

# Angle Head (Flexible type)

## **AHS,AHL,AHSE,AHLE**

### Instruction manual

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Thank you very much for purchasing our NT Angle Head.

This instruction manual provides the description of the correct usage and precautionary remarks on handling.

Please thoroughly read this manual and use the product in the correct manner.

## Safety Instructions

To use the product correctly for your safety and to avoid hazardous conditions and property damages, this instruction manual provides various safety information and warning.

 <b>WARNING</b>	Indicates hazardous conditions that, if not faithfully followed, could result in death or serious injury.
 <b>CAUTION</b>	Indicates hazardous conditions that, if not faithfully followed, may result in injury or property damages.

### WARNING



Attach tools, collet, tapping chuck and tap adapter correctly. Failure to do so may cause drop or fly out of tools, collet, tapping chuck and tap adapter during machine operation, and may consequently result in injury.



Mount angle head on the machine tool correctly. Follow the description in the instruction manual of the machine tool. Failure to do so may cause angle head drop or fly out during machine operation, and may consequently result in injury.



Take necessary precautions against fire when using oil-gased cutting fluid, such as coolant mist, etc.



If any trouble occurs, stop use immediately. Failure to do so may cause drop or fly out of tools, collets, tapping chuck and tap adapters during machine operation, and may consequently result in injury. If repair is necessary contact your local distributor.



Do not disassemble or modify angle heads. Angle heads are designed to the specifications of the corresponding tools and machines. Disassembling or modification may result in tool damage or angle head failure.

### CAUTION



Do not touch tools with bare hands. When installing or removing your cutting tool or the collet, use a waste cloth or wear gloves.



Do not touch the rotating tools or the angle head. When replacing a tool or attaching/removing a collet, make sure that it is stopped completely. Touching the rotating tool or angle head may trap your hand result in injury.



Use a protective cover or wear goggles during cutting to avoid injury resulting from chip fly out.



Do not touch tools or angle heads on completion of continuous operation. You may suffer burns because tools or angle heads are heated to high temperatures during operation.



Use our products. Use the NT angle heads, collets, tapping chuck and tap adapters. To avoid tool damage or failure, do not use different manufacturers' products.

#### NOTE

NT TOOL Corp. assumes no resuponsibility for any machine trouble while NT products are used. After workpieces are machined with our NT products, be sure to measure the accuracy.

## Maintenance

- When angle heads are not used over a prolonged period, wipe them clean, dry and apply rust inhibitor.



Water-soluble coolant, rust, oil film, dust, etc. remaining on the angle heads may cause sticking and result in operation failure.

- If any trouble occurs, stop use immediately.



Failure to do so may cause tool to drop or fly out during machine operation, and may consequently result in injury. If repair is necessary, contact your local distributor.

## Operational Precautions

- Run the spindle in reverse rotation.**
- Maximum rotational speed of machine should not exceed  $3000\text{min}^{-1}$ .
- Make sure that you cannot use the spindle with internal coolant feeding.
- Tighten all bolts securely.
- For end-milling, we recommend you to take a light cut.
- Extended use results in heating. Please be careful about it.
- Stop spindle immediately if symptom such as tool spindle revolution failure, excessive heating (Room temperature +  $30^{\circ}\text{C}$ ), etc. Please contact our distributor nearest you or NT TOOL directly for consultation.



NEVER attempt to repair spindle yourself: Repair by unqualified personnel may impair the safe operation of spindle.

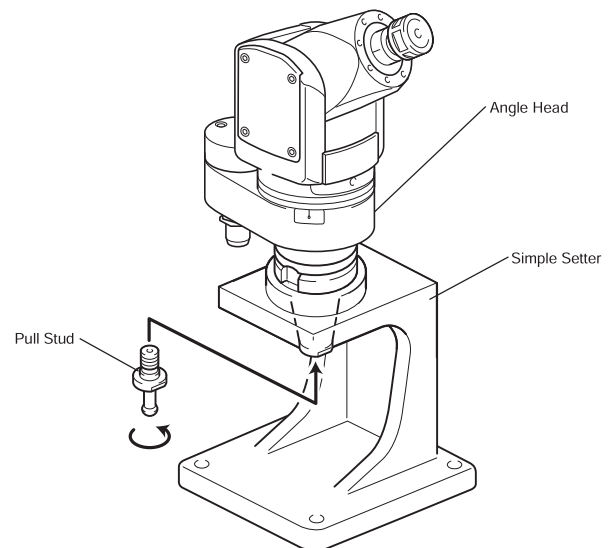
- The plunger extension length of this product is set, when assembled, in accordance with the "A" dimension. DON'T adjust the plunger extension for yourselves.



