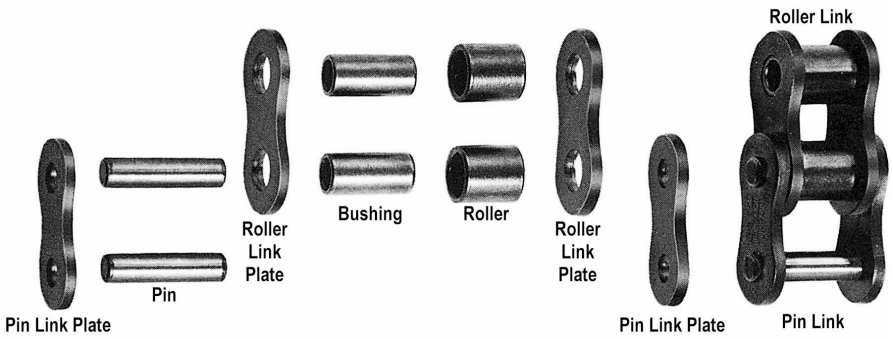
CONTENTS

1. CHAIN CONSTRUCTION

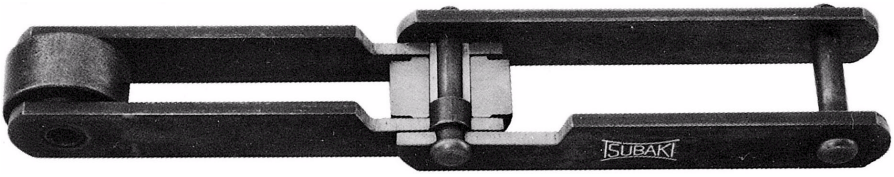
RS Roller and RF Conveyor Chains consist of alternate connections of roller links and pin links. The roller link consists of a roller plate to which two bushings with rotatable rollers are press-fitted. This roller link is alternately connected to the pin link plate in which two pins have been securely press-fitted.

Fig. 1-1 RS Roller Chain Construction



PINS Pins are made to exact specifications for high strength, sturdiness and wear resistance and rigidly press-fitted to the link plates. Pins resist shearing force through chain tension and rotate in the bushings, providing bearing surfaces when the chain articulates over a sprocket.	**ROLLERS** Rollers are free to rotate over the bushings. When the chain engages with the sprocket, the rollers work as bearings and serve to reduce shock and wear. When the chain is running on rails or wear strips, the rollers reduce running friction on the chain.
LINK PLATES Link plates are the component part receiving chain tension. The holes for press-fitted pins or bushings are accurately punched to maintain uniform pitch.	**BUSHINGS** Bushings are made to achieve high wear resistance and are press-fitted to the roller link plates, providing a bearing surface for pin rotation

Fig. 1-2 RF Conveyor Chain Construction



2. RS ROLLER CHAIN CONNECTING LINKS

Tsubaki Roller Chain links can be easily connected using standard connecting links. Although an offset-type connecting link is available for connection of an odd number of links, it is best to use standard connecting links as much as possible.

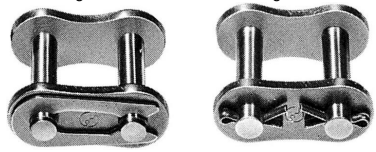
CONNECTING LINKS

Tsubaki uses two types of connecting links and generally two types of fasteners for RS Roller Chain:

1) A regular connecting link with either a spring clip or cotter pin type fastener
2) A special tight-fitting connecting link with either a spring clip or cotter pin type fastener (must be specially ordered)

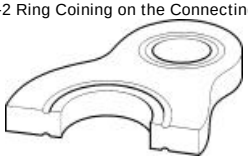
Fig. 2-1 Standard Connecting Link

For smaller sized links (under RS60) a spring clip is used. For larger chain (RS80 and over or 3~6 strands of RS40 and RS50) a cotter pin (or roll pin type for RS 240) is best.



Spring Clip Cotter Pin

Fig. 2-2 Ring Coining on the Connecting Link



The connecting links on RS80~RS240 are ring-coined (patent pending)- a Tsubaki innovation. This decreases pin hole stress on the face plate and increases strength and durability.

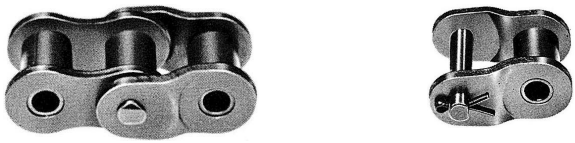
The regular connecting link is suitable for most all power transmission applications and has ample strength to handle high loads over a long period of time. In certain severe conditions, such as high impact or heavy load power transmission and applications with high speed drives, a tight-fitting connecting link, which has slightly higher fatigue strength than the regular connecting link, may be specially ordered from Tsubaki.

OFFSET LINKS

One-pitch offset links and two-pitch offset links are available for RS Roller Chain. Two-pitch offset links consist of a roller link and an offset link with a riveted pin, as shown in the photo below. Please check the power transmission chart in Tsubaki's General Catalog for further details.

Handling of the one-pitch offset link is relatively easy. However, as the performance is inferior to the two pitch offset link or the chain itself, one pitch offset links should be confined to lighter loads and middle to low speed power transmission with reduced start and stop impact loads.

Fig. 2-3 Offset Links



Two-Pitch Offset Link One-Pitch Offset Link

NOTE: *Two-pitch offset links for RS41 and one pitch offset links for RS25 are not available.*

3. HOW TO CONNECT RS ROLLER CHAIN

A convenient and easy way to connect and install roller chain is to:

1) Wind the chain around one of the sprockets such that the free ends are separated by only one sprocket tooth.
2) Insert the connecting link in the two end links of the chain.
3) Install the free plate (connecting link plate) of the connecting link and fasten the plate using the spring clip or cotter pin fasteners supplied.

If the sprocket teeth cannot be used due to lay out:

1) Wind the chain around the sprockets such that the free ends come together in the area between the sprockets.
2) Using a chain puller, or by hand, pull the chain ends together and insert the connecting link.
3) Install the free plate (connecting link plate), then insert and secure the fasteners.

For both methods, be sure to tap the ends of the chain pins after the fasteners have been inserted. By tapping the ends of the pins, the fasteners will rest snugly against the outside of the connecting link plate. This will help the chain to flex freely and smoothly as it goes around the sprocket in addition to allowing better lubricant penetration and greater fastener life.

An offset link must be used where an odd number of pitches are required. However, offset links should be avoided if possible. This is because the allowable working load of the offset link is considerably less than the base chain or standard connecting link. Therefore, it is better to add one link and take up the extra slack by varying the center distance between the shafts or by installing an idler.

NOTE: **The tight-fitting connecting link is made to fit exactly with the pin. Do not make the link plate holes bigger or the diameter of the pin smaller, as doing so may damage the chain or reduce its life and performance.*

** For cotter pin type chain, a regular pin link can be used as a substitute for the connecting link. The pin link plate must be carefully driven onto the pin, parallel to the connecting link. If the connecting link plate is not installed parallel to the connecting link, chain damage or increased wear may result.*

Fig. 3-1 Connecting RS Roller Chain on a Sprocket

4. HOW TO DISCONNECT RS ROLLER CHAIN

There are two relatively simple methods for cutting RS Roller Chain. One way is to use a chain vise and punch, and the other is to use a chain breaker. The following are points for disconnecting RS Roller Chain:

USING A CHAIN VISE

1) For riveted type Tsubaki Roller Chain, first grind down one end of the pin to be removed. For cottered type, be sure to take out the cotter pin.

