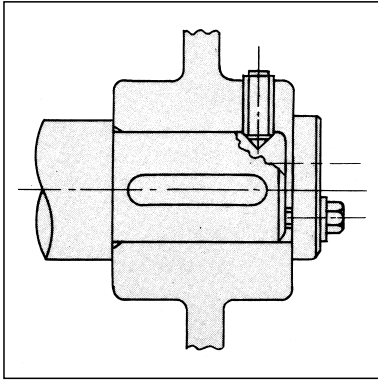


## Installation

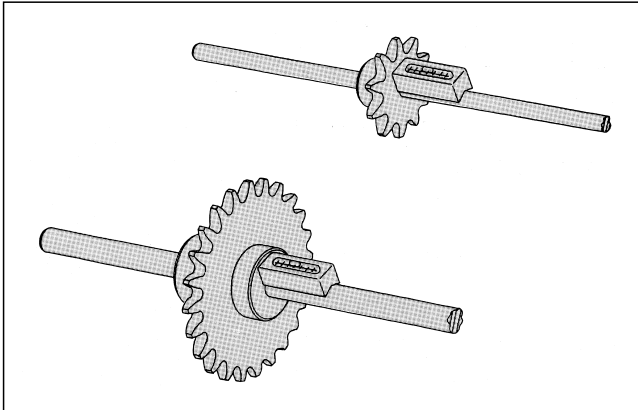
### Installation of sprockets

For smooth transmission and extended life of the roller chain, it is important to correctly install proper sprockets. Use the following installation procedure.

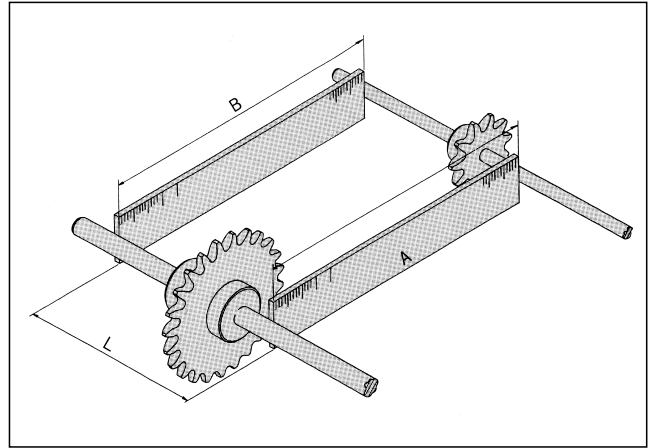
1. Properly install a sprocket on a shaft, and fix it with a key to prevent it from rattling during operation. Also, place the sprocket as close as possible to the bearing.



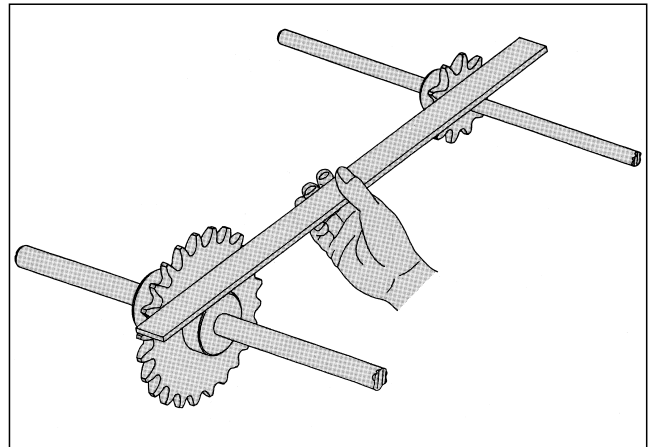
2. Adjust the shaft levelness to  $\pm 1/300$  or less using a level.



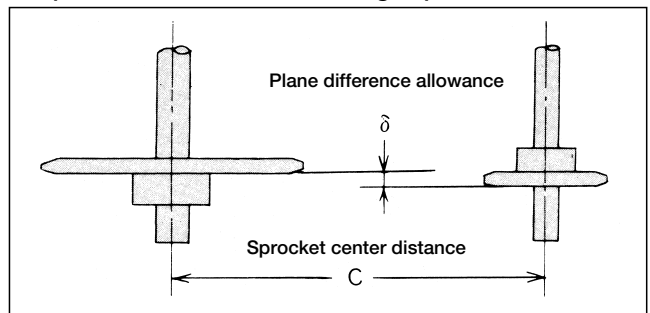
3. Adjust the shaft parallelism ( $\frac{A-B}{L}$ ) to  $\pm 1/300$  or less.



4. Adjust the level of driving and driven sprockets using a linear scale. (Also adjust the idler and the sprockets, or the tensioner and the sprockets in the same way.)



Keep the allowance  $\delta$  in the range specified below.



Sprocket center distance C	Allowance $\delta$ (mm)
1m or less	$\pm 1$
1m~10m	$\pm C$ (mm) / 1000
10m or more	$\pm 10$

## Installation of roller chain

When connecting a roller chain with the sprockets, observe the following procedure. When the connecting link is not well lubricated, apply sufficient grease.

### When using the sprocket teeth

1. Engage the chain with the sprockets so that both ends of the chain are on one of the sprockets, as shown in the following photo.
2. Insert connecting pins at the joint.
3. Fit a connecting plate, and fasten by a spring clip or cotters.

