

## 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.)	

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".

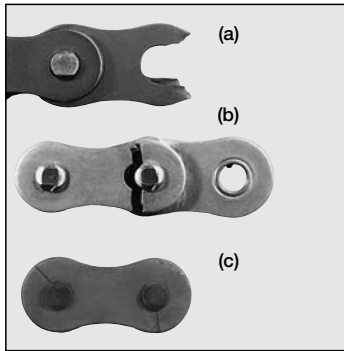
Note: See "Fracture patterns of respective chain components" on P.136.

## 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.

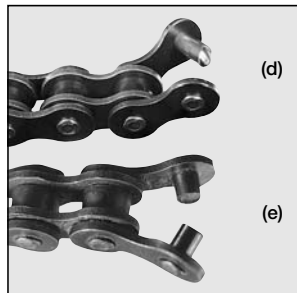
When a large tension acts to fracture a plate, as shown in (a), the cut ends are oblique and plastic deformation occurs. However, when the load is slightly larger than the maximum allowable tension, fatigue fracture occurs, and any plastic deformation does not occur as shown in (b). A significant feature 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.

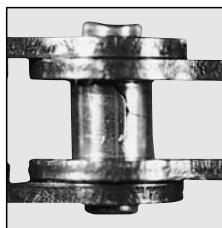
### • Fracture of pins

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.

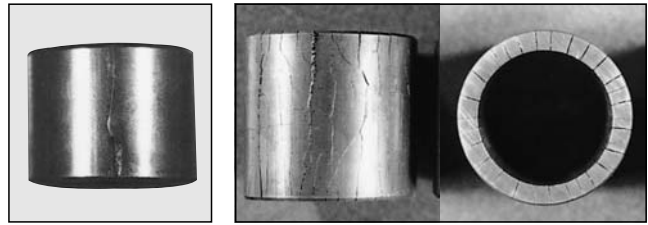


### • Fracture of bushings

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.



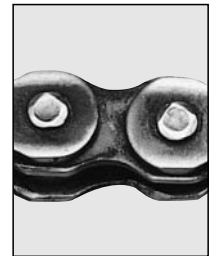
### • Fracture of rollers



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)