2) As shown in the photo, put the chain into the vise groove and tighten the vise to secure the chain.

3) Hit the head of the pin with a punch or hammer. Be sure to hit the pins alternately so that they can be removed at the same time.

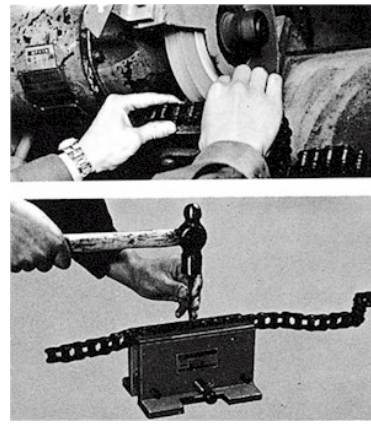


Fig. 4-1 Disconnecting RS Roller Chain

NOTE: *For riveted types, be sure to grind off the riveted part of the pin. If the pin is taken out without grinding, it will take more time and may damage the chain. Chain vises and punches for RS40 to RS240 are available.*

Table 4-1 Chain Vise Selection

Chain No.⇨ Strands	RS40	RS50	RS60	RS80	RS100	RS120	RS140	RS160	RS180	RS200	RS240
1		CV-1									
2			CV-2				CV-3				
3								Not in stock			

indicates **CV-1** indicates **CV-2** indicates **CV-3**

NOTE: *1) For the overlapping areas of Table 4-1, the smaller type of chain vise is easier to use.*
2) These chain vises can also be used for double-pitch chain other than RS Roller Chain.

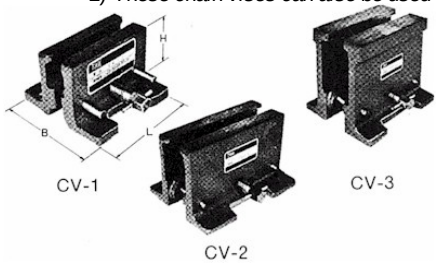


Fig. 4-2 Chain Vise Types

Table 4-2 Chain Vise Dimensions

Type	L	H	B
CV-1	100 (3.94)	65 (2.56)	94–115 (3.70–4.53)
CV-2	180 (7.09)	110 (4.53)	120–151 (4.72–5.94)
CV-3	200 (7.87)	170 (6.69)	180–220 (7.09–8.66)

HOW TO DISCONNECT RS ROLLER CHAIN

CHAIN PUNCHES

When using a chain punch, be sure to remove both pins simultaneously. Link plates cannot be used again once the pins have been removed.

Fig 4-3 Punch Selection

Primary Punch

Secondary Punch

Riveting Punch

Table 4-3 Punch Selection

Chain No.	Primary punch	Secondary punch	Riveting punch
RS40~RS60	S-1	D-1	For RS40
RS80~RS120	S-2	D-2	For RS50
RS140~RS240	S-3	D-3	For RS80
			For RS60

CHAIN BREAKER

A chain breaker is a tool made for cutting chain. The chain breaker does not require a firm working table and can cut chain already set on a machine. RS25 and RS35 type chains require a chain breaker.

Table 4-4 Chain Breaker Selection

Chain No. / Strands	RS25	RS35	RS41	RF06B	RS40	RS50	RS60	RS80	RS100	RS120	RS140	RS160	RS160	RS200	RS240
1	CS-A1	CS-A2	CS-A3	CS-A4	CS-B1			CS-C1		CS-C2		CS-C3			
2															

NOTE: *1) A4 type, B type, C type and double-strand A type are manufactured to order, all others are held in stock.*

2) This series can also be used for BS Roller Chain and Tsubaki Marine Chain, however, a chain breaker specially manufactured for Marine Chain is also available.

Fig. 4-4 Chain Breaker Types

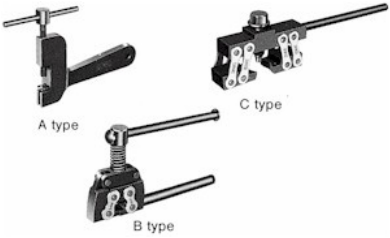


Fig. 4-5 Using the chain breaker

5. SPROCKETS FOR RS ROLLER CHAIN

Good quality sprockets are essential for maximum power transmission efficiency. The tooth configurations of Tsubaki Sprockets conform to JIS and ANSI standards. All Tsubaki sprockets are precision components with finely balanced boss and rim parts that are exactly in accordance with Tsubaki's stated specifications.

A Type | B Type | C Type | Double Strand B Type | Double Strand C Type

Fig. 5-1 Sprocket Types

SPROCKET MATERIALS

Suitable sprocket materials should be selected according to working conditions and requirements. Proper selection will result in higher performance and better cost effectiveness.

Table 5-1 Sprocket Materials

Type	Material
A Type	Low Carbon Steel
B Type	High Carbon Steel
C Type	Ductile Cast Iron (RS40~RS120) Cast Iron (RS140~RS160)

HIGH FREQUENCY HARDENING FOR TIPS OF SPROCKET TEETH

Roller Chain is often used for high-speed power transmission. To meet this requirement, single row, new B Type for RS35~RS100 sprockets, and double row, new B Type for RS40~RS100 standard sprockets with fewer teeth, are strengthened at the tooth tip by means of high frequency hardening.

Hardening of tooth tips is required in the following cases:

1) The number of teeth is 24 or less and the sprocket is used at a speed over 1/8 of the maximum speed shown in the power transmission capacity chart for RS Roller Chain.
2) Small sprockets and speed ratios over 1:4.
3) Use with heavy loads at low speed.
4) Use under abrasive conditions (on tooth).

SHAFT HOLE PROCESSING

If the shaft hole is to be processed by the customer, processing should be done based on the tooth bottom. If processing is to be done by Tsubaki, information on keyway dimensions and the required shaft hole is required.

6. SPROCKET INSTALLATION

Careful and accurate installation of sprockets is required for smooth roller chain power transmission and maximum life of the sprocket and chain.

SPROCKET ALIGNMENT

1) Level each shaft, checking the adjustment with a level applied directly to the shaft. The inclination should be adjusted within the range ±1/300.

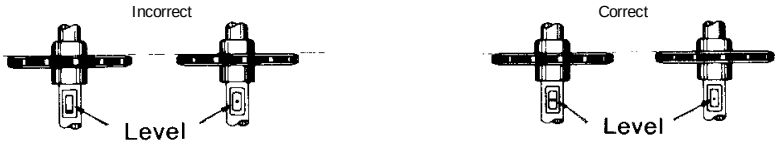


Fig. 6-1 Shaft Alignment

2) Align the shaft for parallelism using a scale. Parallelism of the shafts should be adjusted so that the inclination is within the range ±1/300 (A-B/L).

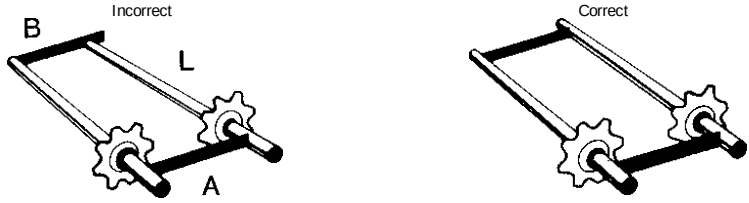


Fig. 6-2 Shaft Parallelism

3) Check the axial alignment of the sprocket using a straight edge or scale. The following are the tolerances depending on the distance between the shafts:

Up to 1m (3.3'): ±1mm (0.04")

1m (3.3') to 10m (33'): $\pm \frac{\text{distance between two shafts}}{1{,}000}$

Over 10m (33'): ±10mm (0.39")

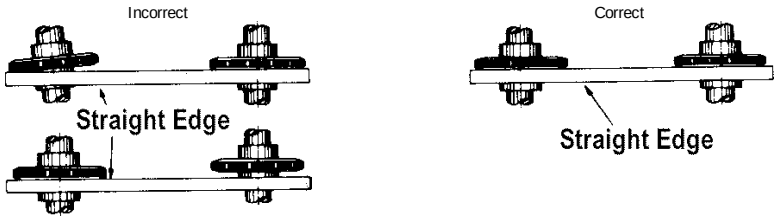


Fig. 6-3 Axial alignment

4) Attach the sprockets to the shafts using keys, collars, set bolts, etc. as necessary.

