[Technical Data]
Free Flow Chain / Table Top Chain Selection

■Selection Procedure for Free Flow Conveyor Chains

[Step 1] Confirm Usage Condition

Confirm that the following conditions are true.
Temp.: -10°C ~ +80°c
Chain Velocity: 5~15m/min
Conveyor Length: 15m or less
Environment: No abrasive dusts, corrosive gasses, or high humidity

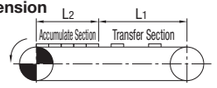
[Step 2] Finalize Chain Selection

Calculate Transferred Item Mass per 1m, and select a chain satisfying the Allowable Load Mass from the table below.
$WA(kg/m)=(W_1+W_2)/PL$
WA: Transferred Item Mass per 1m (kgf)
W_1: Workpiece Mass (kgf)
W_2: Pallet Mass (kgf)
P_L: Pallet Move Distance (m)

Table 1 Allowable Load Mass

Chain	Allowable Load Mass (kgf/m)
WCHE3	30
WCHE4	55
WCHE5	75

[Step 3] Confirm Allowable Tension



$T=G/1000\times(Hw+Cw)L_1 \cdot fc+Aw \cdot L_2 \cdot fa+(Aw+Cw)L_2 \cdot fr+1.1Cw(L_1+L_2) \cdot fc$

T: Max. Tension Applied on Chain (kN)
L_1: Transfer Section Length (m)
L_2: Accumulation Section Length (m)
Hw: Transfer Section Transferred Mass including pallets (kg/m)
Aw: Accumulation Section Transferred Mass including pallets (kg/m)
Cw: Chain Weight (kg/m)
fa: Friction Coefficient of Transferred Item and Chain During Accumulation
fc: Friction Coefficient of Chain and Rail
fr: Friction Coefficient of Chain and Rail During Accumulation
G: Gravitational Acceleration=9.80665 (m/s^2)

Table 2 Friction Coefficient of Free Flow Conveyor Chains

	Friction Coefficient
fa	0.10
fc	0.08
fr	0.20

(T) Max. Tension Applied on Chain is multiplied with (Table 3 K_1) Velocity Factor and (Table 4 K_2) Transferred Item Load Factor.
Tension per single chain is calculated (Two chains typically used for free-flow conveyors).
Allowable Chain Tension ≥ $(T\times K_1\times K_2)/2$
If the calculated result exceeds the allowable tension of selected chain, re-select a chain one size larger or re-calculate with conveyor length divided into shorter sections.

Table 3 Velocity Factor Table

Chain Velocity m/min.	Factor K_1
1~4 or less	1.0
Over 4, 8 or less	1.1
Over 8, 10 or less	1.2
Over 10, 14 or less	1.5
Over 14, 18 or less	1.6

Table 4 Transferred Item Load Factor

Average Transferred Item Weight Wa (kg/m)	Factor K_2
30 or less	1.00
31~40	1.10
41~50	1.15
51~70	1.20
71~90	1.25
91~120	1.35

Table 5 Max. Allowable Tension for Free Flow Conveyor Chains

Chain Velocity m/min.	Allowable Tension (kN)
WCHE3	0.55
WCHE4	0.88
WCHE5	1.37

■Selection Procedure for Table Top Conveyor Chains

[Step 1] Calculate Effective Tension (Fe)

$Fe=g \cdot (m \cdot Lc \cdot \mu R+(m+M) \cdot (Lc-A) \cdot \mu R+MA \cdot A \cdot (\mu c+\mu R)+m \cdot A \cdot \mu R)$

Fe: Effective Tension (N)
Lc: Conveyor Length (m)
A: Accumulation Span Length (m)
* A=0 when there is no Accumulation.
M: Mass of Transferred Item
MA: Mass of Transferred Item for Accumulation Section
m: Chain Mass (kg/m)
μc: Dynamic Friction Coefficient of Chain and Transferred Item
μR: Dynamic Friction Coefficient of Chain and Rail
g: Gravitational Acceleration=9.80665 (m/sec^2)

Table 1 Friction Coefficient

Lubrication Method	Material of Transferred Item				
	Steel	Aluminum	Glass	Paper	Plastic
Dry	0.25	0.2	0.15	0.3	0.2
Soap Water	0.15	0.12	0.1	–	0.15

Lubrication Method	Gide Rail Material			
	Steel	Stainless steel	UHMW Polyethylene	Nylon
Dry	0.2	0.2	0.15	0.2
Soap Water	0.12	0.12	0.1	0.14

*The Friction Coefficients above are estimated values with safety ratio added, for use as tension calculation components.

[Step 2] Calculate Post-adjusted Tension based on conditions

$Fs=Fe \cdot Cs$

Fs: Post-adjusted Tension (N)
Cs: Load Correction Factor

For frequent starts and stops	=1.2
For wear intensive applications	=1.2
For multiple row use	=1.25
For other than above	=1.0

[Step 3] Calculate Chain Allowable Tension

$Fadm=FN \cdot Va \cdot Ta$
Fadm: Allowable Tension (N)
FN: Max. Allowable Tension (N)
Va: Velocity Factor
Ta: Temperature Factor

Table 2 Maximum Allowable Tension

Type	Nominal	Max. Allowable Tension (N)
TPCH	826	1650
	1143	

Table 3 Velocity Factor

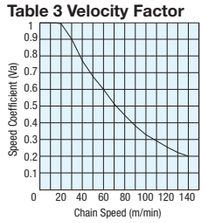
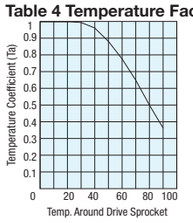


Table 4 Temperature Factor



[Step 4] Compare Allowable Tension and Post-adjusted Tension

If Fs≤Fadm, the selection is applicable.

