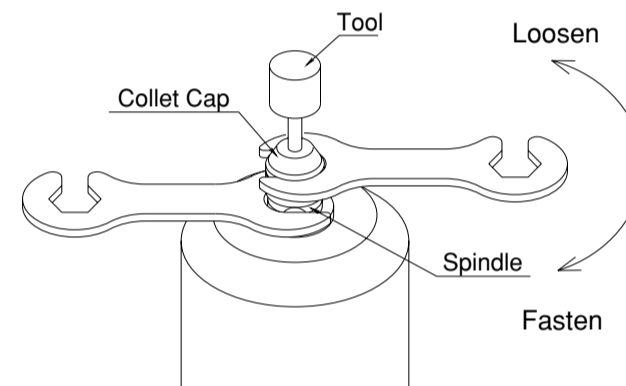


Fig. 3

### 6 Replacing Collet Chuck

Change the collet chuck as follows.

- ① Loosen the collet cap, according to the "Mounting Tool" section, until it comes off. Remove the collet cap from the spindle with the tool. (Fig.4)
- ② When removing the collet chuck from the collet cap for cleaning or replacing, hold the collet cap in one hand and incline the collet chuck toward the spanner seat. (Fig. 5)
- ③ To mount the collet chuck, incline the collet chuck toward the spanner seat and insert. (Fig.5)

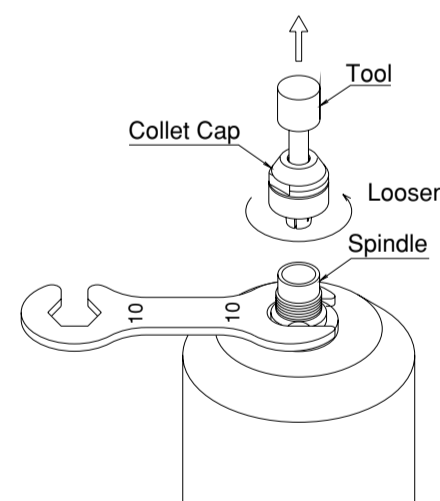


Fig. 4

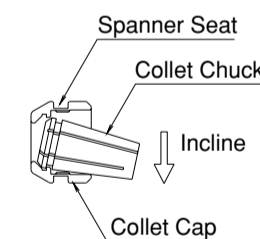


Fig. 5

### 7 Installing Spindle

To install the spindle on a holder, the installation as shown in Fig. 6 is recommended. If not possible, install it as shown in Fig. 7. Do not use mounting screws pushing directly on the spindle as shown in Fig. 8, because this could damage the housing and may result in failure of rotation, or overheating.

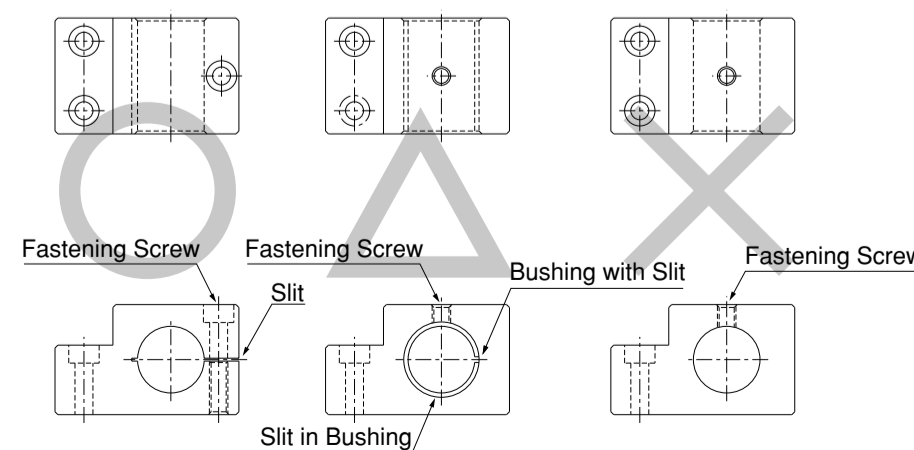


Fig. 6

Fig. 7

Fig. 8

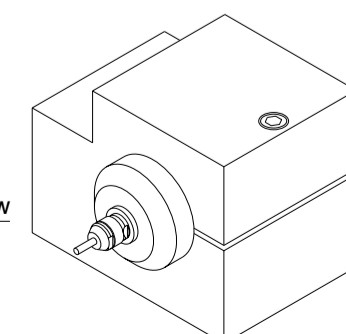


Fig. 9

## 8 Connecting with Air Line Kit

This air bearing spindle, NRA-5080, requires the air line kit, and the AL-982 is recommended. Insert the  $\phi 4$  air hose from the inlet joint of the spindle to the secondary joint of the air line kit through the reducer ( $\phi 6/\phi 4$  fitting). (Fig. 10)  
Adjust the compressed air pressure to 0.5 MPa (5 kgf/cm<sup>2</sup>) correctly.