7. RS ROLLER CHAIN LUBRICATION

All Tsubaki Roller Chain is pre-lubricated with a special high-grade lubricant before packing. Tsubaki's lubricant has been specially developed to thoroughly penetrate all parts of the chain, especially the critical areas where the pin and bushing surfaces articulate with each other when the chain is fully loaded.

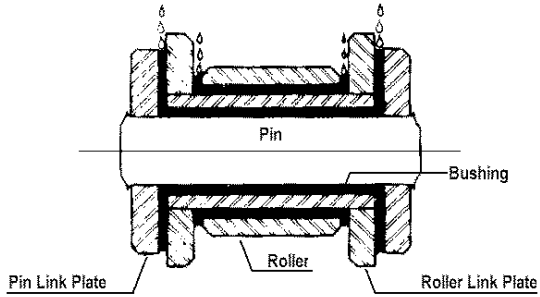
Proper lubrication of roller chain is essential for peak performance and full chain life. Care should be taken to strictly follow the lubrication schedule and recommendations. If this is not done, the service life of the chain will be shortened and maximum power transmission will not be delivered, no matter how high performing the chain or sprocket is.

Since wear between pins and bushings cause chain elongation, lubrication must be maintained on all contact surfaces. Proper lubrication forms an oil film which:

1) Reduces abrasion and chain wear
2) Reduces chain friction and noise
3) Functions as a coolant when the chain is run at high speeds
4) Functions as a cushion against impact

Lubricants for Roller Chain must be selected and applied according to the application and working conditions of the chain. Once applied, the lubricant should not be wiped off with a cloth or washed with certain solutions, e.g. TRICLEAN. For more details, see "Lubrication Methods."

Fig. 7-1 Proper Penetration of Lubricant



The lubricant should penetrate the areas shown in Fig. 7-1 above.

RECOMMENDED LUBRICANTS

Only high-grade oil of suitable viscosity should be used for RS Roller Chain lubrication. The proper type of oil to be used depends on the chain specifications, working conditions and lubrication system.

Oils to avoid:

1) Heavy oil (except under special conditions)
2) Low grade oil
3) Impure oil or grease
4) Used oil

The oils listed above should not be used because they do not lubricate the chain effectively and will reduce chain service life or even cause chain breakage or irreparable damage.

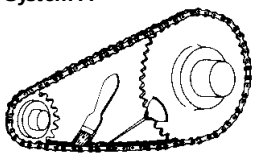
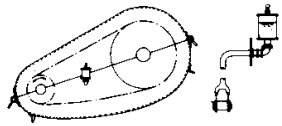
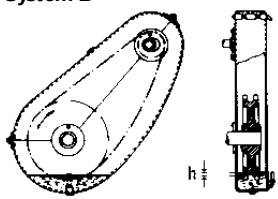
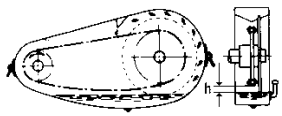
RS ROLLER CHAIN LUBRICATION

Table 7-1 Lubrication Selection

Lubricating System	A, B				C			
Ambient temperature⇒ / Chain No.	-10° ~ 0°C	0° ~ 40°C	40° ~ 50°C	50° ~ 60°C	-10° ~ 0°C	0° ~ 40°C	40° ~ 50°C	50° ~ 60°C
RS50 or smaller	SAE 10	SAE 20	SAE 30	SAE 40	SAE 10	SAE 20	SAE 30	SAE 40
RS60 and RS80	SAE 20	SAE 30	SAE 40	SAE 50				
RS100					SAE 20	SAE 30	SAE 40	SAE 50
RS120 or larger	SAE 30	SAE 40	SAE 50					

LUBRICATING SYSTEM AND QUANTITY OF OIL APPLIED

The following lubricating systems are recommended. Refer to the power transmission capacity chart in Tsubaki's general catalog for selection of the best system.

	Method	Quantity of Oil
System A 	**Manual Application** Oil is applied with an oil filler or brush on the slack side of the chain.	Oil should be applied at a fixed interval, generally about every 8 hours, or as often as necessary to prevent the bearing areas from becoming dry.
	**Drip Lubrication** A simple case can be used. Oil from the oil cup is supplied by drip-feeding.	5 to 50 drops of oil per minute are necessary for every strand of chain. Actual quantity depends on the speed.
System B 	**Oil Bath Lubrication** The chain is installed in a leak free casing.	Depth "h" from the oil surface to the chain should be 6mm (¼") to 12mm (½"). If "h" is too high, the composition of the oil may change and lose some of its effectiveness due to heat generated.
	**Lubrication By Rotating Disc** Oil can be splashed on the chain using a rotating disc installed in a leak-free casing. For this method, speed along the circumference of the disc should be over 200m/min. (656ft./min.). If the width of the chain is over 124mm (4.9"), use a rotating disc on both sides.	The clearance "h" between the oil surface and lowest position of chain should be within 12mm (½") to 25mm (1").

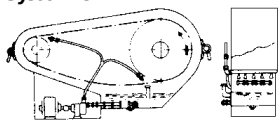
	Method	Quantity of Oil
System C 	**Lubrication Using a Pump** The chain is contained in a leak free case and a pump is used to circulate and cool the oil. When the number of chain strands is “n”, “n+1” lubrication supply holes are necessary.	Oil should be supplied according to Table 7-2.

Table 7-2 Quantity of Oil for Lubrication Using a Pump ℓ/min. (gal/min.)

Chain speed m/min. (ft./min.)	Chain Number RS60 and under	RS80 RS100	RS120 RS140	RS160 and over
500-800 (1,600-2,600)	1.0 (0.26)	1.5 (0.40)	2.0 (0.53)	2.5 (0.66)
800-1,100 (2,600-3,600)	2.0 (0.53)	2.5 (0.66)	3.0 (0.79)	3.5 (0.92)
1,100-1,400 (3,600-4,600)	3.0 (0.79)	3.5 (0.92)	4.0 (1.06)	4.5 (1.19)

Regardless of the lubricating system used, roller chain should be washed periodically with petroleum or gasoline. Examine the pin and bushing to confirm the effectiveness of the lubrication. The appearance of a red or reddish brown color is usually the result of insufficient lubrication.

8. RS ROLLER CHAIN INSTALLATION AND LAYOUT

SPEED RATIO AND CHAIN LAP

The speed ratio of RS Roller Chain can range up to 7:1 under normal conditions. However, a speed ratio of 10:1 is possible if the required speed is very slow. Chain lap on the small sprocket must be at least 120°.

DISTANCE BETWEEN SHAFTS

Optimum distance between sprockets is 30 to 50 times the pitch of the chain except when there is a pulsating load. In such cases, the distance can be up to 20 times the pitch of the chain.

LAYOUT

When arranging the roller chain drive, the centerline of both sprockets should be as close to horizontal as possible, though the angle of installation can be up to 60°. If installation is close to vertical, the chain tends to slip off the sprockets easily with slight chain elongation, In this case, an idler or guide stopper is recommended.

