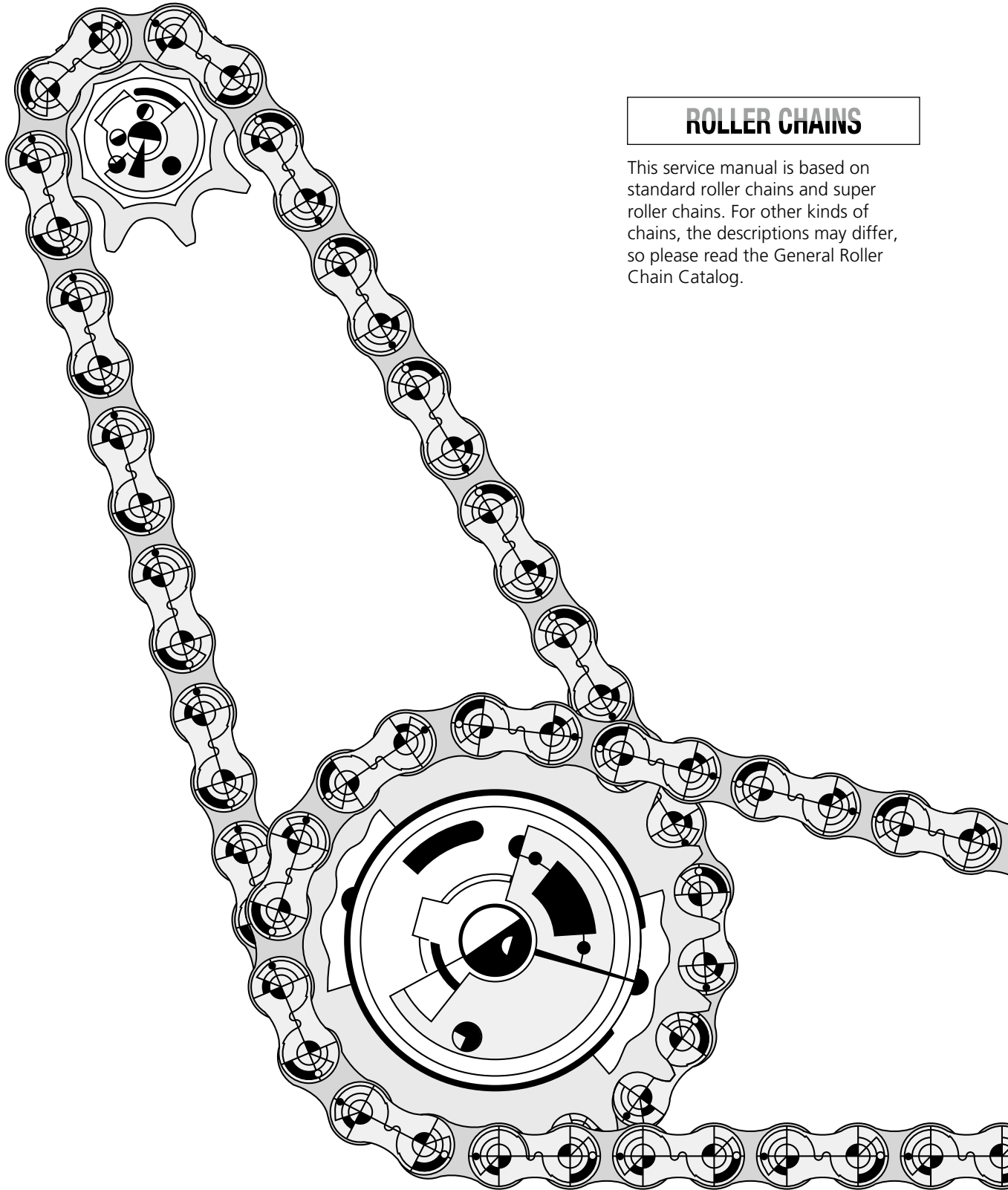


# Roller Chains Service Manual



## ROLLER CHAINS

This service manual is based on standard roller chains and super roller chains. For other kinds of chains, the descriptions may differ, so please read the General Roller Chain Catalog.



**ZEXUS CHAIN Co., Ltd.**



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# Introduction

Errors or shortcomings in selection handling and maintenance of roller chains or sprockets may cause major accidents, including chain breakage or damage. This catalog includes information to assist in the correct selection, handling and maintenance of chains and sprockets, so please read it with care before using our products.

## Catalog Symbols

This catalog uses the two symbols below. Please check their meanings and be sure you fully understand them before reading the rest of the catalog.

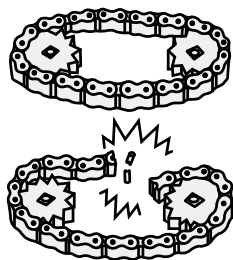
Symbol	Meaning
 Warning	This symbol indicates content which, if ignored, can lead to incorrect handling that could result in death or serious injury.
Caution	This symbol indicates content which, if ignored, can lead to incorrect handling that could result in personal injury and equipment damage.

## 1. Product Use

Please pay particular attention to the following points when using roller chains and sprockets.

### 1-1 Select chains correctly

- ① Roller chains may break when an excessive load is placed on them. Be sure to use any chain only within its proper load capacity, based on an understanding of its structure and specifications.
- ② Use of roller chains in alkaline or acidic environments can cause brittle fracture, so be sure to select the appropriate chains for the conditions in which it will be used.



- ③ The performance of roller chains declines at high and low temperatures, possibly causing them to break in some situations, so be sure to select the right chain for the conditions.
- ④ Do not use offset link when roller chain is used for hanging or conveying vertically.

- ⑤ Maximum allowable load decreases when using standard connecting link or offset links as shown below.

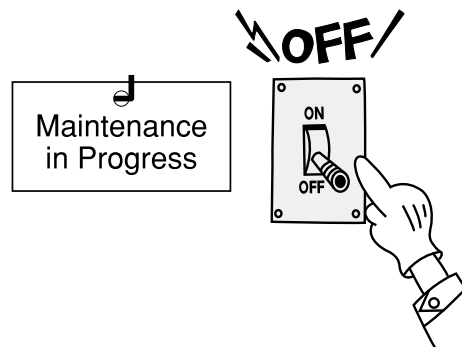
	rate of maximum allowable load
Not used	100%
Standard Connecting Link	80%
Offset Link	65%

Avoid using offset links as much as possible by adjusting the center distance or other methods.

## 1-2 Install chains correctly

### → Refer to 9p“Handling of Roller Chains and Sprockets”

- ① Make sure the main power supply is switched off before starting maintenance and inspection work, and take precautions to prevent anyone from switching it on by mistake.



- ② In hanging or vertical transport devices, adopt the following safety measures in case of roller chain breakage.



#### Warning

- People must not be in the area beneath the conveyor system.
- To prevent death, injury and equipment damage, use a mechanism to prevent the load from falling in the event of a chain break, or take other safety precautions to prevent danger.