Angle head failure may result.

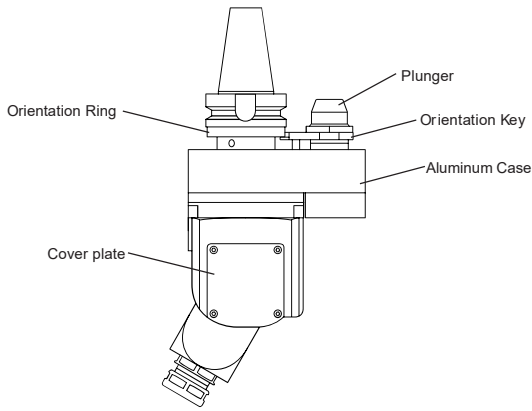
- Check allowable weight for ATC.
- Take a precaution for excessive heating. (Indication of excessive heating: Room temperature +  $30^{\circ}\text{C}$ )

## Attaching the Pull Stud



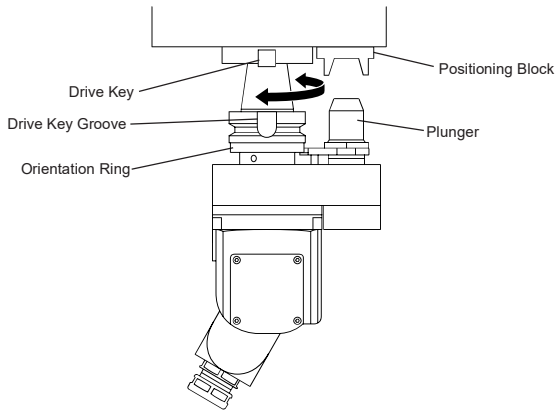
- Firmly fix angle head to NT simple setter or a fixing jig.
- Attach the pull stud to angle head. Choose a pull stud to match with the machine spindle. For details on attaching, refer to the Pull Stud instruction manual.

## Parts



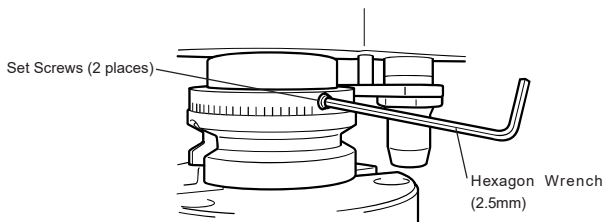
## Adjusting the Plunger Angle

The drive key of the spindle of the machining center will fit into the drive key groove of the angle head and also the plunger will fit into the positioning block.



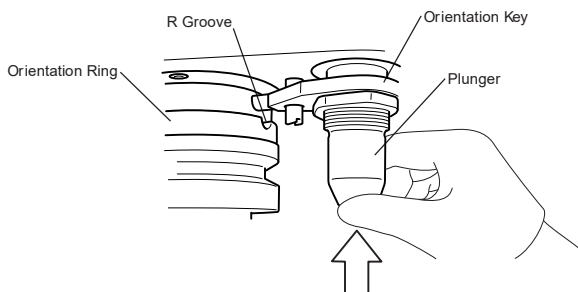
1. Firmly fix angle head to NT simple setter or a fixing jig.
2. Loosen the orientation ring set screws (2 places) with a hexagon wrench (2.5mm).

**!** Do not draw out the screws. Otherwise they will be lost.



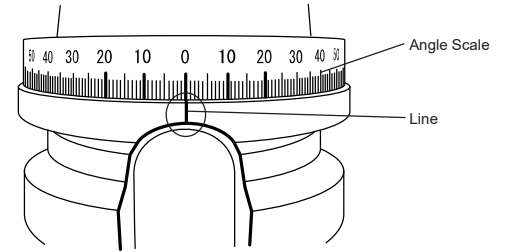
3. Fit the salient (height) portion of the orientation key into the R groove portion of the orientation ring.

Turn the orientation ring with the plunger pressed down until the orientation key gets locked into the radius groove of the orientation ring.