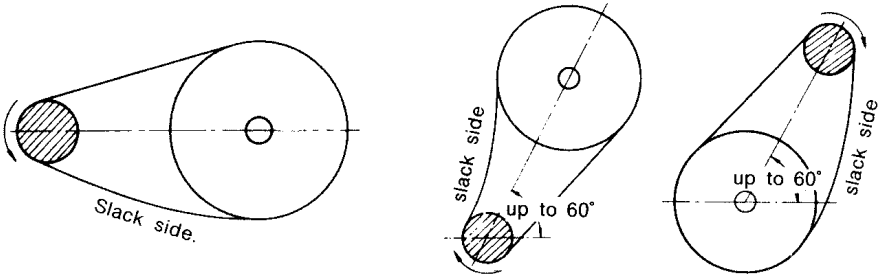


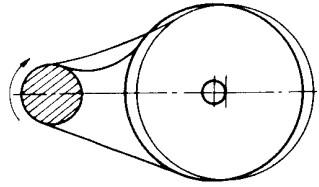
Fig 8-1 General Arrangement (Driving shaft is shown with oblique lines.)

It is best to keep the angle of installation within 60°. If the angle must be over 60°, please refer to No. 3 on the next page.

LAYOUTS REQUIRING ATTENTION

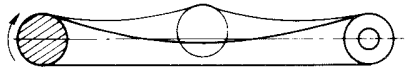
1) If the slack side is on the top, it is necessary to consider the following for eliminating extra chain slack.
   When the driving distance is short, the center distance between the sprockets can be adjusted.

Fig. 8-2 Short Distance



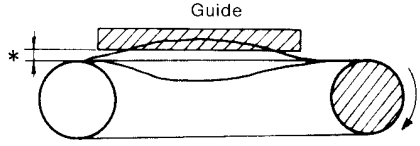
When the center distance is long, chain slack can be adjusted by installing an idler as shown in the diagram below.

Fig. 8-3 Long Distance



2) For pulsating loads caused by high chain speed:
   A stopper will help prevent vibration. The tune of the chain's individual frequency, impact period of driven shaft or cordal action of the chain often cause chain vibration.

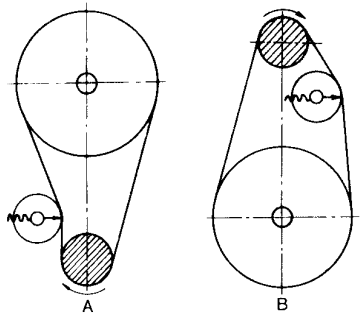
Fig 8-4 Guide Stopper



*Clearance between cham and the guide stopper should be 2mm (5/64") to 4mm (5/32")

3) For vertical centerlines:
   Install an idler to eliminate extra chain slack. When the driving shaft is on the lower side (A), an idler is essential.

Fig. 8-5 Vehicle Centerlines

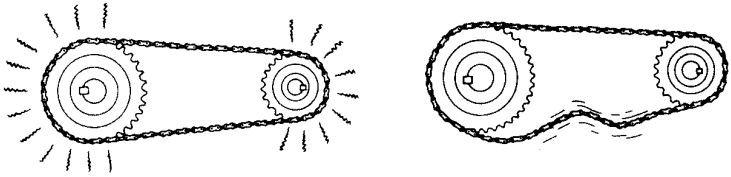


ROLLER CHAIN TENSION

Initial tension for roller chain power transmission is not as critical as for belt transmissions. Generally, roller chain is used with adequate slack. Slack on the lower side is most desirable.

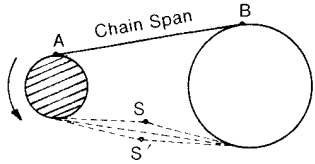
If the chain is tightened excessively, chain damage or rapid use of lubricant may result. If the chain is too loose, damage due to vibration or chain winding, may result.

Fig. 8-6 Improper Chain Tension



Adequate slack (SS) is to be adjusted to 4% of the chain span (AB). For example, if the span is 800mm (31.5"), slack should be 800mm (31.5") X 0.04= 32mm (1.26").

Fig. 8-7 Measuring Chain Slack



For the following cases, slack should be about 2%.

1) Vertical power transmission (idler is required)
2) Distance between the shafts is over 1m (3.3ft)
3) Heavy loads and frequent starting
4) Sudden backward rotation

The chain will elongate slightly from the beginning of initial driving from 0.05% to 0.1% of the full length. As this causes extra slack, adjustment of slack is required. A tensioner can be used to take up the slack or the shaft can be adjusted. After this adjustment, chain elongation should be minimal.

TRIAL RUN

Before regular driving, the following points should be checked by doing a trial run:

1) Fitting of connecting link plate (and spring clip or cotter pin) is proper
2) Chain slack is adequate
3) Lubrication is sufficient
4) Chain does not touch its case
5) There is no abnormal noise
6) Chain does not vibrate excessively
7) Chain does not wind around the sprocket
8) There are no kinks or parts where the chain is stiff. If any problems are found, reinstall the chain and sprocket referring to the "check-points" on pages 15-17.

9. RS ROLLER CHAIN CHECK POINTS

Chain life is generally considered to have expired when the chain does not engage properly with the sprocket due to damage of its parts or elongation. The chain is usually replaced when this occurs. A long working life without unexpected trouble can be achieved if the chain is properly selected for the conditions of its application. To help prevent premature wear or damage, the following points should be checked. Observe the chain and sprockets for these items.

POINTS TO OBSERVE

1) Abnormal Noise
2) Vibration of the chain
3) Chain rising on the sprocket
4) Chain winding around the sprocket
5) Stiff bending of chain, or kinks
6) Amount and condition of lubrication
7) Whether the chain contacts the case
8) Appearance of the chain. Check for dirt, corrosion, damage on the outside surface of the roller, contact marks, etc. Also check the inside and edge surfaces of the linkplate and edge surface of the pin.
9) Damage on the sprocket teeth surfaces and side surfaces of teeth and engaging area
10) Abrasive stretch of the chain
11) Bending of chain and rotation of roller

CHECK POINTS

1) Lubrication

While the chain is driving, check if the lubricating oil moves toward the link plates, and if the chain or rotating disc is immersed in the lubricating oil of the oil bath. When the chain is stopped, check for dirt or abrasive particles produced by improper lubrication. When the chain is removed, the connecting link pin and the edge of the inside of the bushing should be checked. If there is any damage, or a red or reddish brown color can be noticed, lubrication is improper or insufficient.

2) Link Plate

If repeated loads in excess of the allowable load are applied to the chain, there is a strong possibility of fatigue breakage of the link plate. Fatigue breakage is difficult to anticipate until a crack is produced. Usually a crack develops at the edge of a hole or at the side of the link plate, as shown in the illustrations below. The presence of cracks should be checked carefully. Continuous checking can prevent accidents.

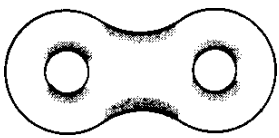


Fig. 9-1 Positions where cracks are likely to develop

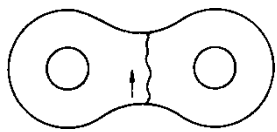


Fig. 9-2 Example of an expanding crack

3) Roller Link

Care should be taken to avoid repeated impact loads over the allowable load as fatigue breakage may occur. The roller should be checked in the same way as the link plate. If foreign objects interfere with the engagement of the roller and sprocket, the roller may be damaged and a crack may develop. Careful attention should be paid to this. Chains damaged due to fatigue breakage must be completely replaced.

