

# NTN<sup>®</sup>

## TRI-BALL JOINT

Constant Velocity Joints  
(Small and Medium size)

CAT. No. 5602-IV / E



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This agreement allocates the risks of product failure between NTN and the purchaser. This allocation is recognized by both parties and is reflected in the price of the goods. The purchaser acknowledges that it has read this agreement, understands it, and is bound by its terms.

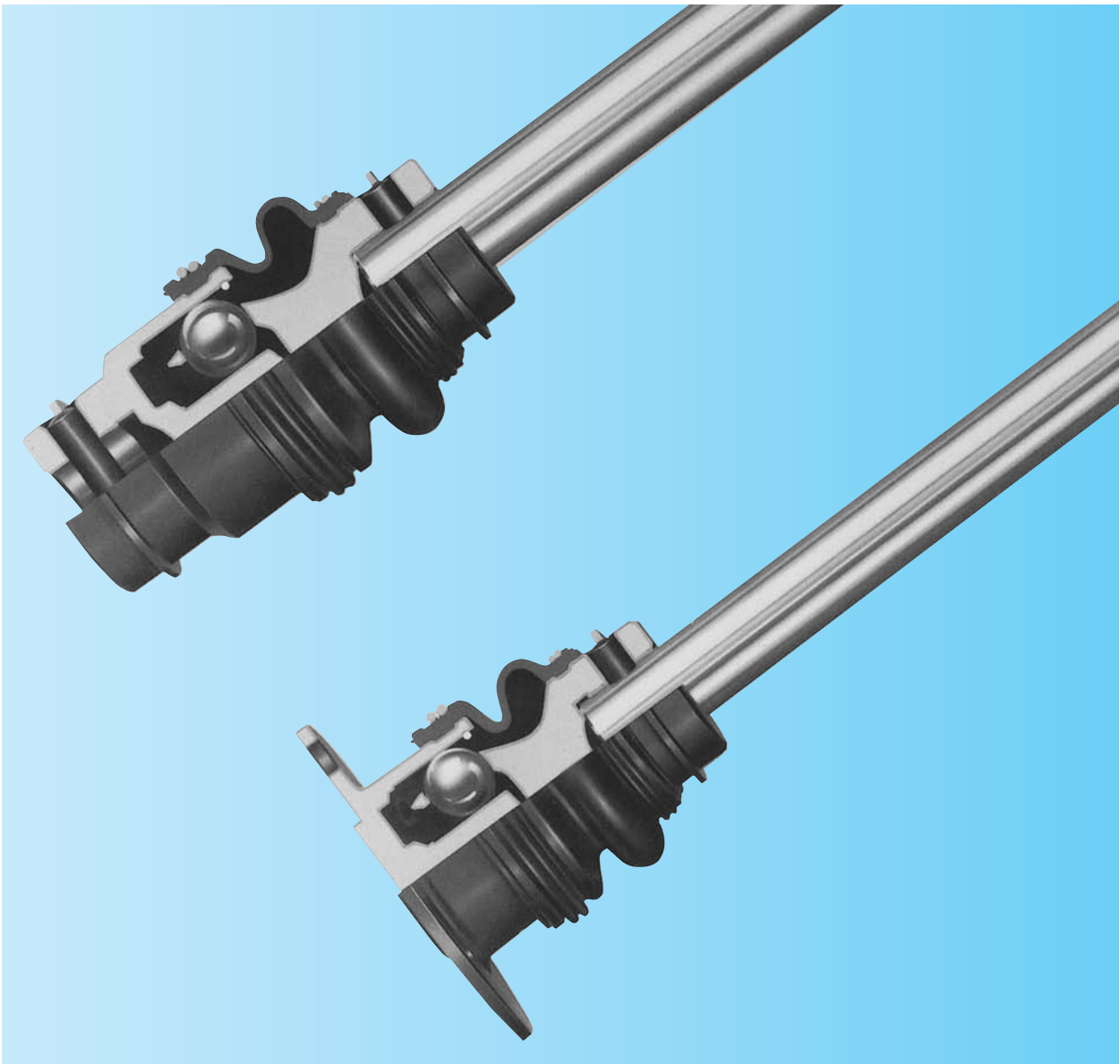
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# NTN

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## 1. Characteristics

### Completely constant velocity

- Unique design for completely constant velocity.

### Excellent performance and efficiency

- Smooth and highly efficient performance by transmitting power through balls (Fig. 1).
- Secondary moments is 1/2 of the value of a pivot joint.

### Easy installation

- Inside expansion allows easy installation, especially of the flange type.
- Micro-adjustment between the equipments is possible by the inside expansion.
- Easy installation of the boss type by setting with pin(s) or keying.

### Superb lubrication and sealing properties

- Very suitable for operating enabled by sealing with special grease.
- Excellent water proof and dust protection by complete seal with a rubber boot.
- Maintenance-free as a proper amount of grease is filled in the joint.

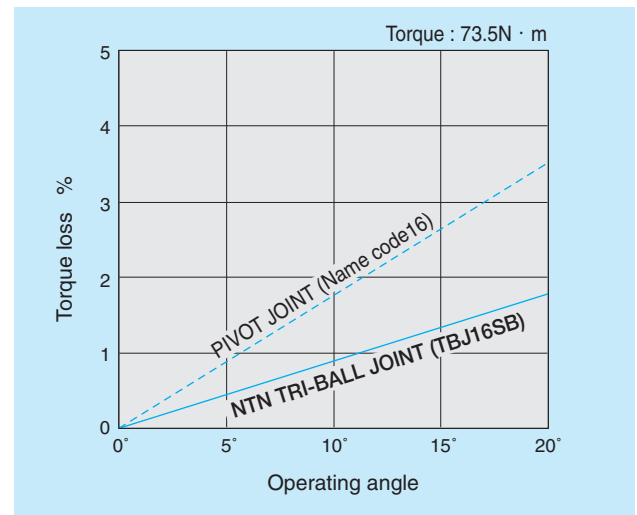


Fig. 1 Transmission efficiency of TRI-BALL JOINT

## 2. Structure and Motion

NTN TRI-BALL joint has a structure as shown in Fig. 2.

The outer race which united with the center shaft and the torque tube transmit torque through three balls. Besides, the joint has a stop-ring, a boot and bands. The stop-ring prevents ball omission from outer race. The boot and bands prevent splashing grease and invasion of foreign substance from the outside.

When torque tube is twisted, the ball is pushed by the torque tube pocket, with force  $P_r$  and it acts forces  $P_o$  and  $P_i$

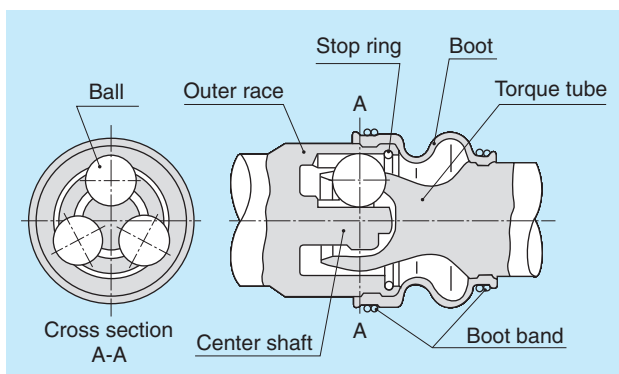


Fig. 2

at the contact point of tracks. The coupled force about center  $O$  due to  $P_o$  and  $P_i$  is equal to the torque added on the outer race.

### Remarks;

If TRI-BALL joint turns with an operation angle, it maintains constant velocity by eccentricity between outer race center and torque tube center. For this reason, it may vibrate depending on an operation angle and revolutions.

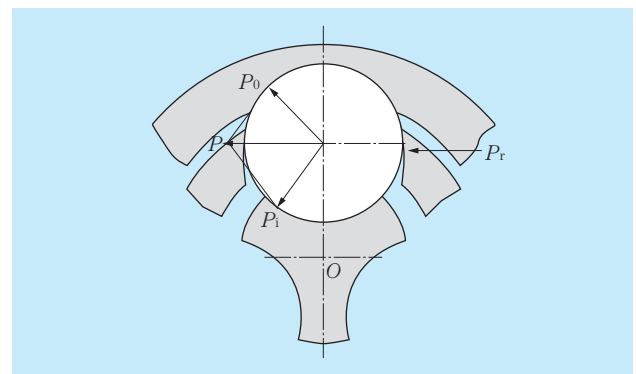


Fig. 3

### 3. Type and Variety

The NTN TRI-BALL Joints have two series.... Simple substance series and shaft connection series (Two joints connected to a shaft).

Table 1 Simple substance series

Type	Symbol	Structural drawing	Dynamic allowable operating angle	Remarks
Single	Boss type SB SBC (for high speed)		Series No. incl. 35 : 18° over 42 : 16°	(1) Applicable shaft diameter : $\phi 8$ to $\phi 60$ mm. (2) Max. diameter is smaller than flange type's. (3) Please refer to NTN when using one joint.
		Flange type SF SFC (for high speed)		Series No. incl. 35 : 18° over 42 : 16°
	With semi-finished flange SFF SFFC (for high speed)			Series No. incl. 35 : 18° over 42 : 16°
Double	Boss type DB DBC (for high speed)		 $\theta = 8^\circ$	(1) Applicable shaft diameter : $\phi 8$ to $\phi 60$ mm. (2) Large inside expansion. (3) Max. diameter is smaller than flange type's.
		Flange type DF DFC (for high speed)		 $\theta = 8^\circ$
	With semi-finished flange DFF DFFC (for high speed)			 $\theta = 8^\circ$
Single welded boss type	SBW		Series No. incl. 35 : 18° over 42 : 16°	(1) Optimum fitting to special shape holes i.e. key slotted / grooved hole, square hole, etc. (2) Applicable shaft diameter : $\phi 80$ mm. (3) The shaft fitting area adjustable to any required length. (4) Please inform NTN of the dimensions as the welding is done by NTN. (5) Please refer to NTN when using one joint.
Double welded boss type	DBW		 $\theta = 8^\circ$	(1) Optimum fitting to special shape holes i.e. key slotted / grooved hole, square hole, etc. (2) Applicable shaft diameter : $\phi 80$ mm. (3) The shaft fitting area adjustable to any required length. (4) Please inform NTN of the dimensions as the welding is done by NTN.