4. Align the angle scale of the orientation ring with the correct angle to the line of the drive key groove.

**!** The angle scale is just a guideline. So before attaching it to a machine, be sure to fine-adjust it and check whether it can be attached accurately or not.



5. Initiate the MC spindle orientation so that the spindle may be oriented to the tool change position (ATC position).

If you fail to do so, the angle head may come out because of misalignment between the drive key and the positioning block.

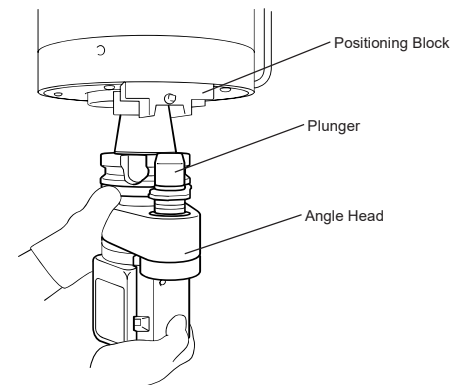
6. Clean the inner diameter taper portion of the spindle of the machining center and also the shank taper portion of the angle head.

**!** If dust and oil adhere, the angle head may be dropped.

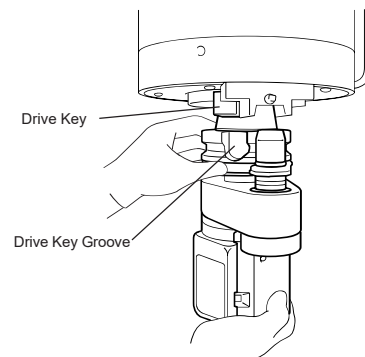
7. Fit the position of the plunger to the position of the positioning block and then, insert the angle head to the spindle manually.

**!** At this time, do not pull the pull stud.

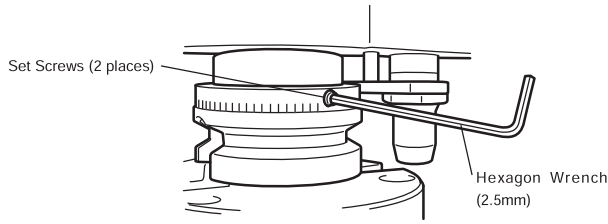
**!** When attaching the angle head to the spindle, please be careful not to drop it.



8. Fine-adjust it by turning the flange portion manually in order that the drive key of the spindle may fit into the key groove of the angle head.

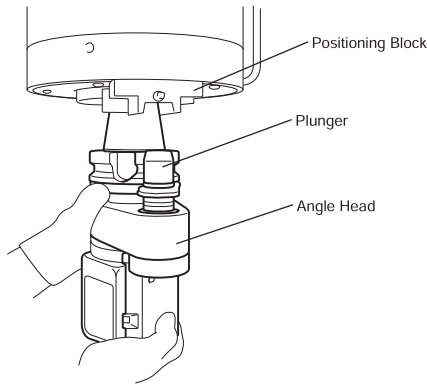


9. After adjustment, remove the angle head from the spindle, and tighten the orientation ring set screws (2 places) with a hexagon wrench (2.5mm).



10. Insert the angle head to the spindle manually once again.

- ! At this time, check whether the drive key groove fits smoothly or not, and also check whether the plunger fits the positioning block properly or not.
- ! When attaching the angle head to the spindle, please be careful not to drop it.

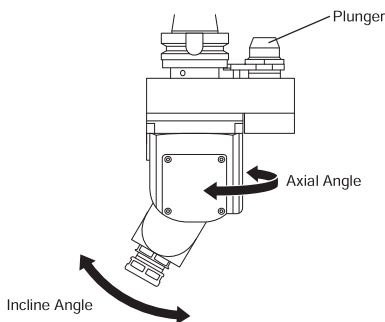


11. If the angle head is set properly, fix it to the machining center. Then check whether it is possible to replace it smoothly with ATC.