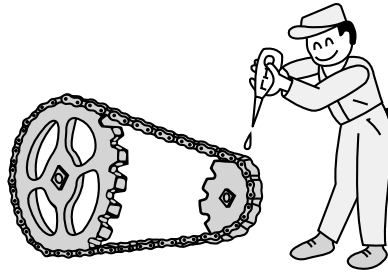
- ③ Roller chains and sprockets may sustain uneven wear, breakage, or failure due to misalignment or improper centering. Ensure proper installation.
- ④ Always attach preventive safety equipment (safety covers) to chain and sprocket devices.

- ⑤ Plating treatment for Roller Chains and Sprockets are dangerous
  - Do not plate treatment for heat treated chains and sprocket wheels. It causes chain broken due to hydrogen brittleness.
- ⑥ Welding and heating roller chains and sprockets are dangerous.
  - Do not weld heat treated chains and sprocket wheels. It causes chain broken or strength failure due to heat affect.
  - When heating or cutting heat treated chains and sprocket wheels by blowtorch or other heat source, remove all parts which affected by heat.

## 1-3 Maintaine equipment properly

### →Refer to 9p“Handling of Roller Chains and Sprockets”

- ① The lifespan of roller chains vary enormously depending on whether they receive proper maintenance and lubrication. Wear extension can cause the chain to ride off the sprocket, or to break, so practice appropriate maintenance and lubrication.
- ② Roller chains and sprockets are consumable parts. As such, they require proper periodic maintenance and replacement. Avoid replacing only part of a chain. Replace the chain as a whole.



## 2. Types of Roller Chains

### Roller Chains

#### Standard Roller Chains

Standard Roller Chains meet ANSI(JIS)/BS Standard. NO.25~240/06B-32B are available. Multiple strands are available.

#### Super Roller Chains

Super Roller Chains are designed to provide greater tensile strength and resistance to fatigue failure. NO.80~240 are available. Multiple strands are also available.

#### Stainless Steel Roller Chains

#### Nickel Plated Roller Chains


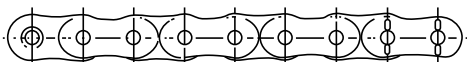




#### Heavy Series Roller Chains

#### Heavy Duty Chains

#### Side Bow Chains (curved running chain)

#### O-ring Chains

### Features of Roller Chain, Connecting Link, Offset Link

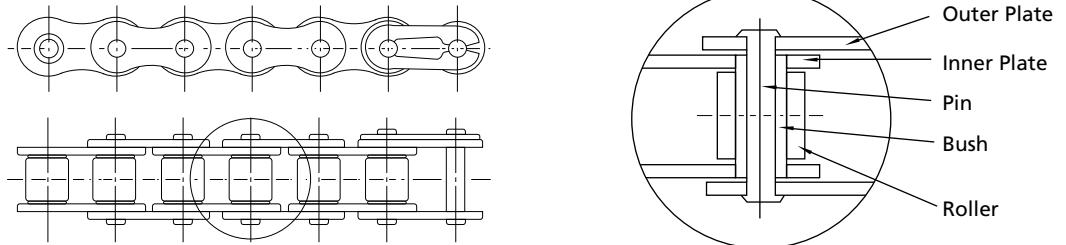
	Standard Roller Chains	Super Roller Chains
Chain	<ul style="list-style-type: none"> <li>• ANSI(JIS)/BS Standard</li> <li>• NO.25~240(Single and multiple strands)</li> <li>• 06B~32B(Single and multiple strands)</li> <li>• Rivetted Type/Cottered Type</li> <li>• Connecting Link/Offset Link</li> </ul>  <p>Standard Roller Chains</p>	<ul style="list-style-type: none"> <li>• Greater tensile strength and resistance to fatigue failure</li> <li>• NO.80~240(Single and multiple strands)</li> <li>• Rivetted type chain is provided unless otherwise specified.</li> <li>• Semi Press-fitted type connecting links are supplied.</li> <li>• Offset links are not available.</li> <li>• Impossible to assemble with Standard Roller Chains.</li> </ul>  <p>Super Roller Chains</p>
Connecting Link	<ul style="list-style-type: none"> <li>• The commonly used connecting links are the clip type and the cotter pin type.</li> <li>• The structure features a loose-fitted type</li> </ul>  <p>Standard Connecting Link</p>	<ul style="list-style-type: none"> <li>• For Super Roller Chains only</li> <li>• Semi Press-fitted type</li> </ul>  <p>Connecting Link for Super Roller Chains</p>
Offset Link	<ul style="list-style-type: none"> <li>• Used when the chain has an odd number of links.</li> <li>• Loose-fitted type</li> <li>• Offset Link/2-Pitch Offset Link</li> </ul>  <p>Offset Link</p>	 <p>2-Pitch Offset Link</p>

Offset links for Super Roller Chains are not available.

## 3. Roller Chain Structures

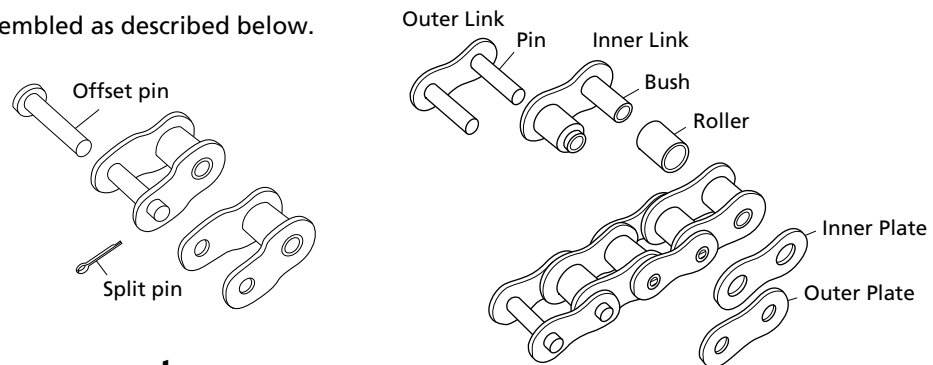
Roller Chains comprise components such as link plates, pins, bushes, and rollers. The example below is a standard roller chain.

### 3-1 Structures



### 3-2 Assembly




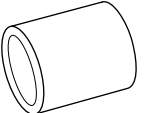

Each component is assembled as described below.



### 3-3 Role of Components

The roller chain consists of four components: link plates (outer plate and inner plate), pins, bushes, and rollers. The basic role of each component is shown in the table below.