Table 2 Shaft connection series

Type	Symbol	Structural drawing	Remarks
Boss type	<b>BB</b> <b>BB··C</b> (for high speed)		<b>SB</b> type joints of simple substance series connected with a solid shaft.
	<b>BP</b> <b>BP··C</b> (for high speed)		<b>SB</b> type joints of simple substance series connected with a steel pipe.
	<b>BT</b> <b>BT··C</b> (for high speed)		<b>SB</b> type joints of simple substance series connected with an intermediate sliding spline shaft.
Flange type	<b>FB</b> <b>FB··C</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with a solid shaft.
	<b>FB··F</b> <b>FB··FC</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with a solid shaft and provided with semi-finished flange.
	<b>FP</b> <b>FP··C</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with a steel pipe.
	<b>FP··F</b> <b>FP··FC</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with a steel pipe and provided with semi-finished flange.
	<b>FT</b> <b>FT··C</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with an intermediate sliding spline shaft.
	<b>FT··F</b> <b>FT··FC</b> (for high speed)		<b>SF</b> type joints of simple substance series connected with an intermediate sliding spline shaft and provided with semi-finished flange.

- Notes**
- 1) Solid shaft connection series are suitable for shorter connecting distance of joints, steel pipe series for longer distance, and sliding spline series for larger expansion.
  - 2) High speed joints are properly adjusted in the internal gap of the joint and in the bend of the shaft.
  - 3) Carefully handle the intermediate sliding spline joint series. When the allowable expansion is exceeded, the splined shaft may come off.
  - 4) To prevent loosening of the parallel pin that links the joint and shaft, a dual snap ring arrangement is used. For a particular application that involves high speed or is subjected to violent vibration, a special jam arrangement is available. For advice, contact NTN engineering.
  - 5) When loaded with torque, an intermediate sliding spline joint series joint cannot expand in axial direction. To accommodate axial expansion, use an NTN sliding type constant velocity joint for industrial machinery or a combination of fixed and sliding joints. For possible combinations, contact NTN engineering.

## 4. Selection

### 4.1 Type

Determine the appropriate type of joints among those listed in **Table 1** and **2**, taking into consideration the installation/ mounting method and service conditions.

### 4.2 Series number

Confirm the service conditions mentioned on page 47 and follow the steps below to determine the series number.

#### 1) Load

In the case of constant or variable loads shown in **Fig. 4**, obtain each working torque and interpret them as  $T_a$  (N·m) or  $Q_a$  (kW).

#### 2) Type of driving equipment

Obtain coefficient of motor  $K_1$  based on **Table 3**.

#### 3) Operation angle

Angle coefficient  $K_2$  are shown in **Table 4** according to operation angle.

**Table 3 Coefficient of motor  $K_1$**

Type of motor		$K_1$	
Motor	Electric motor, Turbine	1	
	Gasoline engine	4-cylinder or over	1.25
		3-cylinder or less	1.5
	Diesel engine	4-cylinder or over	2
3-cylinder or less		3	
Driven machine	Machine developing strong vibration or impact (crusher, screening machine, etc.)	3	
	Machine running continuously at a constant speed and developing minor vibration (storage/drainage pump, blower, etc.)	1.5	

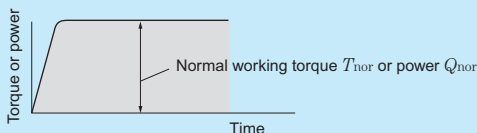
**Remarks**

- 1) Adopt the coefficient for the motor or that for the driven machine, whichever is greater.
- 2) The joints may be broken by the twisting resonance, when they are directly connected to reciprocating engines or plunger pumps. The type of joints should be carefully selected after checking the resonance revolution numbers of the twisting vibration for the driving mechanism.

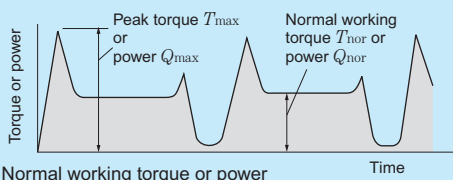
**Table 4 Coefficient of operating angle  $K_2$**

operating angle	$K_2$	operating angle	$K_2$
$\leq 4^\circ$	1.0	$\leq 12^\circ$	0.63
$5^\circ$	0.95	$14^\circ$	0.54
$6^\circ$	0.90	$16^\circ$	0.48
$8^\circ$	0.82	$18^\circ$	0.43
$10^\circ$	0.72	—	—

#### 1) When torque or power is constant

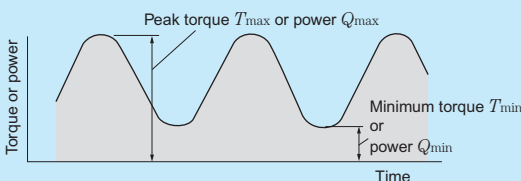


#### 2) When torque or power changes in one direction and the peak time is short



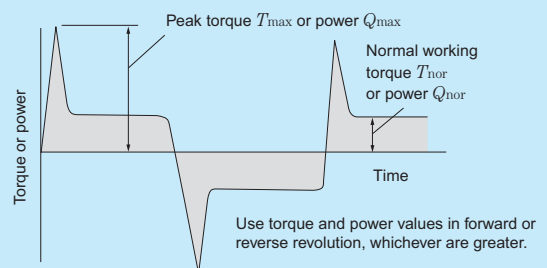
$$T_a = \frac{T_{max} + T_{nor}}{2} \quad Q_a = \frac{Q_{max} + Q_{nor}}{2}$$

#### 3) When torque or power fluctuates evenly in one direction



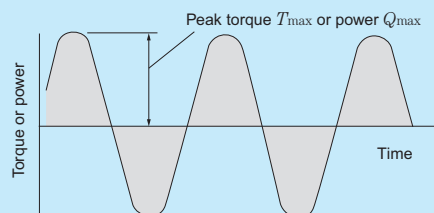
$$T_a = \frac{T_{min} + 2T_{max}}{3} \quad Q_a = \frac{Q_{min} + 2Q_{max}}{3}$$

#### 4) When torque or power alternates at forward and reverse revolution and the peak time is short



$$\text{Normal working torque or power} \\ T_a = \frac{T_{max} + T_{nor}}{2} \quad Q_a = \frac{Q_{max} + Q_{nor}}{2}$$

#### 5) When torque or power fluctuates evenly in both forward and reverse revolution



$$\text{Normal working torque or power} \\ T_a = \frac{4}{5} T_{max} \quad Q_a = \frac{4}{5} Q_{max}$$

**Fig. 4**



**4) Equivalent working torque or equivalent working power**

Obtain the equivalent working torque  $T_e$  (N · m) or the equivalent working power  $Q_e$  (kW) by the following equation.

$$T_e = \frac{K_1}{K_2} \cdot T_a \quad \text{or} \quad Q_e = \frac{K_1}{K_2} \cdot Q_a$$

The relation between the torque and the power is

$$T = 9550 \cdot \frac{Q}{n}$$

Where,

- $T$  : Torque                      N · m
- $Q$  : Power                        kW
- $n$  : No. of revolutions    min<sup>-1</sup>

**5) Series Number**

After  $T_e$  value is obtained, determine the Series Number from **Table 5** "Transmission Capacity of the joint with 7,200 hrs. life".

**6) Variable torques**

For variable torques, choose a product, listed among those in **Table 6**, with peak torque not exceeding the dynamic allowable torque (allowable value for the revolutions in one direction or forward / reverse rotation).

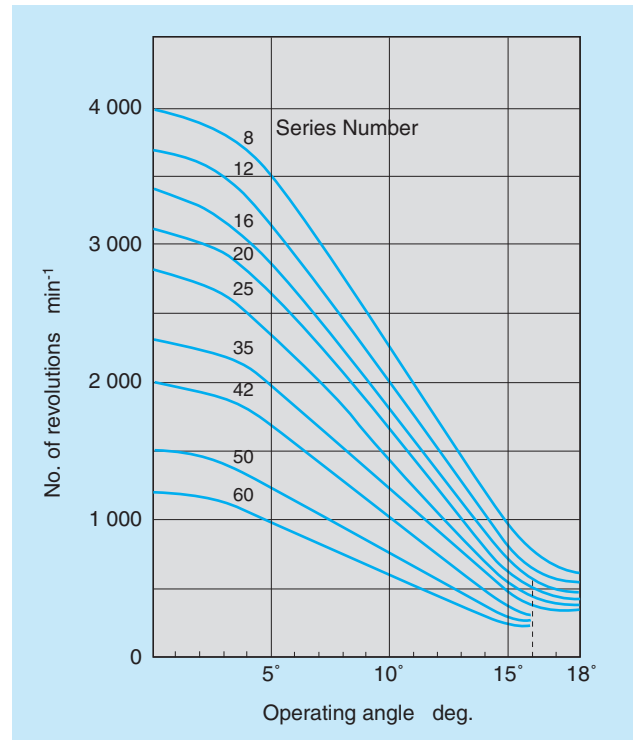
**7) Confirmation of allowable rotating speed**

Confirm the service rotating speed does not exceed the allowable rotating speed referenced in **Fig. 5** and **6**. **Fig. 5** shows the operating angle of joints and allowable rotating speeds. **Fig. 6** shows the allowable rotating speeds, depending on the joint length. The lower value of either **Fig. 5** or **6** is determined as the allowable rotating speed. For intermediate sliding spline joint series, the allowable rotating speeds are one-half of the values in **Fig.6**.