- ! Check allowable weight for ATC.
- ! Take a precaution for excessive heating.  
(Indication of excessive heating : Room temperature + 30°C)

### Adjusting Cutting Tool axis Angle

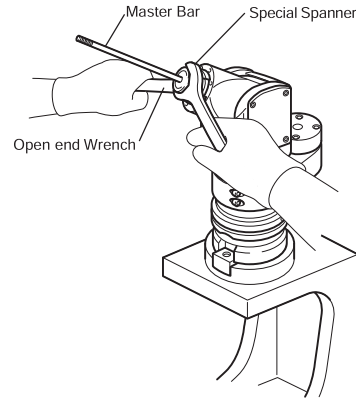
Adjust axial angle (adjusting cutting tool axis angle to the plunger) and incline angle (adjusting cutting tool axis angle to the spindle).



1. Firmly fix angle head to NT simple setter or a fixing jig.
  2. Remove the cap nut from the angle head.
  3. Install a master bar, which comes with angle head, into the angle head. Slightly tighten the nut by hand.
- ! In the case of AHS07, the master bar must be installed in the Angle Head it is fitted into the attached cap nut.

4. Tighten the portions of the angle head body that need tightening with an open end wrench. Tighten the cap nut of the master bar with a special spanner. (See the Standard Tightening Torque Chart.)

- ! When attaching or removing cap nut or master bar, two wrenches must be used. One is for holding tool spindle and the other is for tightening and loosening cap nut or master bar.
- ! Tighten the cap nut without holding the tool spindle part may result in poor accuracy or breakage of the angle head. ALWAYS uses two spanners, one on the cap nut and the other on the tool spindle.
- ! Do not use a conventional spanner, master bar or angle head may be damaged.
- ! For your safety, loosen the nut slowly.

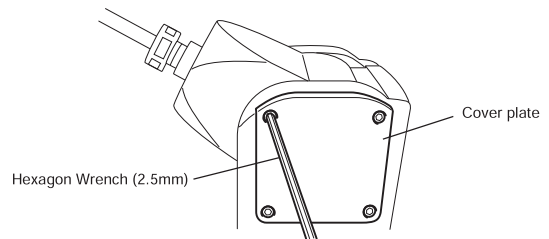


[Standard Tightening Torque Chart]

Holder Size	Open end Wrench Size	Special Spanner Size	Standard Tightening Torque
AHS07	16mm (Commercially available)	S-0	10~15 N•m
AHS09	21mm (Commercially available)	S-1L	30~35 N•m
AHS16	S-4L	S-4L	40~45 N•m
AHL16	S-3L	S-4L	40~45 N•m
AHL22	S-5L	S-5L	55~60 N•m
AHSE11	16mm (Commercially available)	S-0	10~15 N•m
AHSE16	S-4L	FK0034	35~40 N•m
AHSE20	S-4L	FK0034	40~45 N•m
AHLE20	S-3L	FK0034	40~45 N•m
AHSE25	S-4L	HS-1-16	55~60 N•m
AHLE25	S-5L	HS-1-16	55~60 N•m
AHLE32	S-5L	HS-2-20	65~70 N•m

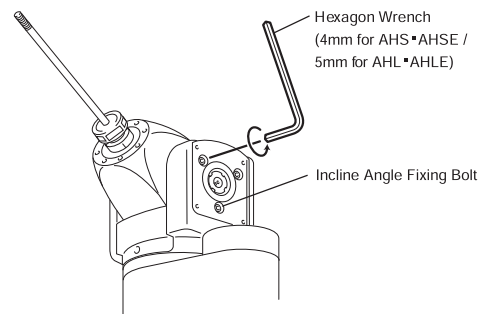
5. Adjust incline angle.

- a. Remove the cover plates (2 places) with a hexagon wrench (2.5mm).

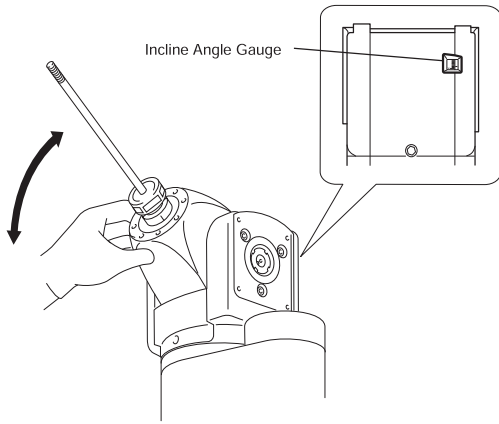


- b. Loosen the incline angle fixing bolts (3 pieces each at both right and left) with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).

- ! Do not remove the incline angle fixing bolts. Otherwise, it may misalign the bolts and the screw holes, preventing the bolts from fitting.



