Thank you for purchasing the 'Tsubaki Pin Gear Drive Unit'.
Please install , operate and inspect the product in accordance with this manual in order to fully demonstrate the functions of the product.
Please follow the safety regulations (e.g., Occupational Safety and Health Regulations) when using this product.

Warning	Caution
1. Follow the safety regulations when using this product. 2. Be sure to follow the instructions below when installing, removing, maintaining and inspecting. 1) Turn off the power 2) Do not get under the device which may fall. 3) Fix the moving parts of the device. 4) Wear appropriate clothing and protect for the work.	1. Use fixing cover in case of loosening of bolts. 2. Bolt used for mounting should have the specified strength and size , and tightened with the tightening torque 3. Be sure to inspect or remove the pin gear drive unit with the load not fully acting on it.

Installation

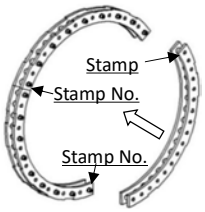
Pin gear drive units are available in two drive methods, rotary (pin wheel) and linear (pin rack), and in four different shapes.

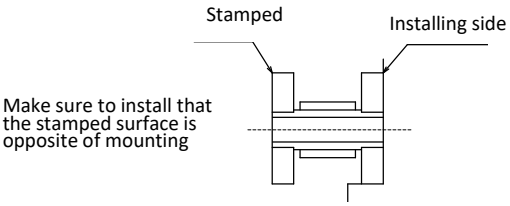
Rotational Drive — Pin Wheel { **— Outer Installation** / **— Inner Installation** } ※ **Pin Wheel is horizontally installed**

Linear Drive — Pin Rack { **— Horizontal Installation (flat)** / **— Vertical Installtion (angle)** }

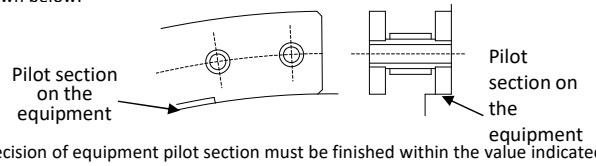
1. Installation of pin wheel (Outer and Inner Drive)

① Pin wheels are available in one piece or in segmented.
Segments should be installed in close contact so that there are no gaps between the surface, and make sure that the stamped surface to be in front (opposite side of the installing side) as shown below.
One-piece unit as well should be installed with the stamped surface to be faced.
As for the numbers in the stamp, it does not matter if they are not in the order.





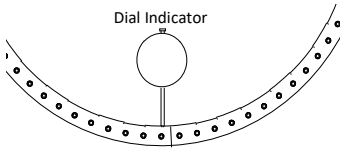
② Pin wheel installing area (machined surface) is machined at the same time as the bush mounting holes (roller center), so the surface can be used as a reference surface for centering when fitting the pin wheel into the pilot section on the equipment as shown below.



The rotational precision of equipment pilot section must be finished within the value indicated in the table below.

	Frame No.													
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
Precision of pilot section runout [mm]	**0.3**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.2**	**1.6**	**2.0**	**2.4**	**3.2**

③ When the equipment doesn't have pilot section, mount the pin wheel temporarily then use dial indicator to adjust reading precision of runout on mounting inner diameter (for external contact) or the outside diameter (for internal contact) and mount.
If the device is not a perfect circle due to welded construction, etc., the mounting holes of the pinwheel may not align with the mounting holes of the pinwheel. Therefore, machining the mounting bolt and tapped holes on the device side in order to match the actual product is recommended.



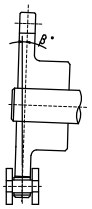
The rotational precision of pin wheel (circumferential runout) must be finished within the value indicated in the table below.

	Pin Gear Drive Unit Frame No.													
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
Precision of pin wheel runout [mm]	**0.5**	**0.6**	**0.8**	**1.0**	**1.2**	**1.4**	**1.5**	**1.8**	**2.0**	**2.4**	**3.2**	**4.0**	**4.8**	**6.4**

④ Inclination angle of pin gear to pin wheel

Inclination angle of pin gear to pin wheel (angle β) should be within the value indicated in the below table.

