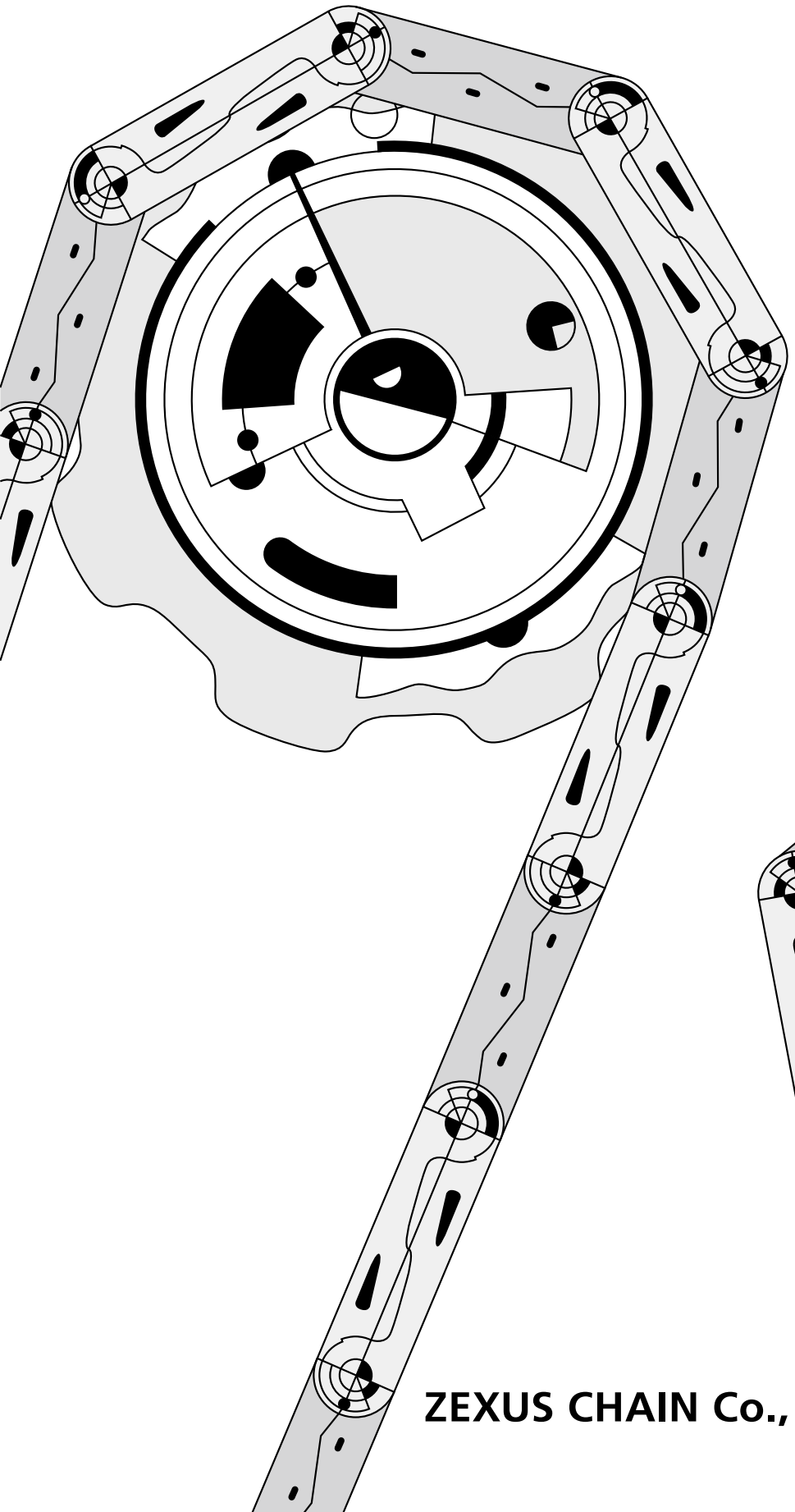
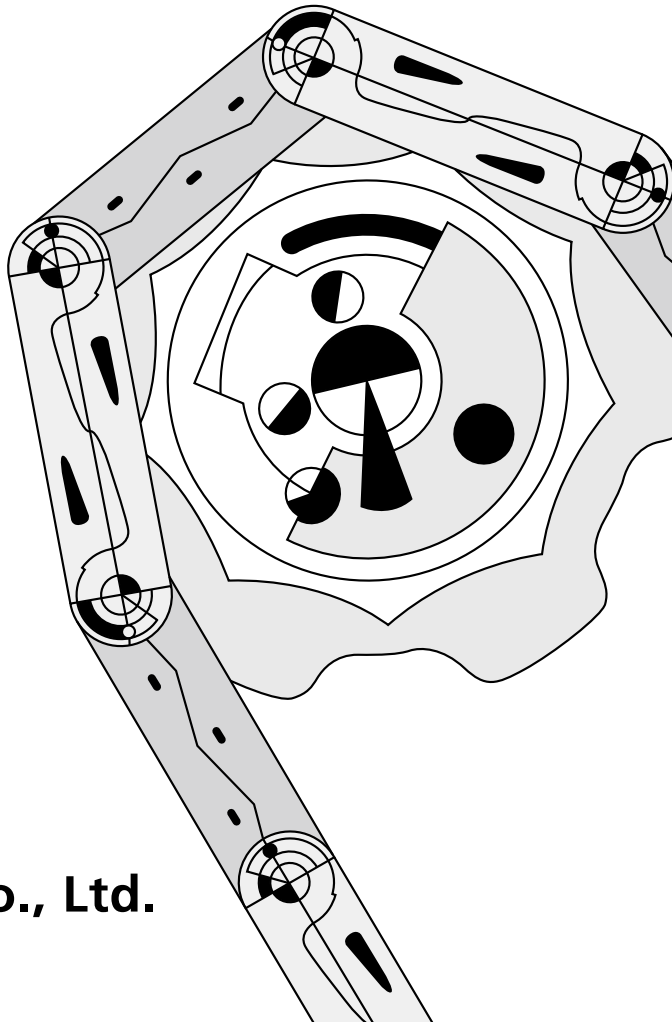
Conveyor Chains Service Manual