Fig. 9-3 Crack produced on the roller

4) Sprocket

Chain and sprocket engagement can be checked by observing the roller and tooth surfaces. The proper margin (A) and improper margin (B) are shown in Fig. 9-4. The installation should also be checked. The normal area where wear will occur is slightly above the bottom of the lowest point between the sprocket teeth. If tension remains on the slack side, the roller will slightly touch the lowest point between the sprocket teeth. When an idler or tightener is used, wear will occur almost directly between the sprocket teeth.

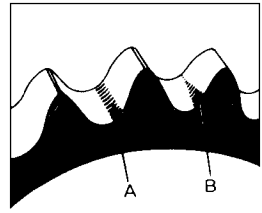


Fig. 9-4 Areas to Check for Sprocket Wear

5) Chain Elongation

Chain stretch is calculated as the total amount of elongation caused by wear on the pin and bushing, but not caused by deformation of the link plate. Remaining chain life can be estimated by measuring chain elongation.

MEASURING CHAIN ELONGATION

1) The chain should be measured by stretching it slightly.
2) Measure the distance, using a vernier, of the inside (L1) and outside (L2) of rollers at both ends of the measured links, to get measurement (L).

$$L=\frac{L1 + L2}{2}$$

3) Chain elongation can then be calculated.

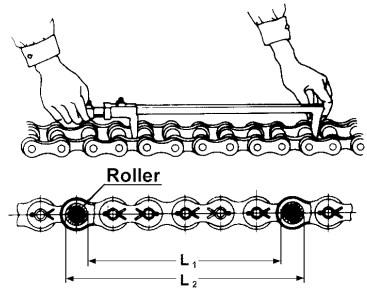


Fig. 9-5 Measuring Chain Elongation

$$\text{Chain Elongation} = \frac{\text{Measured Length - Standard Length}}{\text{Standard Length}} \times 100(\%)$$

Standard Length = Chain Pitch x Number of Links

RS ROLLER CHAIN CHECK POINTS

NOTE: *When measuring, use at least 6 to 10 links to help keep any measuring error to a minimum When measurement cannot be done with a vernier, it is possible, though less accurate, to use a tape measure. If a tape measure is used, the measured length should be as long as possible.*

Table 9-1 Maximum Allowable Chain Elongation

Number of Teeth on Driving Sprocket	Chain Elongation (%)
60 and under	1.5
61~80	1.2
81~100	1.0
100 and over	0.8

Table 9-2 Standard Length and 1.5% Elongation

1mm (inch)

CHAIN SIZE (No.)		RS25	RS35	RS41	RS40	RS50	RS60	RS80
6 link measure	Original	38.10 (1½)	57.15 (2¼)	76.20 (3)	76.20 (3)	95.25 (3¾)	114.30 (4½)	152.40 (6)
	1.5% elongation	38.67 (1.52)	58.01 (2.28)	77.34 (3.05)	77.34 (3.05)	96.68 (3.81)	116.01 (4.57)	154.69 (6.09)
10 link measure	Original	63.50 (2½)	95.25 (3¾)	127.00 (5)	127.00 (5)	158.75 (6¼)	190.50 (7½)	254.00 (10)
	1.5% elongation	64.45 (2.54)	96.68 (3.81)	128.91 (5.08)	128.91 (5.08)	161.13 (6.34)	193.36 (7.61)	257.81 (10.15)
CHAIN SIZE (No.)		RS100	RS120	RS140	RS160	RS180	RS200	RS240
6 link measure	Original	190.50 (7½)	228.60 (9)	266.70 (10½)	304.80 (12)	342.90 (13½)	381.00 (15)	457.20 (18)
	1.5% elongation	193.36 (7.61)	232.03 (9.14)	270.70 (10.66)	309.37 (12.18)	348.04 (13.70)	386.72 (15.23)	464.06 (18.27)
10 link measure	Original	317.50 (12½)	381.00 (15)	444.50 (17½)	508.00 (20)	571.50 (22½)	635.00 (25)	762.00 (30)
	1.5% elongation	322.26 (12.69)	386.72 (15.23)	451.17 (17.76)	515.62 (20.30)	580.07 (22.84)	644.53 (25.38)	773.43 (30.45)

CHECKING CHAIN ACCESSORIES

Check for damage to any metal fittings. It is also important to make sure any metal fittings are as secure as possible. Loose fitting attachments may reduce the life of the chain. Generally, a tolerance up to H8, H9 for the pin hole diameter is permitted.

10. USE UNDER SPECIAL CONDITIONS

Generally, roller chain should be used in relatively clean air and in a temperature of 10°C to 60°C (50°F to 140°F). The following points are for use under temperatures other than the above.

Ambient Temperature	COMMENTS
-50°C to -30°C (-60°F to -20°F)	A special, cold-resistant material should be used for temperatures under -30°C (-20°F).
-30°C to -10°C (-20°F to 15°F)	1) Oil for lubrication under super low temperatures must be used 2) Power transmission efficiency is reduced
60°C to 150°C (140°F to 300°F)	Oil for lubrication under high temperatures is required
150°C to 260°C (300°F to 480°F)	1) Oil for lubrication under very high temperatures must be used 2) Since the abrasion resistance of the chain is reduced, a larger sized chain is recommended
over 260°C (over 480°F)	1) Oil for lubrication under super high temperatures must used 2) Heat resistant steel must be used when the temperature is over 260°C (480°F); otherwise the hardness of the chain will decrease, thereby significantly reducing the chain's strength

USE IN WET CONDITIONS

If the chain is used in a sterilizing machine or water screen, for example, where the chain is splashed with water or goes through heated vapor, the following problems may occur:

1) An increase in abrasive stretch due to improper or insufficient lubrication
2) Shortened life of the chain from oxidization of the chain material

In such cases, the following measures are required:

1) Decrease bearing pressure using a larger sized chain
2) Plating or use of stainless steel
3) Use of a more suitable lubricant

USE UNDER SPECIAL CONDITIONS

USE IN ACIDIC OR ALKALINE CONDITIONS

If the chain is exposed to acids like sulfuric acid or nitric acid, abrasion will increase. Brittleness and breakage may occur due to chemical corrosion being added to the usual mechanical abrasion. Chain is effected more by acid than alkali. Electrochemical corrosion caused by sea water or pit water may also occur. In such cases, the following measures are required depending on the extent of the problem.

1) Plating
2) Use of various kinds of anti-corrosive steel

USE UNDER CONDITIONS WHERE ABRASION IS A PROBLEM

Chain abrasion may occur if strong abrasive materials such as sand, coke, and metal particles get on the chain or when dust is in the air. Particles can get into the moving parts or the areas where the chain and sprocket engage. In this case, the following measures are required:

1) Reduce bearing pressure by using a larger sized chain
2) Increase abrasion resistance by applying special processing to parts of the chain where abrasion is a problem

11. HOW TO CONNECT RF CONVEYOR CHAIN

Unless otherwise specified, new conveyor chains are usually supplied in 3m (10ft.) lengths to facilitate handling. The chain is made in even numbers of pitches, with an inner link at one end and an outer link at the other end, so they may be easily joined together.
To connect the chain:

1) First fit the pinholes of the outer link plate to the bushing holes to be connected and insert the pins.

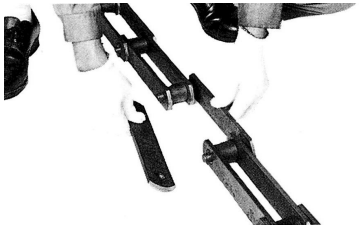


Fig. 11-1 Inserting the Pins

2) Hold the counter plate with a hammer (A) and tap the pinheads with another hammer (B) until the pins are completely inserted into the link plate.