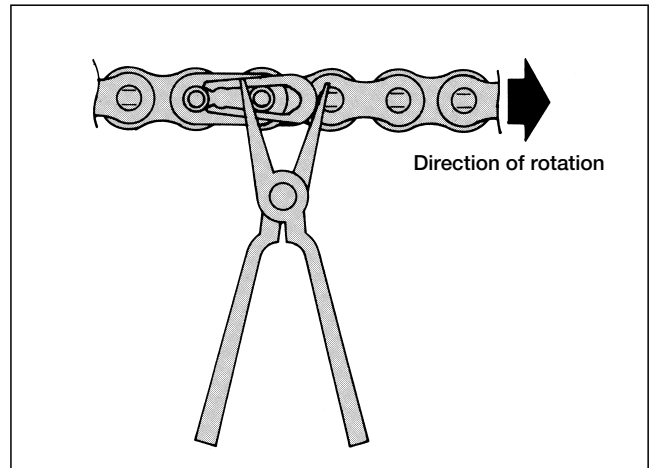


Pay extra attention not to damage the tooth heads of the sprocket.

### When using tools

#### Cautions

1. When a connecting plate is fastened by a spring clip, apply the spring clip to the pin grooves of the connecting pins as illustrated below, and lock it using pliers, etc. As for the direction of spring clip insertion, keep the opening of the spring clip turned in the direction opposite to the direction of chain rotation, as illustrated below.



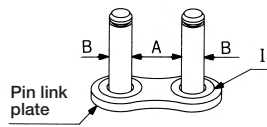
2. In circumstances where the sprocket center distance can hardly be adjusted, an odd number of links may be used. However, add one link, to use an even number of links and eliminate the sag by shifting a sprocket or installing an idler.
3. When an H-connecting link is used, pins must be driven into the connecting plate because of interference. In this case, ensure that the pair of pins are kept parallel to each other when inserted into the connecting plate. Never make the holes of the connecting plate larger or make the pins thinner for easier connection work. This applies also when a cotter type outer link (CP) is used instead of a connecting link.

## How to connect O-ring Chains

### Remarks to connect general O-ring Chains:

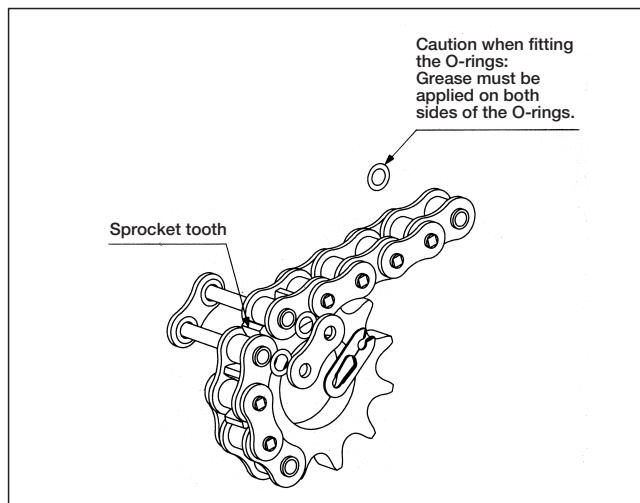
1. A connecting link of an O-ring Chain for general application is pre-coated with grease at the pins. Before connection, confirm the grease on the surfaces of pins, and if the amount of grease is small, apply grease with bare hands. (If gloves are used, the grease will be absorbed by the gloves.)

Example: When the connecting link (I) of an O-ring chain for general application is shipped, O-rings are fitted at the roots of the pins. If the O-rings come loose due to vibration during transport, refit the O-rings in to the roots of the pins.



In this case, be sure to return the grease collected at the roots of the pins to the central surfaces of the pins, more at portion A than at portions B shown in the above illustration. (Portions A is worn because of sliding with the bushings.)

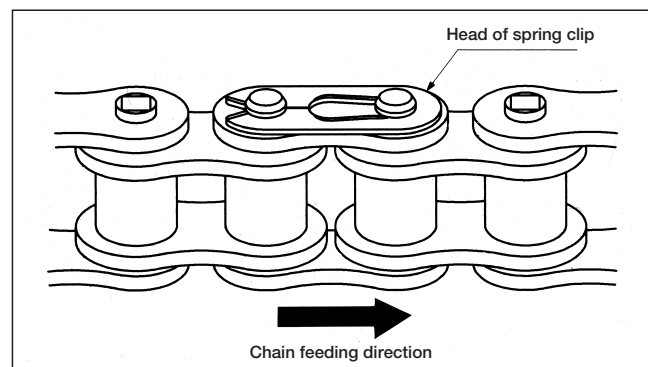
2. The chain can be most easily connected on the teeth of a sprocket. Engage the links at both ends of the chain with the sprocket teeth and fit connecting pins. If the sprocket can be moved, the chain can also be connected on the loosened side.



3. Connecting procedure

- ① Confirm that O-rings are attached to the roots of the pins.
- ② If the amount of grease applied on the connecting pins is small, coat the pins with grease at the central portions.
- ③ Insert the connecting pins into the bushings of the inner links at both ends.
- ④ Confirm that the grease is applied to the entire face of the O-ring, and fit the O-ring onto the connecting pins.
- ⑤ Insert the connecting pins into the connecting plate and while pressing the connecting plate, install the spring clip. Confirm whether the head (the end without a split) of the spring clip is turned in the feeding direction of the chain. (See the following illustration.)
- ⑥ Be sure to confirm that the spring clip is securely fitted in the clip grooves of the connecting pins.

