# Bancollan Round Belt

## 1. Product Introduction

We offer the Bancord round belt (joint type) of a long cord type as a round belt. However, for recent office equipment and optical machinery, the needs for round belts that do not require joining and have excellent low-temperature characteristics have been increasing. The Bancollan round belt is a high-performance round belt that has undergone our original quality improvements and meets those needs.

### Features

**■ Easy belt installation**

The belt can be easily installed by stretching it even when the center distance is fixed. Unlike a belt containing tension members, there is no need to slide pulleys or take time for tension adjustment; hence, it reduces the installation man-hour.

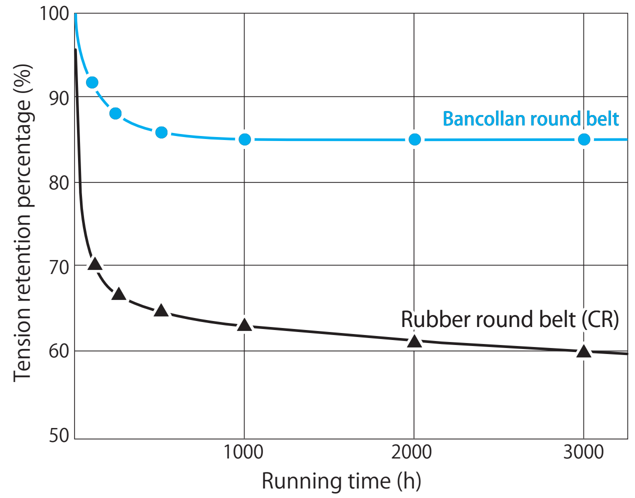
**■ Stable tension**

For belts without tension members, tension stability is especially important for belt performance. The Bancollan round belt has less changes in tension due to bending or permanent elongation than general rubber round belts or belts containing tension members, and can be used with almost no maintenance.

**■ Smooth start even at low temperature**

The specially compounded polyurethane rubber mostly prevents the belt from hardening or becoming set even at -20 °C. Therefore, it starts smoothly with no trouble due to the starting torque.

Fig. 1 Tension changes of the Bancollan round belt (Initial stretch rate 6%)




### Example of use

**Office equipment**
Copiers
Fax machines
Electric typewriters
Registers
Ticket vending machines, bill exchange machines
Automatic ticket gates
Weighing-pricing machines
Automatic cash payment machines

**Optical equipment/music equipment**
Tape decks
VTR

**Others**
Ultra-compact fans, air pollution measurement machines
Vacuum cleaners, spectroscopic analysis devices
Stirring machines, desktop winding machines
Roller conveyors
Rotating lights
Polishing machines

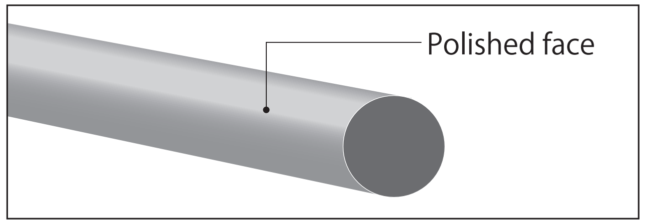




### Structure and Characteristics

For orders for Bancollan round belts, please specify the belt sizes shown in Table 1 if possible. However, as this belt is made to order, please contact us about delivery period, lots, and prices.

**■ Belt appearance**




**■ Belt indication example**

4 × 305

Effective length (mm)
Cross-sectional diameter (mm)

Sizes are indicated in units of individual package.

**■ Basic physical properties of the belt**

| Item \ Material | | #267WLS |
|---|---|---|
| Hardness | | 72° (JIS) |
| Specific gravity | | 1.26 |
| Tensile stress | When stretched by 4% | 35×10⁴ (Pa) |
| | When stretched by 6% | 50×10⁴ (Pa) |
| | When stretched by 8% | 64×10⁴ (Pa) |
| Tensile strength | | 3000 or more (N/cm²) |
| Elongation at the time of break | | 600(%) |

### Dimensional Tolerance

**■ Belt cross-sectional tolerance**

(Unit: mm)

| Cross-sectional diameter | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Tolerance | ±0.10 | ±0.10 | ±0.15 | ±0.20 |

