

JIS

JAPANESE INDUSTRIAL STANDARD

**Rubber belt conveyors
with carrying idlers —
Calculation of operating
power and tensile forces**

JIS B 8805—1992

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Rubber belt conveyors with carrying idlers - B 8805-1992
 Calculation of operating power and tensile forces

1. Scope

This Japanese Industrial Standard specifies respective calculation formulae for the overall resistance, artificial friction coefficient, operating power requirement, belt tensions, capacity and cross-sectional area of the material on the belt for stationary type rubber belt conveyors, hereafter referred to as the "conveyors", using the rollers for belt conveyor and pulleys for belt conveyor specified in JIS B 8803 and JIS B 8814 mainly to be used for carrying loose bulk materials.

Remarks 1. The applicable standards to this Standard are as given in the following:

JIS B 0140 Glossary of terms relating to conveyors
 (Part 1, kinds of conveyors)

JIS B 0141 Glossary of terms relating to conveyors
 (Part 2, conveyor parts and accessories)

JIS B 8803 Rollers for belt conveyors

JIS B 8814 Pulleys for belt conveyors

2. The equivalent International Standard to this Standard is as follows:

ISO 5048-1989 Continuous mechanical handling equipment -
 Belt conveyors with carrying idlers -
 Calculation of operating power and tensile forces

2. Definitions

For the purposes of this Standard, the following definitions apply, and others are in accordance with the glossaries of terms relating the conveyors of JIS B 0140 and JIS B 0141.

- (1) loose bulk materials The materials in the states of lumps, grains and powders (for example, such as ores, coal, earth and sands and cereals) not being packaged.
- (2) angle of repose Angle formed with the horizontal surface by the surface of a conical heap of material falling slowly and regularly from a small height onto a horizontal surface.
- (3) surcharge angle Angle of repose of a material when being carried on a belt. Generally this value takes a smaller value than the static angle of repose (See Attached Fig. 1).
- (4) troughed angle Angle formed with the horizontal surface by both end rollers (See Attached Fig. 1).

- (5) apparent specific gravity Mass per unit volume including the spaces between the materials to be carried. This is expressed in the unit of kg/m^3 , and is different from the true specific gravity of the material itself to be carried.

3. Symbols and units Symbols and units to be used for the calculation formulae relating to the belt conveyors shall be in accordance with Table 1.

Table 1. List of symbols and units

Symbol	Description	Unit
a_o	Installation spacing of carrying idlers	m
a_u	Installation spacing of return idlers	m
A	Contact area between the belt and the belt cleaner	m^2
b	Usable width of the belt	m
b_i	Width between skirt plates	m
B	Belt width	m
C	Coefficient for calculating F_N	—
C_e	Trough factor	—
d	Belt thickness	m
d_o	Shaft diameter of inside bearing	m
D	Pulley diameter	m
e	Base of natural logarithms	—
f	Artificial friction coefficient	—
F	Average belt tension at the pulley	N
F_1	Tight-side tension at the driving pulley (See Fig. 1)	N
F_2	Slack-side tension at the driving pulley (See Fig. 1)	N
F_3	Belt tension at the return-side	N
F_H	Main resistances	N
$F_{\max}$	Maximum belt tension	N
$F_{\min}$	Minimum belt tension	N
F_N	Secondary resistances	N
F_{S_i}	Special main resistances	N

Table 1 (Continued)

Symbol	Description	Unit
F_{s1}	Special main resistances	N
F_{ST}	Resistance due to slope	N
F_{MA}	Acceleration resistance of materials to be carried	N
F_f	Resistance of material to be carried and skirt of accelerating part	N
F_t	Wrapping resistance of belt with pulleys	N
F_i	Bearing resistance of pulley	N
F_e	Resistance when the idlers have been tilted frontward	N
F_{sl}	Frictional resistance between the material to be carried and the skirt outside accelerating area	N
F_r	Frictional resistance due to belt cleaner	N
F_a	Frictional resistance of unloading scraper	N
F_T	Resultant working force on pulley	N
F_U	Overall resistances	N
g	Acceleration due to gravity	m/s ²
h	Sagging amount of belt	m
(h/a)	Allowable sagging rate between the idlers	—
H	Lift of conveyor	m
I_v	Capacity	m ³ /s
k	Slope factor where loaded at the slope part of belt conveyor	—
k_1	Reduction factor when over-loaded	—
k_a	Scraping factor	N/m
l	Skirt length	m
l_3	Length of centre idler of three-roller trough	m
l_b	Accelerating area length	m
L	Conveyor length (centre to centre distance between the shafts)	m

Table 1 (Continued)

Symbol	Description	Unit
L_e	Length of the installation equipped with tilted idlers	m
P	Pressure between the belt cleaner and the belt	N/m ²
P_A	Required power	kW
P_M	Motor power	kW
q_B	Mass of belt	kg/m
q_G	Mass of material handled	kg/m
q_{RO}	Mass of the rotating parts of idlers along the carrying side	kg/m
q_{RU}	Mass of the rotating parts of idlers along the return side	kg/m
S	Cross-sectional area of the material on the belt	m ²
S_1	Heaped-up cross-sectional area due to surcharge angle	m ²
S_2	Troughed sectional area cut horizontally of effective belt	m ²
v	Belt speed	m/s
v_0	Initial speed of material handled	m/s
α	Angle of repose	°
δ	Slope angle of conveyor	°
ϵ	Tilt angle to frontward direction (Angle at belt flat plane)	°
η_1	Mechanical efficiency of transmission, in the case of positive	—
η_2	Mechanical efficiency of transmission, in the case of negative	—
θ	Surcharge angle of material handled	°
λ	Trough angle	°
μ	Friction coefficient between the driving pulley and the belt	—