**Roles of Roller Chain Components**

Component Names	Primary Role
 Link plates (outer plate and inner plate)	<ul style="list-style-type: none"> <li>Ensures strength as a tension member when tension is applied to the chain.</li> <li>Possesses sufficient fatigue strength and toughness to withstand repeated loads and impact loads during use.</li> </ul>
 Pin	<ul style="list-style-type: none"> <li>Similarly to the link plate, it provides strength as a tension member when tension is applied to the chain while also withstanding bending, shear, and impact forces.</li> <li>Possesses wear resistance since the outer surfaces of the Pin and Bush slide against each other during operation.</li> </ul>
 Bush	<ul style="list-style-type: none"> <li>Provides a bearing function with the pin and possesses wear resistance on both the inner and outer surfaces.</li> <li>Provides crushing strength to withstand impact loads.</li> </ul>
 Roller	<ul style="list-style-type: none"> <li>Provides impact resistance and crushing strength to withstand the impact forces generated when it engages with the sprocket during operation.</li> <li>Rollers are wear resistant since they rotate by sliding.</li> </ul>
 Split pin • Clip	<ul style="list-style-type: none"> <li>Used in joints to prevent the outer plate from coming off during operation.</li> </ul>



## 4. About Sprockets

### 4-1 Main Types



A type



B type



C type



Double type

### 4-2 Materials

The materials of sprockets are shown in the table on the right as standard. However, consult us if you have any specific requirements.

Types	Materials
A type	SS400
B type	S35C, SS400
C type	SS400, FCD600

### 4-3 Hub Diameter and Hub Width

The hub diameter and hub width of standard sprockets may need to be designed individually depending on constraints of usage conditions and installation space.

Below is an outline of the method for determining hub diameter and hub width.

Hub diameter  $D$  (mm) =  $\alpha d + 2b + 5$

Hub width  $L$  (mm) =  $(1.1 \sim 1.5) d$

$\alpha$  : Coefficient Based on Sprocket Material

$d$  : Shaft Diameter (mm) =  $\sqrt[3]{\frac{16 \cdot T}{\pi \cdot \tau}}$

$T$  : Torque Acting on the Shaft (kgf·mm)

$\tau$  : Allowable Shear Stress (kgf / mm<sup>2</sup>)

$b$  : Keyway Depth in the Hub Section (mm)

Coefficient  $\alpha$

Materials	$\alpha$
FCD600	1.4
S35C, SS400	1.25

#### Caution

- The methods for determining hub diameter and hub width shown here are simplified calculations. For detailed design, refer to standard mechanical design practices.

### 4-4 Bore Machining

Consult us if you have any specific requirements of finishing services for the bore. Please specify the bore diameter, keyway dimensions, and tolerances.

#### Caution

- When machining the bore of the sprocket, use the tooth root as the reference to maintain accuracy.

## 4-5 Tooth Tip Hardening

Some standard sprocket products are pre-treated with tooth tip hardening.

### Caution

- If wear resistance and impact resistance are required for the sprocket, apply tooth tip hardening before use.

## 4-6 Lubrication of Sprockets

Use according to the specified lubrication conditions. (Refer to page 13 for lubrication types)

### Caution

- For low speeds and heavy loads, application of grease or a similar lubricant to the sprocket tooth surfaces is recommended.

## 4-7 Selection of Number of Sprocket Teeth

For smooth transmission, the number of teeth on small sprockets should be as large as possible, ideally 15 to 17 or more with an odd number of teeth. Sprockets with 14 or fewer teeth should only be selected for very low-speed applications where shock is not a concern.

### Caution

- The minimum number of sprocket teeth is limited to 9.

## 4-8 Sprocket and Roller Chain Wrap Angle

The wrap angle between the sprocket and the roller chain should ideally be around 120° to 180°.

### Caution

- When used for suspension applications, a wrap angle of 90° or more is required.

## 5. Handling Roller Chains and Sprockets

### 5-1 Use

Please pay attention to the following points when cutting, joining, maintaining, installing, inspecting or otherwise working with roller chains.



#### Warning

- Make sure the main power supply is switched off before starting maintenance and inspection work, and take precautions to prevent anyone from switching it on by mistake.
- Wear suitable clothing and protective equipment (safety glasses, safety boots, etc.) when working.
- Strictly observe the general standards of the Industrial Safety and Health Law, Volume 2, chapter 1, section 1

### 5-2 Installation

#### (1) Installation of Sprockets

Proper installation of the sprocket is essential for smooth transmission of the roller chain. The installation accuracy of the sprocket has a significant impact on the lifespan of both the chain and the sprocket. Below are the alignment methods and allowable tolerances for general applications (excluding special cases).

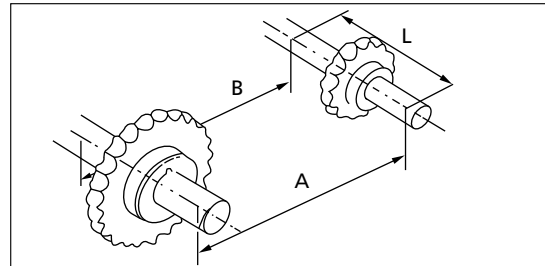
##### Alignment Procedure

##### ① Shaft Parallelism and Tolerances

Adjust the dimension in the diagram

$$\text{to } \pm \frac{1}{300} = \frac{A-B}{L}$$

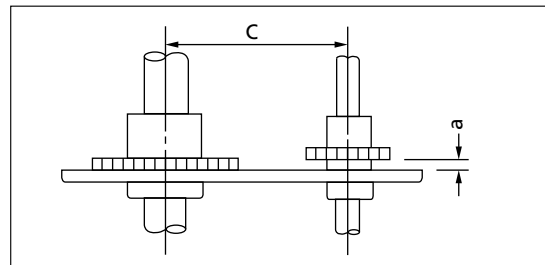
When the center distance is short, use a straight edge for measurement; when it is long, use a tape measure or similar tool.



##### ② Sprocket Alignment and Tolerances

Place a straight edge against the tooth side surfaces (machined areas) of the pair of sprockets, and adjust gap 'a' to be within the allowable tolerance.

When the center distance is long, use a piano wire or similar tool for measurement. In this case, rotate the sprocket to ensure there is no variation in the value of 'a'.

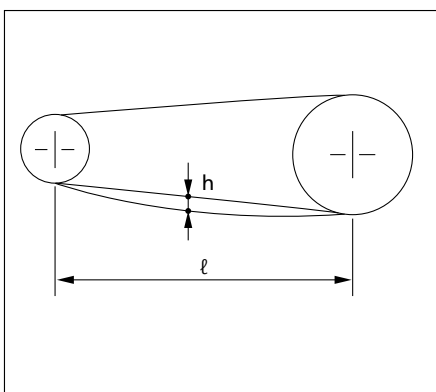


Sprocket centering tolerance

Center Distance c (m)	Allowable Tolerance a (mm)
$c < 1$	$\pm 1$
$1 \leq c \leq 10$	$\pm c(\text{mm})/1000$
$c > 10$	$\pm 10$

#### (2) Roller Chain Tensioning Method

Unlike belt drives, roller chains do not require initial tensioning. The appropriate slack amount h depends on conditions, but generally it should be around 4% of center distance  $\ell$ .

