[Technical Data]
Double Speed Chain / Table Top Conveyor Chain Selection

Selection Procedure for Double Speed Chains

[Step 1] Confirm Usage Condition

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

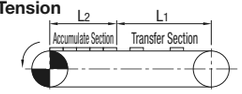
[Step 2] Determine Chain

Based on the result from calculation of conveyed object mass per square meter, select a chain that satisfies the requirements for the allowable load mass.
WA(kg/m)=(W_1+W_2)/PL
WA: Conveyed Object Mass per Square Meter (Kgf)
W_1: Workpiece Mass (kgf)
W_2: Pallet Mass (kgf)
P_L: Pallet Travel Length (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: Conveyed Object Mass on Transfer Section, including that of pallets (kg/m)
Aw: Conveyed Object Mass on Accumulation Section, including that of pallets (kg/m)
Cw: Chain Weight (kg/m)
fa: Friction Coefficient between conveyed object and Chain During Accumulation
fc: Friction Coefficient between Chain and Rail
fr: Friction Coefficient between Chain and Rail During Accumulation
G: Gravitational Acceleration=9.80665 (m/s^2)

Table 2 Friction Coefficient of Double Speed Chains

	Friction Coefficient
fa	0.10
fc	0.08
fr	0.20

Multiply the max. tension applied to a chain (T) by the velocity factor (K_1) and the conveyed object load factor (K_2).
For Free Flow Conveyors , which are generally designed to have two chains installed, calculate the tension for each of the two chains.
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 Conveyed Object Load Factor

Average Conveyed Object 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 Double Speed 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)

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

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

Table 1 Friction Coefficient

Lubrication Method	Material of Conveyed Object				
	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, so those values serve as element for tension calculation.

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

Fs=Fe · 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 · Va · 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

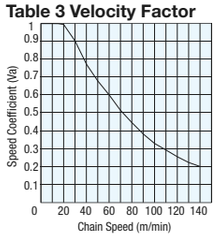
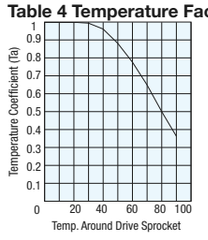


Table 4 Temperature Factor



[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

Check the Core Body for Allowable Tension

Check the selected belt core body for adequacy of the corresponding allowable stress, by going through the following steps.

[Step 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.)

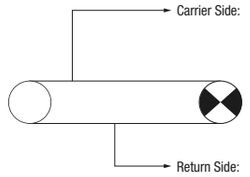


Table of Roller Weight (Table 2)

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.

[Step 2] Power Requirement

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

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

[Step 3] Motor Power

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

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

The motor with 0.1kW or less output may encounter the power shortage phenomenon.
Thus, check the motor for its characteristics before use.

[Step 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

Based on the 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 as follows)

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

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

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

[Step 5] Using Pretension to Calculate Maximum Tension

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

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

Table of Tc Values (Table-5)

No. of Tension Members (No. of Plys)	1 Pc.	2 Pcs.	3 Pcs.
Initial Tension (N/mm)	0.15	0.30	0.45

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

[Step 6] Allowable Stress

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

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

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.