If the value is exceeded from the value indicated below table, unbalanced load will act on the rollers and bushes, causing uneven wear and break.



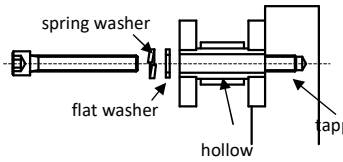
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
Pin gear inclination angle β(°)	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.12**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**

⑤ Installation of pin wheel to the device

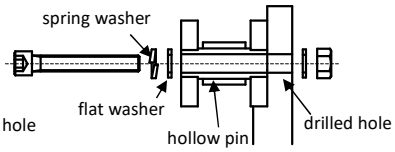
Align the hollow pin hole (bush hole) with the tapped hole on the device, insert and tighten the hex socket head bolt or use a drill hole (bolt hole) and tighten with a nut. If the mounting bolt is a steel, tensile strength rank of hex socket head bolt should be 12.9 and stainless with rank of 50, SUS304 or SUS316. Tighten the bolt evenly with more than the min. pcs of bolt per segment. (refer table below)

Use a torque wrench to tighten bolts. Large tightening torque is required for the large size bolts, so use hydraulic torque wrench or similar tool to tighten the bolts securely.

<For installation with bolts>



<For installation with bolts and nuts>



	Pin gear drive unit frame No.													
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
mounting bolt size	**M4**	**M4**	**M6**	**M8**	**M10**	**M12**	**M12**	**M16**	**M16**	**M20**	**M30**	**M36**	**M42**	**M48**
min. pcs for a segment	**8**	**13**	**10**	**8**	**7**	**6**	**9**	**6**	**7**	**6**	**4**	**6**	**6**	**5**

⑥ Precautions of bolt handling

・ Steel type

Be sure to use flat and spring washer which has enough strength for the bolt strength classification on bolt seating.

（Use only flat washer which has sufficient strength such as heat treated washer for PDU150 and over. Spring washers are not necessary used, but if used, it has to match the strength classification.）

Tighten securely to prevent loosening. Use of an anti-loosening agent is also effective.

Appropriate tightening torques are shown in the table below.

Appropriate tightening torque for hexagon socket head cap screws (strength class 12.9)[N・m

M4	M6	M8	M10
4.8	**16.7**	**40.2**	**81.3**
M12	M16	M20	M30
142	**348**	**676**	**2350**
M36	M42	M48	
3000	**4800**	**7000**	

・ Stainless type

Be sure to use both flat and spring washer for bolt seating.

Since stainless steel bolts are prone to galling and seizure during tightening, applying a lubricant containing molybdenum disulfide or fluoroplastic to the bolt seat and threaded surface to prevent galling and seizure is recommended.

Securely tighten the bolt to prevent loosening.

The table below shows the proper tightening torque when using bolts made of SUS304 or SUS316.

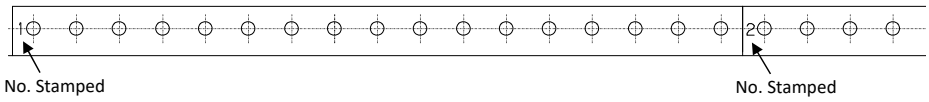
When using high-strength stainless steel bolts other than SUS304 or SUS316, titanium bolts, corrosion-resistant coated bolts, etc., please check with the bolt manufacturer for the appropriate tightening torque.

Appropriate tightening torque for SUS304(SUS316) hexagon socket head cap screws (strength class 50)[N・m

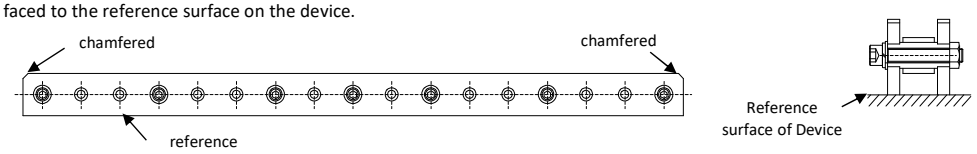
M4	M6	M8	M10	M12	M16	M20
0.82	**2.8**	**6.7**	**13.1**	**22.5**	**55**	**108**

2. Installation of Pin rack (Flat type)

① The pin rack has stamped no. on one side. Install the pin rack that the stamped side is on the same side.