ZEXUS
JAPAN INDUSTRIAL CHAINS





CONVEYOR CHAINS

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

ZEXUS CHAIN Co., Ltd.

Contents

Introduction

Our conveyor chains, sprockets and other products are widely used in mainstream conveyor systems, to meet customer requests. Their specifications, applications and environments are very diverse.
Nevertheless, errors or shortcomings in selection, handling and maintenance can not only impede the flow of material on the conveyor but can cause major accidents, including chain breakage and conveyor 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.

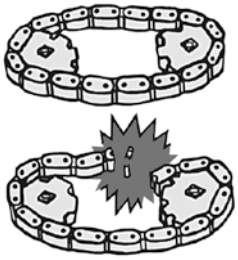
Symbol	Meaning
Warning	This symbol indicates content which, if ignored, can lead to incorrect handling that could result in death or serious injury.
Caution	This symbol indicates content which, if ignored, can lead to incorrect handling that could result in personal injury and equipment damage.

1. Product Use

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

1-1 Select chains correctly

① Conveyor 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.



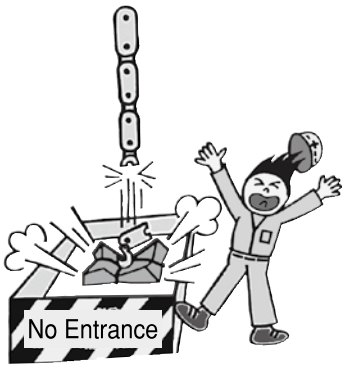
② Use of conveyor chains in alkaline or acidic surroundings can cause brittle fracture, so be sure to select the appropriate chains the conditions in which it will be used.

③ The performance of conveyor 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.

Warning

The following points must be strictly observed when using conveyor chains for vertical conveying.

- People must not be 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.



1-2 Install chains correctly
→ Refer to 6p"Handling of Conveyor Chains and Sprockets"

① Conveyor chains may break due to uneven loading and wear caused by poor alignment of equipment or changes over time. Make sure the chain is attached correctly.

② Do not subject the conveyor chains to direct impact, or to direct heating by blowtorch etc. Such treatment will greatly reduce chain performance and could cause the chain breakage.

③ Re-machining chains and sprockets is dangerous.
Never electroplate heat-treated chains or sprockets, as it can cause hydrogen embrittlement fracture.
Never weld heat-treated chains or sprockets, as heat effects can reduce strength, causing the chain to break.
After using a blowtorch or other heat source to heat or cut a chain, be sure to remove all components on either side of the heated area that may have been affected by the heat.

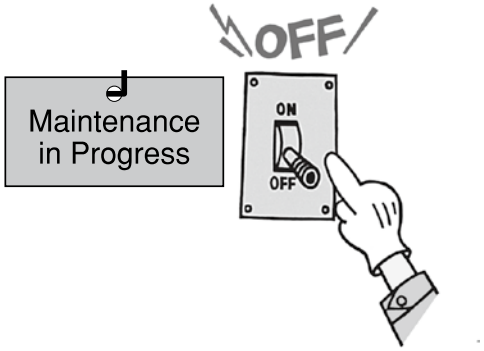
④ Safety covers etc. must be installed to make sure nobody can touch equipment while it is in operation.

⑤ If any foreign body etc. gets tangled in the conveyor chain while it is in motion, the chain may slip off the sprocket or, in some cases, break.

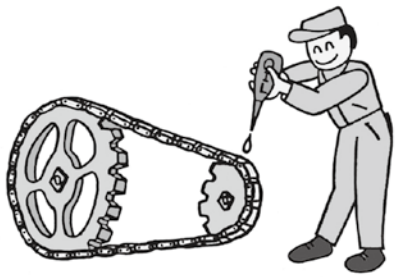
⑥ Conveyor chains may come off the sprocket or, in some cases, break if foreign objects become lodged in the chain during operation.