**Table 6. Allowable maximum torque**

Unit :N · m

Series number	Static allowable maximum torque	Dynamic allowable torque	
		When torque varies by revolution in one direction	When start/stop or forward/reverse revolution is repeatedly operated
8	31.4	14.7	9.81
12	118	53.9	34.3
16	274	127	83.3
20	539	245	157
25	932	441	274
35	2 550	1 180	765
42	4 120	1 860	1 220
50	7 260	3 330	2 210
60	13 700	6 370	4 220



**Fig. 5 Operating angle of joints and allowable rotating speed**

**Table 5. Transmission capability (Equivalent operating transmission torque)**

Unit :N · m

Series number	No. of revolutions    min <sup>-1</sup>																
	10	50	100	200	300	400	500	600	800	1,000	1,200	1,500	1,800	2,000	2,500	3,000	3,600
8	8.92	6.47	5.69	5	4.61	4.31	4.22	4.02	3.82	3.63	3.43	3.24	3.04	2.94	2.65	2.55	2.35
12	32.5	23.9	20.9	18.3	17	16	15.4	14.8	14	13.4	12.6	11.8	11.1	10.7	9.9	9.32	8.73
16	76.5	56.9	49	43.1	40.2	38.2	36.3	35.3	33.3	31.4	29.4	27.5	26.5	25.5	23.5	21.6	20.6
20	147	108	95.1	83.3	76.5	75.6	69.6	67.7	63.7	60.8	57.8	53	50	48	45	42	-
25	265	196	166	147	137	132	127	122	118	108	98.1	96.1	90.2	87.3	81.4	76.5	-
35	706	520	461	402	373	353	333	324	304	294	274	255	245	235	216	-	-
42	1,130	824	726	628	588	549	529	510	480	461	441	402	382	373	-	-	-
50	2,010	1,470	1,290	1,130	1,050	990	951	912	863	833	784	726	686	-	-	-	-
60	3,850	2,820	2,470	2,160	2,000	1,890	1,810	1,750	1,660	1,590	1,500	-	-	-	-	-	-

**Remarks:** The values of the equivalent working transmission torque is based on the life of 7,200 hours.

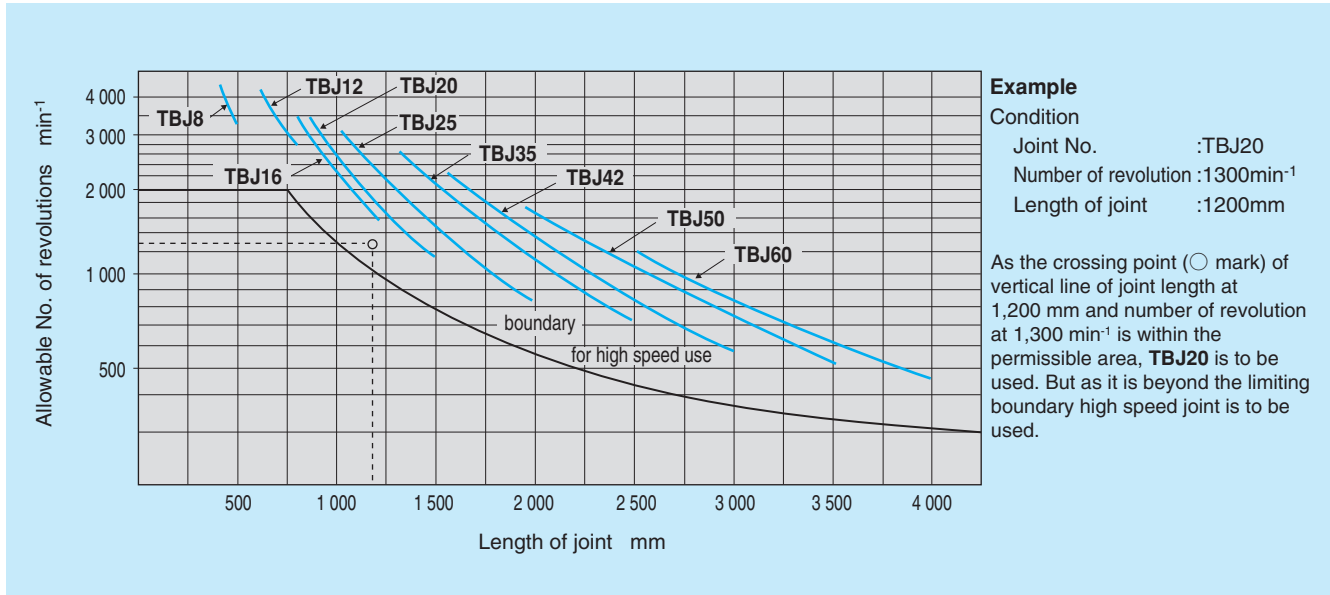


Fig. 6 Operating angle of joints and allowable rotating speed

### 4.3 Allowable expansion

The allowable expansion inside the joint varies with operating angles. By referring to Fig. 8, 9 and 10, determine the appropriate allowable inside expansion.

When the required expansion exceeds the allowable values, use BT, FT and other types, which are an intermediate sliding spline connection series.

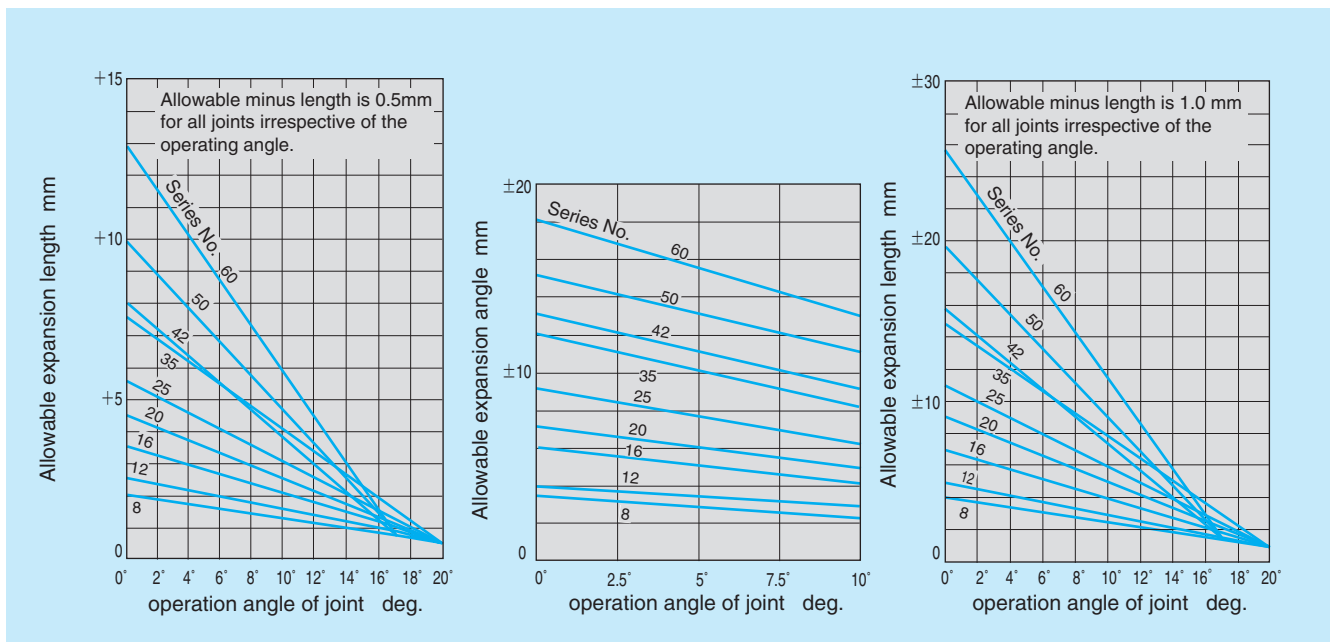


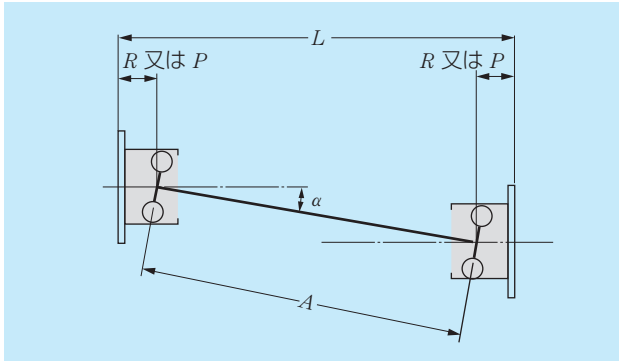
Fig. 7 Allowable expansion length for single type (type : SB, SF)

Fig. 8 Allowable expansion length for double type (type : DB, DF)

Fig. 9 Allowable expansion length for shaft connection series (type : BB, BP, FB, FP)

### 4.4 Length of joint

The recommended joint length, depending on installation mounting distance ( $L$ ), and the operating angle ( $\alpha$ ) of the joint, can be obtained by the following equations.



$$L = A + 2R$$

$$L = A + 2P$$

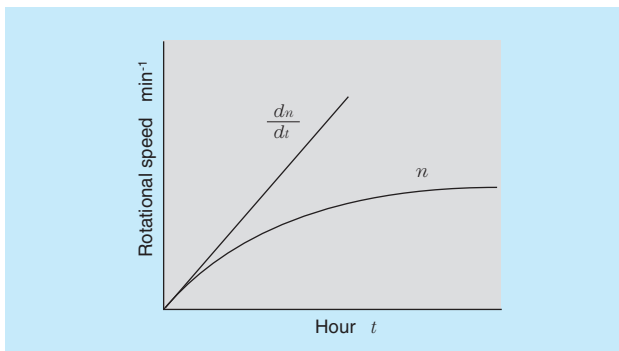
Refer to the dimensions table for the values of  $R$  and  $P$ .