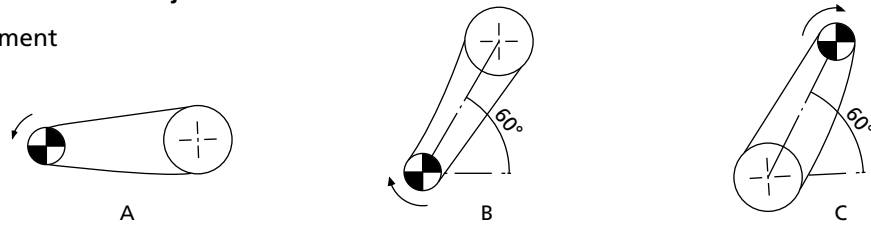


#### Caution

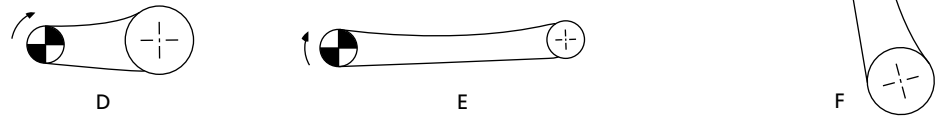
- In the following cases, a slack amount h of around 2% is appropriate.
  1. When the transmission is vertical or nearly vertical
  2. When the center distance is 1 m or more
  3. When operating under heavy loads with frequent starts
  4. When operating under forward and reverse rotation
  5. When subject to vibration or impact
  6. When the reduction ratio is 7 : 1 or greater

### (3) Shaft Alignment and Tension Adjustment Device

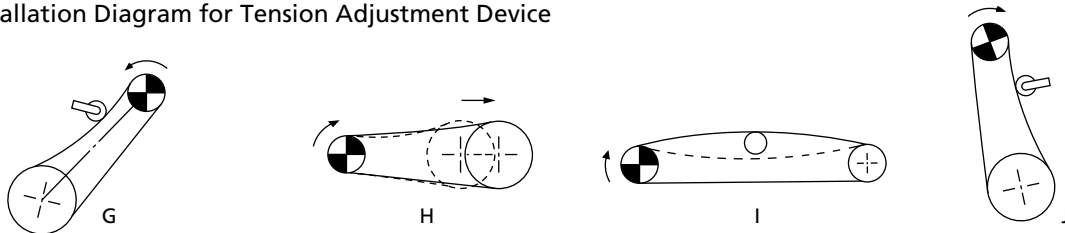
#### ① Preferred Arrangement



#### ② Arrangements to Avoid



#### ③ Installation Diagram for Tension Adjustment Device



#### Caution

- For shaft arrangements A, B, and C in item ①, a center distance of 30 to 50 times the chain pitch is recommended (within 20 times if there is pulsation).

### (4) Cutting and Joining of Roller Chains

When cutting and joining roller chains, use jigs and tools such as a staking punch as shown in the diagram. Note that the tip of the punch is thinner than the pin diameter and may break if struck with a hammer.



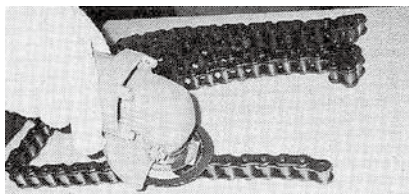
Cutting and joining tools

#### Caution

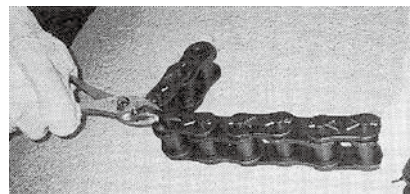
- When working, wear protective equipment (safety glasses, work gloves, etc.).

#### Cutting of Roller Chains

- ① For rivet-type chains, grind down the end of the pin using a grinder (sander).
- ② For cotter-type chains, remove the split pin (S pin).

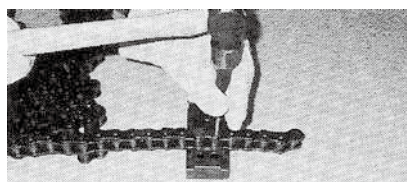


rivet-type



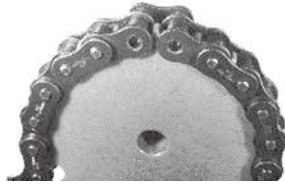
cotter-type

- ③ Using a hammer and punch, alternately tap the heads of the pair of pins to remove them.



## Joining of Roller Chains

- ① When the connecting link is a loose fitted type or an offset link  
Position the joint section on the sprocket and insert the connecting link or offset link.  
Next insert the outer plate of connecting link or pin of offset link and secure it with a clip or split pin.



Connecting Link (Clip Type)



Connecting Link (Split Pin Type)



Offset Link



2-Pitch Offset Link

### Caution

- Be careful not to damage the sprocket teeth when joining the chain with connecting link or offset link.
- When securing with a clip, position the clip opening in the opposite direction of the chain's rotation. This prevents it from coming off.
- Open the split pin of the connecting link to approximately 60°.

- ② For Semi Press-fitted Connecting Link of Super Roller Chains  
Place a backing plate on the chain and press-fit it using a hammer or a dedicated punch.  
Then, secure it with a spring pin.

### Caution

- During assembly, do not enlarge the plate holes with a drill or thin out the pins with a file, even if the plate is difficult to fit. Doing so may cause breakage.
- Ensure the spring pin protrudes evenly on both the top and bottom.



Connecting Link for Super Roller Chains

### Caution

- Do not reuse clips, split pins, or similar components once they have been used, and avoid using commercially available split pins. This may lead to reduced strength or a shortened lifespan.
- Do not incorporate used connecting links or disassembled roller chain components into a new roller chain. This may lead to reduced strength or a shortened lifespan.
- After connecting the roller chain, perform the following inspections before powering on to prevent accidents.
  - a) Check that the connected section is properly joined.
  - b) Ensure that the roller chain is properly engaged with the sprocket teeth.
  - c) Check if there are any objects nearby that could cause interference or scatter.

## 5-3 Lubrication (Oiling)

Lubrication is extremely important for roller chain transmission. Improper lubrication could shorten the service life of a roller chain. Lubrication for roller chain transmission is also extremely important because chains have recently been used under more severe conditions such as high speeds and heavy loads. The following is a list of lubrication points, lubrication methods, and types of lubricants, so be sure to lubricate chains with reference to this list.

### (1) Lubrication points

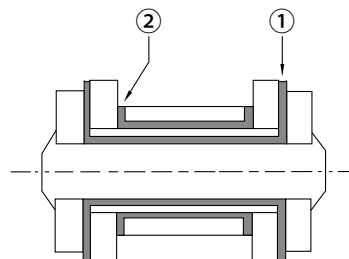
The important lubrication points for roller chain lubrication are ① and ② in the figure.

#### ① Lubrication between pins and bushings

This prevents wear between the pin and the bushing, which is the main cause of wear on the roller chain.

#### ② Lubrication between bushings and rollers

This prevents wear between the bushing and roller, reduces noise, and absorbs impact loads.



### (2) Lubricating oil

In general, use a high-grade industrial lubricant. Select a lubricant with appropriate viscosity according to the ambient temperature, lubrication type, and chain size from the table below.