1-3 Maintaine equipment properly
→Refer to 6p"Handling of Conveyor 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 The lifespan of conveyor 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.



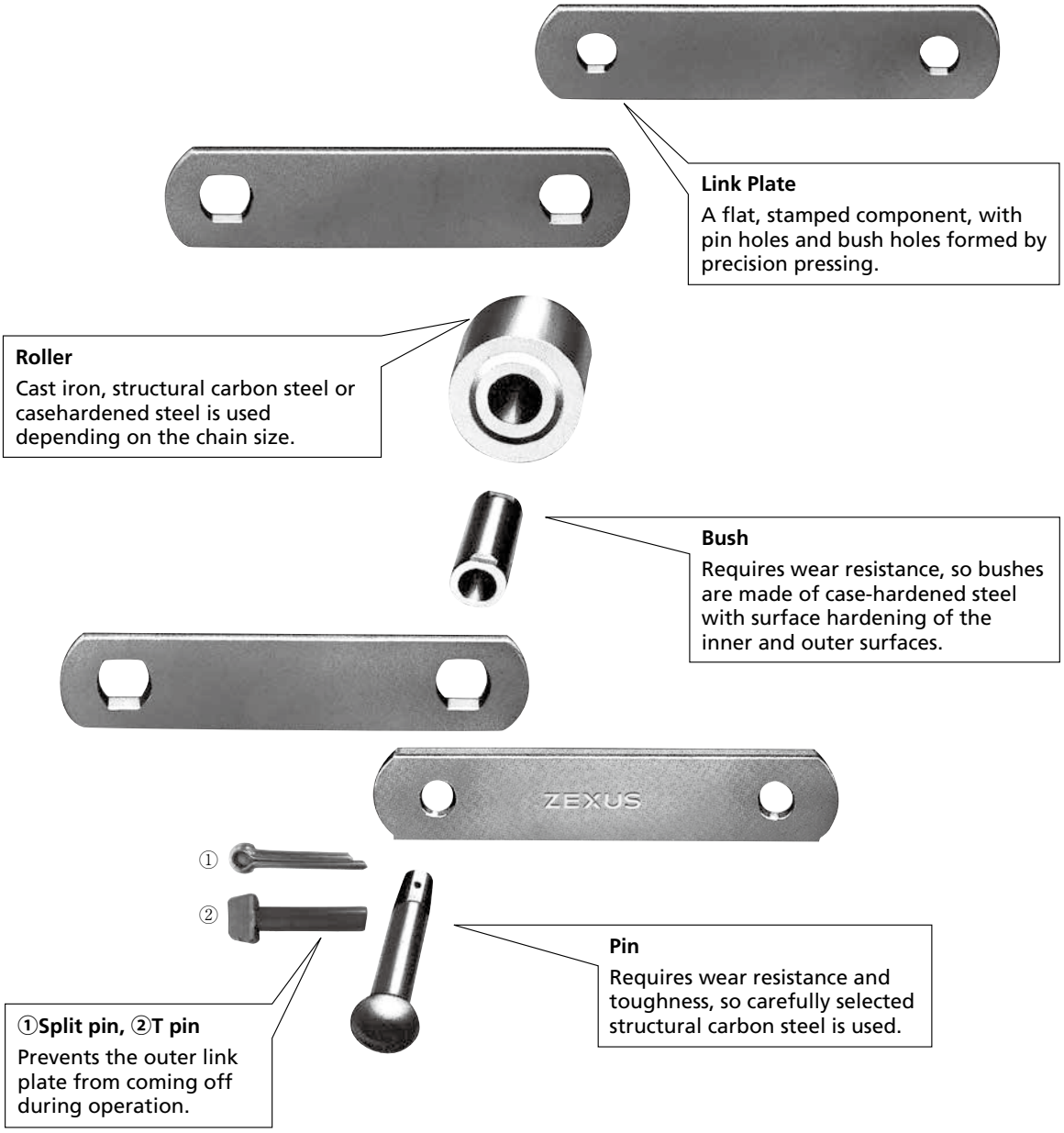
③ Conveyor chains and sprockets are consumable parts. As such, they require proper periodic maintenance and replacement. Avoid replacing only part of a chain. Replace the chain as a whole.

1-4 Storage of Conveyor Chains and Sprockets

Handle chains and sprockets as mechanical components. Do not throw or drop them when unpacking them, and store them away from rain, condensation, dust etc.

2. Conveyor Chain Structures

Conveyor chains comprise components such as link plates, pins, bushes and rollers. The example below is a standard conveyor chain.



Link Plate
A flat, stamped component, with pin holes and bush holes formed by precision pressing.

Roller
Cast iron, structural carbon steel or casehardened steel is used depending on the chain size.

Bush
Requires wear resistance, so bushes are made of case-hardened steel with surface hardening of the inner and outer surfaces.