### 4.5 Starting torque and breaking torque

The torque of inertia in the shaft works on the joint during starting, stopping or reversing rotation and it is liable to exceed the output of the electric motor and engine to a great extent. Hence, the determination of joint number only by the electric motor output may cause unexpected troubles such as breakage of the joint body or the shaft. For applications where starting, stopping and reversing rotation are frequently encountered, determine the joint number with the start and brake torques (torque of inertia) not to exceed the maximum dynamic allowable torque given in the table of transmission capacity (Table 6).

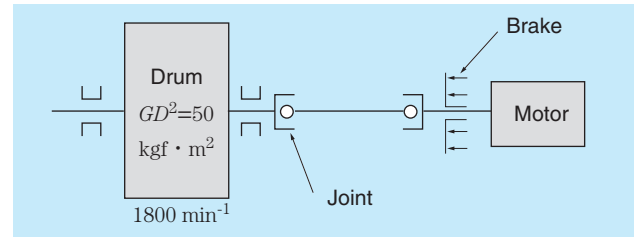
$$T = \frac{GD^2}{38.2} \cdot \frac{dn}{dt}$$

- $T$  : Starting or braking torque (torque of inertia)  $N \cdot m$
- $GD^2$  : Moment of vibration of the shaft connected to the joint  $kg \cdot m^2$
- $\frac{dn}{dt}$  : Change in rotating speed per unit time  $min^{-1}/sec$



### (Example)

Obtain the torque to be worked on the joint when the drum of  $GD^2=50kg \cdot m^2$  rotating at a speed of  $1,800min^{-1}$  stops for 5 seconds.



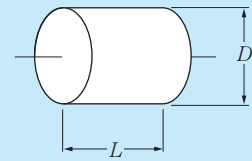
$$\frac{dn}{dt} = \frac{1\,800}{5} \text{ min}^{-1}/\text{sec}$$

$$GD^2 = 50 \text{ kg} \cdot \text{m}^2$$

$$T = \frac{GD^2}{38.2} \cdot \frac{dn}{dt} = \frac{50}{38.2} \times \frac{1\,800}{5} = 471.2 \text{ N} \cdot \text{m}$$

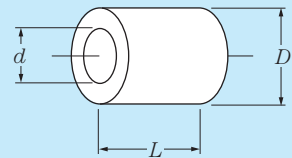
### Equations for $GD^2$

#### ● Solid



$$GD^2 = \frac{\pi}{8} r \cdot L \cdot D^4 = \frac{1}{2} W \cdot D^2 \text{ kg} \cdot \text{m}^2$$

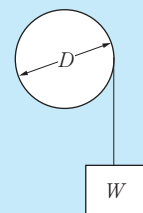
#### ● Hollow



$$GD^2 = \frac{\pi}{8} r \cdot L (D^4 - d^4) = \frac{1}{2} W (D^2 + d^2) \text{ kg} \cdot \text{m}^2$$

- $D$  : Outer diameter  $m$
- $d$  : Bore diameter  $m$
- $L$  : Length  $m$
- $r$  : Mass  $kg/m^3$
- $W$  : Weight  $kg$

#### ● Example : Winch



$$GD^2 = W \cdot D^2 \text{ kg} \cdot \text{m}^2$$

**(Example)**

Determine the triball joint to meet for the following specification.

- Transmission power  $T_a = 3.7 \text{ kW}$
- No. of revolutions  $n = 1\,800 \text{ min}^{-1}$
- Operating angle  $\alpha = 5^\circ$
- Peak torque 200% of working torque

**1) Equivalent working torque**

From the specification,

- $T_a = 3.7 \text{ kW}$
- $K_1 = 1$  (Table 3; using the electric motor)
- $K_2 = 0.95$  (Table 4)

$$Q_e = \frac{1}{0.95} \times 3.7 \doteq 3.9 \text{ kW}$$

Hence the equivalent normal transmission torque is obtained as follows.

$$T_e = \frac{9550 \times Q_e}{n} = \frac{9550 \times 3.9}{1\,800} \doteq 20.7 \text{ N} \cdot \text{m}$$

**2) Determination of series number**

Based on Table 5. TBJ 16 in the column of  $n = 1,800 \text{ min}^{-1}$  satisfies the requirement of the torque  $20.7 \text{ N} \cdot \text{m}$  to be an appropriate joint of 7,200 hrs. life.

**3) Confirmation of sufficient peak torque and allowable rotating speed**

By the following equations, the working torque  $19.6 \text{ N} \cdot \text{m}$  is obtained.

$$\begin{aligned} \text{Working transmission power } Q_a &= 3.7 \text{ kW} \\ n &= 1,800 \text{ min}^{-1} \end{aligned}$$

From the specification, the peak torque is 200% of the working torque i.e.  $39.2 \text{ N} \cdot \text{m}$  which is sufficiency smaller than the dynamic allowable torque  $127 \text{ N} \cdot \text{m}$  of TBJ 16 for safety operation.

Allowable rotating speed of TBJ 16 is  $3,500 \text{ min}^{-1}$  at an operating angle  $5^\circ$ ,  $n = 1,800 \text{ min}^{-1}$  is within the limit value (Refer to Fig. 5).

## 5. Joint Number

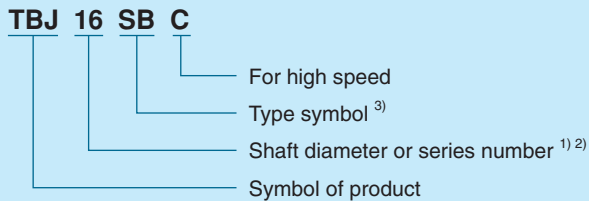
The joint number of simple substance series consists of the shaft diameter or series number and type symbol.

The joint number of shaft connection series consists of series number.

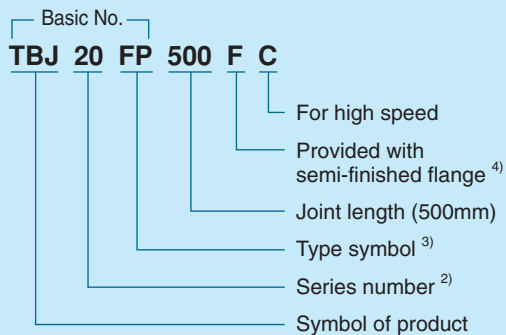
The symbol and the joint length etc.

### (Example)

#### Simple substance series



#### Shaft connection series



**Notes:** 1) For joints of the same shaft diameter, discrimination is made by addition of the symbol **M** next to type symbol.

2) Series number stands for the type of the joint body classified by its load-carrying capacity.

3) Type symbol

Simple substance series

**SB** ... Single boss type joint

**DB** ... Double boss type joint

**SF** ... Single flange type joint

**DF** ... Double flange type joint

Shaft connection series

**B** ... Boss type joint

**F** ... Flange type joint

**B** ... Solid shaft

**P** ... Steel pipe

**T** ... Slide spline shaft

} Former symbols

} Latter symbols

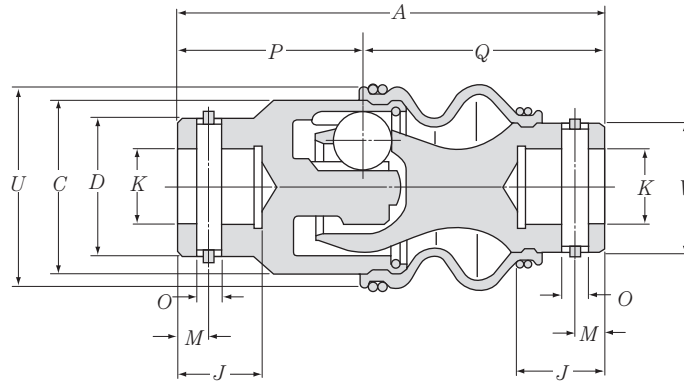
4) For the joint without semi-finished flange, provided with bolts, nuts and washers, the symbol **Z** follows the symbol for the joint length.

**Remarks:** When any additional processing is applied to the standard products e.g. the processing for a special bore diameter and key groove is applied to the flange hub, the joint number is to be changed.