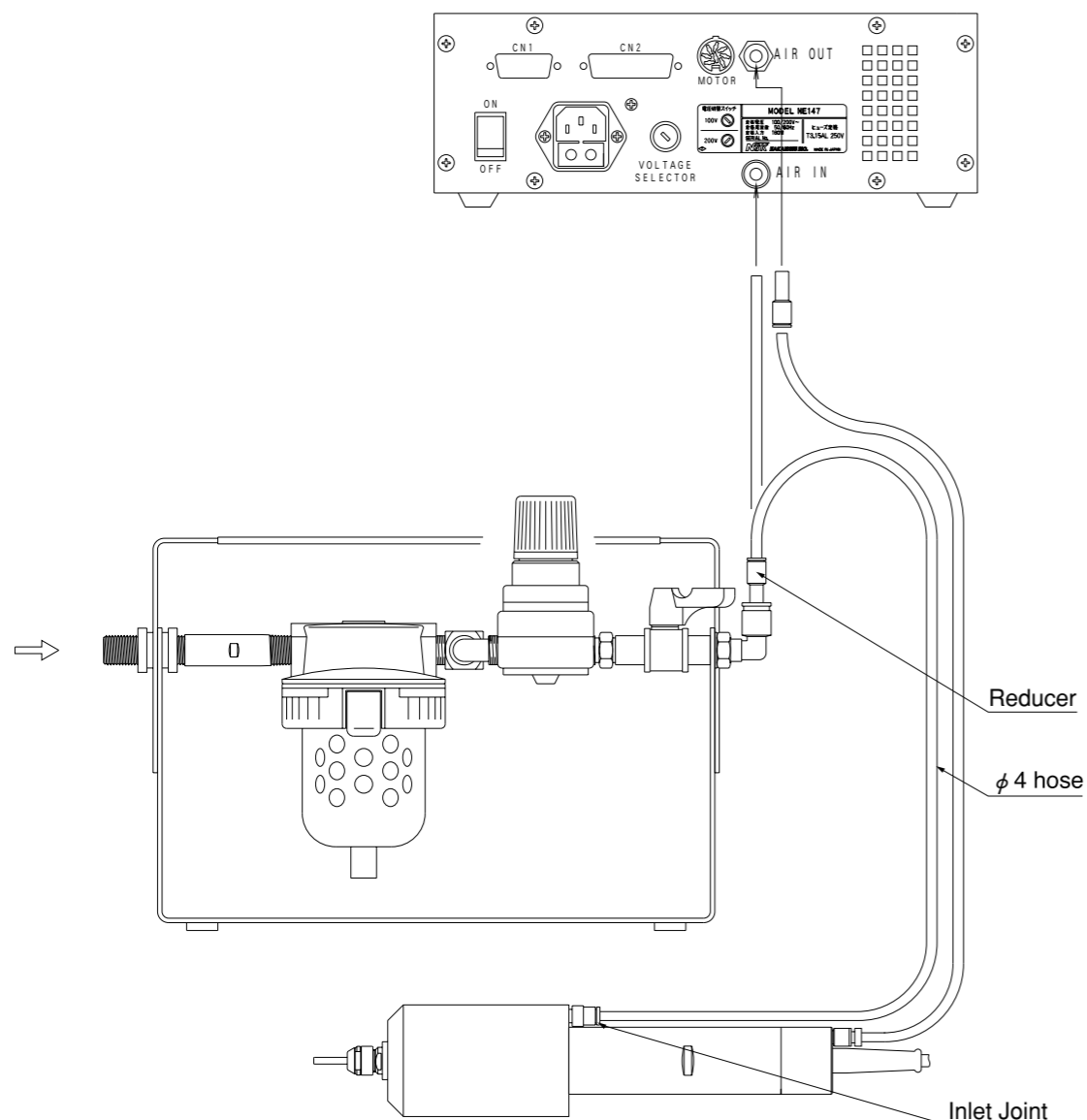


Fig. 10 Connecting with Air Line Kit (AL-982)