Pin
Requires wear resistance and toughness, so carefully selected structural carbon steel is used.

①Split pin, ②T pin
Prevents the outer link plate from coming off during operation.

3. Handling Conveyor Chains and Sprockets

Pay attention to the following points when cutting and joining, maintaining, attaching, inspecting or otherwise working with conveyor chains.

⚠ Warning

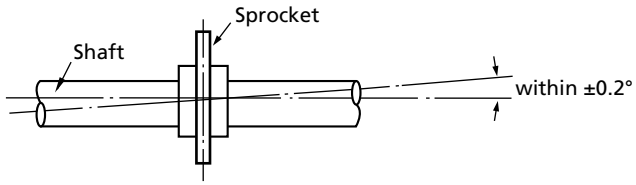
- Turn off the power supply and all other drive sources before starting work, and take precautions to make sure nobody can switch the power on by mistake.
- Always wear appropriate clothes and protective equipment (safety goggles, safety boots, etc.).
- Strictly observe the general standards of the Ordinance on Labor Safety and Hygiene, Volume 2, chapter 1, section 1 (see p.15).

3-1 Installation of Sprockets

Incorrect sprocket attachment can have a major impact on the smooth operation of the conveyor, and can cause eccentric load on the chains, greatly shortening their service life. The general attachment and alignment methods and allowable values are presented below.

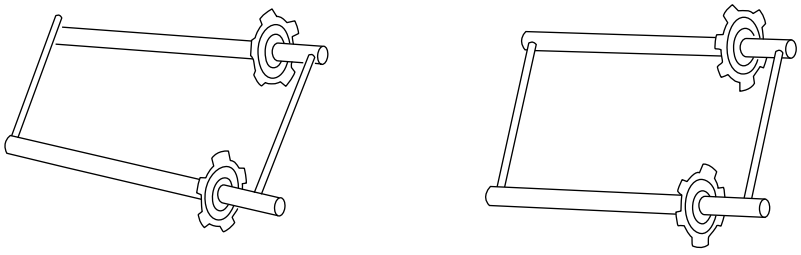
(1) Shaft Horizontality

Adjust the horizontality of the shaft to +/-0.2°, using a level.



(2) Shaft Parallelism

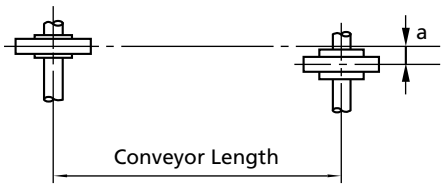
Use a scale, piano wire etc. to adjust the parallelism of the shafts to within +/-1mm.



(3) Sprocket Alignment

Use a straight edge to adjust the toothed sides (machined parts) of the pair of sprockets, so that distance "a" is within the allowable value (guideline).

If the conveyor is long, use piano wire etc. for measurement. When doing so, turn the sprockets to make sure there is no inconsistency in the value of "a".



Allowable Value (guideline) a

Conveyor Length	a (mm)
less than 10m	8
more than 10m	10

Caution

- When using sprockets in parallel, make sure their teeth are in phase.

3-2 Cutting and Joining of Conveyor Chains

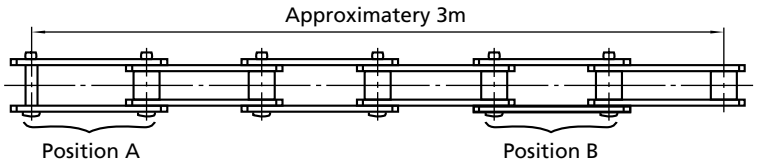
For ease of handling conveyor chains, they are divided into lengths of approximately 3m long, so they must be joined on site to make the required length. They must also be cut and spliced when replaced. The method is described below.

Caution

- Use jigs (stands, press plates) for cutting and joining work.

(1) How to cut Conveyor Chains

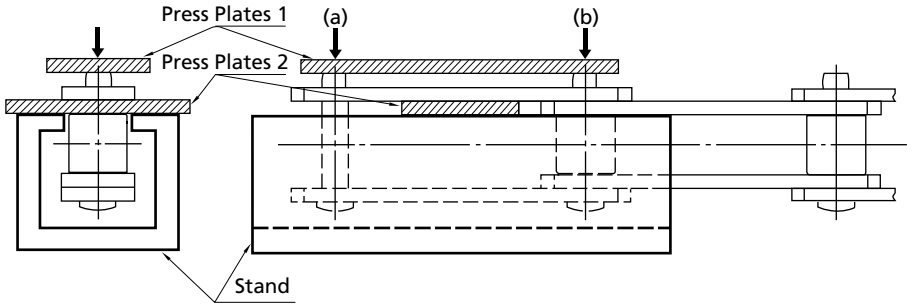
Conveyor chains are delivered in approximately the form below. Follow the methods below to disassemble the chain at a joint end (position A), or at the middle (position B).