Lubrication type	I・II				III			
Ambient temperature (°C)	−10~0	0~40	40~50	50~60	−10~0	0~40	40~50	50~60
Chain number								
50 or less	SAE10W	SAE20	SAE30	SAE40	SAE10W	SAE20	SAE30	SAE40
60・80	SAE20	SAE30	SAE40	SAE50				
100					SAE20	SAE30	SAE40	SAE50
120 or more	SAE30	SAE40	SAE50					

### Caution

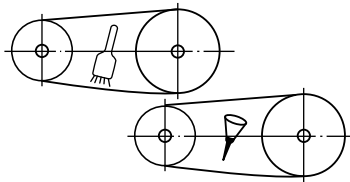
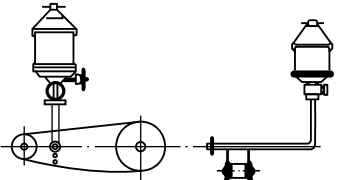
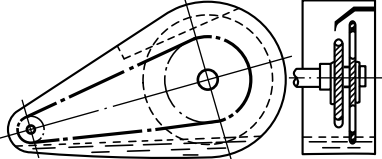
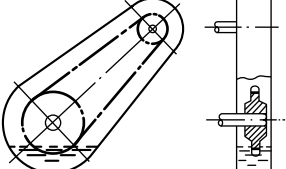
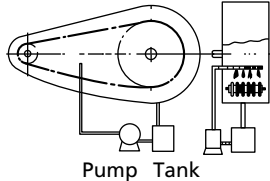
- Do not use waste oil as it may contain foreign matter, dust, or chips, or heavy oil or grease as they have a high viscosity and cannot penetrate the area between the pin and the bushing smoothly.
- If the ambient temperature is below −10°C or above 60°C, a special lubricant is required. In such cases, please contact us.

### Commercial lubricating Oil (for reference)

Manufacture	Idemitsu Kosan Co., Ltd.		ENEOS Corporation	
Viscosity				
SAE10W	Daphne Mechanic Oil	32	FBK OIL RO	32
SAE20		68		68
SAE30		100		100
SAE40		150		150
SAE50		220		220

\*Manufacturers' names are listed in no particular order.

### (3) Lubrication method

Type	Lubrication method	How to perform lubrication	Illustration
I	a	Brush or oil bottle method A method of lubrication with a brush or oil can periodically (every 8 hours), depending on usage conditions	
	b	Drip lubrication A method of lubricating a chain by applying about 20 drops of oil per minute	
II	Disk lubrication	A method of applying oil with a disc attached to the sprocket shaft	
	Oil tank lubrication	A method of pouring oil into a sealed casing and immersing a part of a chain in the oil	
III	Forced lubrication	A method of forced injection lubrication using a casing that does not leak oil and circulating the oil by means of a pump	 Pump Tank

## 5-4 Maintenance and Inspection

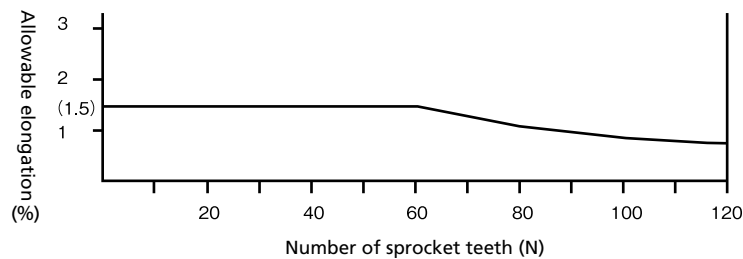
### (1) Maintenance

#### ① Caution during installation

- Chain elongation is caused by the wear between the pin and the bushing.
- Each chain is coated with anti-rust lubricant at the time of shipment. Do not wash or wipe off the lubricant when installing chains. Also, be careful not to place the chain directly on the floor to prevent sand or dust from adhering to it.

#### ② Timing of replacement

- When the chain elongation reaches +1.5%. (When the number of teeth is 60 or more, the allowable elongation becomes smaller as shown in the graph below.)
- When the link plate is significantly damaged, cracked, or deformed.
- When the chain is found to have significant scratches, cracks, or rotation defects.
- When a bent pin or warped link plate is observed.
- Significant rusting and chain bending defects are observed



Number of sprocket teeth and allowable elongation

### Caution

When replacing a chain, avoid replacing only one part of the chain with a new one. When replacing a chain, replace the entire chain with a new one.

#### ③ Check Oil Lubrication

- Remove the chain periodically and clean it with kerosene. After that, fully lubricate the chain.

### Caution

- When cleaning, do not use acid, alkali, gasoline, or benzene.

- Powders and foreign matter that accelerate wear must be completely removed.
- Metal surfaces cleaned with solvents are prone to rusting, and should be lubricated immediately to prevent rusting.
- Inspect the contact surfaces of the pins and the bushings, and if they are shiny, this indicates that the lubrication was proper. Apply oil again and use the chain.

#### ④ Chain elongation measurement procedure (caliper measurement)

Chain length is usually measured by applying a load of approximately 1% of the average tensile strength. To measure an existing chain, measure the inner and outer dimensions between the rollers on the tension side as shown in the figure below.

- To minimize measurement error, measure at least 6 links.

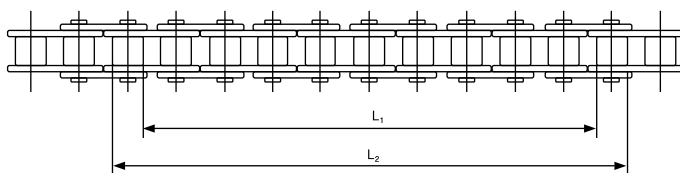


Figure of 10links measuring

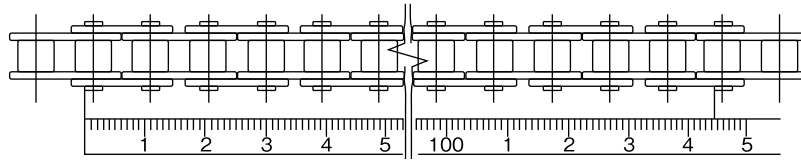
- Measurement length =  $\frac{L_1 + L_2}{2}$
- Standard length = Chain pitch × Number of links
- Chain elongation (%)  

$$= \frac{\text{Measured length} - \text{Standard length}}{\text{Standard length}} \times 100$$



⑤ Chain elongation measurement procedure (measurement with a measuring tape)

- To avoid measurement error, remove the chain and measure a distance close to the number of all links in a straight line.



(e.g.) No.40 × 82 links measuring

- Standard length =  $12.7\text{mm} \times 82 = 1,041.4\text{mm}$
- Measured length =  $1,044.8\text{mm}$
- Chain elongation (%) =  $\frac{1,044.8 - 1,041.4}{1,041.4} \times 100 = 0.3\%$

**(2) Inspection**

When roller chains and sprockets are installed, perform the trial run inspection shown below before operation. In addition, since conditions may change over time during operation, perform daily and regular inspections to ensure safe use.