### ⚠ Caution in use of Air Line Kit

- ① It is important to supply clean, dry air to NRA-5080. Install an air filter or air dryer between the compressor and NAKANISHI's air line kit. Mount it as close to the air line kit as possible. Although the air line kit has an air filter, it is suggested to additionally connect a large capacity air filter in case of high humidity season or where humidity is high.
- ② Do not supply oil by the lubricator. Oil could cause rotation problem and failure.
- ③ Connect air hoses securely. The nominal air pressure for air hose is 1.0 MPa (10kgf/cm<sup>2</sup>) maximum. If this maximum pressure is exceeded, the hose can explode, causing injury. Set the air compressor to 1.0 MPa (10kgf/cm<sup>2</sup>) or below.

## 9 Operating Procedure

- (1) Start to work the spindle
  - ① Supply 0.5 MPa air from the air line kit to the air bearing spindle.
  - ② Turn the spindle by hand and chuck if it rotates lightly
  - ③ Start to work the motor gradually. (Refer to the operation manual for E800.)

### ⚠ Warning

First supply air to the air bearing of the spindle when operating the spindle. And operate the spindle gradually (continue to work it up to maximum motor speed for more than 3 sec.) after confirming spindle's float perfectly (after checking to operate by hand lightly).  
If not correctly, this will cause spindle's failure.

- (2) To stop the spindle
  - ① Stop the spindle rotation. (Refer to the operation manual for E800.)
  - ② Stop the air supply to the air bearing after the spindle stops rotating.

### ⚠ Warning

If stop operating the spindle, need to stop it's rotation. After confirming it, be sure to stop air supply to the air bearing.  
If not correctly, this will cause spindle's failure.

## 10 Cautions in use of tools

- ① Do not use the cutting tools/grindstones in excess of their maximum peripheral speed. When rotating the stemmed grindstones of the 2,000 m/min maximum peripheral speed, the diameter should be  $\phi 8$ mm or less at 80,000 min<sup>-1</sup>.

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

- ② Do not extend a stemmed grindstone greater than 13 mm from the chuck. (See Fig.11 and Table 1.)  
If extending needs to be longer than 13 mm, operate at lower speed.
- ③ Do not use tools with poor concentricity or with cracks or damages.
- ④ It is recommended to dress the grindstone as often as possible prior to use.
- ⑤ For grinding, one axial feed shall not exceed 0.005mm. Reciprocate the tool movement a few times per one cut feed depth, and move to the next step.
- ⑥ Run the tool within the tool manufacturer's recommended speed. (Use of tool beyond the recommended speed range could cause the tool to damage or fail.)
- ⑦ Keep the tool shank always clean. If foreign matters and debris are left in the collet chuck, they could deteriorate the tool retaining force and the concentricity.
- ⑧ Do not give a strong shock to the spindle. Do not disassemble.

Table 1. Overhang Distance and Speed

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

N : Max. operating speed at 13mm overhang.

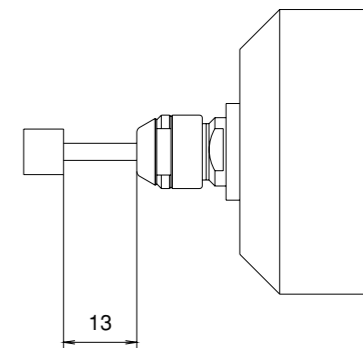


Fig. 11

## 11 Troubleshooting

Trouble	Probable Cause	Action Taken
Excessive tool run-out.	Debris inside the collet chuck or the spindle.	Clean inside the collet chuck and the spindle
	The collet chuck is not properly mounted.	Mount the collet chuck properly.
	The air pressure for air bearing is not set properly.	Set the proper air pressure.
Unusually vibration or noise during rotation.	Bent tools.	Replace tools.
	The air pressure for air bearing is not set properly.	Set the proper air pressure.
Bad Rotation.	Bent tools.	Replace tools.
	Debris or oil-mist mixed in air of the air bearing.	Overhaul the air bearing. Supply clean air at all times.
	Overloaded excessively, or the spindle axis contacting the air bearing stationary member.	Decrease the loads.

※Specifications may be changed without notice.

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