This completes jointing of the connecting link. Note that grease on the surfaces of connecting pins and O-rings can be removed during installation work. In this case, re-grease using the grease on the surface of the base chain or the grease in the polyethylene bag in which the connecting link was contained.



## Maintenance

### Check

#### a. Confirm the following before operation

Connected joint	<ul style="list-style-type: none"> <li>Confirm that the connection is sufficient and that components have no problem.</li> <li>Confirm that bending is smooth (in the case of O-ring chain, bending is slightly stiff).</li> </ul>
Chain sprocket attachment	<ul style="list-style-type: none"> <li>Confirm that there is no serious flaw, rust or wear.</li> <li>Confirm that sag is proper.</li> <li>Confirm that no pin rotates.</li> <li>Confirm that rollers rotate smoothly.</li> <li>Confirm that the chain engages with the teeth of sprockets.</li> </ul>
Interference	<ul style="list-style-type: none"> <li>Confirm that there is nothing interfering with the chain, or that nothing is likely to interfere with the chain or safety cover.</li> </ul>
Lubrication	<ul style="list-style-type: none"> <li>Confirm that the amount of lubrication is appropriate. (For the amount of lubrication, see the table of lubrication types.)</li> </ul>
Driving and driven shafts	<ul style="list-style-type: none"> <li>Confirm that the axial measurement and parallel measurement are proper.</li> <li>Confirm that the difference of sprocket planes is within the allowance.</li> </ul>
Peripheral equipment	<ul style="list-style-type: none"> <li>Confirm that peripheral equipment is installed correctly.</li> </ul>

#### b. After confirmation and adjustment of the above a, install the safety cover, and switch on the power to start operation.

- It is possible for the chain to be thrown should it break. Do not stay in the direction of rotation during operation.

### Caution

- |                                |  |
|--------------------------------|--|
| Obstacles                      | <ul style="list-style-type: none"> <li>Obstacles may cause breaking or fracturing which can scatter materials and injure people nearby. Be sure to remove all obstacles.</li> </ul>  |
| Abnormal noise                 | <ul style="list-style-type: none"> <li>Abnormal noise during operation is a sign of trouble. Immediately switch off the power, and determine the cause.</li> </ul>   |
| Flaws and rust                 | <ul style="list-style-type: none"> <li>If any serious flaws or rust is visible, it may cause the chain to break and fracture and possibly injure people nearby. Confirm that the chain has no serious flaws or rust.</li> </ul>  |
| Sprocket                       | <ul style="list-style-type: none"> <li>If a sprocket is worn, the sprocket may break, or the chain may ride over the sprocket, breaking it and possibly resulting in injury to people nearby. Confirm that the sprockets are not worn.</li> </ul>  |
| Devices that prevent accidents | <ul style="list-style-type: none"> <li>Install accident prevention devices. To avoid human injury caused by scattered materials, install safety devices (safety cover, safety net, etc.).</li> <li>Install an emergency stop device. To avoid human injury due to unexpected overload, install an emergency shutdown device such as a load controller or a brake.</li> </ul> |

### Before trial operation

Confirm the following on chain installation before starting operation.

- The chain correctly engages with the sprockets.
- The joints are normal. (The spring clips are correctly installed and cotters are not bent.)
- The chain sag is proper.
- The chain is not in contact with the chain case.
- The lubrication is proper.

### Check items during trial operation

If the chain can be manually rotated, rotate it to confirm that there is no abnormality before starting trial operation.

Be alert to the following during trial operation.

- Whether there is abnormal noise. If the chain contacts the chain case or if the chain heavily vibrates, abnormal noise occurs. Check the installation of chain case and chain sag.
- Whether lubrication is normal during operation. Re-check the condition of lubrication.

### Elongation limit of chain Limit of Chain Sag

- Events caused by sag failure

Even if the sag of the chain is normal before the start of operation, it can increase if the chain is elongated due to

wear of pins, bushings, etc. If the sag is excessive, the following will occur.

- Abnormal vibration
- Chain rollers ride over the heads of sprocket teeth.
- The chain is seized by a sprocket.
- The chain contacts the chain case.

These conditions can often cause abnormal noise. Should any abnormal noise occur, immediately stop operation, and check carefully to determine the cause. Such conditions often cause damage not only to the chains, but to the entire equipment. A preliminary check is necessary.

#### • Elongation limit of chain

Even if sag adjustment is normal, excessive elongation of the chain can cause abnormalities similar to those caused by sag failure that inhibit smooth transmission. In such cases, replace the chain. A guide for replacement based on chain elongation limit is listed below. Even if only one link reaches the elongation limit, replace the entire chain with a new one. Unless lubrication is normal, the chain will elongate quickly, causing the aforementioned troubles. Read the contents of "Lubrication" in the next section carefully for performing proper maintenance.

### Elongation limits of chain

Number of teeth of large sprocket	Regular chain	O-ring chain and Sintered bushing roller chain
40 or less	2.0%	1.0%
41~60	1.5	1.0
61~80	1.2	1.0
81~100	1.0	1.0
101 or more	0.8	0.8

※ If elongation of an O-ring chain or Sintered bushing roller chain exceeds the value in the above table, the wear rate of the chain becomes equivalent to a standard chain, and chain wear rapidly increases from that point.

※ The above elongation limits are applicable when the chain can be taken up or when a sag adjusting device is installed. If the shafts are fixed without any sag adjusting device, the recommended elongation limit is 0.5 to 0.7%.