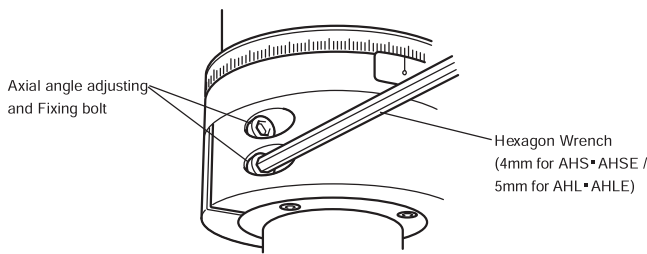
c. Obtain the desired incline angle, referring to the incline angle gauge.



d. Pretighten the incline angle fixing bolts with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).

6. Adjust the axial angle.

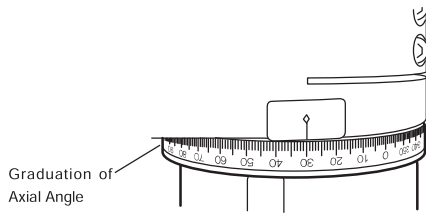
a. Loosen the axial angle adjusting and fixing bolts (2 places) with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).



b. Install Angle Head in the machine spindle by hand and pull it up with retention stud.

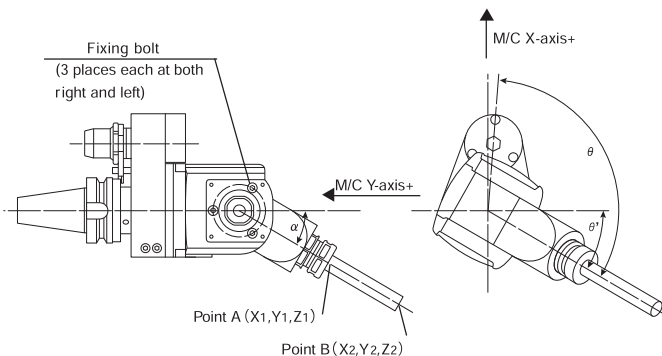
**!** When attaching the angle head to the spindle, please be careful not to drop it.

c. Turn the case by hand until the desired angle is reached, referring to the graduation of axial angle.

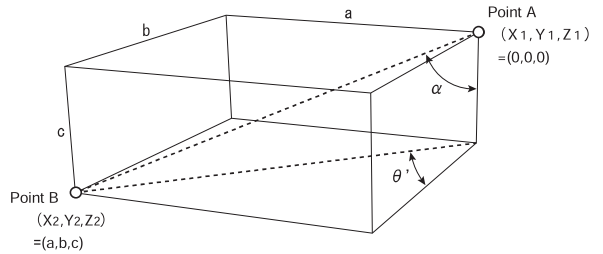


d. Pretighten the axial angle adjusting and fixing bolts (2 places) with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).

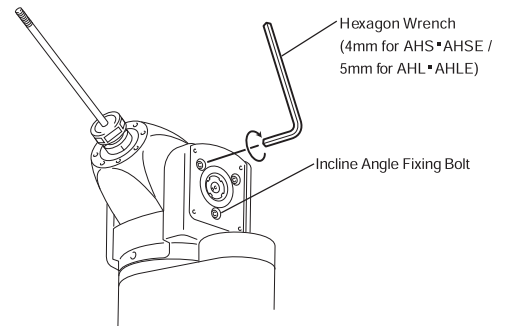
7. Fine-adjust axial angle and incline angle.



- a. Fix a dial gauge or a test indicator on the machining center table.
- b. Set the probe of dial gauge or a test indicator at somewhere near the root of master bar.
  - !** Measuring head of a dial gauge or a test indicator must be set at right angle to the Z-axis of the machine.
- c. Tilt the Z-axis on the machining center up and down to set the needle of the dial gauge or the test indicator to 0 (zero) when the needle-runout is at the maximum.
- d. Operate the handle to shift the spindle to calculational Point B ( $X_2=a, Y_2=b, Z_2=c$ ). Tilt the Z-axis up and down to read needle-runout. Set Angle  $\theta$  with an accuracy of less than  $\pm 1'$  ( $\pm 0.03$ ) to Point A runout. Set Angle  $\alpha$  with Z-axis position accuracy of less than  $\pm 1'$  ( $\pm 0.03$ ) at Point A and B.