[Step 5] Calculating Required Power

$P=Fs \cdot V/(60 \cdot \eta)$
P: Required Power (W)
V: Chain Velocity (m/min)
η: Transmission Efficiency

[Technical Data]
Selection of Flat Belts

Allowable Stress for Tension Member

Check the belt that is selected for allowable stress, using the following procedures.

1. Calculating the Effective Tension

The effective tension of a belt can be calculated using Formula 1.

Formula1 $F=f(W_G+W_1+W_2)L+f(W_1+W_3)L\pm W_G \cdot H$

(Carrier Side) (Return Side) (Vertical Side)

F: Effective Tension
f: Rolling friction coefficient of rollers, or friction coefficient between belt and supports (Select from Table -1)
ωG: Weight of Carried Materials per Meter of Belt kg/m
ω1: Weight of belt per Meter kg/m
ω2: Carrier Roller Weight per 1m kg/m (Select from Table -2)
ω3: Return Roller Weight per 1m kg/m (Select from Table -2)
L: Conveyor Horizontal Length m
H: Vertical Height (+Up angle, -Down angle) m

Table of f Values(Table 1)

Belt Surface in Contact with Supports	Smooth	Cloth Surfaced
Roller Support	0.05	0.05
Roller+Steel Plate Support	0.2	0.3
Steel Supported (SUS·SS)	0.4	0.5
Plywood Support	0.5	0.6

(When knife edges are used, add 0.2 to the above values in Table -1.)

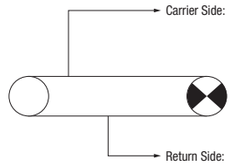


Table of Roller Weight (Table 2)

Roller Dia. (mm)	Single Roller (kg/roller)	Allowable Load (kg/roller)
28.6	0.2	50

Table-2 shows the weight of the revolving parts of a roller that meets (JISB8805-1965).
For accurate calculation, check the actual weight of the roller being used.

2. Power Requirement

Formula 2 $P=\dfrac{F \cdot V}{60000}$

P: Power Requirement kW
F: Effective Tension N
V: Belt Speed m/min
60000: 60×102 (Constant)

3. Motor Power

Formula 3 $Pm=\dfrac{P}{\eta}$

Pm: Motor Power kW
P: Power Requirement kW
η: Mechanical Efficiency (Standard Mechanical Efficiency Range: 0.5~0.65)

For efficient operation, it is recommended to check the motor property if the motor for use has a power rating less than 0.1kW.

4. Using the Tension on the Loose Side to Calculate Maximum Tension

Formula 4 $F_{M1}=F \cdot K$

F_{M1}: Maximum Tension N
F: Effective Tension N
K: Coefficient

Using Value μ selected from Table-3 and the wrap angle (θ), select value K from Table-4.
(When the wrap angle (θ) is not listed in Table 4, Calculate from)

$K=\dfrac{e^{\mu\theta'}}{e^{\mu\theta'}-1}$

μ: Friction coefficient between driving pulley and belt (Select from Table-3)
e: Base of Natural Logarithm (2.718)
θ': Radian ($\theta'=\theta\times\dfrac{2\pi}{360}$)

List of μ values (Table-3)

Pulley Surface \ Surface Shape in Contact with Pulley		Smooth	Cloth Surfaced
Bare Steel Pulley	Dry	0.2	0.3
	Wet	0.15	0.2
Rubber Ranking Pulley	Dry	0.3	0.35
	Wet	0.2	0.25

Table of Value K Based on Wrap Angle (θ) (Table-4)

θ° \ μ	0.1	0.15	0.2	0.25	0.3	0.35	0.5
180	3.8	2.7	2.2	1.9	1.7	1.5	1.3
190	3.6	2.6	2.1	1.8	1.6	1.5	1.3
200	3.4	2.5	2.0	1.8	1.6	1.5	1.3
210	3.3	2.4	2.0	1.7	1.5	1.4	1.2
220	3.2	2.3	1.9	1.7	1.5	1.4	1.2
230	3.1	2.3	1.9	1.6	1.4	1.4	1.2

5. Using Pretension to Calculate Maximum Tension

Formula 5 $F_{M2}=F+B \cdot Tc$

FM2: Maximum Tension N
B: Belt Width cm
TC: Initial Tension N/cm (Select from Table-5)

Table of Tc Values (Table-5)

No. of Tension Members (No. of Plys)	1 Pc.
Initial Tension (N/cm)	1.5

Compare F_{M1} (Formula 4) and F_{M2} (Formula 5), and Make the larger as the Max. Tension FM.

6. Allowable Stress

Formula 6 $C\geq\dfrac{F_M}{B}$

C: Allowable Stress for Belt N/cm
FM: Effective Tension kg
B: Belt Width cm

When the allowable stress for the belt being used is equal to or higher than the maximum tension per 1cm width of the belt as expressed by Formula 6 above, the belt is suitable for use.