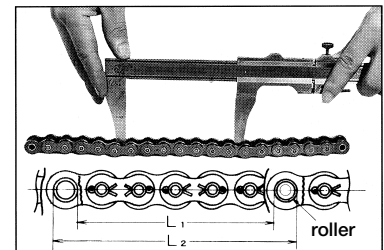
#### • Elongation measuring method

- To eliminate rattling other than a slight amount of play in the chain as a whole, tighten the chain lightly and measure the elongation.

Note: For an accurate measurement, measure the elongation of the chain applying a measuring load (specified by ANSI) to the chain.

- As illustrated below, measure the inner length ( $L_1$ ) and the outer length ( $L_2$ ) and obtain the measured length ( $L$ ).

$$L = \frac{L_1 + L_2}{2}$$



- Then, obtain chain elongation.

$$\text{Chain elongation} = \frac{\text{Measured length} - \text{Reference length}}{\text{Reference length}} \times 100(\%)$$

$$\text{Reference length} = \text{Chain pitch} \times \text{Number of links}$$

- In order to reduce the measuring gap, measure the length of about six to ten links.

### Chain wear-elongation check gage

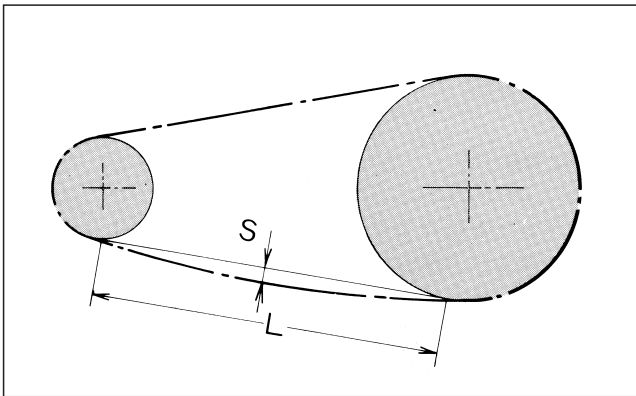
We recommend and can supply a chain wear-elongation check gage (P.114) for facilitated finding of elongation limit.

## Sag adjustment of roller chain

To use a roller chain for a longer period of time, proper sag is an important component. If the roller chain is over-tensioned, the oil film between pins and bushings is lost, shortening chain life and damaging the bearings. If the chain sags overly, the chain will vibrate or be seized by the sprocket. In about 50 hours (it differs depending on the service conditions) after starting the roller chain use, the chain will be elongated by about 0.1 percent of the entire length due to the conformability of respective contacts. So, adjust the sag at this time. Thereafter, if proper lubrication is maintained, the elongation will be negligible. Check and adjust the sag at proper intervals.

### Optimum sag

In general, keep sag  $S$  at about 2 % of span  $L$ , but in the case described below, keep it at about 1 %.



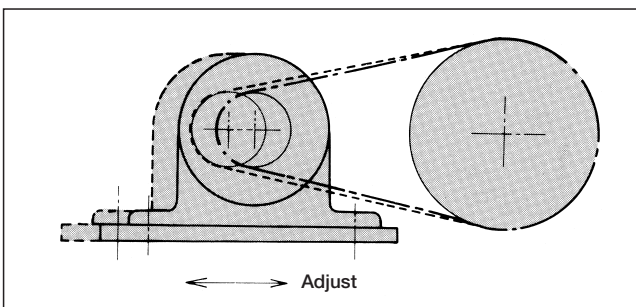
Keep sag at 0.01L or less in the following cases:

- When the chain is installed vertically or almost vertically.
- When the chain is installed horizontally or almost horizontally with the top slackened.
- When the center distance between sprockets exceeds 50 times the chain pitch.
- When vibration or shock occurs.
- When the chain is frequently started and stopped.
- When the chain is suddenly reversed.
- When the speed ratio is 7:1 or more (keeping the speed ratio at 7:1 or less is safer and preferable.)

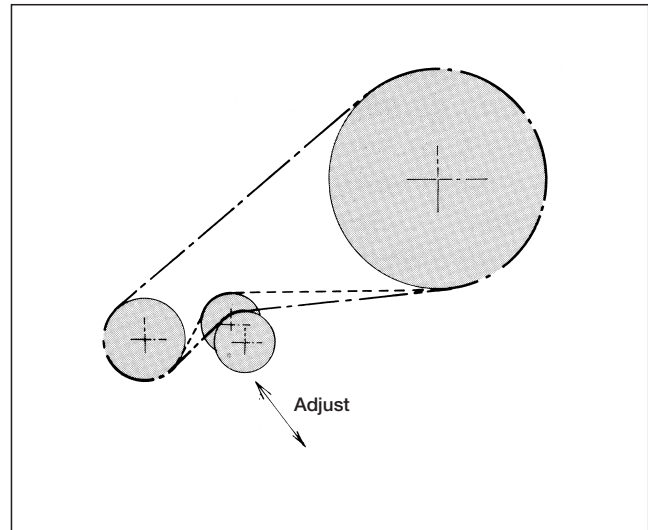
## How to adjust sag

Adjust sag in the following ways.

### 1. Adjustment of the center distance



### 2. Adjustment using a tensioner or idler



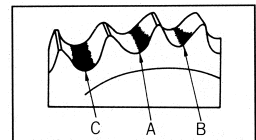
### 3. Increase or decrease of pitch number by offset link

By using an offset link, the total length of a chain can be increased or decreased by one pitch. However, since offset link performance is generally poor, an even number of links, if possible, is recommended.