**■ Effective length**

(Unit: mm)

| Effective length | Tolerance |
|---|---|
| 100~200 | ±2.0 |
| 201~400 | ±3.0 |
| 401~500 | ±4.0 |

### Belt Size

Table 1 Table of belt standard sizes

(Unit: mm)

| φ2 | | φ3 | | φ4 | | φ5 | |
|---|---|---|---|---|---|---|---|
| Effective length | Effective center perimeter | Effective length | Effective center perimeter | Effective length | Effective center perimeter | Effective length | Effective center perimeter |
| 104 | 110.2 | 107 | 113.4 | 135 | 143.1 | 157 | 166.4 |
| 107 | 113.4 | 108 | 114.5 | 140 | 148.4 | 168 | 178.1 |
| 100 | 106.0 | 113 | 119.8 | 142 | 150.5 | 182 | 192.9 |
| 112 | 118.7 | 115 | 121.9 | 160 | 169.6 | 200 | 212.0 |
| 115 | 121.9 | 120 | 127.2 | 165 | 174.9 | 210 | 222.6 |
| 120 | 127.2 | 128 | 135.7 | 170 | 180.2 | 220 | 233.2 |
| 125 | 132.5 | 132 | 139.9 | 173 | 183.4 | 225 | 238.5 |
| 130 | 137.8 | 138 | 146.3 | 175 | 185.5 | 230 | 243.8 |
| 134 | 142.0 | 140 | 148.4 | 184 | 195.0 | 247 | 261.8 |
| 135 | 143.1 | 145 | 153.7 | 197 | 208.8 | 248 | 262.9 |
| 140 | 148.4 | 150 | 159.0 | 200 | 212.0 | 250 | 265.0 |
| 145 | 153.7 | 153 | 162.2 | 206 | 218.4 | 275 | 291.5 |
| 147 | 155.8 | 155 | 164.3 | 213 | 225.8 | 290 | 307.4 |
| 152 | 161.1 | 160 | 169.6 | 225 | 238.5 | 300 | 318.0 |
| 158 | 167.5 | 165 | 174.9 | 230 | 243.8 | 305 | 323.3 |
| 160 | 169.6 | 170 | 180.2 | 235 | 249.1 | 310 | 328.6 |
| 163 | 172.8 | 172 | 182.3 | 240 | 254.4 | 315 | 333.9 |
| 167 | 177.0 | 175 | 185.5 | 250 | 265.0 | 320 | 339.2 |
| 170 | 180.2 | 180 | 190.8 | 254 | 269.2 | 330 | 349.8 |
| 180 | 190.8 | 182 | 192.9 | 258 | 273.5 | 345 | 365.7 |
| 183 | 194.0 | 190 | 201.4 | 264 | 279.8 | 348 | 368.9 |
| 190 | 201.4 | 193 | 204.6 | 270 | 286.2 | 363 | 384.8 |
| 194 | 205.6 | 200 | 212.0 | 275 | 291.5 | 374 | 396.4 |
| 196 | 207.8 | 201 | 213.1 | 284 | 301.0 | 375 | 397.5 |
| 200 | 212.0 | 204 | 216.2 | 285 | 302.1 | 380 | 402.8 |
| 213 | 225.8 | 213 | 225.8 | 290 | 307.4 | 402 | 426.1 |
| 227 | 240.6 | 223 | 236.4 | 300 | 318.0 | 416 | 441.0 |
| 239 | 253.3 | 230 | 243.8 | 305 | 323.3 | 422 | 447.3 |
| 244 | 258.6 | 236 | 250.2 | 316 | 335.0 | 434 | 460.0 |
| 250 | 265.0 | 240 | 254.4 | 323 | 342.4 | 440 | 466.4 |
| 273 | 289.4 | 250 | 265.0 | 332 | 351.9 | 460 | 487.6 |
| 290 | 307.4 | 260 | 275.6 | 346 | 366.8 | | |
| 330 | 349.8 | 270 | 286.2 | 361 | 382.7 | | |
| 444 | 470.6 | 275 | 291.5 | 367 | 389.0 | | |
| | | 282 | 298.9 | 374 | 396.4 | | |
| | | 285 | 302.1 | 377 | 399.6 | | |
| | | 290 | 307.4 | 385 | 408.1 | | |
| | | 294 | 311.6 | 390 | 413.4 | | |
| | | 305 | 323.3 | 415 | 439.9 | | |
| | | 308 | 326.5 | 440 | 466.4 | | |
| | | 314 | 332.8 | 450 | 477.0 | | |
| | | 318 | 337.1 | | | | |
| | | 330 | 349.8 | | | | |
| | | 347 | 367.8 | | | | |
| | | 356 | 377.4 | | | | |
| | | 359 | 380.5 | | | | |
| | | 363 | 384.8 | | | | |
| | | 376 | 398.6 | | | | |
| | | 387 | 410.2 | | | | |
| | | 390 | 413.4 | | | | |
| | | 395 | 418.7 | | | | |
| | | 400 | 424.0 | | | | |
| | | 410 | 434.6 | | | | |
| | | 430 | 455.8 | | | | |
| | | 441 | 467.5 | | | | |
| | | 450 | 477.0 | | | | |
| | | 460 | 487.6 | | | | |