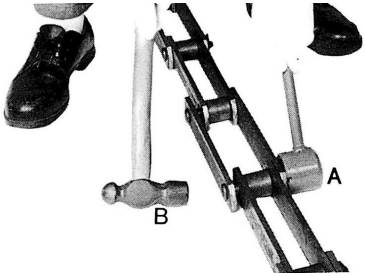


Fig. 11-2 Putting on the Link Plate

3) Insert new T-pins or cotter pins into the bearing pins and bend the ends to prevent loosening.

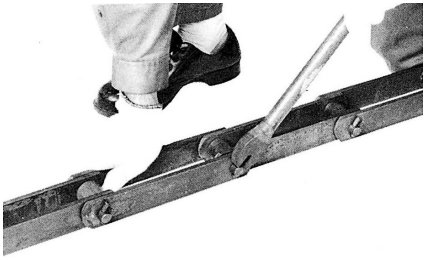


Fig. 11-3 Inserting New T-Pins or Cotter Pins

4) Check that the chain has smooth flexibility and no kinks

12. HOW TO DISCONNECT RF CONVEYOR CHAIN

Like RS Roller Chain, Tsubaki RF Conveyor Chain can be easily taken apart either manually or with a vise or chain breaker.

1) Begin by removing the bent T-pin or cotter pins where the chain is to be cut.

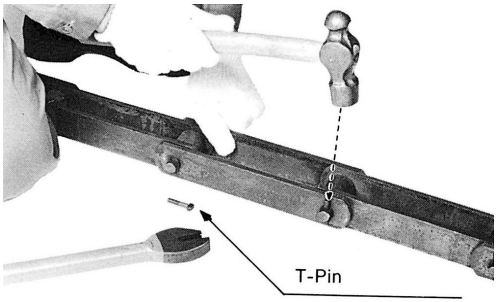


Fig. 12-1 Removing the T-Pin or Cotter Pins

2) Hold the link plate with a tool on the pin head side and from the opposite side, with another hammer, tap the pin end until the pin is dislodged.

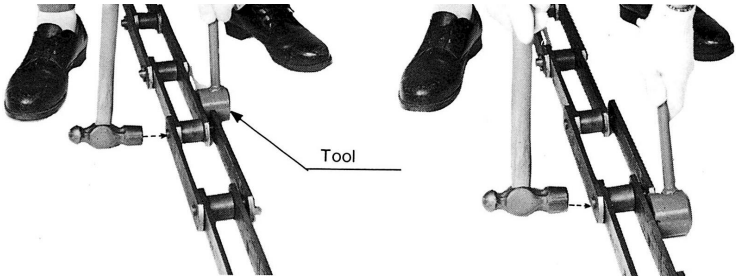


Fig. 12-2 Dislodging the Pins

3) The chain can now be disconnected.

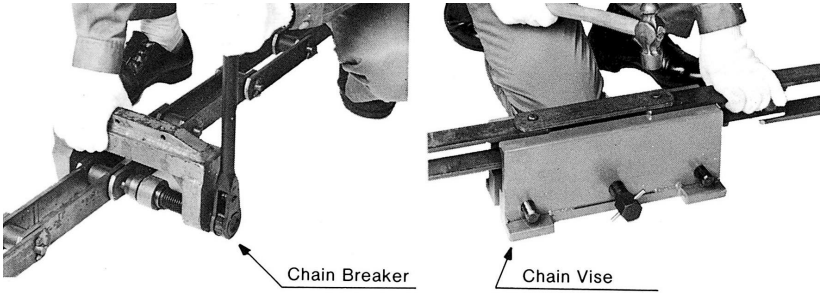
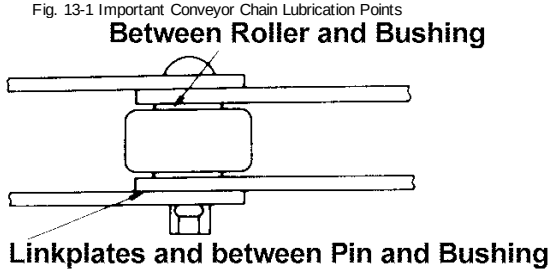


Fig. 12-3 Using a Chain Breaker and Chain Vise

13. RF CONVEYOR CHAIN LUBRICATION

As with other power transmission chains, Tsubaki Conveyor Chains require proper lubrication. Good lubrication reduces wear, economizes horsepower and works to reduce chain pulsation. Lubrication should be applied once a week by dripping or brushing Turbine Oil #75~#120 into crevices as shown below. For conveyor chains with grease pockets, grease should usually be supplied once every six months.

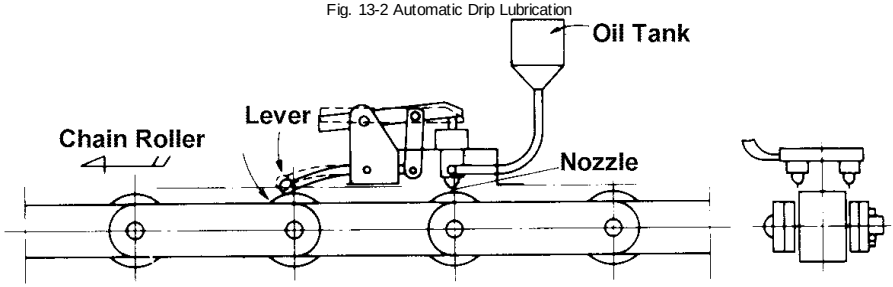
Fig. 13-1 Important Conveyor Chain Lubrication Points



AUTOMATIC LUBRICATION SYSTEM

An automatic lubrication system can be used to save labor or when manual lubrication is impossible due to the location of the chain.

Fig. 13-2 Automatic Drip Lubrication



The automatic drip lubrication system pictured above utilizes the chain roller as a cam. The roller pushes up the lever of a pump as it passes by and causes the oil to drip.

This lubricator, however, cannot be used when the conveyor chain is used as an overhead trolley conveyor or when the chain requires many points to be lubricated. In these cases, a mist type lubricator operated by compressed air is recommended. For coil conveyor chain, an automatic grease feeder is available.

WHERE LUBRICATION IS INEFFECTIVE

Lubrication is ineffective, in most cases, for bulk conveyors that convey powdery and granular materials. For Flow or Trough Conveyors, the chain buries itself in the material as it moves in the conveying direction. Dust or other particles become embedded in the chain and reduce or eliminate any lubricative effect of the oil.

14. RF CONVEYOR CHAIN INSTALLATION AND LAYOUT

ADJUSTMENT OF CHAIN TENSION

The correct amount of chain slack is essential for proper operation of the chain. When the chain is too tight, working parts such as chain, sprocket wheel, shaft, bearing, etc. carry a much heavier load. On the other hand, too much slack is also harmful and causes the chain to climb the sprocket teeth.

FREQUENCY OF ADJUSTMENT

The chain has a tendency to stretch a certain amount at the beginning of operation due to slight distortion of its component parts. After such initial elongation, the chain stretches slightly, but constantly, by normal wear. To maintain proper chain tension, adjustments, if necessary, should be made at regular intervals. Neglect of careful inspection increases the chance of an accident.