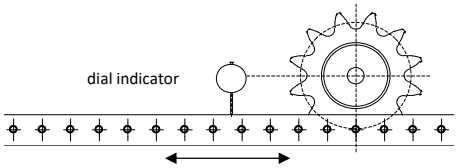


② On the opposite side of pin rack reference surface is chamfered as shown below. Install the surface not chamfered to be faced to the reference surface on the device.



③ The surfaces of the segments should be installed in close contact with each other so that there are no gaps. If there is a gap, the pitch may not match and accurate meshing may not be possible.

④ When there is no reference surface on the device, temporarily install the pin rack on the device first, then adjust the parallelism by placing the dial indicator on the outer circumference of the roller of pin rack as shown below.



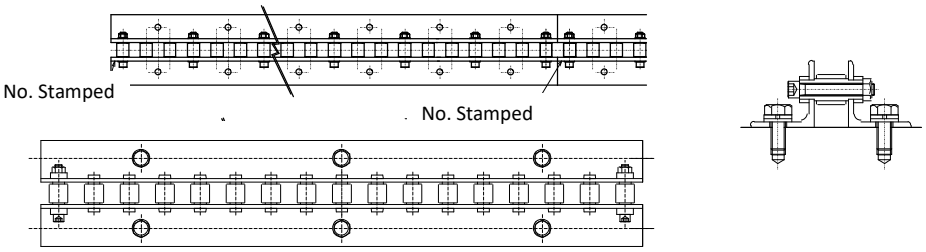
⑤ Inclination angle of pin gear against to pin rack
Same as for pinwheels.(Please refer to section 1 ④)

⑥ Installation of pin rack to device
Same as for pinwheels.(Please refer to section 1 ⑤)

⑦ Precautions of bolt handling
Same as for pinwheels.(Please refer to section 1 ⑥)

3. Installation of pin rack（Angle）

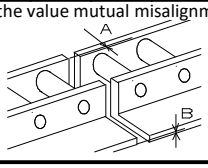
① The pin rack has stamped no. on one side. Install the pin rack that the stamped side is on the same side.



② Angle type is manufactured based on the bottom surface of mounting leg, so install this surface to ground to the mounting surface.
Angle type is made of Angle steel (mountainous steel), so it may have slight bent or warp.. Even if there are a slight gap between, fix the angle type as it is.
If the mounting surface is not flat, use shims or etc. to secure it in place.
For mounting bolts, use hexagon socket head cap screws (steel-strength class: 12.9 Stainless-strength class: 50) or hexagon bolt (steel-strength class: 10.9, Stainless -strength class: 50) shown below on all the mounting holes.

	Pin gear drive unit frame No.													
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
mounting bolt size	**M8**	**M10**	**M12**	**M12**	**M12**	**M16**	**M16**	**M16**	**M20**	**M20**	**M30**	**M36**	**M42**	**M48**

③ Install with the value mutual misalignment of segment joints to be less than the values shown below.

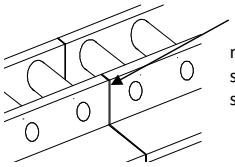


A: Left-right misalignment
B: Vertical (height) misalignment

		Pin gear drive unit frame No.													
		PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
Misalignment tolerance[mm]	A	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**	**0.4**	**0.4**	**0.5**	**0.5**	**0.6**	**0.8**	**1.0**	**1.2**	**1.5**
	B	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**	**0.4**	**0.4**	**0.5**	**0.5**	**0.6**	**0.8**	**1.0**	**1.2**	**1.5**

④ The surfaces of the segments should be installed in close contact with each other so that there are no gaps.
If there is a gap, the pitch may not match and accurate meshing may not be possible.