## 6. Dimension Table

### Simple substance series

#### SB type, SBC type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

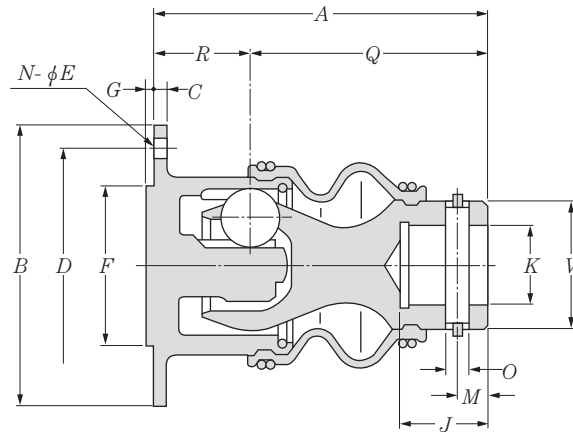
Series number	Joint number		Dimensions											Mass kg	
	General	High speed	K <sup>1)</sup>	J	M	O	P	mm			Q	V	A		
								D	C	U <sup>2)</sup>			Standard	Expansion <sup>3)</sup>	
8	TBJ 8SB	TBJ 8SBC	8	10	4	3	22	18	20	25	28	15	50	+2 -0.5	0.09
	TBJ10SB	TBJ10SBC	10	10	4	3	22	18	20	25	28	15	50	+2 -0.5	0.09
	TBJ12SBM	TBJ12SBMC	12	14	6	4	25	20	20	25	31	18	56	+2 -0.5	0.08
12	TBJ12SB	TBJ12SBC	12	16	6	4	30	26	29	36	41	23	71	+2.5 -0.5	0.22
	TBJ14SB	TBJ14SBC	14	16	6	4	30	26	29	36	41	23	71	+2.5 -0.5	0.22
	TBJ16SBM	TBJ16SBMC	16	18	8	6	32	29	29	36	42	23	74	+2.5 -0.5	0.23
16	TBJ16SB	TBJ16SBC	16	18	8	6	36	32	38	45	44	30	80	+3.5 -0.5	0.42
	TBJ18SB	TBJ18SBC	18	18	8	6	36	32	38	45	44	30	80	+3.5 -0.5	0.42
	TBJ20SBM	TBJ20SBMC	20	22	10	8	40	38	38	45	47	30	87	+3.5 -0.5	0.48
20	TBJ20SB	TBJ20SBC	20	22	10	8	45	38	47	56	55	36	100	+4.5 -0.5	0.75
	TBJ22SB	TBJ22SBC	22	22	10	8	45	38	47	56	55	36	100	+4.5 -0.5	0.75
	TBJ25SBM	TBJ25SBMC	25	28	12	10	51	47	47	56	61	36	112	+4.5 -0.5	0.89
25	TBJ25SB	TBJ25SBC	25	28	12	10	58	50	58	68	68	45	126	+5.5 -0.5	1.5
	TBJ30SB	TBJ30SBC	30	28	12	10	58	50	58	68	68	45	126	+5.5 -0.5	1.4
	TBJ35SBM	TBJ35SBMC	35	40	16	12	68	58	58	68	82	45	150	+5.5 -0.5	1.7
35	TBJ35SB	TBJ35SBC	35	40	16	12	80	70	79	90	100	60	180	+7.5 -0.5	3.9
	TBJ40SB	TBJ40SBC	40	40	16	12	80	70	79	90	100	60	180	+7.5 -0.5	3.7
42	TBJ42SB	TBJ42SBC	42	55	25	14	105	80	92	105	125	70	230	+8 -0.5	8.0
50	TBJ50SB	TBJ50SBC	50	65	30	16	120	90	110	125	150	90	270	+10 -0.5	14
60	TBJ60SB	TBJ60SBC	60	80	35	18	150	110	137	160	185	106	335	+13 -0.5	28

- Notes**
- 1) Bore tolerance : H7
  - 2) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.
  - 3) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 7 on page 8).

- Remarks**
1. For selection of the joints with small load carrying capacity against the shaft diameter, whose joint numbers have the symbol **M**, be careful about the torque to be loaded.
  2. Be sure to use the two joints. Only one joint of this type can not allow the misalignment between the two shaft.
  3. The boot band for the joints of series number 8 and 12 are of coil shape, and those of series number 16 to 60 are of band shape.

Simple substance series

SF type, SFC type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

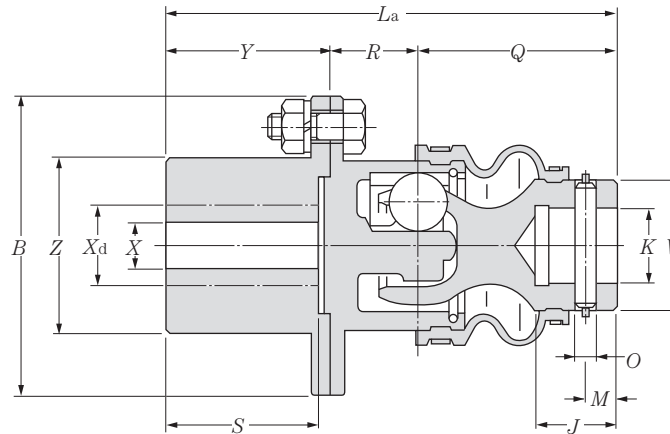
Series number	Joint number		Dimensions mm													Mass kg		
	General	High speed	B	D	N-E	F <sup>1)</sup>	G	C	R	K <sup>2)</sup>	J	M	O	Q	V		A	Standard Expansion <sup>3)</sup>
8	TBJ 8SF	TBJ 8SFC	44	34±0.1	3- 4.3	16	1.5	2	12	8	10	4	3	28	15	40	+2 -0.5	0.09
	TBJ10SF	TBJ10SFC	44	34±0.1	3- 4.3	16	1.5	2	12	10	10	4	3	28	15	40	+2 -0.5	0.09
	TBJ12SFM	TBJ12SFMC	44	34±0.1	3- 4.3	16	1.5	2	12	12	14	6	4	31	18	43	+2 -0.5	0.09
12	TBJ12SF	TBJ12SFC	55	44±0.1	3- 5.3	24	2	2.5	14	12	16	6	4	41	23	55	+2.5 -0.5	0.20
	TBJ14SF	TBJ14SFC	55	44±0.1	3- 5.3	24	2	2.5	14	14	16	6	4	41	23	55	+2.5 -0.5	0.20
	TBJ16SFM	TBJ16SFMC	55	44±0.1	3- 5.3	24	2	2.5	14	16	18	8	6	42	23	56	+2.5 -0.5	0.20
16	TBJ16SF	TBJ16SFC	70	56±0.15	3- 6.4	30	2	3	18	16	18	8	6	44	30	62	+3.5 -0.5	0.41
	TBJ18SF	TBJ18SFC	70	56±0.15	3- 6.4	30	2	3	18	18	18	8	6	44	30	62	+3.5 -0.5	0.41
	TBJ20SFM	TBJ20SFMC	70	56±0.15	3- 6.4	30	2	3	18	20	22	10	8	47	30	65	+3.5 -0.5	0.41
20	TBJ20SF	TBJ20SFC	86	68±0.15	3- 8.4	38	2.5	3.5	23	20	22	10	8	55	36	78	+4.5 -0.5	0.72
	TBJ22SF	TBJ22SFC	86	68±0.15	3- 8.4	38	2.5	3.5	23	22	22	10	8	55	36	78	+4.5 -0.5	0.72
	TBJ25SFM	TBJ25SFMC	86	68±0.15	3- 8.4	38	2.5	3.5	23	25	28	12	10	61	36	84	+4.5 -0.5	0.71
25	TBJ25SF	TBJ25SFC	102	82±0.15	3-10.5	48	2.5	4	30	25	28	12	10	68	45	98	+5.5 -0.5	1.4
	TBJ30SF	TBJ30SFC	102	82±0.15	3-10.5	48	2.5	4	30	30	28	12	10	68	45	98	+5.5 -0.5	1.4
	TBJ35SFM	TBJ35SFMC	102	82±0.15	3-10.5	48	2.5	4	30	35	40	16	12	82	45	112	+5.5 -0.5	1.4
35	TBJ35SF	TBJ35SFC	132	110±0.2	3-12.5	68	3	5	40	35	40	16	12	100	60	140	+7.5 -0.5	3.4
	TBJ40SF	TBJ40SFC	132	110±0.2	3-12.5	68	3	5	40	40	40	16	12	100	60	140	+7.5 -0.5	3.3
42	TBJ42SF	TBJ42SFC	152	126±0.2	3-14.5	88	3	15	60	42	55	25	14	125	70	185	+8 -0.5	7.0
50	TBJ50SF	TBJ50SFC	180	150±0.25	6-14.5	104	4	15	70	50	65	30	16	150	90	220	+10 -0.5	12
60	TBJ60SF	TBJ60SFC	198	170±0.25	6-14.5	140	5	15	85	60	80	35	18	185	106	270	+13 -0.5	20

Notes 1) Centering location's tolerance : h9  
 2) Bore tolerance : H7  
 3) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 7 on page 8).

Remarks 1. For selection of the joints with small load carrying capacity against the shaft diameter, whose joint numbers have the symbol M, be careful about the torque to be loaded.  
 2. Be sure to use the two joints. Only one joint of this type can not allow the misalignment between the two shaft.  
 3. The boot band for the joints of series number 8 and 12 are of coil shape, and those of series number 16 to 60 are of band shape.