## Other checks

### ● Checking sprocket

If a sprocket is not installed at the correct position of the shaft or is not parallel to the shaft, the plates of the chain may be flawed, or the chain may be twisted. This can be judged by examining the contact faces of the sprocket teeth. In this illustration, a uniform contact as indicated by A is normal. If the contact is different on both sides as indicated by B, correction is necessary.



### ● Checking idler or tensioner

When sag is adjusted, check also whether the idler or tensioner itself is damaged. If the contact between an idler or tensioner and a chain is at the center of the tooth gap bottom as indicated by C, it is normal. If the contact is as indicated by A or B, the bearing of the idler or tensioner may be abnormal.

### ● Checking chain attachments

In the case of a chain with attachments, it can result in accidents if a mounted part is loosely installed or comes off. Furthermore, if an installation hole is enlarged due to wear, the chain life may be shortened.

For troubles during operation, see "Trouble Shooting".

## Lubrication

### Necessity of lubrication

In a roller chain transmission, even if the chain and sprockets are designed to suit the service conditions, poor lubrication inhibits maintaining performance and life to design specifications. In the case of a roller chain, the wear loss caused under proper lubrication is dramatically different from that caused without it. Troubles caused due to insufficient lubrication include the wear of pins and bushings, rough engagement with the sprockets, increased noise, and breakage as a result of prolonged undesirable conditions. Proper lubrication is very important. Requirements of lubrication and the effects of proper lubrication are listed below.

Requirements of lubrication	Effects of proper lubrication
<ul style="list-style-type: none"> <li>• Selection of lubricant</li> <li>• Lubricating points</li> <li>• Lubrication type (lubricating method, lubrication intervals, amount of lubrication)</li> </ul>	<ul style="list-style-type: none"> <li>• The wear of frictional portions is decreased.</li> <li>• Power loss is decreased.</li> <li>• Seizure is prevented.</li> <li>• Frictional heat is decreased.</li> <li>• Generated heat is eliminated.</li> <li>• Ensure smooth operation and extends machine life.</li> </ul>

### Selection of lubricant

Select the lubricant of a roller chain in reference to the lubrication type (P.133), ambient temperature and chain No., according to the following table.

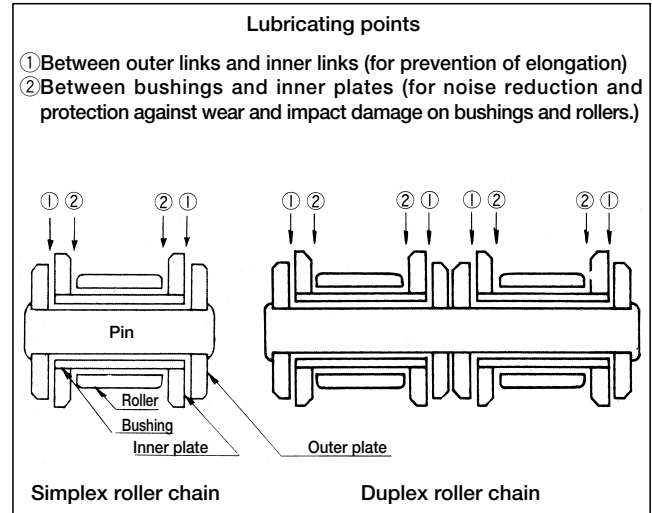
Lubricant should be a mineral oil of good quality. It is important that the lubricant contains no dust or foreign substance. Never use waste oil. If the ambient temperature is extremely low (-10°C or lower) or high (+60°C or higher), a specific oil is necessary. In this case, please consult our engineering department.

Type of lubrication Chain No.	A, B				C			
	Atmospheric temperature							
	-10°C ~ 0°C	0°C ~ 40°C	40°C ~ 50°C	50°C ~ 60°C	-10°C ~ 0°C	0°C ~ 40°C	40°C ~ 50°C	50°C ~ 60°C
<b>DID 25~DID 50</b>	SAE10W	SAE20	SAE30	SAE40	SAE10W	SAE20	SAE30	SAE40
<b>DID 60~DID 80</b>	SAE20	SAE30	SAE40	SAE50				
<b>DID 100</b>					SAE20	SAE30	SAE40	SAE50
<b>DID 120~DID 240</b>	SAE30	SAE40	SAE50		SAE20	SAE30	SAE40	SAE50

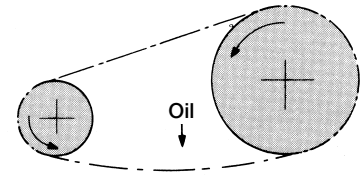
Special kind of lubricant must be applied when ambient temperature is -10°C or lower or 60°C or higher. Please consult us for appropriate selection of lubricant.

### Lubricating points

If the chain is immersed in an oil bath, oil penetrates every part of the chain. In the case of manual lubrication, brush lubrication or drip lubrication, ensure that the oil sufficiently penetrates the portions of ① and ② in the following illustration.