① Trial Run Inspection

- Check the chain is correctly installed
- Check the clips, split pins, etc. at the chain joint are correctly installed
- Check the split pins at the chain joint are correctly spread
- Check the appropriate take-up tension (Not too loose or too tight)
- Check that the chain doesn't touch chain cover
- Check that chain is lubricated properly

② Daily Inspection

- Check for abnormal vibrations, noises, etc.
- Check obstacles that may interfere with the chain and sprocket
- Check the chain components, dirt, corrosion, improper lubrication etc.
- Check each components for scratches, deformation, damage or other abnormalities.
- Check the roller rotation, bending, or gaps in each part
- Check the condition of the contact area with the sprocket
- Check the chain wear elongation
- Check abnormality of the joints, clips, or split pins
- Check rusting of the chain (Red rust due to poor lubrication or rust due to environmental deterioration)
- Check lubricating oil carbonization or other deterioration
- Check adhesive powder or forging matter that accelerates wear

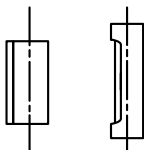
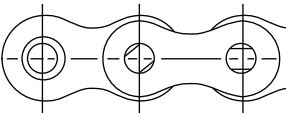
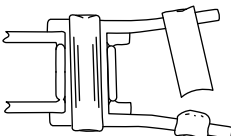
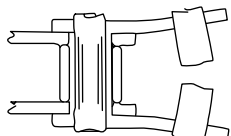
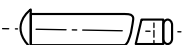
③ Periodic Inspection

- Check the paragraphs ① and ② above visually or with a measuring device while the machine is running, stopped, and with the chain removed.
- Perform regular inspections according to the usage conditions and environment. If the usage conditions are severe, increase the number of inspections.

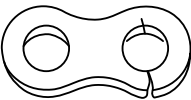
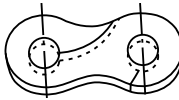
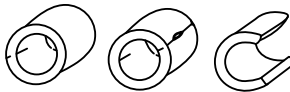
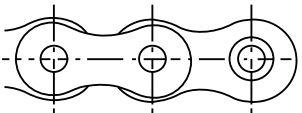
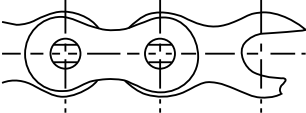
④ Other

- Predict failures and take measures to prevent accident according to the inspection result.

## 〈Clarification of problems and Countermeasures〉

Problem	Probable Causes	Countermeasures
 <p>Wear of parts</p>	<ul style="list-style-type: none"> <li>• Overload</li> <li>• Insufficient lubrication</li> </ul>	<ul style="list-style-type: none"> <li>• Proper lubrication</li> <li>• Replace with new chain if the elongation exceeds the allowable limit.</li> </ul>
 <p>Pin rotation</p>	<ul style="list-style-type: none"> <li>• Overload</li> <li>• Insufficient lubrication</li> </ul>	<ul style="list-style-type: none"> <li>• Replace with new chain as soon as possible</li> </ul>
Abnormal noise	<ul style="list-style-type: none"> <li>• Excessive chain tension or looseness</li> <li>• Contact with chain cover</li> <li>• Loose bolts and nuts (e.g., conveyor case)</li> </ul>	<ul style="list-style-type: none"> <li>• Adjustment of chain tension</li> <li>• Adjustment of the chain cover</li> <li>• Retightening of bolts and nuts</li> </ul>
Chain vibration	<ul style="list-style-type: none"> <li>• Excessive chain slack</li> <li>• Long distance between shafts</li> <li>• Poor bending</li> </ul>	<ul style="list-style-type: none"> <li>• Adjustment of the chain tensioner</li> <li>• Idler installation</li> <li>• Lubricate the chain or replace it with a new one.</li> </ul>
Wear of the inner plate and side of the sprocket teeth	<ul style="list-style-type: none"> <li>• Sprocket misalignment</li> </ul>	<ul style="list-style-type: none"> <li>• Adjustment of sprocket alignment</li> <li>• Replace with new chain depending on the degree of wear</li> </ul>
Poor chain bending	<ul style="list-style-type: none"> <li>• Excessive load</li> <li>• Sprocket misalignment</li> <li>• Insufficient lubrication</li> <li>• Foreign matter intervention, poor atmosphere</li> <li>• Rusting</li> </ul>	<ul style="list-style-type: none"> <li>• Change chain size</li> <li>• Adjustment of alignment</li> <li>• Clean the chain and lubricate it according to usage conditions.</li> </ul>
Chain rides up on sprocket teeth	<ul style="list-style-type: none"> <li>• Wear elongation</li> <li>• Excessive chain slack</li> <li>• Worn or deformed sprockets</li> </ul>	<ul style="list-style-type: none"> <li>• Replace with new chain</li> <li>• Install tension if necessary</li> <li>• Replace with new sprocket</li> </ul>
Chain doesn't come off from sprocket smoothly	<ul style="list-style-type: none"> <li>• Long distance between shafts</li> <li>• Wear elongation</li> <li>• Worn or deformed sprockets</li> </ul>	<ul style="list-style-type: none"> <li>• Install idler</li> <li>• Replace with new chain</li> <li>• Replace with new sprocket</li> </ul>
 <p>Broken pins</p>	<ul style="list-style-type: none"> <li>• The fractured part is close to the link plate position, and the fractured surface is characterized by a spherical shape with a bright surface.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the load and re-select a chain.</li> </ul>
 <p>Broken pins</p>	<ul style="list-style-type: none"> <li>• Center of pin is broken at nearly right angle</li> <li>• The pin was repeatedly subjected to loads exceeding its fatigue strength. Or, under corrosive environment, the pin may break starting from the corroded part.</li> <li>• Beach marks are observed on the fracture surface.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the load and re-select a chain.</li> </ul>
 <p>Broken offset pin</p>	<ul style="list-style-type: none"> <li>• Broken offset pin (cut at the base of the flattened part)</li> </ul>	<ul style="list-style-type: none"> <li>• Discontinue the use of the offset link.</li> <li>• Review chain selection</li> </ul>

### 〈Clarification of problems and Countermeasures〉

Problem	Probable Causes	Countermeasures
 <p>Fatigue failure of a plate</p>	<ul style="list-style-type: none"> <li>• Fatigue failure of the plate vertically from the hole</li> <li>• Occasionally also occurs from the center mark position.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the load on the chain</li> <li>• Review chain selection</li> </ul>
 <p>Stress corrosion cracking of plates</p>	<ul style="list-style-type: none"> <li>• Stress corrosion cracking of the plate, starting from the hole in the plate where the pin or bushing is press-fitted</li> </ul>	<ul style="list-style-type: none"> <li>• Protect the chain from acid and alkaline atmospheres with chain covers.</li> <li>• Review chain selection</li> </ul>
 <p>Broken rollers</p>	<ul style="list-style-type: none"> <li>• Cracking of the rollers occurs from flaws in the indentation caused by foreign matter</li> <li>• Fatigue failure</li> </ul>	<ul style="list-style-type: none"> <li>• Review rotational speed and load as well as consider lubrication appropriate to usage conditions, and chain covers for removal of foreign matter.</li> </ul>
 <p>Worn plates</p>	<ul style="list-style-type: none"> <li>• The bottom of the plates are worn due to friction with the guides</li> </ul>	<ul style="list-style-type: none"> <li>• Replace with new chain if wear of more than 5% of the plate height occurs</li> </ul>
 <p>Fractured plate</p>	<ul style="list-style-type: none"> <li>• Static breakage of plate with overload exceeding tensile strength</li> </ul>	<ul style="list-style-type: none"> <li>• Review the load on the chain and chain selection</li> </ul>