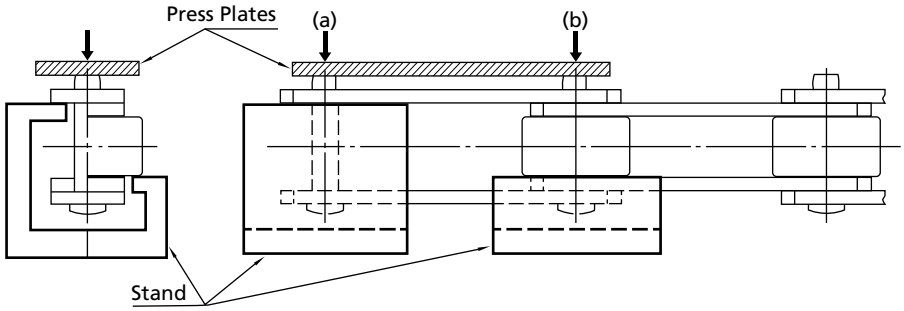
How to cut at a joint end

To cut the joint end, use a stand as shown in the diagram below, place press plates 1 and 2 over the pins, then hit (a) and (b) alternately with a hammer, to remove the pins.

with an S (M) type Roller

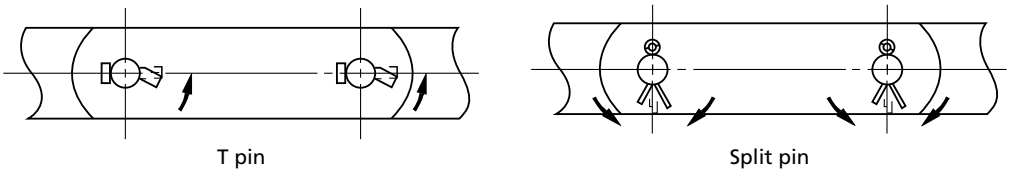


with an R (F) type Roller



Central Disassembly

① Extract the T pins (split pins)
Remove the two split pins at the break point. Use a spanner or pliers to straighten bent T pins or split pins for extraction.

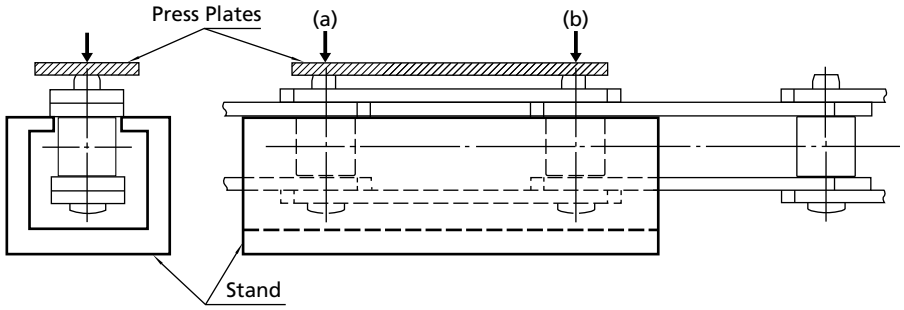


Caution

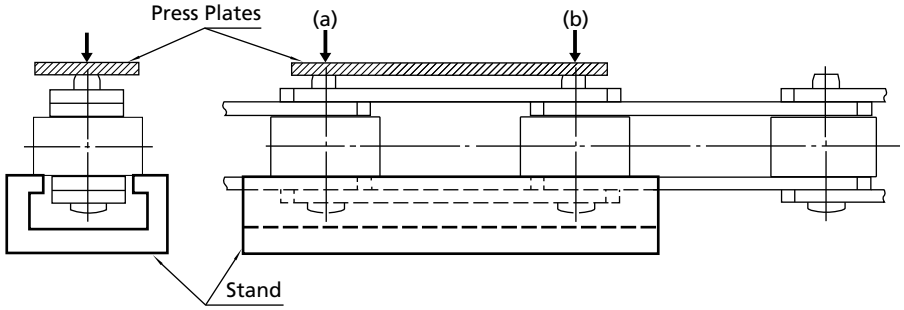
・Do not reuse straightened T pins or split pins.

② Extract the pins
To break a chain in the center, use the stand as shown below, place press plates against the pins, and then hit (a) and (b) alternately with a hammer, to remove the pins.