⑤ Inclination angle of pin gear against to pin rack
Same as for pinwheels.（Please refer to section 1 ④）

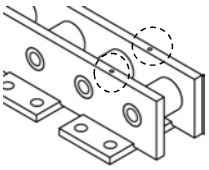


⑥ Precautions of bolt handling
Same as for pinwheels.（Please refer to section 1 ⑥）

※When using hexagonal bolts, use tightening torque shown in the table below. (steel type)

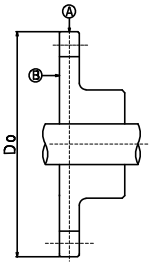
Appropriate tightening torque for steel hexagon bolt（strength class 10.9) [N・m]

M4	M6	M8	M10
4.02	**13.7**	**34.3**	**67.6**
M12	M16	M20	M30
118	**289**	**568**	**1960**
M36	M42	M48	
3000	**4800**	**7000**	



⑦ The tapped holes for suspension bolt are available on PDU180 and PDU240. Use as needed.

4. Installation of Pin gear (common)



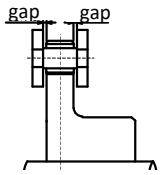
① The rotational precision of pin gear must be finished within the value indicated in the table below.

	Pin gear outer dia Do					
	50 or below	150 or below	250 or below	650 or below	1000 or below	over 1000
Pin gear vertical runout A	**0.1**	**0.12**	**0.15**	**0.0006×Do**	**0.4**	**0.45**
Pin gear lateral runout B	**0.12**	**0.15**	**0.15**	**0.0006×Do**	**0.0006×Do**	**0.6**

② The center distance of between pin gear and pin wheel/ pin rack is mentioned on the product DWG.Install accurately.
(Tolerances are also shown).

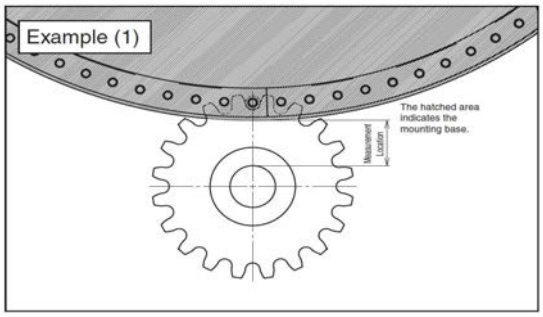
③ Install the pin gear while adjusting its teeth surface to be ground parallel to the roller.
（Refer ④ in section 1 "Inclination angle of pin gear to pin wheel"）

④ Adjust the gap so that the pin gear tooth are centered on the inside width of the pin wheel /pin rack and avoid contact with the frame during operation.

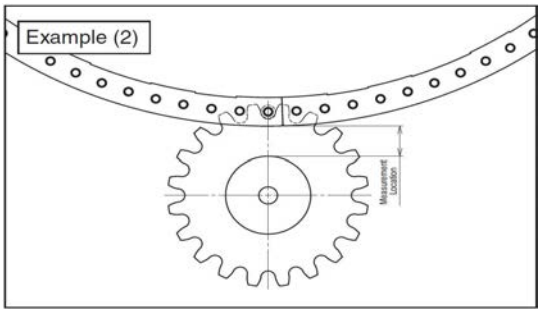


⑤ Example of Center Distance Adjustment

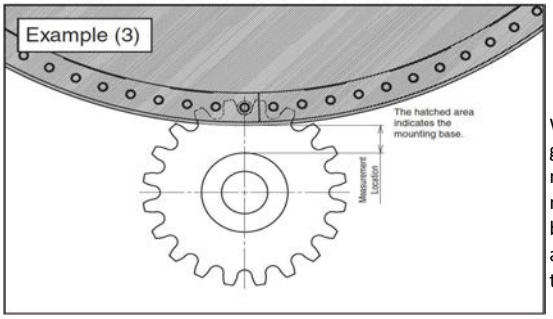
The Pin Gear Drive Unit itself does not have a function for directly setting the center distance.
If the equipment does not provide a function to adjust the center distance, set it by referring to the following instructions.



Measure the distance between the mounting base and the shaft, and
confirm the center distance.
(Calculate and adjust the center distance based on the diameter
of the measurement location on the mounting base and the shaft
diameter.)