## Inspection Sheet (Example)

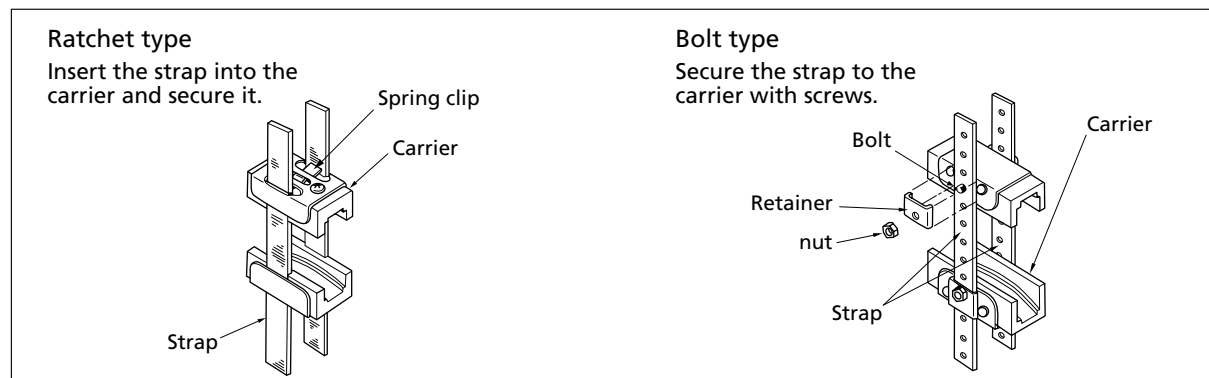
		Person in Charge

Date of Inspection: year,                      month,                      day										
Factory Name					Chain Name					
Equipment Name					Start Date of Operation					
Center Distance					Speed		m/min,		r/min	
Number of Links					Sprockets		Drive	Number of teeth	Driven	
Electric Motor		KW                      P                      Hz			Load Variation		Small	Medium	Large	
Dimensions		Standard Value	Measured Value	Remarks ----- Atmosphere  Operating Time						
	Roller Diameter									
	Plate Height									
	Chain Length									
Inspection Items	Test Operation and Daily Inspection				Regular Inspection					
	Item				Pass / Fail	Item				Pass / Fail
	1	Is the chain properly installed?				1	Is the lubrication functioning properly?			
	2	Are the clips on connecting links properly installed?				2	Is the chain flexibility adequate?			
	3	Is the split pin properly opened (60°)?				3	Is the chain free from twisting or deformation?			
	4	Is the chain slack appropriate?				4	Is the chain movement smooth?			
	5	Condition of Appearance: Dirt, Corrosion, and Lubrication Status				5	Are the plates, rollers, and pins free from cracks or other damage?			
	6	Are there any scratches, deformations, cracks, or damage on the components?				6	Sprocket Wear			
	7	Is the engagement proper?				7	Sprocket Installation Accuracy			
	8	Presence of Abnormal Noise				8	Is the safety device functioning properly?			
	9	Is the chain movement smooth?				9	Wear Elongation			
	10	Is there any overheating?				10	Condition of Terminal Fittings			
	11	Is it free from contact with the chain cover or other parts?				11				
	12	Is there any adhesion of dust or foreign substances that could accelerate wear?				12				
	13	Is the chain free from rust?				13				
	14	Are the sprockets free from wear?				14				
	15	Are the sprocket teeth free from deformation or damage?				15				
Assessment	Chain									
	Sprockets									

## 6. Handling of SnapIdle™

### 6-1 Types of SnapIdle™

A SnapIdle™ is a type of tensioner used to adjust the slack in the chain. It adjusts the slack by clamping the chain's link plate with a special resin 'carrier.' There are two types, as shown in the diagram below: the 'ratchet type' and the 'bolt type.'



### 6-2 Precautions for Use

When using a SnapIdle™, it is necessary to meet the usage environment and application criteria listed below. Please ensure that each of the following items is met.

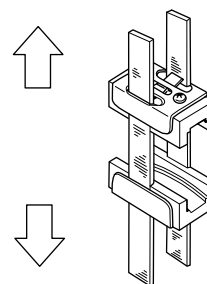
#### (1) Usage Environment

- ① Usable Temperature: 80°C or below
- ② Chain Speed
  - Without Lubrication: 150 m/min or below
  - Drip Lubrication: 300 m/min or below
  - Oil Tank Lubrication: 450 m/min or below

#### ③ Reference for Tensile Strength

The reference values for the tensile strength of the installed strap are as shown in the table below.

Reference for Tensile Strength	
Size	Tensile Strength kN (kgf)
Ratchet type	0.49(50)
SI-40~60	3.43(350)
SI-80~120	5.68(580)
SI-140~160	15.6(1600)



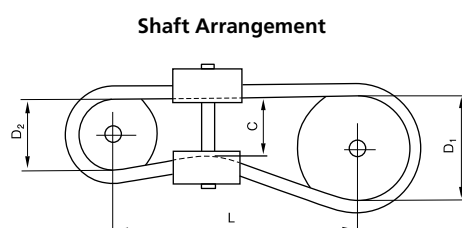
- ④ Use in an environment free from sand, dust, and other particles.

- ⑤ SnapIdle™ cannot be used for horizontal operation.

#### (2) SnapIdle™ Application Criteria

- ① When attaching the SnapIdle™ to the chain, ensure that the relationship with the sprocket and center distance falls within the following range.

1) Sprocket Ratio	$= \frac{D_1}{D_2} \leq 4$
2) Vertical-to-Horizontal Ratio	$= \frac{D_1}{L} \leq 0.5$
3) Taper Ratio	$= \frac{C}{D_2} \leq 0.85$



- ② Select the SnapIdle™ according to the chain size (specification) from the table below.

SnapIdle™ Application Table

Size	Applicable Chains
SI-35N	35
SI-40, SI-40N	40, 25-2, 41, C2040
SI-50, SI-50N	50, C2050
SI-60	60, 35-2, C2060H
SI-80	80, 35-3, 40-2, C2080H
SI-100	100, 50-2, C2100H
SI-120	120, 35-4, 40-3, 60-2, C2120H
SI-140	140
SI-160	160, 40-4, 50-3, 80-2, C2160H

## 6-3 Installation and Maintenance

### (1) Installation Procedure

- ① Insert the strap into the carrier from both sides and place it onto the chain.
- ② Cut the strap to an appropriate length.
- ③ Insert the carrier in the opposite direction of the strap, ensuring that the strap is inserted evenly on both sides.
- ④ Insert the strap further and tighten it with both carriers until the chain slack is reduced to an appropriate level.