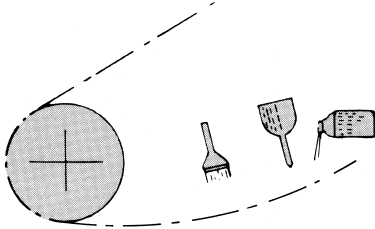
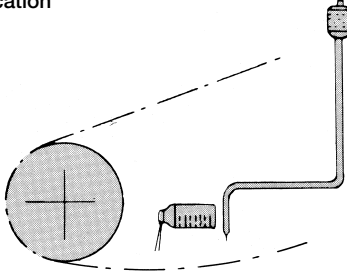
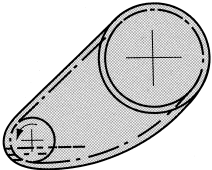
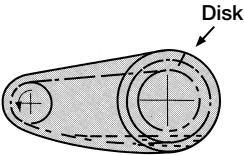
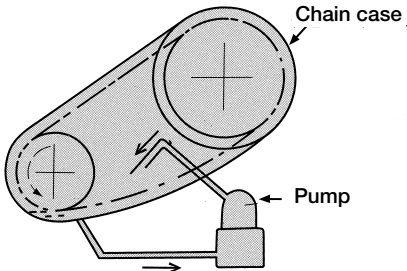


Lubricate on the sag side of the chain, i.e., at the position indicated in the following illustration. Since the lubricant is also useful for rust prevention, coating the entire surface of the chain with the oil is recommended.



### Lubrication types (Explanation of A, B and C in the tables of Drive performance (kW ratings))

The allowable kilowatt ratings of chains shown in table of the drive performance (kW ratings) is based on the condition that any of the following lubrication is adopted. If any of the following lubrication cannot be adopted or in circumstances where earth, sand or dust exists, see the DID Ultimate Life Chain Series (see P.64).

Lubrication type	Name and method	Lubrication intervals and amount	Caution
<p><b>A</b></p> <p>Use DID chain lube (see P.114).</p>	<p>Lubricator Brush</p> 	<p>Carry out periodical using a lubricator or brush at least once a day.</p>	<p>While rotating the chain slowly, lubricate the entire length uniformly three to four times. Take care not to allow your hand or clothes to be caught by the chain during lubrication. Note that extra oil will be scattered when the operation is started.</p>
	<p>Drip lubrication</p> 	<p>Supply about 5 to 20 drops of oil per minute.</p>	<p>In this case, since extra oil is scattered, installing a simple casing is recommended.</p>
<p><b>B</b></p>	<p>Oil bath lubrication</p> 	<p>Keep the chain immersed in oil, about 10 mm below the oil surface. If immersion is too deep, the oil will become abnormally hot.</p>	<p>The container should be leak proof. Before using the container for the first time, thoroughly wash the inside to remove dust and other foreign substance.</p>
	<p>Disk lubrication</p> 	<p>A disk is used to apply oil to the chain. Keep the disk immersed in oil, at a depth of about 20 mm. Keep the peripheral speed higher than 200 m/ min.</p>	
<p><b>C</b></p>	<p>Forced feed lubrication</p> 	<p>The amount of lubrication must be set to avoid abnormal heating. In general, the oil amount should be set at a level not to allow the chain high temperature over 60°C.</p>	<p>The oil container should be leak proof. When using the container for the first time, thoroughly wash the inside to remove all dust and foreign substance.</p>

## General cautions for lubrication

Unless proper lubrication is carried out, chain fatigue will result earlier, causing various problems. Careful inspection is necessary.

### In the case of insufficient lubrication

If the lubricant is exhausted, red rust is generated between the inner and outer plates, causing wear drastically. When a chain is disassembled after going under such condition, red rust is visible on the surfaces of pins, and the surfaces are roughened, as shown in this photo. (Normally, pins have a mirror surface.) The lubricant must be applied before this happens.



### Do not use grease for lubrication !!

Do not use grease to lubricate your chains, since grease takes too long to reach the inside through pins and bushings at ambient temperature. Use the machine oil shown in the table on P.132 or DID Chain Lube/DID HI-PWR Lube (a spray lubricant).

Before lubrication, remove foreign substances and dirt from the chain as thoroughly as possible. If water is used for washing the chain, quickly dry it to prevent rusting, and then lubricate.

### In the case of drip lubrication, oil bath lubrication or forced feed lubrication

Check the following:

1. The lubricant is not dirty.
2. The amount of lubricant is correct.
3. Lubricant is uniformly applied to the chain.

### Cautions

Dust contamination must be avoided to maintain wear resistance. If temperature rises abnormally or the chain squeaks, the oil may be exhausted. Check to verify the condition.

## Troubleshooting Guide

Trouble	Possible cause	Correction
A pin, bushing or roller is fractured.  Note: See "Fracture patterns of respective chain components" on P.136.	High speed revolution exceeding the tolerance of chain and sprockets	Decelerate the speed, or select a chain with a smaller pitch. Otherwise, select a sprocket with a larger number of teeth. Refer to the details of "Selection by Drive Performance (kilowatt ratings)" (P.120).
	Sudden large shock load	Avoid shock load as much as possible. Install a damper, etc., to damp the shock load.
	Improper lubrication	Periodically supply the correct lubricant. Spray type chain oil "DID Chain Lube" is recommended.
	Corrosion of chain	Check the service circumstances and lubrication condition, and select a proper chain.
	Wear of sprocket	Replace it with a new one. Use a sprocket conforming to the correct standard dimensions.
Abnormal noise	Seized foreign substances	Immediately remove the foreign substances, and strictly control the service circumstances.
	Chain is excessively tensioned or sagged.	Pay constant attention to the chain sag. Correct by adjusting it according to the procedure stated in "Sag adjustment of roller chain" (P.131).
	Incorrect alignment of sprockets	Check the alignment between both the large and small sprockets.
	Large wear elongation of chain or wear of sprocket	Replace chains that are elongated beyond the tolerance and worn sprockets with new ones.
	Incorrect installation of chain case	If the chain contacts the chain case, immediately correct and adjust.
	Improper lubrication	Lubricate properly and periodically. (See "Lubrication types" (P.133).
Improper combination of chain and sprockets	When replacing the chain, use the correct chain size and sprocket sizes. Select a chain suitable for sprocket sizes, and sprockets suitable for the chain size. (Especially be alert when replacing HK Series multiplex chain.)	