With the roller in contact with the tooth root of the pin gear, measure the clearance between the frame of the pin wheel or pin
rack and the hub of the pin gear, and contact Tsubaki as adjustment
to our specified value is required.



With the roller in contact with the tooth root of the pin gear,
measure the clearance between the outer diameter of the mounting
base and the hub of the pin gear, and contact Tsubaki as adjustment
to our specified value is required.

Operation

1. Lubrication

Before operation, be sure to apply sufficient extreme-pressure grease to ensure that it is fully distributed over the entire roller surface.(The inner surfaces of the rollers of the pin wheel / pin rack are pre-lubricated with grease.)
Examples of recommended greases are shown in the table below. Select the grease consistency (NLGI No.) according to the application.

Manufacturer	Grease Name	NLGI No. (Consistency Number)	Grease Operating Temperature Range
Idemitsu Kosan Co., Ltd.	Daphne Grease MP No. 0, No. 1, or No. 2	0, 1, or 2	−20 to 130°C
	Daphne Eponex SR	0, 1, or 2	−20 to 160°C
ExxonMobil Ltd.	Mobilux EPO, EP1, or EP2	0, 1, or 2	−10 to 130°C
	Mobil SHC Polyree 005, 221, 222, or 462		−20 to 170°C
Nippon Grease Co., Ltd.	Nigtight LE-0, LE-1, or LE-2	0, 1, or 2	−20 to 120°C
Sumico Lubricant Co., Ltd.	Sumiplex MP No. 0, No. 1, or No. 2	0, 1, or 2	−20 to 200°C
	Sumiplex L-MO No. 0, No. 1, or No. 2	0, 1, or 2	−10 to 240°C

NLGI (National Lubricating Grease Institute) (USA)

Apply grease to the pin gear or the rollers.
Applying grease to both the pin gear and the rollers helps eliminate uneven application.
The guideline amount of grease per roller is shown in the table below.
Apply grease in several passes to ensure it is evenly distributed over the entire roller surface.
After trial operation, an appropriate amount of grease remains when grease is present in the clearance between the rollers and the frame.

	Frame No.													
	PDU020	PDU022	PDU030	PDU035	PDU040	PDU050	PDU055	PDU070	PDU080	PDU090	PDU120	PDU150	PDU180	PDU240
Application Amount (g)	**0.5**	**0.5**	**1.0**	**1.5**	**2.5**	**3.0**	**4.0**	**6.0**	**7.0**	**10.0**	**20.0**	**30.0**	**40.0**	**80.0**

2. Operation

① Strength of Equipment

Design the equipment using the Pin Gear Drive Unit so that it can sufficiently withstand the intended operating conditions.

Provide safety mechanisms as necessary, with due consideration for safe operation.

② Checks Before Operation

Before starting operation, perform the following checks over the entire range of the pin wheel / pin rack.

- Smooth meshing between the pin gear and pin wheel / pin rack
  Confirm smooth operation by visual inspection or by checking data obtained from equipment sensors.
- No abnormal noise or vibration during meshing
  Perform a trial operation and confirm that no unusual noise is generated and that the equipment does not vibrate excessively.
- No contact between the pin gear and the frame of the pin wheel / pin rack
  Using a scale or thickness gauge, confirm that the clearance between the teeth and the frame is appropriate.
- No contact between the pin gear tooth root and the rollers
  Check the pin gear positioning by visual inspection, insertion of a reference rod, and confirmation of abnormal noise.
- No uneven contact between the pin gear tooth surface and the rollers
  Using a contact marking compound (such as red lead) or grease, confirm the contact condition between the tooth surface and the rollers.

Maintenance and Inspection

① Inspection of condition of lubrication

The engagement parts of the pin gear and roller should be regularly inspected and lubricated to prevent them from drying out and to ensure that there is always oil on them.

(Although it depends on the frequency of use and the operating environment, grease should be applied about once a month.)