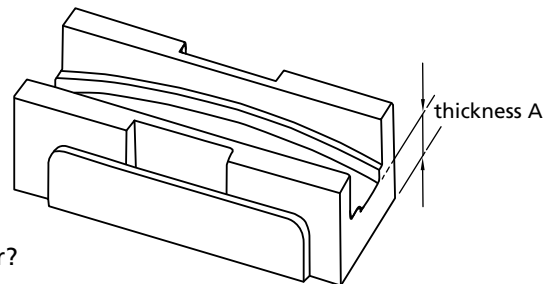
#### Caution

- Be careful not to overtighten the carrier. Excessive tightening will shorten the lifespan of the SnapIdle™. An appropriate level of tightening allows the SnapIdle™ to move slightly in the direction of the chain's travel during operation.
- Note that the ratchet-type strap does not move in the reverse direction.
- For carrier adjustment, use the bolt mounting holes for the bolt type, and press into the carrier for the ratchet type.
- Do not overtighten the mounting nuts.
- Ensure that the SnapIdle™ does not interfere with other components during operation.

### (2) Maintenance

Inspect the following items according to operating conditions.

- ① Is the amount of strap movement excessive?
- ② Is the strap free from twisting?
- ③ Is the chain free from contact with the side of the carrier?
- ④ What is the wear condition of the sliding surface of the carrier?
- ⑤ Lubricating the SnapIdle™ is effective in extending its lifespan, so perform regular lubrication.



#### Caution

- The replacement guideline is when end thickness A in the diagram reaches 0 mm.
- If chain slack increases due to chain elongation, stop operation and readjust according to the installation procedure.
- Increase the frequency of maintenance and inspections when operating in the forward and reverse directions or when used in a vertical position.

## Volume 2 Safety Standards

### Chapter 1 Prevention of hazards due to machinery

#### Section1 General standards

##### (Prevention of hazards due to motors, rotating shafts and similar equipment)

**Article 101** The business operator must provide mechanical equipment, such as motors, rotating shafts, gears, pulleys, belts and other elements which could threaten workers, with covers, barriers, sleeves, footbridges and other necessary devices. (Source 20(1))

2 The business operator shall use fastenings for rotating shafts, gears, pulleys, flywheels and similar devices that are embedded or provided with a cover. (Source 20(1))

3 The business operator shall not use projecting fittings in the seams of belts. (Source 20(1))

4 The footbridges provided by the business operator under article 1 shall be provided by hand rails 90cm high. (Source (20(1))

5 When a footbridge is available, the worker must use said footbridge. (Source 26)

##### (Prevention of hazards due to breakage of belts)

**Article 102** Where a belt passes over a passage or working area, and where said belt is 3m or more between pulleys, 15cm or more wide, or runs at a speed of 10m/s or more, the business operator shall install barriers surrounding the area beneath the belt. (Source 20(1))

##### (Power cutoff devices)

**Article 103** The business operator shall provide a power cutoff device, such as a switch, clutch or belt shifter, for every machine. However, this requirement need not apply to a series of linked machines which have a single, common power cutoff device, and which do not require physical human action within the process to feed in or remove raw materials etc. (Source 20(1))

2 Where the machinery in the preceding article includes machining functions such as cutting, extracting, compressing, striking out, bending or squeezing, the business operator shall provide a position from which the operator engaged in said machining processes can operate the power cutoff device described in the same article without moving from the standard working position. (Source 20(1))

3 The power cutoff device described in clause 1 shall be easy to operate, and shall be free from any risk that the machinery could start to move again unexpectedly due to contact, vibration or other cause. (Source 20(1))

##### (Operation starting signals)

**Article 104** Where the operator is to start the operation of a machine, and that operation could pose a hazard for the operator, the business operator shall establish a certain, fixed signal, appoint a person to issue that signal, and make all concerned employ the signal. (Source 20(1))

2 Workers must obey the signals specified in the preceding clause.

##### (Prevention of hazards due to flying machined products or other objects.)

**Article 105** Where there is a risk that machined objects could, on being cut off or broken, fly through the air and put workers at risk, the business operator shall provide covers and barriers around machinery that could scatter such machined objects. However, this requirement need not apply if the nature of the work is such that the installation of said covers and barriers would be difficult, provided the workers are made to wear protective equipment. (Source 20(1))

2 If workers are ordered to wear protective equipment under the exception to the preceding clause, they must do so. (Source 26)

##### (Prevention of hazards due to flying cutting fragments)

**Article 106** Where there is a risk of injury to workers from flying cutting fragments, the business operator shall provide covers or barriers around machines that generate such cuttings. However, this requirement need not apply if the nature of the work is such that the installation of said covers and barriers would be difficult, provided the workers are made to wear protective equipment. (Source 20(1))

2 If workers are ordered to wear protective equipment under the exception to the preceding clause, they must do so. (Source 26)

##### (Cessation of operation for cleaning and similar operations)

**Article 107** When a machine (excluding cutting parts) is to be cleaned, oiled, inspected or repaired, and there is potential risk to workers, the business operator must stop the operation of said machine. However, this requirement need not apply if it is necessary to carry out the work while the machine is in operation, provided measures are taken such as covering the hazardous locations. (Source 20(1))

2 When the operation of a machine has been stopped under the preceding clause, safety measures, such as securing the starting device for said machine with a lock and labeling it, must be taken by the business operator to ensure that no worker not involved in said work can start the machine. (Source 20(1))

##### (Cessation of operation for cleaning of cutting parts, and similar operations)

**Article 108** When the cutting parts of a machine are to be cleaned, oiled, inspected or repaired, and there is potential risk to workers, the business operator must stop the operation of said machine. However, this requirement need not apply if the structure of the machine is such that there is no risk to the worker. (Source 20(1))

2 When the operation of a machine has been stopped under the preceding clause, safety measures, such as securing the starting device for said machine with a lock and labeling it, must be taken by the business operator to ensure that no worker not involved in said work can start the machine. (Source 20(1))

3 When cutting dust is swept away from, or cutting agent is applied to, the cutting parts of a machine in operation, the business operator must ensure that the worker uses a brush or other suitable implement. (Source 20(1))

4 A worker ordered to use such an implement under the preceding clause must do so. (Source 26)

##### (Prevention of hazards due to winding rollers etc.)

**Article 109** Where there is a risk of injury to workers from rollers, coils or similar devices for paper, cloth, wire rope etc., the business operator shall provide covers or barriers around such devices. (Source 20(1))

##### (Wearing of working hats etc.)

**Article 110** Where there is a risk that the hair or clothing of workers working on a power-driven machine could become entangled in said machine, the business operator shall ensure that said workers wear suitable working hats and working clothing. (Source 20(1))

2 A worker ordered to wear working clothes or a working hat under the preceding clause must do so. (Source 26)

##### (Prohibition on the use of gloves)

**Article 111** Where there is a risk that the hands of a worker working on a drilling machine, chamfering machine or other device with rotating blades could become entangled in the machine, the business operator shall not allow the worker to wear gloves. (Source 20(1))

2 A worker prohibited from wearing gloves under the preceding clause must not do so. (Source 26)



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