- The effective length is the center perimeter with no stretch.
- The effective center perimeter represents the center perimeter when the belt is stretched by 6%.

# 2. How to Design

## Step 1. Determining conditions required for the design

① Machine type
② Transmission power, or rated power of the driving machine
③ Degree of load fluctuation
④ Daily operating hours
⑤ Speed ratio

$$\left(\frac{\text{Pinion revolution}}{\text{Revolution of large pulley}}\right)$$

⑥ Temporary center distance
⑦ Pulley diameter restriction
⑧ Operating environment (high temperature, low temperature, oil, water, dirt, acid, alkali)

## Step 2. Calculating the design power

Correct the driven load and obtain the design power to be used.

$$Pd = Pt \times \left(\frac{Ko}{K\theta_1 \times Kt}\right)$$

| | | |
|---|---|---|
| Pd | : Design power | (W) |
| Pt | : Transmission power (driven load or motor rating) | (W) |
| Ko | : Load correction factor | **(Table 2)** |
| $K\theta_1$ | : Pinion contact angle correction factor | **(Table 3)** |
| Kt | : Correction factor by initial stretch rate | **(Table 4)** |

When the transmission power was given in torques, convert it into watts with the following equation.

$$Pt = Tr \cdot n \times 1.047 \times 10^{-3}$$

| | | |
|---|---|---|
| Pt | : Transmission power | (W) |
| Tr | : Torque | (N•cm) |
| n | : Revolution | (rpm) |

Table 2 Load correction factor (Ko)

| Load characteristics | Factor Ko |
|---|---|
| When the maximum load is used | 1.0 |
| When a normal load is used | 1.3 |
| When the frequency of starting and stopping is high | 1.5 |

Table 3 Pinion contact angle correction factors ($K\theta_1$)

| Equation for contact angle calculation | $\Theta_1 = 180 - 57.3(Dp - dp) / C$ | | | | | |
|---|---|---|---|---|---|---|
| (Dp-dp)/C | 0.0 | 0.4 | 0.6 | 0.8 | 1.0 | 1.4 |
| $\theta_1$ (°) | 180 | 157 | 145 | 133 | 120 | 91 |
| Correction factor $K\theta_1$ | 1.00 | 0.94 | 0.91 | 0.87 | 0.82 | 0.70 |

Table 4 Correction factors by initial stretch rate (Kt)

| ⊿T (%) | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| Correction factor Kt | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 |

The correction factors in **Table 3** and **Table 4** correct the basic power rating; however, for convenience, they are in the form of correcting the transmission power.

## Step 3. Selecting a cross-sectional diameter

**Select a cross-sectional diameter so that Pr ≥ Pd from the basic power rating Pr and the design power Pd in** Tables 5 to 8 (→ P. 300).
When Pr < Pd, increase the number of belts or increase the cross-sectional diameter.

## Step 4. Selecting an effective length

With the following equation, obtain the effective center perimeter of the belt and set the belt with the effective center perimeter closest to it from **Table 1 (→ P. 298)**.

$$L' = 2C' + 1.57(Dp + dp) + \frac{(Dp - dp)^2}{4C}$$

| | | |
|---|---|---|
| L' | : Effective center perimeter of the belt | (mm) |
| C' | : Center distance | (mm) |
| Dp | : Large pulley pitch diameter | (mm) |
| dp | : Pinion pitch diameter | (mm) |

Check the following points for the selected belt in accordance with the conditions.