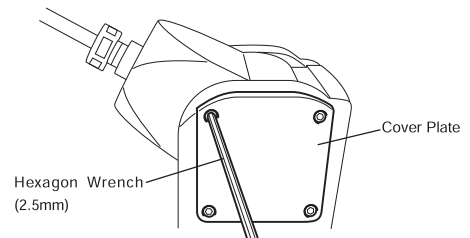
e. After setting the angles, the incline angle fixing bolts (3 places each at both right and left) with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).



- f. Press the probe to around the base of the master bar (Point A).
- g. Tilt the Z-axis on the machining center up and down to set the needle of the dial gauge or the test indicator to 0 (zero) when the needle-runout is at the maximum.
- h. Operate the handle to shift the spindle to calculational Point B ( $X_2=a, Y_2=b, Z_2=c$ ). Tilt the Z-axis up and down to read needle-runout. Set Angle  $\alpha$  with Z-axis position accuracy of less than  $\pm 1'$  ( $\pm 0.03$ ) at Point A and B.
- i. After adjustment, tighten the axial angle adjusting and fixing bolts (2 places) with a hexagon wrench (4mm for AHS•AHSE, 5mm for AHL•AHLE).

8. Remove the angle head from the machining center spindle to fix it on a tightening jig such as simple setter.

9. Attach the right and left cover plates with a hexagon wrench (2.5mm).



10. After using the tool for 1,000 hours in total, grease must be changed. Contact us through the shop of purchase.

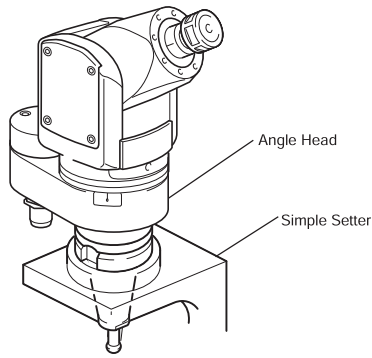
**!** Tighten the cap nut without holding the tool spindle part may result in poor accuracy or breakage of the angle head. Always use two spanners, one on the cap nut and the other on the tool spindle.

**!** Do not use a conventional spanner, master bar or angle head may be damaged.

## Attaching and Removing the Cutting Tool

### ● Attaching and removing drill / end-mill

1. Firmly fix angle head to NT simple setter or a fixing jig.



2. Remove the cap nut from the angle head.
3. Choose a collet (sold separately) to match with the tool shank.  
For AHS and AHL type angle heads, please select FDC collet.  
For AHSE and SHLE type, please select ER collet.

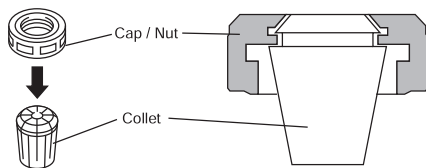
4. Clean the tool shank, collet and inner diameter taper portions of the angle head with a waste cloth.

**!** If dust or oil remains on the tool shank, collet or inner taper area of angle head, the cutting tool may not turn or may come out of spindle.

**!** Do not touch tools with bare hands. When attaching or removing your cutting tool or the collet, use a waste cloth or wear gloves.

5. Attach the collet to the cap nut.

Placing a collet on a table, put a cap nut on it, pressing straight down. Check that the inner groove of the nut firmly fits into the outer groove of the collet.



6. Attach that cap nut to the angle head.  
Slightly tighten the cap nut by hand.

7. Insert a cutting tool into collet.

**!** Insert cutter shank into angle head spindle by over the length of collet internal diameter.

**!** Do not clamp the cutter's edge with collet.

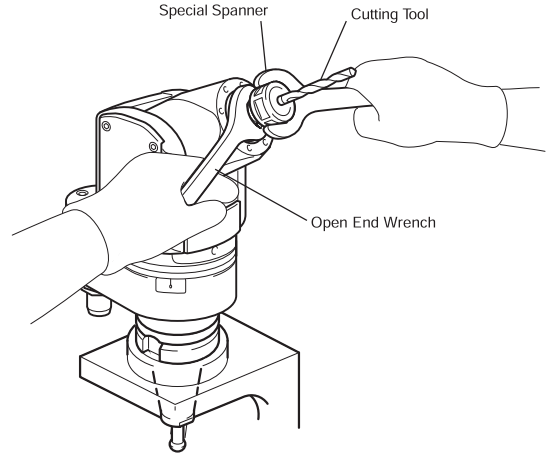
**!** Do not touch tools with bare hands. When attaching or removing your cutting tool or the collet, use a waste cloth or wear gloves.