② Daily Inspection

Check daily basis on the operating condition as follows:

《Check points》

・Abnormal noise and vibration
Check if the noise is not louder than usual
Also check there is no periodic abnormal noises
Check there is no abnormal vibration or abnormal periodic vibration

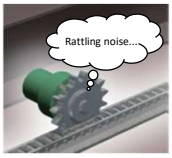
・Loose mounting bolts
Check if there are no loose mounting bolts
Retighten loose parts if any.（Refer ⑥ Precautions of bolt handling on 1-1: Installation of pin wheel)

・Roller rotation
Check that the rollers rotate smoothly by hand.
If any part does not rotate, it may be a lack of lubrication. Grease should be applied and also shorten the grease application interval.

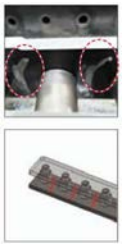
・Mounting condition
Check for any changes from the initial installation condition.
If any, recheck the abnormality in related parts.

・Lubrication condition
Make sure that the rollers and pin gears are sufficiently coated with grease.
Apply grease if there is no or not enough adhesion.

Abnormality and its handling

Symptom	Possible Cause	Corrective Action
Abnormal noise occurs  Failure example (Abnormal noise)	Improper installation of pin gear, pin wheel, or pin rack	Carry out inspection and adjustment in accordance with the above procedures. Confirm the installation accuracy of the pin wheel or pin rack. Check the axial runout and radial runout of the pin gear, and adjust as specified in the catalog.
	Severe wear of pin gear, pin wheel, or pin rack	Replace with new parts.
	No lubrication or insufficient lubrication	Apply lubrication and continue appropriate lubrication on a regular basis.
Pin gear disengages	Improper installation of pin gear, pin wheel, or pin rack	Carry out inspection and adjustment in accordance with the above procedures. Make corrections to the center distance as required.

Abnormality and its handling

Breakage of pin gear teeth	Excessive impact load or excessive load	Review operating conditions, such as making start-up and stopping smoother, or select a model suitable for the operating conditions. Increase the frame size of the Pin Gear Drive Unit.
	Ingress of foreign matter	Improve the operating environment.
Wear on the side surfaces of the pin gear teeth/ Wear on the inner side of the frame of the pin wheel or pin rack 	Improper installation of the pin gear, pin wheel, or pin rack	Carry out inspection and adjustment in accordance with the above procedures. Confirm the installation accuracy of the pin wheel or pin rack. Check the axial runout and radial runout of the pin gear, and make adjustments as necessary.
Rusting	No lubrication or insufficient lubrication/ Mismatch between environment and specifications	After replacement with new parts, continue appropriate lubrication. Improve the operating environment.
Breakage of pin gear teeth/ bushing 	Excessive impact load or excessive load	Review operating conditions, such as making start-up and stopping smoother, or select a model suitable for the operating conditions. Increase the frame size of the Pin Gear Drive Unit.
	Ingress of foreign matter	Improve the operating environment.
Breakage of bushing 	Excessive impact load or excessive load	Review operating conditions, such as making start-up and stopping smoother, or select a model suitable for the operating conditions. Increase the frame size of the Pin Gear Drive Unit.
Roller cracks 	Excessive impact load or excessive load	Review operating conditions, such as making start-up and stopping smoother, or select a model suitable for the operating conditions. Increase the frame size of the Pin Gear Drive Unit.
	Excessive rotational speed	Review operating conditions (Allowable tangential speed: 50 m/min).
	No lubrication or insufficient lubrication	After replacement with new parts, continue appropriate lubrication.
Roller does not rotate	No lubrication or insufficient lubrication	After replacement with new parts, continue appropriate lubrication.
	Excessive load	Reselect the model. Increase the frame size of the Pin Gear Drive Unit.
	Foreign matter enters between the bushing and the roller	Remove foreign matter periodically. Improve the operating environment.
Uneven roller wear 	No lubrication or insufficient lubrication	After replacement with new parts, continue appropriate lubrication.
	Excessive load	Reselect the model. Increase the frame size of the Pin Gear Drive Unit.
	Improper installation of the pin gear, pin wheel, or pin rack	Carry out inspection and adjustment in accordance with the above procedures. Confirm the installation accuracy of the pin wheel or pin rack. Check the inclination angle of the pin gear relative to the pin wheel, and make adjustments as necessary.