Simple substance series

SFF type, SFFC type (for high speed)



Series number	Joint number		Dimensions mm									
	General	High speed	Maximum operating shaft size									
			B	Z	X	X <sub>d</sub> <sup>1)</sup>	S	Y	K	V	O	M
8	TBJ 8SFF	TBJ 8SFFC	44	25	0	10	22	24	8	15	3	4
	TBJ10SFF	TBJ10SFFC	44	25	0	10	22	24	10	15	3	4
	TBJ12SFMF	TBJ12SFMFC	44	25	0	10	22	24	12	18	4	6
12	TBJ12SFF	TBJ12SFFC	55	34	0	16	30	32.5	12	23	4	6
	TBJ14SFF	TBJ14SFFC	55	34	0	16	30	32.5	14	23	4	6
	TBJ16SFMF	TBJ16SFMFC	55	34	0	16	30	32.5	16	23	6	8
16	TBJ16SFF	TBJ16SFFC	70	42	10	22	40	42.5	16	30	6	8
	TBJ18SFF	TBJ18SFFC	70	42	10	22	40	42.5	18	30	6	8
	TBJ20SFMF	TBJ20SFMFC	70	42	10	22	40	42.5	20	30	8	10
20	TBJ20SFF	TBJ20SFFC	86	52	10	30	48	51	20	36	8	10
	TBJ22SFF	TBJ22SFFC	86	52	10	30	48	51	22	36	8	10
	TBJ25SFMF	TBJ25SFMFC	86	52	10	30	48	51	25	36	10	12
25	TBJ25SFF	TBJ25SFFC	102	60	15	38	54	57	25	45	10	12
	TBJ30SFF	TBJ30SFFC	102	60	15	38	54	57	30	45	10	12
	TBJ35SFMF	TBJ35SFMFC	102	60	15	38	54	57	35	45	12	16
35	TBJ35SFF	TBJ35SFFC	132	86	20	56	75	78.5	35	60	12	16
	TBJ40SFF	TBJ40SFFC	132	86	20	56	75	78.5	40	60	12	16
42	TBJ42SFF	TBJ42SFFC	152	95	20	62	90	94	42	70	14	25
50	TBJ50SFF	TBJ50SFFC	180	110	30	72	105	110	50	90	16	30
60	TBJ60SFMF	TBJ60SFFC	198	136	30	90	125	131	60	106	18	35

Notes 1) For machining, the concentricity relative to outside diameter Z must be dia. 0.1 mm or less.

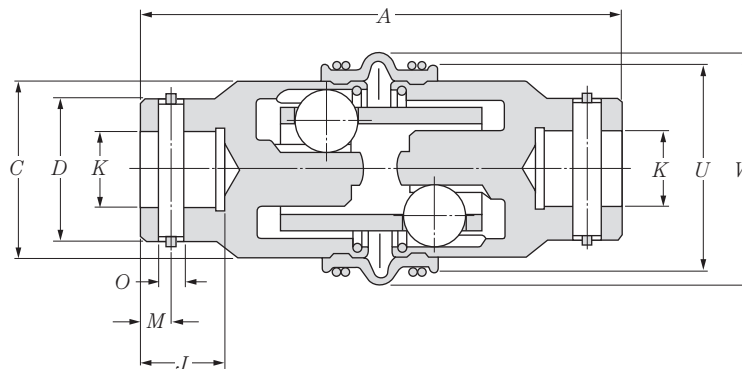
Remarks This series utilizes NTN SF type joints attached with semi-finished flange.



Dimensions mm					$GD^2$ kg · m <sup>2</sup>	Mass kg
<i>J</i>	<i>R</i>	<i>Q</i>	<i>L<sub>a</sub></i> Standard Expansion			
10	12	28	64	+2 -0.5	0.09 × 10 <sup>-3</sup>	0.21
10	12	28	64	+2 -0.5	0.09 × 10 <sup>-3</sup>	0.21
14	12	31	67	+2 -0.5	0.09 × 10 <sup>-3</sup>	0.21
16	14	41	87.5	+2.5 -0.5	0.35 × 10 <sup>-3</sup>	0.47
16	14	41	87.5	+2.5 -0.5	0.35 × 10 <sup>-3</sup>	0.47
18	14	42	88.5	+2.5 -0.5	0.35 × 10 <sup>-3</sup>	0.47
18	18	44	104.5	+3.5 -0.5	1.10 × 10 <sup>-3</sup>	0.90
18	18	44	104.5	+3.5 -0.5	1.10 × 10 <sup>-3</sup>	0.90
22	18	47	107.5	+3.5 -0.5	1.10 × 10 <sup>-3</sup>	0.90
22	23	55	129	+4.5 -0.5	3.10 × 10 <sup>-3</sup>	1.7
22	23	55	129	+4.5 -0.5	3.10 × 10 <sup>-3</sup>	1.7
28	23	61	135	+4.5 -0.5	3.10 × 10 <sup>-3</sup>	1.7
28	30	68	155	+5.5 -0.5	7.50 × 10 <sup>-3</sup>	2.9
28	30	68	155	+5.5 -0.5	7.50 × 10 <sup>-3</sup>	2.9
40	30	82	169	+5.5 -0.5	7.50 × 10 <sup>-3</sup>	2.9
40	40	100	218.5	+7.5 -0.5	32.0 × 10 <sup>-3</sup>	7.2
40	40	100	218.5	+7.5 -0.5	32.0 × 10 <sup>-3</sup>	7.2
55	60	125	279	+8 -0.5	86 × 10 <sup>-3</sup>	13
65	70	150	330	+10 -0.5	205 × 10 <sup>-3</sup>	22
80	85	185	401	+13 -0.5	410 × 10 <sup>-3</sup>	37

Simple substance series

DB type, DBC type (for high speed)



Allowable operating angle  $\theta$  Dynamic 8°  
Static 10°

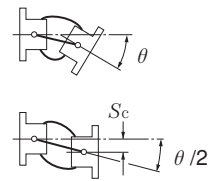
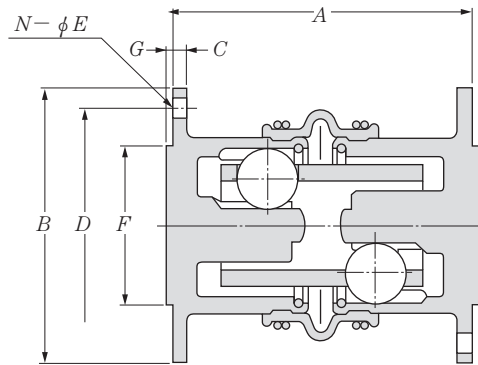
Series number	Joint number		Dimensions										Allowable offset centering $S_c$	Mass kg
	General	High speed	$K^{1)}$	$J$	$M$	$O$	$C$	mm		$U$	$W^{2)}$	Expansion <sup>3)</sup>		
								$D$	$U$		Standard			
8	TBJ 8DB	TBJ 8DBC	8	10	4	3	20	18	25	28	60	± 3.5	1.0	0.10
	TBJ10DB	TBJ10DBC	10	10	4	3	20	18	25	28	60	± 3.5	1.0	0.10
	TBJ12DBM	TBJ12DBMC	12	14	6	4	20	20	25	28	66	± 3.5	1.0	0.08
12	TBJ12DB	TBJ12DBC	12	16	6	4	29	26	36	38	80	± 4.0	1.5	0.32
	TBJ14DB	TBJ14DBC	14	16	6	4	29	26	36	38	80	± 4.0	1.5	0.32
	TBJ16DBM	TBJ16DBMC	16	18	8	6	29	29	36	38	84	± 4.0	1.5	0.34
16	TBJ16DB	TBJ16DBC	16	18	8	6	38	32	45	50	100	± 6.0	2.0	0.60
	TBJ18DB	TBJ18DBC	18	18	8	6	38	32	45	50	100	± 6.0	2.0	0.60
	TBJ20DBM	TBJ20DBMC	20	22	10	8	38	38	45	50	108	± 6.0	2.0	0.61
20	TBJ20DB	TBJ20DBC	20	22	10	8	47	38	56	60	125	± 7.0	2.5	1.1
	TBJ22DB	TBJ22DBC	22	22	10	8	47	38	56	60	125	± 7.0	2.5	1.1
	TBJ25DBM	TBJ25DBMC	25	28	12	10	47	47	56	60	137	± 7.0	2.5	1.4
25	TBJ25DB	TBJ25DBC	25	28	12	10	58	50	68	80	160	± 9.0	3.5	2.0
	TBJ30DB	TBJ30DBC	30	28	12	10	58	50	68	80	160	± 9.0	3.5	1.9
	TBJ35DBM	TBJ35DBMC	35	40	16	12	58	58	68	80	180	± 9.0	3.5	2.3
35	TBJ35DB	TBJ35DBC	35	40	16	12	79	70	90	110	212	±12	4.5	5.4
	TBJ40DB	TBJ40DBC	40	40	16	12	79	70	90	110	212	±12	4.5	5.2
42	TBJ42DB	TBJ42DBC	42	55	25	14	92	80	105	120	280	±13	5	11
50	TBJ50DB	TBJ50DBC	50	65	30	16	110	90	125	150	320	±15	7	20
60	TBJ60DB	TBJ60DBC	60	80	35	18	137	110	160	177	410	±18	8	38

- Notes**
- 1) Bore tolerance : H7
  - 2) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.
  - 3) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 8 on page 9).

- Remarks**
1. For selection of the joints with small load carrying capacity against the shaft diameter, whose joint numbers have the symbol **M**, be careful about the torque to be loaded.
  2. The boot band for the joints of series number 8 and 12 are of coil shape, and those of series number 16 to 60 are of band shape.