8. Grip the tool spindle of the angle head body that need tightening with an open end wrench. Tighten the nut with a special spanner (sold separately). (See the Standard Tightening Torque Chart.)

**!** Tightening the nut without holding the tool spindle part may result in poor accuracy of the angle head. ALWAYS uses two spanners, one on the nut and the other on the tool spindle.

**!** Do not use a conventional spanner, nut, collet or angle head may be damaged.

**!** For your safety, loosen the nut slowly.



[Standard Tightening Torque Chart]

Holder Size	Open end Wrench Size	Special Spanner Size	Standard Tightening Torque
AHS07	16 <sub>mm</sub> (Commercially available)	S-0	10~15 N·m
AHS09	21 <sub>mm</sub> (Commercially available)	S-1L	30~35 N·m
AHS16	S-4L	S-4L	40~45 N·m
AHL16	S-3L	S-4L	40~45 N·m
AHL22	S-5L	S-5L	55~60 N·m
AHSE11	16 <sub>mm</sub> (Commercially available)	S-0	10~15 N·m
AHSE16	S-4L	FK0034	35~40 N·m
AHSE20	S-4L	FK0034	40~45 N·m
AHLE20	S-3L	FK0034	40~45 N·m
AHSE25	S-4L	HS-1-16	55~60 N·m
AHLE25	S-5L	HS-1-16	55~60 N·m
AHLE32	S-5L	HS-2-20	65~70 N·m

9. Remove your cutting tool by following this procedure reverse order.

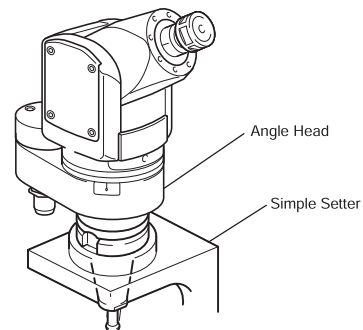
### ● Attaching and removing tap

**!** Tapping chucks and tap adapters are optionally available. Choose a appropriate tapping chuck and tap adaptor for Angle Head size and tap size.

**!** Before attaching the tap adapter, use a waste cloth to clean the mounting section. If dust or oil remains on the mounting section, the tap adapter may be unfastened.

**!** See the Tap Adapter manual for cutter mounting and removal procedures.

1. Firmly fix angle head to NT simple setter or a fixing jig.

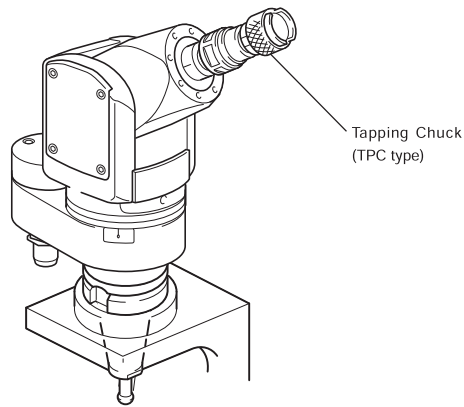


2. Remove the cap nut from the angle head.
3. Choose right tapping chuck (optional) for Angle Head and tap adaptor in use.

**!** Special tapping chuck is required for AHSE and AHLE type angle heads. Please contact our distributor nearest you or NT TOOL directory.

Angle Head Type	Tapping Chuck Type	Tap Adapter Type
AHS16, AHL16	TPC16-1	WE1, WEN1
AHL22	TPC22-1	WE1, WEN1
	TPC22-2	WE2, WEN2

4. Align the hexagonal salient of tapping chuck (TPC) with hexagonal concave portion of Angle Head to install the tapping chuck (TPC).  
Tighten the tapping chuck (TPC) by hand.