Frequency of adjustment:

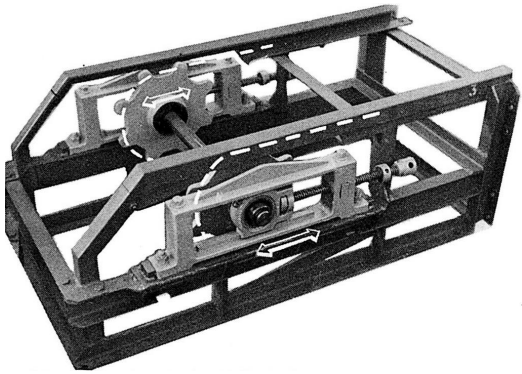
1st week	once a day
2nd~4th week	twice a week
Thereafter	twice a month

NOTE: *The above frequency schedule is based on 8 hours operation a day. When working hours are increased, the frequency of adjustment should be increased accordingly.*

EVEN ADJUSTMENT OF TAKE-UP ON BOTH SIDES

This can be easily accomplished when take-ups are cooperating screw type or counterweight type. Where two parallel chains are adjusted by two independently operated take-ups, care must be taken to ensure even stroke on both the left and right side. An uneven adjustment will cause the link plate and the side of the sprocket teeth to interfere with each other and result in an overload condition.

Fig. 14-1 Take-up units



INSUFFICIENT TAKE-UP ADJUSTMENT

If the chain is still too long after complete adjustment of the take-up, shorten it by taking off two links.

ADJUSTMENT OF CHAIN TENSION FOR FLOW CONVEYOR

F Type Flow Conveyor

Proper chain tension for the Tsubaki F Type Flow Conveyor can be determined by the following formula:

1) When material to be conveyed is within the normal temperature range:

$$h = \frac{1}{8} L$$

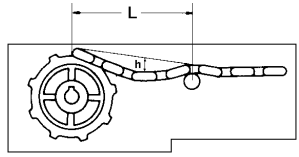
The amount of chain slack just behind the head sprocket should be h, where L=distance between the sprocket and take-up.

2) When material to be conveyed has a high temperature range:

$$h = \frac{1}{16} L$$

When adjusting the chain slack it is best to have two people working as a team. Exchanging signals with each other, one person observes chain slack at the head section and the other person adjusts the take-ups at the tail section. Adjustment should be made for a normal loaded condition.

Fig. 14-2 Measuring Chain Slack



L Type & S Type Flow Conveyor

Chain tension for the Tsubaki L Type and S Type Flow Conveyors is adjusted by inspecting the chain slack through the inspection door located at the side of the curved section of the casing. The chain slack should be adjusted such that it is in the center of the curved section. Too much tension will cause the chain to rub against the casing, and excessive slack will result in chain breakage due to entanglement. Proper chain slack can be calculated in the following ways:

1) When material to be conveyed is normal temperature:

$$a = \frac{1}{2} L$$

2) When material to be conveyed has a high temperature:

$$a = \frac{1}{4} L$$

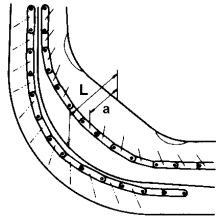


Fig. 14-3 Chain Slack for L-Type & S-Type Flow Conveyors

15. LIFE OF RF CONVEYOR CHAIN AND SPROCKET

After a certain period of time, wear will eventually appear on the chain and sprocket. The life of conveyor chain depends on the wear of each component part and on pitch elongation. Careful inspection is required more often than for power transmission roller chain.
The life of the conveyor chain component parts is shown below. Tsubaki recommends that periodic inspections of the wearing parts are conducted and that care be taken to ensure that proper maintenance is carried out. Also, a schedule for changing the chains should be established.

ROLLER LIFE

When wear between the rail, bushing and roller causes the under surface of the link plate to contact the rail, the chain has usually reached the end of its useability. As shown in Fig. 15-1, when the link plate starts contacting the rail, rolling contact suddenly turns into sliding contact between the link plate and rail, resulting in greater wear, an increase in chain tension and a reduction in transmitted horsepower. Such wear generally appears on horizontal or inclined apron conveyors, slat conveyors, etc.

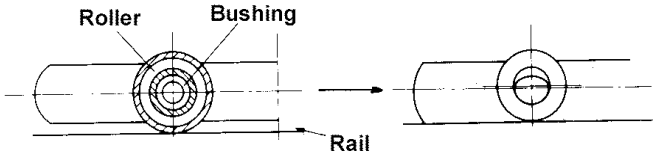


Fig. 15-1 Roller Wear

Where a curved section of rail is provided, the allowed wear amount is decreased by a dimension equivalent to “S”. More care must be taken to observe wear than with horizontal sections.

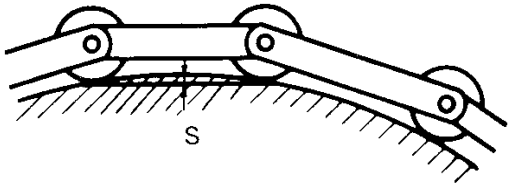


Fig. 15-2 Wear on a curved rail section

The chain life has expired as soon as holes or crevices appear on the rollers due to wear.

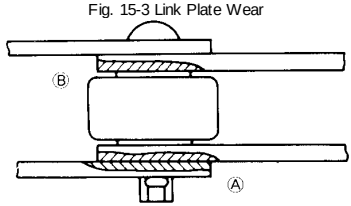
BUSHING LIFE

Bushings are generally useable until holes appear. Holes may appear as a result of conveying very abrasive materials such as iron ore powder, coke, etc.

LINK PLATE LIFE

Reciprocal friction between inner and outer link plates and contact between side surfaces of rollers and inside surfaces of link plates causes wear as indicated by (A) and (B) in Fig. 15-3.

Fig. 15-3 Link Plate Wear

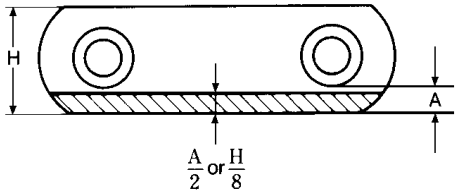


If the amount of wear exceeds 1/3 of the original plate thickness, the tensile strength of the chain will be reduced. When link plate wear appears faster than wear of other component parts, misalignment of the conveyor during installation is the cause in most cases. Misalignment can also develop during operation of the conveyor. Therefore, careful inspection is required to ensure maximum working life: Please check the following items:

a. Correct alignment of driving and driven sprockets
b. Correct alignment of shafts in horizontal and vertical planes
c. Preciseness of level gauge and accurate leveling

With Tsubaki Flow Conveyor Chain, the link plate moves directly on the material to be conveyed or on a steel plate casing. The working life expires when the worn section equals A/2, or H/8 as shown in Fig. 15-4.

Fig. 15-4 Maximum Allowable Link Plate Wear



CHAIN PITCH ELONGATION

When the chain engages with the sprocket or runs on a curved rail section, the chain flexes causing the chain to stretch. In most cases, this is due to wear of the bearing parts such as the pins and bushings. As chain pitch elongation increases, the chain tends to climb the top of sprocket. This makes smooth operation of the conveyor impossible. The limit of pitch elongation is generally 2% of the chain pitch.

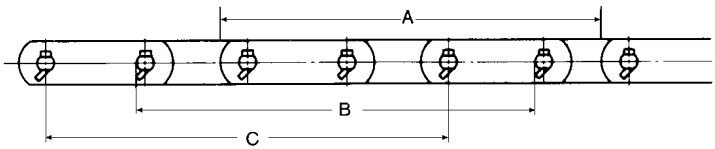
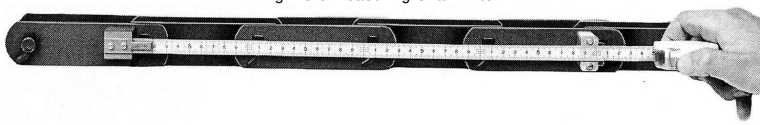


Fig. 15-5 Places to Measure Chain Elongation

Fig. 15-6 indicates the way to measure chain pitch. Using a steel tape measure, measure as many pitches as possible (at least 4 pitches required). Measuring points should be properly determined according to (A), (B) or (C) in Fig. 15-5, depending on the wear condition of the conveyor chain. The chain pitch elongation per link is to be computed by comparing the actual pitch measured against the original chain pitch.