with an S (M) type Roller



with an R (F) type Roller



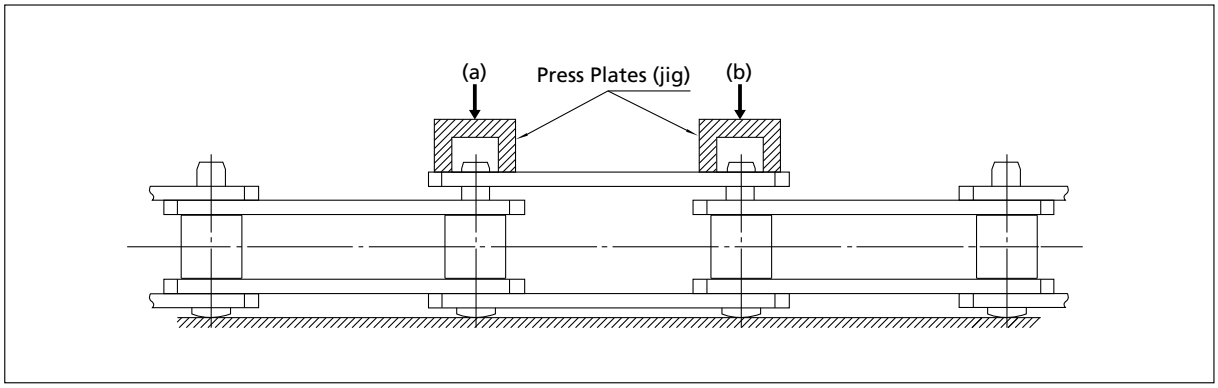
Caution

・You must place press plates over the pins before hitting them with a hammer.
・The pins are hardened by heat treatment, so they could break if struck directly, possibly causing injury.

(2) How to join Conveyor Chains

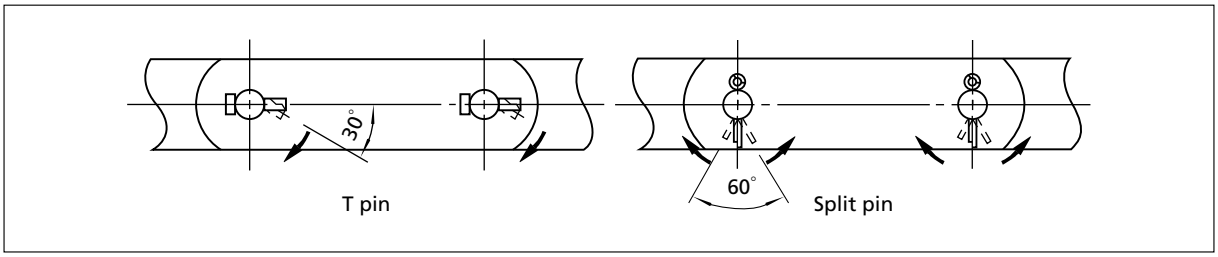
① Chain joining (push fitting outer plates)

To join the chains, use press plates (jigs), as shown in the diagram below, to strike alternately around the holes at (a) and (b), pushing the plate into place.



② T pin (split pin) bending

After pressing the outer plate into place, insert the T pins (split pins) and bend them securely.



Caution

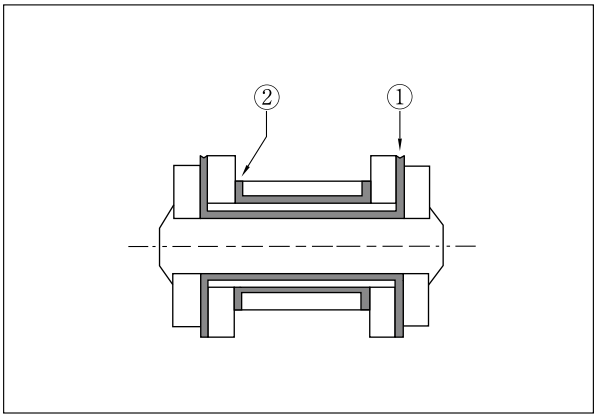
- Use a spanner or pliers to bend the T pins (split pins). Avoid hitting them with a hammer.
- Bend T pins through 30° and split pins through 60°, as standard.

3-3 Lubrication (Oiling)

Lubrication is extremely important for conveyor chains. Improper lubrication could shorten the service life of a conveyor chain. Nowadays, standard conveyor chains are increasingly used in harsh conditions, making lubrication of chains more important than ever. Please note that depending on the usage environment, lubrication may not be possible. In such cases, please contact us.
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 and method

Lubricate the chain at the points ① and ② by dropper or brushing



Caution

- In the early stages of operation, the lubrication interval should be as short as possible to allow for initial wear of the sliding parts.
- Although rust-preventive oil is applied at the time of shipment from our factory, before starting actual operation, please be sure to thoroughly lubricate the product (grease) and operate it without load for 30 minutes or more. Thisno-load operation allows the lubricating oil to penetrate into each part, increasing its effectiveness.

(2) Type of lubricating oil

Commercial lubricating Oil (for reference)

Viscosity \ Manufacture		Idemitsu Kosan Co., Ltd.	ENEOS Corporation
ISO VG	150	Daphne Super Gear Oil 150	BONNOC AX150
	220	Daphne Super Gear Oil 220	BONNOC AX220

*Manufacturers' names are listed in no particular order.

Caution

- Special lubricating oil is required when the ambient temperature is below 0°C or above 50°C. Also, depending on the usage environment, lubrication may not be possible. In such cases, please contact us.