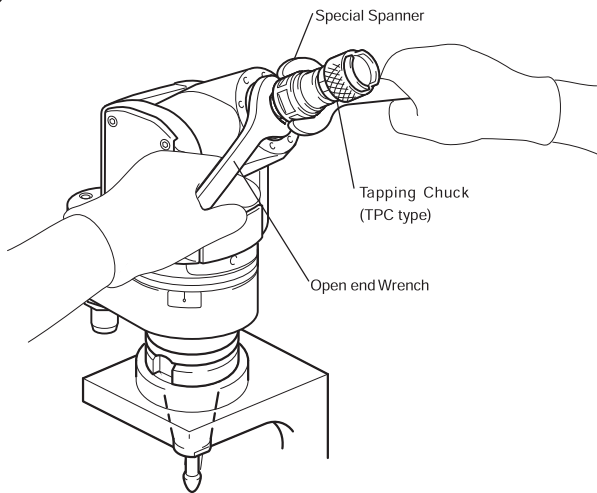


5. Tighten the portions of the angle head body that need tightening with an open end wrench. Tighten the tapping chuck (TPC type) with a special spanner (sold separately). (See the Standard Tightening Torque Chart.)

⚠️ Tighten the tapping chuck (TPC) without holding the tool spindle part may result in poor accuracy or breakage of the angle head. ALWAYS uses two spanners, one on the tapping chuck and the other on the tool spindle.

⚠️ Use designated wrenches only. Otherwise, tapping chuck (TPC) or Angle Head may be broken.

⚠️ For your safety, loosen the nut slowly.



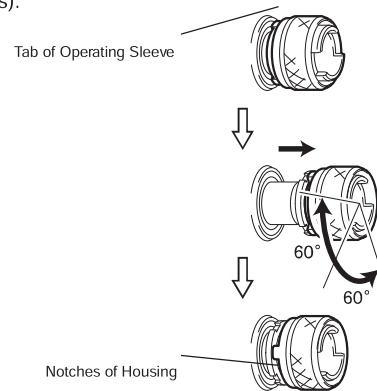
[Standard Tightening Torque Chart]

Holder Size	Open end Wrench Size	Special Spanner Size	Standard Tightening Torque
AHS16	S-4L	S-4L	40~45 N·m
AHL16	S-3L	S-4L	40~45 N·m
AHL22	S-5L	S-5L	55~60 N·m

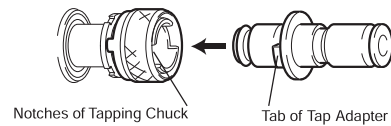
6. Choose appropriate tap adapter (optional) for the tapping chuck in use and for tap size in use.  
7. Clean the tap adapter and the tap adapter mounting section using a waste cloth.

⚠️ If dust or oil remains on the tap adapter or the mounting section, the tap adapter may be unfastened.

8. Pull the operating sleeve until its tabs are disengaged from the cuts of the housing. Turn the operating sleeve 60° (to the midpoint between the cuts).

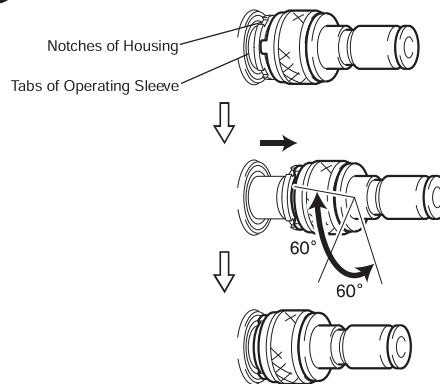


9. Fit the tabs of the tap adapter to the notches of the tapping chuck mounting section, and insert the tap adapter.



10. Turn the operating sleeve while pulling it, and fit the tabs of the operating sleeve to the cuts of the housing.

⚠️ Check that the tap adapter is fixed to the mounting section.



11. See the Tap Adapter manual for cutter mounting procedures.

12. Remove your cutting tool by following this procedure reverse order.

### Test Run

DO NOT start with high spindle speeds. Start with low speed to warm up the spindle for a minute or two, then step up speed to the operating speed. Approximate rotational speed for test run ... 1000rpm

### How to keep tools in good condition

- After using the tool for 1,000 hours in total, grease should be changed. Please contact our distributor nearest you or NT TOOL.
- Stop spindle immediately if symptom such as tool spindle revolution failure, excessive heating (Room temperature + 30°C), etc. Please contact our distributor nearest you or NT TOOL directly for consultation.

⚠️ NEVER attempt to repair spindle yourself: Repair by unqualified personnel may impair the safe operation of spindle.