**(A) When the center distance is fixed**

Check whether the initial stretch rate is between 4% and 8% with the following equation.

$$4 \leqq \Delta t \leqq 8$$

| | | |
|---|---|---|
| Δt | : Initial stretch rate 100(L' / L - 1) | (%) |
| L' | : Effective center perimeter of the belt | (mm) |
| L | : Effective center perimeter of the standard belt | (mm) |

**(B) When the center distance can be adjusted**

Obtain the center distance with the following equation so that the initial stretch rate is 6%.

$$C = \frac{B + \sqrt{B^2 - 2(Dp - dp)^2}}{4}$$

$$B = L \times 1.06 - 1.57(Dp + dp)$$

| | | |
|---|---|---|
| C | : Center distance | (mm) |
| L | : Effective center perimeter of the standard belt | (mm) |
| Dp | : Large pulley pitch diameter | (mm) |
| dp | : Pinion pitch diameter | (mm) |



**Bancollan Round Belt**
Belt Design

Table 5 Table of basic power ratings for ϕ2

(Unit: W)

| Pinion revolution (rpm) | Pinion pitch diameter (mm) | | | | |
|---|---|---|---|---|---|
| | 16 | 18 | 20 | 24 | 28 |
| 250 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 |
| 500 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 |
| 750 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 1000 | 0.7 | 0.8 | 0.9 | 1.1 | 1.2 |
| 1250 | 0.9 | 1.0 | 1.1 | 1.3 | 1.5 |
| 1500 | 1.0 | 1.2 | 1.3 | 1.5 | 1.8 |
| 1750 | 1.2 | 1.3 | 1.5 | 1.8 | 2.1 |
| 2000 | 1.4 | 1.5 | 1.7 | 2.0 | 2.3 |
| 2500 | 1.7 | 1.9 | 2.1 | 2.5 | 2.9 |
| 3000 | 2.0 | 2.3 | 2.5 | 2.9 | 3.3 |
| 3500 | 2.3 | 2.6 | 2.9 | 3.3 | 3.8 |

Table 6 Table of basic power ratings for ϕ3

(Unit: W)

| Pinion revolution (rpm) | Pinion pitch diameter (mm) | | | | |
|---|---|---|---|---|---|
| | 22 | 24 | 28 | 32 | 36 |
| 250 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 500 | 1.1 | 1.2 | 1.4 | 1.5 | 1.7 |
| 750 | 1.6 | 1.7 | 2.0 | 2.3 | 2.6 |
| 1000 | 2.1 | 2.3 | 2.7 | 3.1 | 3.4 |
| 1250 | 2.6 | 2.9 | 3.3 | 3.8 | 4.3 |
| 1500 | 3.2 | 3.4 | 4.0 | 4.5 | 5.1 |
| 1750 | 3.7 | 4.0 | 4.6 | 5.3 | 5.9 |
| 2000 | 4.2 | 4.5 | 5.3 | 5.9 | 6.6 |
| 2500 | 5.2 | 5.6 | 6.4 | 7.2 | 8.0 |
| 3000 | 6.1 | 6.6 | 7.5 | 8.4 | 9.2 |
| 3500 | 7.0 | 7.5 | 8.5 | 9.4 | 10.2 |

Table 7 Table of basic power ratings for ϕ4

(Unit: W)

| Pinion revolution (rpm) | Pinion pitch diameter (mm) | | | | |
|---|---|---|---|---|---|
| | 28 | 32 | 36 | 40 | 45 |
| 250 | 1.2 | 1.4 | 1.5 | 1.7 | 1.9 |
| 500 | 2.4 | 2.7 | 3.1 | 3.4 | 3.8 |
| 750 | 3.6 | 4.1 | 4.6 | 5.1 | 5.7 |
| 1000 | 4.8 | 5.4 | 6.1 | 6.8 | 7.6 |
| 1250 | 5.9 | 6.8 | 7.6 | 8.4 | 9.4 |
| 1500 | 7.1 | 8.1 | 9.0 | 9.9 | 11.3 |
| 1750 | 8.2 | 9.3 | 10.4 | 11.4 | 12.7 |
| 2000 | 9.3 | 10.5 | 11.7 | 12.8 | 14.2 |
| 2500 | 11.4 | 12.8 | 14.2 | 15.4 | 16.8 |
| 3000 | 13.4 | 14.9 | 16.3 | 17.5 | 18.8 |
| 3500 | 15.2 | 16.7 | 18.1 | 19.3 | 24.7 |