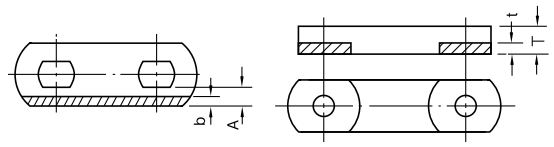
3-4 Maintenance and Inspection

(1) Timing of replacement

When a chain is used, wear occurs in various parts, and the degree of wear can be used as a yardstick for the use limit of the chain.

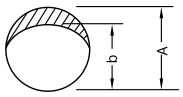
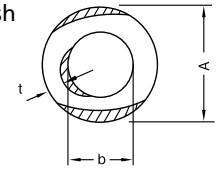
① Link Plate Wear

The undersides of link plates are worn out due to the contact with the transported materials and the casing. Wear is also caused by contact between the inner and outer link plates, and the contact between the inner surface of the inner links and the side of the rollers.

Parts	Timing of replacement	Remarks
Link Plate 	$t=\frac{1}{3}T$	When the chain is subjected to lateral loads.
	$b=\frac{A}{2}$	When the link is in contact with the guide rail

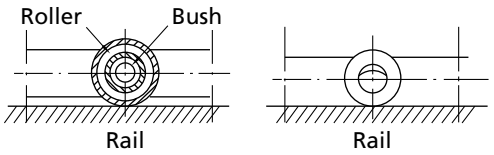
② Pin and Bushing Wear

When the chain engages with the sprockets, it undergoes a bending motion. The frictional wear between the pin and the bushing that occurs at this time causes pitch elongation.

Parts	Timing of replacement for carburized materials	Timing of replacement for hardened and tempered materials	Remarks
Pin 	$\frac{b}{A}=0.975$	$\frac{b}{A}=0.85$	Pin breakage may occur when the cross-sectional area is reduced by one-half.
Bush 	When the amount of wear on the inner or outer diameter is 0.025b or more	$t=(A-b)\times\frac{1}{2}\times 0.4$	

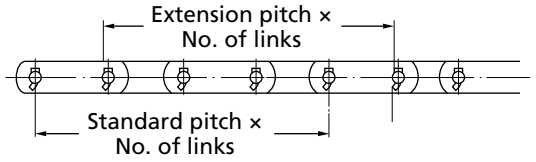
③ Roller Wear

In the case of R-type rollers and F-type rollers, when the rollers wear out, the link plate touches the rail, increasing the abrasion resistance and chain tension. At that point, it is recommended to replace the rollers.
In the case of S-type rollers, you should replace the rollers with new ones when they are worn out and have holes or cracks in them.



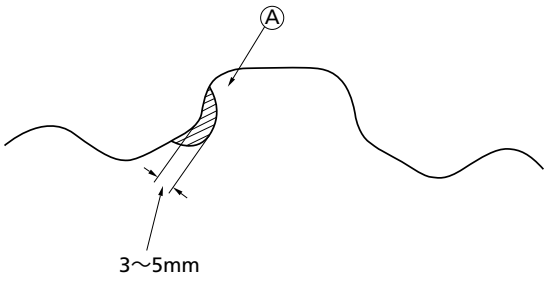
Roller Wear

④ Chain Pitch Elongation
Extension pitch × No. of links
Standard pitch × No. of links
Chain length measurement method
"When a chain is used for an extended period, wear of the pins and the bushings causes the chain to elongate and ride on the sprockets, resulting in malfunctions. Therefore, the limit of pitch elongation should be 2 to 3% of the standard dimension. You should replace the chain with a new one when it reaches the limit. Chain length should be measured with 4 or more links as shown in the figure.



Chain length measurement method

⑤ Sprocket Wear
As sprocket wear progresses as shown in the figure, the rollers of the chain get caught on the tooth tips (A), causing the chain to become entangled (the chain becomes more difficult to separate from sprocket). The amount of wear on the bottom of the sprocket teeth varies depending on the size of the chain and the speed of the chain, but when 3 to 5 mm of the bottom of the sprocket teeth is worn, the sprocket should be replaced with a new one or repaired.



Sprocket Wear

(2) Inspection of Conveyor Chains and Sprockets

① Trial Run Inspection
- ・Check the chain and sprockets are correctly installed
- ・Check T-pins at the chain joint are correctly installed (Be careful of the bending angle)
- ・Check the appropriate take-up tension (Not too loose or too tight)
- ・Check there are no foreign matter interfering with the running of the chain
- ・Check that the chain is properly lubricated
- ・Check for abnormal sound (vibration or noise) during operation

② Daily Inspection
- ・Check for abnormal vibrations, noises, etc.
- ・Check for abnormal rust or dirt on the external part of the chain
- ・Check for abnormalities such as scratches, deformation, unevenness, or damage on the structural parts of the chain, especially on the link plate and roller
- ・Check the meshing by chain and sprockets, and chain can release smoothly
- ・Check the chain bending and smooth roller rotation
- ・Check the chain wear elongation
- ・Check for unevenness in the contact area between the chain and the sprocket (inner surface of the inner plate, side of the sprocket)
- ・Check for the chain tension appropriately
- ・Check that the chain is properly lubricated

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.

