

U.S. TSUBAKI ATTACHMENT CHAIN SELECTION GUIDE

SELECTION PROCEDURE

Attachment Chain Selection Guide

U.S. Tsubaki ANSI single and double pitch roller chain is widely used for conveyor service. The following procedure is useful for economical and quick chain selection.

- Step 1 :** Confirm the operating conditions of the conveyor
- Step 2 :** Tentatively select the chain size
- Step 3 :** Calculate the design chain tension (actual chain tension)
- Step 4 :** Verify the chain selection
- Step 5 :** Verify the allowable roller load

Step 1 Confirm the operating conditions of the conveyor

The following information is needed to design a chain conveyor.

- ① Type of conveyor (slat conveyor, bucket elevator, etc.)
- ② Method of chain travel (horizontal, inclined, or vertical conveyor)
- ③ Type, weight, and size of materials to be conveyed
- ④ Weight of materials to be transported per foot of conveyor length
- ⑤ Conveyor speed
- ⑥ Conveyor length
- ⑦ Lubrication
- ⑧ Considerations for special environments

Step 2 Tentatively select chain size

To tentatively select the chain size, estimate the chain tension (T) by the following formula. A chain with an allowable load equal to or over the above calculated chain tension may be tentatively selected.

$$T \text{ (lbs.)} = M_T \cdot f \cdot k_1 \dots\dots\dots (1)$$

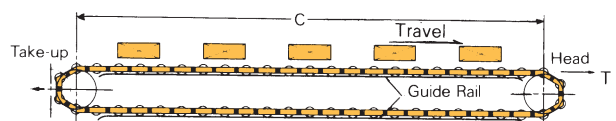
- M_T : Total weight of material conveyed (lbs.)
- f : Coefficient of friction, sliding and/or rolling
(f_1 and/or f_2 of Table I and II)
- k_1 : Chain speed coefficient (Table III)

Step 3 Calculate chain tension

Next, the chain tension should be calculated using the actual weight of the conveyor chain and material conveyed, as shown below.

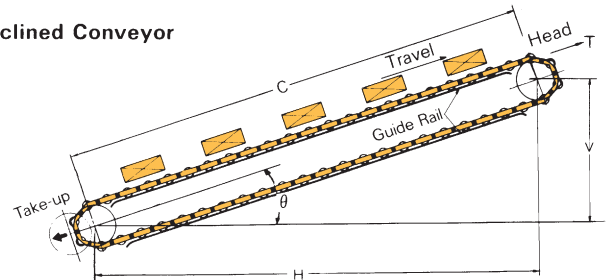
1. Chain rolling

Horizontal Conveyor



$$T = (M + 2.1w)f_1C \dots\dots\dots (2)$$

Inclined Conveyor



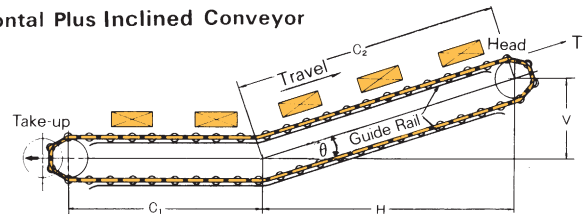
$$T = (M + w)(f_1C\cos\theta + C\sin\theta) + 1.1w(f_1C\cos\theta - C\sin\theta) \dots\dots\dots (3)$$

When $(f_1C\cos\theta - C\sin\theta) < 0$, $1.1w(f_1C\cos\theta - C\sin\theta) = 0$

$$\text{or } T = (M + w)(V + f_1H) + 1.1w(f_1H - V) \dots\dots\dots (4)$$

When $(f_1H - V) < 0$, $1.1w(f_1H - V) = 0$

Horizontal Plus Inclined Conveyor



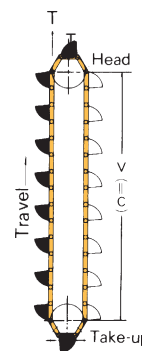
$$T = (M + 2.1w)f_1C_1 + (M + w)(f_1C_2\cos\theta + C_2\sin\theta) + 1.1w(f_1C_2\cos\theta - C_2\sin\theta) \dots\dots\dots (5)$$

When $(f_1C_2\cos\theta - C_2\sin\theta) < 0$, $1.1w(f_1C_2\cos\theta - C_2\sin\theta) = 0$

$$\text{or } T = (M + 2.1w)f_1C_1 + (M + w)(V + f_1H) + 1.1w(f_1H - V) \dots\dots\dots (6)$$