Table 8 Table of basic power ratings for ϕ5

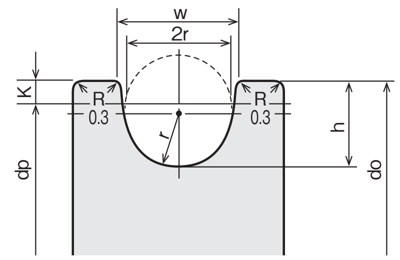
(Unit: W)

| Pinion revolution (rpm) | Pinion pitch diameter (mm) | | | | |
|---|---|---|---|---|---|
| | 36 | 40 | 45 | 50 | 60 |
| 250 | 2.4 | 2.7 | 3.0 | 3.4 | 4.0 |
| 500 | 4.8 | 5.4 | 6.0 | 6.7 | 8.0 |
| 750 | 7.2 | 8.0 | 9.0 | 9.9 | 11.8 |
| 1000 | 9.5 | 10.6 | 11.8 | 13.1 | 15.5 |
| 1250 | 11.8 | 13.1 | 14.6 | 16.1 | 19.0 |
| 1500 | 14.1 | 15.5 | 17.3 | 19.0 | 22.1 |
| 1750 | 16.2 | 17.8 | 19.8 | 21.6 | 24.9 |
| 2000 | 18.7 | 20.0 | 22.1 | 24.0 | 27.4 |
| 2500 | 22.1 | 24.0 | 26.2 | 28.1 | 30.8 |
| 3000 | 25.5 | 27.4 | 29.3 | 30.8 | 31.9 |
| 3500 | 28.2 | 29.9 | 31.3 | 31.7 | 30.7 |

**When the effective lengths in Table 1 (P. 298)** cannot be used, please contact us.

## Pulleys for the Bancollan Round Belt

As pulleys for the Bancollan round belt, please use pulleys with the following dimensions.




### Table of pulley groove dimensions

(Unit: mm)

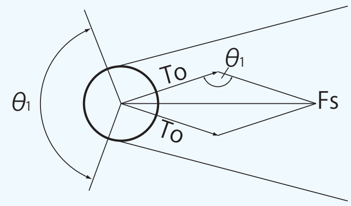
| Belt cross-sectional diameter | φ2 | φ3 | φ4 | φ5 |
|---|---|---|---|---|
| Groove top width **W** ±0.1 | 2.2 | 3.2 | 4.2 | 5.2 |
| Groove depth **h** $^{+0.1}_{-0}$ | 1.3 | 2.0 | 2.7 | 3.3 |
| Groove bottom **r** ±0.05 | 0.9 | 1.4 | 1.9 | 2.4 |
| Difference between outside diameter and pitch diameter **2k** | 0.6 | 1.0 | 1.4 | 1.6 |
| Minimum pulley pitch diameter | 14 | 21 | 28 | 35 |

Avoid using V-grooved pulleys as they can cause partial abrasion of the belt.

## Shaft Load of Bancollan Round Belt

Obtain the shaft load of the Bancollan round belt with the following equation from the following table of the initial tension To in accordance with the initial stretch rate.

$$Fr=2To\sin(\theta_1/2)$$




### Initial tension To

(Unit: N)

| Stretch rate (%) Δt \ Belt cross-sectional diameter | φ2 | φ3 | φ4 | φ5 |
|---|---|---|---|---|
| 4 | 1.08 | 2.45 | 4.31 | 6.76 |
| 5 | 1.27 | 3.53 | 6.57 | 10.3 |
| 6 | 1.57 | 4.31 | 7.64 | 11.8 |
| 7 | 1.76 | 4.80 | 8.62 | 14.4 |
| 8 | 1.96 | 5.19 | 9.60 | 16.5 |