Simple substance series

DF type, DFC type (for high speed)



Allowable operating angle  $\theta$  Dynamic 8°  
Static 20°

Series number	Joint number		Dimensions									Allowable offset centering $S_c$	Mass kg
	General	High speed	B	D	N-E	mm $F^{1)}$	G	C	A				
									Standard	Expansion <sup>2)</sup>			
8	TBJ 8DF	TBJ 8DFC	44	34±0.1	3- 4.3	16	1.5	2	40	±3.5	1.0	0.10	
12	TBJ12DF	TBJ12DFC	55	44±0.1	3- 5.3	24	2	2.5	48	±4.0	1.5	0.27	
16	TBJ16DF	TBJ16DFC	70	56±0.15	3- 6.4	30	2	3	64	±6.0	2.0	0.50	
20	TBJ20DF	TBJ20DFC	86	68±0.15	3- 8.4	38	2.5	3.5	81	±7.0	2.5	1.0	
25	TBJ25DF	TBJ25DFC	102	82±0.15	3-10.5	48	2.5	4	104	±9.0	3.5	2.0	
35	TBJ35DF	TBJ35DFC	132	110±0.2	3-12.5	68	3	5	132	±12	4.5	4.3	
42	TBJ42DF	TBJ42DFC	152	126±0.2	3-14.5	88	3	15	190	±13	5	8.5	
50	TBJ50DF	TBJ50DFC	180	150±0.25	6-14.5	104	4	15	220	±15	7	15	
60	TBJ60DF	TBJ60DFC	198	170±0.25	6-14.5	140	5	15	280	±18	8	27	

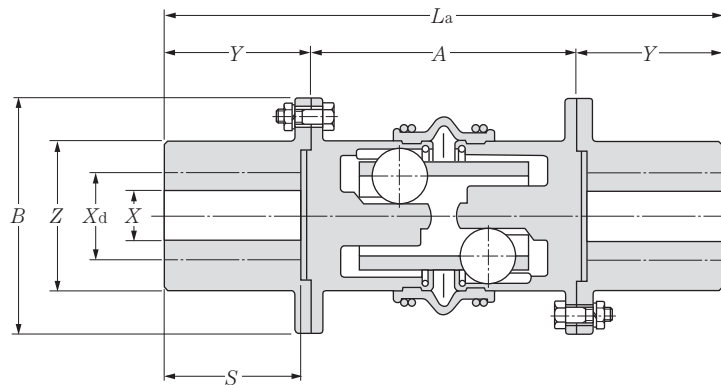
Notes 1) Centering location's tolerance : h9

2) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 8 on page 9).

Remarks The boot band for the joints of series number 8 and 12 are of coil shape, and those of series number 16 to 60 are of band shape.

## Simple substance series

### DFF type, DFFC type (for high speed)



Series number	Joint number		Dimensions mm						
	General	High speed	B	Z	X	Maximum operating shaft size $X_d^{1)}$	S	Y	A
8	TBJ 8DFF	TBJ 8DFFC	44	25	0	10	22	24	40
12	TBJ12DFF	TBJ12DFFC	55	34	0	16	30	32.5	48
16	TBJ16DFF	TBJ16DFFC	70	42	10	22	40	42.5	64
20	TBJ20DFF	TBJ20DFFC	86	52	10	30	48	51	81
25	TBJ25DFF	TBJ25DFFC	102	60	15	38	54	57	104
35	TBJ35DFF	TBJ35DFFC	132	86	20	56	75	78.5	132
42	TBJ42DFF	TBJ42DFFC	152	95	20	62	90	94	190
50	TBJ50DFF	TBJ50DFFC	180	110	30	72	105	110	220
60	TBJ60DFF	TBJ60DFFC	198	136	30	90	125	131	280

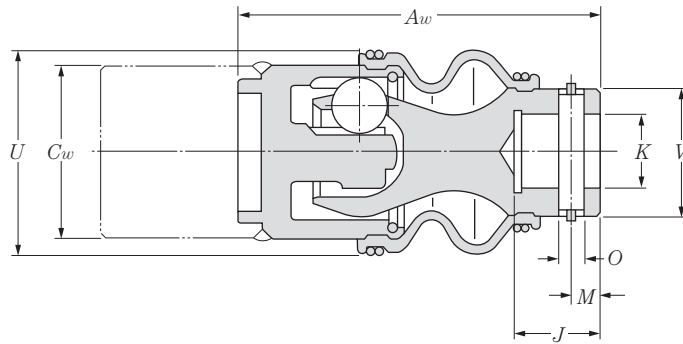
**Notes** 1) For machining, the concentricity relative to outside diameter  $Z$  must be dia. 0.1 mm or less.

**Remarks** This series uses NTN DF type joints attached with semi-finished flange.

Dimensions mm $L_a$		Allowable offset centering mm	$GD^2$ kg · m <sup>2</sup>	Mass kg
Standard	Expansion			
88	± 3.5	1.0	$0.17 \times 10^{-3}$	0.33
113	± 4.0	1.5	$0.64 \times 10^{-3}$	0.80
149	± 6.0	2.0	$2.06 \times 10^{-3}$	1.5
183	± 7.0	2.5	$5.80 \times 10^{-3}$	2.9
218	± 9.0	3.5	$14.0 \times 10^{-3}$	4.9
289	± 12	4.5	$59.5 \times 10^{-3}$	12
378	± 13	5	$165 \times 10^{-3}$	21
440	± 15	7	$375 \times 10^{-3}$	35
542	± 18	8	$770 \times 10^{-3}$	60

Simple substance series (Reference)

SBW type



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

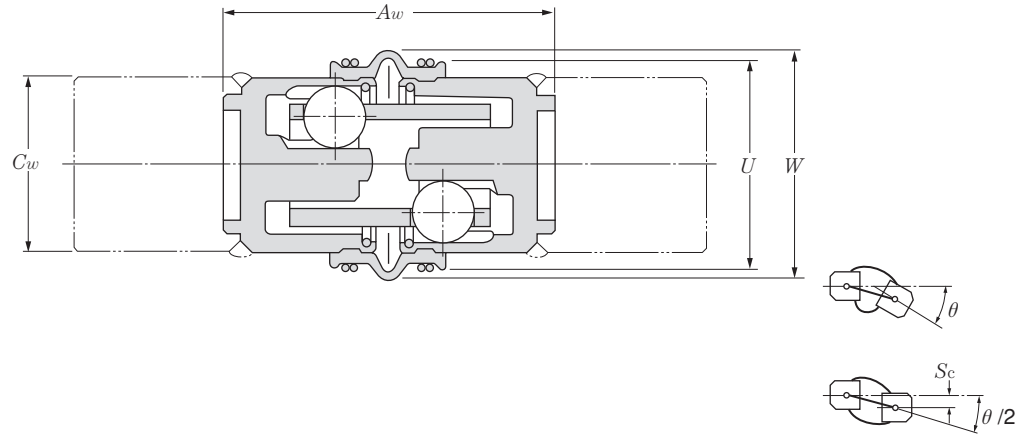
Series number	Joint number	Dimensions mm								
		$K^{1)}$	$J$	$M$	$O$	$U^{2)}$	$C_w$	$V$	Standard	$A_w$ Expansion <sup>3)</sup>
8	TBJ 8SBW	8	10	4	3	25	20	15	44	+2 -0.5
12	TBJ12SBW	12	16	6	4	36	29	23	62	+2.5 -0.5
16	TBJ16SBW	16	18	8	6	45	38	30	69	+3.5 -0.5
20	TBJ20SBW	20	22	10	8	56	47	36	83	+4.5 -0.5
25	TBJ25SBW	25	28	12	10	68	58	45	105	+5.5 -0.5
35	TBJ35SBW	35	40	16	12	90	79	60	149	+7.5 -0.5
42	TBJ42SBW	42	55	25	14	105	92	70	180	+8 -0.5
50	TBJ50SBW	50	65	30	16	125	110	90	220	+10 -0.5
60	TBJ60SBW	60	80	35	18	160	137	106	270	+13 -0.5

- Notes**
- 1) Bore tolerance : H7
  - 2) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.
  - 3) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 7 on page 8).

- Remarks**
1. A flange or a hub can be welded to the outer race of this type of joint. NTN of the dimensions of flange or hub.
  2. Be sure to use the two joints. Only one joint of this type can not allow the misalignment between the two shaft.

Simple substance series (Reference)

DBW type



Allowable operating angle  $\theta$  Dynamic 8°  
Static 20°

Series number	Joint number	Dimensions mm					Allowable offset centering $S_c$
		$C_w$	$U$	$W^{1)}$	Standard	$A_w$ Expansion <sup>2)</sup>	
8	TBJ 8DBW	20	25	28	48	±3.5	1.0
12	TBJ12DBW	29	36	38	62	±4.0	1.5
16	TBJ16DBW	38	45	50	78	±6.0	2.0
20	TBJ20DBW	47	56	60	91	±7.0	2.5
25	TBJ25DBW	58	68	80	118	±9.0	3.5
35	TBJ35DBW	79	90	110	150	±12	4.5
42	TBJ42DBW	92	105	120	180	±13	5
50	TBJ50DBW	110	125	150	220	±15	7
60	TBJ60DBW	137	160	177	280	±18	8

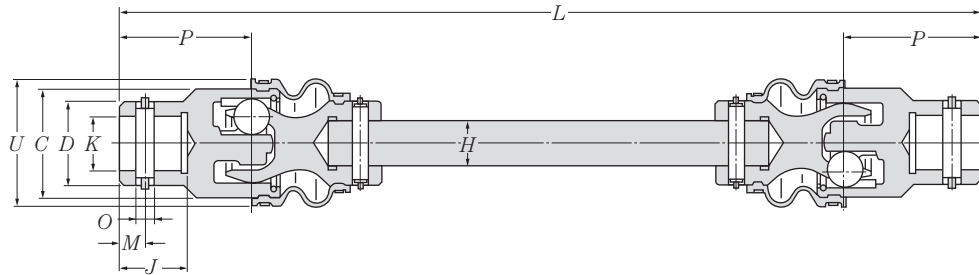
**Notes** 1) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.