Fig. 15-6 Measuring Chain Pitch

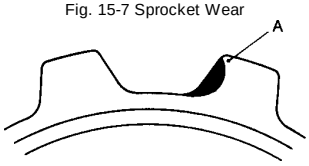


SPROCKET LIFE

When the spocket is worn, the chain tends to cling to the sprockets and vibrate. The amount of allowable wear depends on the conveyor type and chain size, but generally, wear to a depth of 3mm (0.12") to 6mm (0.24") is a sign that the existing sprocket should be repaired or replaced with a new one to ensure continued chain life. One of the following means may be used to extend sproket life:

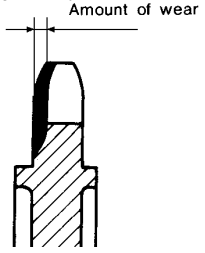
a. Cut section (A) shown in Fig. 15-7 with a grinder.
b. Reverse the sprocket to change the engaging area of the tooth.
c. Surfacing can be made using a welding rod to obtain the correct tooth profile. After making the lower layer with a low hydrogen type welding rod, use the welding rod (Example: Shinko HF600~ 900) to make the upper layer. However, it is more effective to replace the existing sprocket with a new one.

Fig. 15-7 Sprocket Wear



If the sprocket teeth are worn as shown in Fig. 15-8, the alignment of the sprockets may be incorrect. Proper axial alignment of the sprockets will help reduce or even eliminate this type of wear.

Fig. 15-8 Sprocket Tooth Wear



WEAR CHARACTERISTICS OF CONVEYOR CHAIN

[1] Mechanical wear

When conveyor chain is used under reasonable conditions and a normal atomosphere, mechanical wear causes the bearing surface of the chain to shine brightly. With proper lubrication, further life can be assured.

[2] Wear caused by conveyed material

Material having excessive wear characteristics tends to stick to the chain and to wear the surface of the chain due to reciprocal friction between the material and chain. Under such conditions, care should be taken to prevent material from falling on the chain. For extra protection, chains should have higher wear resistant specifications.

[3] Wear due to corrosion

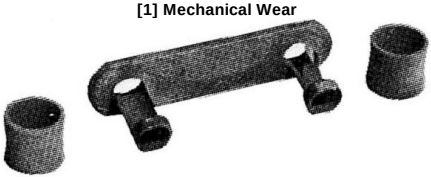
Conveyor chain used in applications where acidic or alkaline chemicals are present, will be subject to corrosive wear as well as mechanical wear. To protect against the chemical corrosion accompanying mechanical wear, stainless steel is recommended.

[4] Electrochemical corrosion

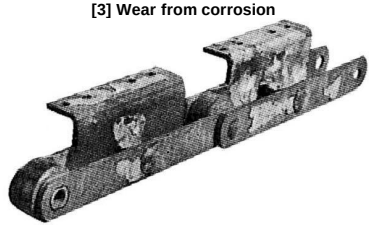
When the chain is splashed with water, and then enters chemical solutions, the surface of the sliding area (i.e., Pin/Bush, Bush/Roller) is exposed to electrochemical corrosion, one of the most damaging types of corrosion. Tsubaki is constantly researching ways to improve the performance of our chains by testing combinations of different materials. Please inquire about our line of special materials.

Fig. 15-9 Types of Wear

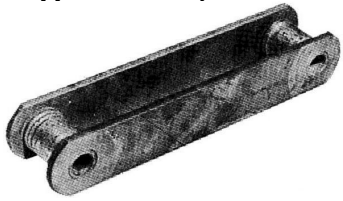
[1] Mechanical Wear



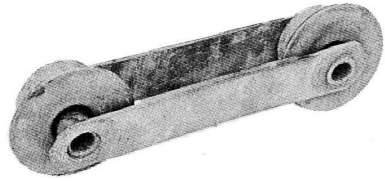
[3] Wear from corrosion



[2] Wear from conveyed materials



[4] Electrochemical corrosion



16. RF CONVEYOR CHAIN CHECK POINTS

MAINTENANCE CHECK POINTS

Check Points	Comments
Centering	A high precision guide rail is essential to ensure proper centering of the conveyor. If centering is not accurate (with no side guide rail), the conveyor chain will wobble and weave resulting in shorter conveyor chain life.
Sprocket alignment	When two or more sprockets are installed in a row, be sure to align the position of the sprocket teeth. If the sprocket teeth are not properly aligned, the working load will not be equally divided and will cause the chain to twist.
Take-up	If take-ups on both sides are uneven, the conveyor chain will not engage smoothly with the sprocket.
Initial chain tension	Maintain adequate chain slack. If chain tension is too high, loss of power will result. This is a dangerous situation and if too loose, the chain will climb the sprocket.
Trial run	An unloaded trial run should be conducted after installation by switching the system on and off several times intermittently. After inspection, continuous operation may begin.
Stopping the conveyor	The conveyor should be stopped when it is not loaded, otherwise the conveyed material may cause an overload when the conveyor starts again.
Lubrication	Except for conveyor chain like the Flow Conveyor, which runs without lubrication, conveyor chain should be lubricated periodically. Lubrication of the reducer, bearing, and driving roller chain is also essential.
Securing conveyor parts	Parts fastened to the conveyor such as buckets, aprons, slates, etc. are apt to loosen due to vibration. Pay careful attention to fastening nuts and bolts securely. Be sure to check periodically.

RF CONVEYOR CHAIN CHECK POINTS

Check Points	Comments
Amount of chain slack	Regularly check and adjust the amount of chain slack.
Temperature and prevention of freezing	When differences in temperatures (summer and winter or between day and night in the winter) are very severe, conveyor damage may occur. Under these circumstances, operate the conveyor carefully taking any variations in temperature into account.
Record of conveyor use and maintenance	After installing the conveyor, prepare a record of the expected capacity to be conveyed, the conveyor's speed, r.p.m. of the main shaft, electric current, voltage, working hours, actual conveying capacity, inspection date, lubricating date, details of trouble, etc. This will serve as protection against unexpected accidents. This record will also be convenient for maintenance and repairs.

17. WARNING

WARNING

USE CARE TO PREVENT INJURY

COMPLY WITH THE FOLLOWING

TO AVOID SERIOUS PERSONAL INJURY

1) Guards must be provided on all chain and sprocket installations in accordance with provisions of ANSI/ASME B15.1 – 1992 "Safety Standards for Mechanical Power Transmission Apparatus," and ANSI/ASME B20.1 – 1993 "Safety Standards for Conveyors and Related Equipment," or other applicable safety standards. When revisions of these standards are published, the updated edition shall apply.
2) Always lock out power switch before installing, removing, lubricating or servicing a chain system.
3) When connecting or disconnecting a chain:
   a. Eye protection is required. Wear safety glasses, protective clothing, gloves and safety shoes.
   b. Support the chain to prevent uncontrolled movement of chain and parts.
   c. Use of pressing equipment is recommended. Tools must be in good condition and properly used.
   d. Determine correct direction for pin/rivet removal or insertion.