When $(f_1H - V) < 0$, $1.1w(f_1H - V) = 0$

Vertical Conveyor

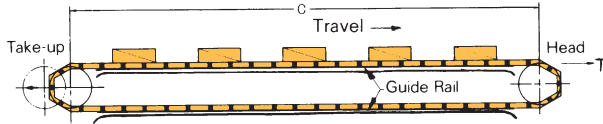


$$T = (M + w)V \dots\dots\dots (7)$$

B - CONVEYOR CHAINS

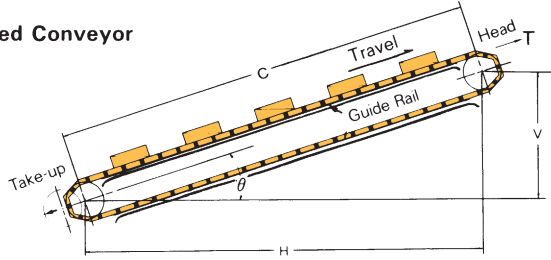
2. Chain sliding

Horizontal Conveyor



$$T = (M + 2.1w)f_2C \dots\dots\dots (8)$$

Inclined Conveyor



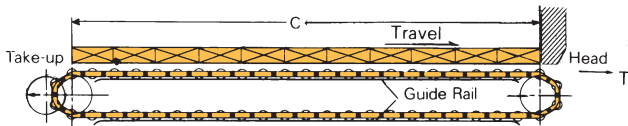
$$T = (M + w)(f_2C\cos\theta + C\sin\theta) + 1.1w(f_2C\cos\theta - C\sin\theta) \dots\dots\dots (9)$$

When $(f_2C\cos\theta - C\sin\theta) < 0$, $1.1w(f_2C\cos\theta - C\sin\theta) = 0$

or $T = (M + w)(V + f_2H) + 1.1w(f_2H - V) \dots\dots\dots (10)$

When $(f_2H - V) < 0$, $1.1w(f_2H - V) = 0$

Horizontal Conveyor for Top Roller Chain and Plastic Outboard Roller Chain



$$T = \left\{ M(f_1 + f_2) + 2.1w \frac{f_1 + f_2}{2} \right\} C \dots\dots(11)$$

3. Calculate the required power

Calculate the required power to drive the conveyor from the following formula.

Horizontal and/or Inclined Conveyor

$$HP = \frac{T \cdot S}{33,000 \times \eta} \dots\dots\dots(12)$$

Vertical Conveyor

$$HP = \frac{M \cdot V \cdot S}{33,000 \times \eta} \dots\dots\dots(13)$$

Where.

- T = Chain tension (lbs.)
- w = Weight of chain and attachments per ft.(lbs./ft.)
- M = Weight of material conveyed per ft.(lbs./ft.)
- V = Vertical center distance of conveyor (ft.)
- H = Horizontal center distance of conveyor (ft.)
- C = Center distance between sprocket (ft.)
- f₁ = Coefficient of rolling friction between chain and guide rail (Table I)
- f₂ = Coefficient of sliding friction between chain and guide rail (Table II)
- η = Transmission efficiency
- S = Speed = $\frac{P \cdot N \cdot n}{12}$ (ft./min.)
- P = Chain pitch (inch)
- N = Number of teeth
- n = Sprocket speed (rpm)

Table I : Coefficient of Rolling Friction (f₁)

Type of Roller	Dry	Lubricated
Oversize "R" roller type	0.12	0.08
Standard "S" roller type	0.21	0.14
Top roller type	0.09	0.06

Table II : Coefficient of Sliding Friction (f₂)

Dry	Lubricated
0.3	0.2

Step 4 Verify chain selection

Multiply the chain tension (T) by the chain speed coefficient (K₁) listed in Table III and verify the following formula.

$T \cdot K_1 \leq$ Max. allowable load of the chain (14)

Table III : Chain Speed Coefficient (K₁)

Chain Speed (ft./min)	Speed Factor (K ₁)
0 ~ 50	1.0
50 ~ 100	1.2
100 ~ 160	1.4
160 ~ 230	1.6
230 ~ 300	2.2
300 ~ 360	2.8
360 ~ 400	3.2

When the design chain tension (T • K₁) is over the allowable load or much less than it, try the same steps again for the next bigger or smaller chain size to select a more suitable chain.

Step 5 Verify the allowable roller load

When the load is carried on the rollers, the total weight of the chain and load per roller should not exceed the allowable roller load shown in Table IV.

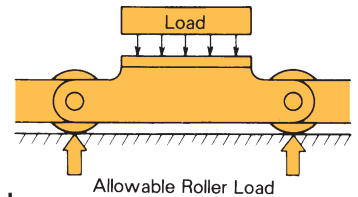


Table IV : Allowable Roller Load

Chain No.	Allowable Roller Load lbs./roller		
	Oversize Roller	Plastic Oversize Roller	Standard Roller
C2040 RS40	143	44	33
C2050 RS50	220	66	44
C2060H RS60	350	110	66
C2080H RS80	590	198	120
C2100H RS100	880	286	180
— RS120	1,320	—	260
— RS140	—	—	300
C2160H RS160	2,160	—	430

Note: Oversize "R" rollers are available only for double pitch roller chains.

U.S. Tsubaki Hi-Tech and Specialty Attachment chains.

In addition to the attachment chains shown in this general catalog, we offer a large variety of Specialty Attachment chains. Refer to our U.S. Tsubaki Attachment Chain Catalog No. LI0666 for additional selections.