(3) Clarification of problems and Countermeasures

Problem	Probable Causes	Countermeasures
General corrosion Corrosive wear	・Corrosion due to moisture, acid, alkali, etc.	・Replace with an environmentally resistant chain series
Damage to pins, bushings, and rollers Deformation of the link plate hole	・Insufficient lubrication ・Jamming by foreign matter ・Corrosion of individual parts ・Use above the allowable load. ・Abnormal load action	・Proper lubrication ・Removal of foreign matter ・Replace with an environmentally resistant chain series ・Review chain and sprocket selections ・Removal of abnormal load and review of chain selection
Abnormal noise	・Excessive chain tension or looseness ・Insufficient lubrication ・Excessive wear of chains and sprockets ・Contact with the chain case ・Damaged bearings ・Sprocket misalignment	・Adjustment of slack ・Proper lubrication ・Replace chains and sprockets ・Removal of the contact with the case. ・Replace bearings ・Adjustment of alignment.
Chain vibration	・Excessive chain slack ・Excessive load fluctuations ・Excessive chain speed leading to pulsation ・The chain has defective bending points. ・Sprocket wear	・Adjustment of slack ・Reduction of load fluctuation or replacement of chains ・Use guide stopper to stop chain swaying ・Removal of defective bending points ・Replace the sprocket
Side wear of the link plate and the sprocket	・Sprocket misalignment	・Adjustment of alignment
Poor chain bending	・Insufficient lubrication ・Entry of foreign matter between the pin and the bushing ・Rust between the pin and the bushing ・Sprocket misalignment	・Proper lubrication ・Lubrication after cleaning the chain and removing foreign matter ・Replace with an environmentally resistant chain series ・Adjustment of alignment
The chain rides up on sprockets.	・Excessive chain slack ・Excessive wear on the bottom of the sprocket teeth ・Excessive chain elongation ・Foreign matter adhering to the bottom of the sprocket teeth	・Adjustment of slack ・Replace sprockets ・Replace chains ・Remove the foreign matters from the bottom of the teeth.
Chain separates poorly from the sprocket	・Sprocket misalignment ・Excessive chain slack ・Excessive wear on the bottom of the sprocket teeth	・Adjustment of alignment ・Adjustment of slack ・Replace the sprocket

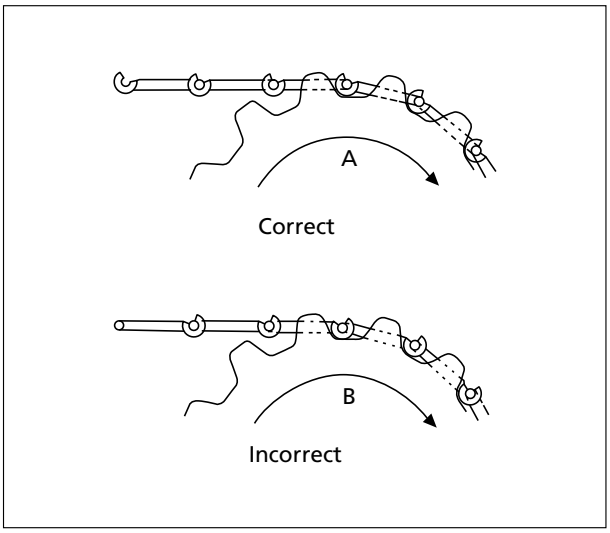
4. Cast Chains and Sprockets

4-1 Installation of Cast Chains

Wrong installation of Cast Chains to Sprocket Wheel can impede its functional operation and accelerate wear of the chain and the sprocket.

Installation of Cast Chains

When chain runs on sprocket wheel, please pay particular attention to rolling friction between barrel of chain and teeth of sprocket wheel.
In use offset type of cast chains (Detachable chain and Pintle Chain) as conveyor chains, put chains in correct way as picture A at right side. Correct chain installation causes friction between pin hole and pin only.
In case of wrong way as picture B at right side, this causes friction not only pin hole and pin but also chain barrel and teeth of sprocket wheel.
In case of straight type of cast chains (steel bushed chain and combination chain), teeth of wheel is worn out alternatively. Please use sprocket wheel which has odd number of teeth.



4-2 Use

Manufacturing methods or structures of cast chains and sprocket wheels are different from other conveyor chains. Please pay particular attention to following points in use.

Caution : Re-machining cast chains and sprockets are dangerous.

- Plating treatment for Cast Chains and Sprockets is dangerous.
  Do not plate treatment for heat treated chains and sprocket wheels. It causes chain broken due to hydrogen brittleness.
- Welding and heating cast 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.

Caution : Dimensional Accuracy of Cast Chains

Please pay particular attention to use Cast Chains because dimensional accuracy of cast chains are bigger than other chains due to machining and structure of cast chains.

- Please check the tolerance of both chains is acceptable in advance when cast chains are used parallelly.
- Cast Chains have dimensional variation in each manufacturing lot. In replacement, please pay particular attention to chain tension.

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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