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	Corrosion of chain	Check the service circumstances and lubrication condition, and select a proper chain.
	Wear of sprocket	Replace it with a new one. Use a sprocket conforming to the correct standard dimensions.
	Seized foreign substances	Immediately remove the foreign substances, and strictly control the service circumstances.
Abnormal noise	Chain is excessively tensioned or sagged.	Pay constant attention to the chain sag. Correct by adjusting it according to the procedure stated in "Sag adjustment of roller chain" (P.131).
	Incorrect alignment of sprockets	Check the alignment between both the large and small sprockets.
	Large wear elongation of chain or wear of sprocket	Replace chains that are elongated beyond the tolerance and worn sprockets with new ones.
	Incorrect installation of chain case	If the chain contacts the chain case, immediately correct and adjust.
	Improper lubrication	Lubricate properly and periodically. (See "Lubrication types" (P.133).
	Improper combination of chain and sprockets	When replacing the chain, use the correct chain size and sprocket sizes. Select a chain suitable for sprocket sizes, and sprockets suitable for the chain size. (Especially be alert when replacing HK Series multiplex chain.)

Trouble	Possible cause	Correction
When a chain rides over a sprocket	Excessive wear elongation of chain	Replace the excessively worn chain with a new one.
	Chain too slack	A chain with too much slack causes the chain to ride over a sprocket, and can damage the tooth heads of a sprocket. Correctly adjust it.
	Worn sprocket or deposition of foreign substances on tooth gap bottom	Replace the worn sprocket with a new one. If foreign substances are deposited on the bottoms of the teeth, immediately remove them.
Wear of plates and sprockets on their lateral sides	Incorrect alignment of sprockets	Misalignment of large and small sprockets result in abnormal wear of the sides of link plates and the sprockets, thereby shortening chain life. Apply a straight edge to the lateral sides of sprockets to check alignment.
Vibration of chain (whipping)	Chain too slack	Adjust to a proper sag. Consider the installation of spring type idler or tensioner.
	Uneven wear elongation	Imperfect and uneven lubrication causes uneven wear and pitch irregularity. Immediately replace the chain, and lubricate the entire chain evenly.
	Stiff link	See the following column.
Stiff link	Load in excess of tolerance	Select a DID chain with a larger allowable tension.
	Misalignment of sprockets	If the alignment between sprockets is incorrect, the force applied from the sides of the sprockets opens the inner plates, which interferes with the outer plates and cause stiff links. Align the large and small sprockets properly.
	Corrosion of chain Improper lubrication	If a chain is left without lubrication for a long time or in a corrosive atmosphere, rust is generated and smooth motion is inhibited. A corroded chain must be replaced. Be sure to lubricate periodically.
	Interference between plates and foreign substances	If a chain comes in contact with foreign substances during feeding, the inner and outer plates may be opened. Immediately remove the foreign substance.
	Ingress of foreign substances into bending sections of chain.	If sand or mud enters bending sections, remove the chain, and wash and lubricate, or replace the chain. Furthermore, install a case, etc. to prevent the ingress of sand and mud.
Fractured chain	Fatigue fracture	If a chain is used for a long time at a load exceeding the maximum allowable tension, fatigue fracture of plates and bending fatigue fracture of pins occur. If the chain life before fatigue fracture is shorter than the expected life, select a chain with a larger maximum allowable tension. For example, if a DID50 Standard Roller Chain is used for 750 cc motor-cycles, it may be fractured in a short time. In this case, rather than the chain being faulty, the selection was incorrect.
	Ductile fracture of plates Fracture of pins by shear or bending	If a load or impact extremely larger than the allowable tension acts on a chain, ductile fracture of plates or fracture of pins by shear or bending occurs. This fracture occurs when the chain size selected is incorrect and allowable tension is too small. Re-select a proper chain.
	When the chain rides over a sprocket	The fracture caused when the chain rides over a sprocket is mainly caused by wear elongation. Select an appropriate chain, and lubricate properly.
	Hydrogen embrittlement	Remember that a chain might be broken suddenly by hydrogen embrittlement if it comes in contact with acids.
	Interference of foreign substances	If foreign substances interfere with or are seized by the chain during feeding, excessive load acts on the chain, and its life will be shortened or it may break suddenly. Make necessary arrangements for an appropriate service circumstances, and be sure to immediately remove any foreign substances.
Rotation of pin (see P.136)	Excessive tension Riding of chain over sprocket Corrosion of chain and improper lubrication	If excessive tension is the cause, select a chain larger in allowable tension. See the column "When the chain rides over a sprocket". See the third frame of "Stiff link".

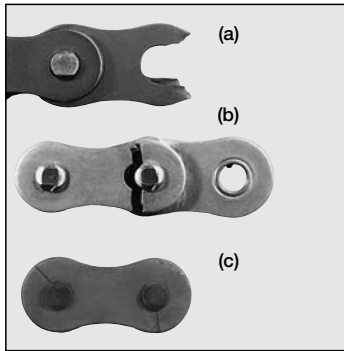
Note: See "Fracture patterns of respective chain components" on P.136.

## Fracture patterns of respective chain components

To be aware beforehand of how and which part of the chain is damaged under improper use greatly helps to clarify the cause and determine corrective measures in such an event.

### • Fracture of plate.

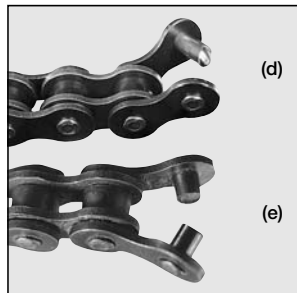
When a large tension acts to fracture a plate, as shown in (a), the cut ends are oblique and plastic deformation occurs. However, when the load is slightly larger than the maximum allowable tension, fatigue fracture occurs, and any plastic deformation does not occur as shown in (b). A significant feature of fatigue fracture is that a crack occurs in the direction almost perpendicular to the pitch line (center line between both pins).



In the case of hydrogen embrittlement by an acid, the crack mostly occurs in the direction as shown in (c), and the cut ends are flat, while the area around the cut ends may be decolorated due to erosion by the acid.

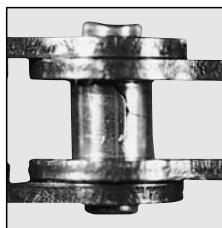
### • Fracture of pins

When a pin is fractured by excessive tension, the fracture occurs close to the plate, with a bulged specular surface formed by shearing, as shown in (d). However, when the acting force is not so strong, fatigue fracture takes place after a long period of time around the center of the pin as shown in (e), and the fractured surface is flat with small undulations.

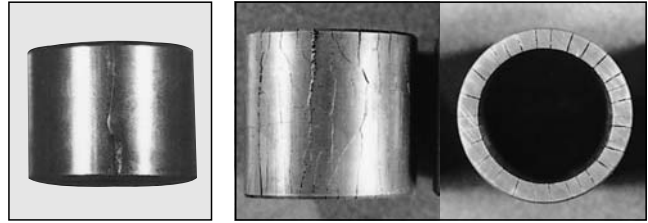


### • Fracture of bushings

As with rollers, bushings fracture by shock. Generally, as shown in the photo, a vertical crack occurs and stops near the plates. One crack can also be superimposed on another, causing the central portion to come off. In general, it can be said that a larger crack is caused by a larger tension.



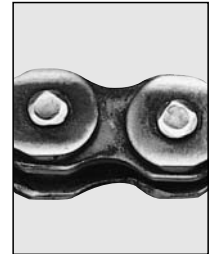
### • Fracture of rollers



When a roller fractures during operation, typically vertical splitting occurs as shown in the photo, and in general, pitch marks of fatigue extend from the inside of the roller and cause splitting. If splitting occurs all at once due to a large tension, the cause can be identified easily since the split faces are not polished. If tension is excessive, the rollers are forcefully pressed against the tooth faces of sprockets, and a roller end may be cracked and deformed.

### • Rotation of pins

As shown in the photo, the rotation of a pin can be identified by the deviance of the rivet mark on the pin head from the correct position. If the chain is disassembled, galling is found between pins and bushings in most cases. The cause of galling is improper lubrication or excessive tension. When a machine has been out of use for a long period of time, rust may develop between pins and bushings, causing the pin to rotate.



## Elongation of chain

In general, the elongation of chains includes the following three types;

### 1. Elastic elongation by chain tension

If a load acts on a chain, the respective components of the chain are elastically deformed, causing elongation. If the load is removed, the original length is restored.

### 2. Plastic elongation by chain tension

If a load in excess of the elastic limit acts on a chain, plastic elongation occurs. In this case, even if the load is removed, the original length cannot be restored. Plastic elongation of chain may diminish its performance. Replace it without delay.

### 3. Wear elongation of chain

Chains are subject to wear since pins and bushings are worn by mutual contact. After use for a long time, the wear appears as an increase of chain length. This is wear elongation. Wear elongation is an important factor for deciding the timing of chain replacement. See P.137.

## Timing for Replacement

If the engagement between chain and sprockets becomes defective or any factor that causes excessive decline in the strength of the chain occurs, replace the entire chain. When any of the following conditions occur in the chain you use, replace the entire chain to maintain safety.

- When a chain is worn close to the "Elongation limit of chain" on P.130.
  - When a flaw or crack occurs in a plate.
  - When a flaw or crack or defective rotation of a roller is observed.
  - When a chain link is stiff.
  - When a pin has been rotated.
  - When a pin is bent or otherwise deformed or when a plate is seriously warped.
  - When rust buildup prevents smooth bending of the chain.
  - When diluted sulfuric acid or any other corrosive material is deposited.
- ※ If you cannot judge whether a flaw is "harmful", please consult us.

## Replacement of sprockets and how to order

The life of sprockets is generally several times the life of a chain, but if the teeth are worn because of insufficient lubrication or damaged because of a shock load, etc., the sprockets must be replaced.

- When placing an order, please specify the following if the chain No. is known.

1. Chain No. and number of strands
2. Type of sprockets
3. Shaft hole diameter (d) (This is not necessary if you drill this hole; in this case, drill a hole not exceeding the maximum shaft hole diameter.)
4. Number of teeth
5. Hub diameter (DH) and length (L) (in the case of non-standard sprockets)
6. Whether the tooth heads are hardened

- Specify the following items, if the chain No. is unknown

1. Tooth thickness (T)
2. Root diameter (DB) (Caliper diameter (DC) in the case of odd-number teeth)