2) Allowable expansion is based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 8 on page 8).

**Remarks** 1. A flange or a hub can be welded to the outer race of joint. Provide NTN with the dimensions of flange or hub.

## Shaft connection series

### BB type, BB · C type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°

Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions										
	General	High speed	$K^{2)}$	$D$	$C$	$U^{3)}$	$O$	mm		$J$	$H$	$P$	$L^{4)}$
								$M$	$J$	$H$	$P$	min.	max.
8	TBJ 8BB	TBJ 8BB···C	8	18	20	25	3	4	10	8	22	100	300
	TBJ10BB	TBJ10BB···C	10	18	20	25	3	4	10	10	22	100	300
12	TBJ12BB	TBJ12BB···C	12	26	29	36	4	6	16	12	30	145	350
	TBJ14BB	TBJ14BB···C	14	26	29	36	4	6	16	14	30	145	350
16	TBJ16BB	TBJ16BB···C	16	32	38	45	6	8	18	16	36	160	400
	TBJ18BB	TBJ18BB···C	18	32	38	45	6	8	18	18	36	160	400
20	TBJ20BB	TBJ20BB···C	20	38	47	56	8	10	22	20	45	200	450
	TBJ22BB	TBJ22BB···C	22	38	47	56	8	10	22	22	45	200	450
25	TBJ25BB	TBJ25BB···C	25	50	58	68	10	12	28	25	58	255	500
	TBJ30BB	TBJ30BB···C	30	50	58	68	10	12	28	30	58	255	500
35	TBJ35BB	TBJ35BB···C	35	70	79	90	12	16	40	35	80	360	600
	TBJ40BB	TBJ40BB···C	40	70	79	90	12	16	40	40	80	360	600
42	TBJ42BB	TBJ42BB···C	42	80	92	105	14	25	55	42	105	460	700
50	TBJ50BB	TBJ50BB···C	50	90	110	125	16	30	65	50	120	540	800
60	TBJ60BB	TBJ60BB···C	60	110	137	160	18	35	80	60	150	670	900

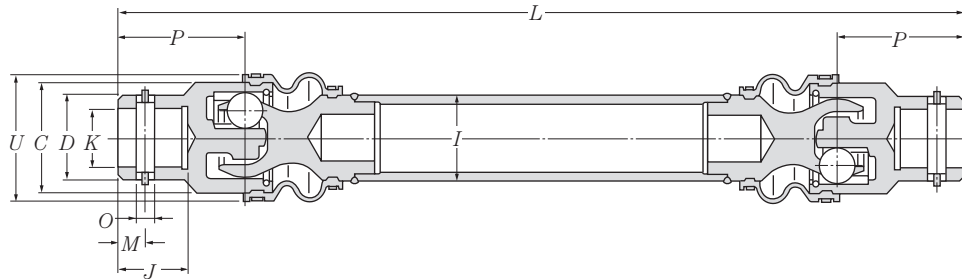
- Notes**
- 1) Joint number is referred to as the basic number plus joint length ( $L$ ).  
 (Example)  $L = 100$  : TBJ8BB100 ...General use  
 TBJ8BB100C...For high speed
  - 2) Bore tolerance : H7
  - 3) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.
  - 4) Joint length is of 1 mm interval.
  - 5) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).



Allowable <sup>5)</sup> expansion against <i>L</i> mm	<i>GD</i> <sup>2</sup> kg · m <sup>2</sup>		Mass kg	
	<i>L</i> =1000 mm	per additional length 100 mm	<i>L</i> =1000 mm	per additional length 100 mm
+ 4 -1	0.034 × 10 <sup>-3</sup>	0.001 × 10 <sup>-3</sup>	0.49	0.04
+ 4 -1	0.050 × 10 <sup>-3</sup>	0.003 × 10 <sup>-3</sup>	0.70	0.06
+ 5 -1	0.210 × 10 <sup>-3</sup>	0.006 × 10 <sup>-3</sup>	1.2	0.09
+ 5 -1	0.330 × 10 <sup>-3</sup>	0.012 × 10 <sup>-3</sup>	1.5	0.12
+ 7 -1	0.680 × 10 <sup>-3</sup>	0.02 × 10 <sup>-3</sup>	2.1	0.16
+ 7 -1	0.790 × 10 <sup>-3</sup>	0.03 × 10 <sup>-3</sup>	2.5	0.20
+ 9 -1	1.80 × 10 <sup>-3</sup>	0.05 × 10 <sup>-3</sup>	3.4	0.25
+ 9 -1	2.00 × 10 <sup>-3</sup>	0.07 × 10 <sup>-3</sup>	3.9	0.30
+11 -1	5.25 × 10 <sup>-3</sup>	0.12 × 10 <sup>-3</sup>	5.9	0.39
+11 -1	6.30 × 10 <sup>-3</sup>	0.25 × 10 <sup>-3</sup>	7.3	0.55
+15 -1	23.5 × 10 <sup>-3</sup>	0.46 × 10 <sup>-3</sup>	12	0.76
+15 -1	26.0 × 10 <sup>-3</sup>	0.79 × 10 <sup>-3</sup>	14	0.99
+16 -1	54.0 × 10 <sup>-3</sup>	0.96 × 10 <sup>-3</sup>	20	1.1
+20 -1	130 × 10 <sup>-3</sup>	1.93 × 10 <sup>-3</sup>	31	1.5
+26 -1	345 × 10 <sup>-3</sup>	4.00 × 10 <sup>-3</sup>	50	2.2

Shaft connection series

BP type, BP··C type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm										
	General	High speed	K <sup>2)</sup>	D	C	U <sup>3)</sup>	O	M	J	I	P	L <sup>4)</sup> min. max.	
8	TBJ 8BP	TBJ 8BP··C	8	18	20	25	3	4	10	18	22	145	500
	TBJ10BP	TBJ10BP··C	10	18	20	25	3	4	10	18	22	145	500
12	TBJ12BP	TBJ12BP··C	12	26	29	36	4	6	16	25.4	30	160	800
	TBJ14BP	TBJ14BP··C	14	26	29	36	4	6	16	25.4	30	160	800
16	TBJ16BP	TBJ16BP··C	16	32	38	45	6	8	18	31.8	36	180	1 200
	TBJ18BP	TBJ18BP··C	18	32	38	45	6	8	18	31.8	36	180	1 200
20	TBJ20BP	TBJ20BP··C	20	38	47	56	8	10	22	35	45	220	1 500
	TBJ22BP	TBJ22BP··C	22	38	47	56	8	10	22	35	45	220	1 500
25	TBJ25BP	TBJ25BP··C	25	50	58	68	10	12	28	45	58	270	2 000
	TBJ30BP	TBJ30BP··C	30	50	58	68	10	12	28	45	58	270	2 000
35	TBJ35BP	TBJ35BP··C	35	70	79	90	12	16	40	60.5	80	380	2 500
	TBJ40BP	TBJ40BP··C	40	70	79	90	12	16	40	60.5	80	380	2 500
42	TBJ42BP	TBJ42BP··C	42	80	92	105	14	25	55	70	105	460	3 000
50	TBJ50BP	TBJ50BP··C	50	90	110	125	16	30	65	89.1	120	500	3 500
60	TBJ60BP	TBJ60BP··C	60	110	137	160	18	35	80	101.6	150	650	4 000

- Notes
- 1) Joint number is referred to as the basic number plus joint length (L).  
 (Example) L = 145 : TBJ8BP145 ...General use  
 TBJ8BP145C...For high speed
  - 2) Bore tolerance : H7
  - 3) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.
  - 4) Joint length is of 1 mm interval.
  - 5) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).

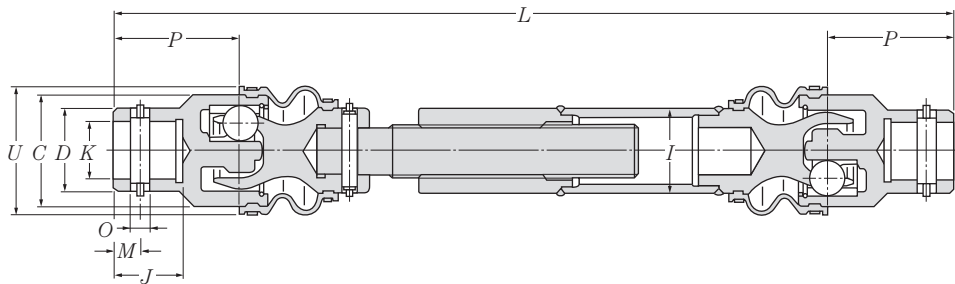
Allowable <sup>5)</sup> expansion against L mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
	L=1000 mm	per additional length 100 mm	L=1000 mm	per additional length 100 mm
+ 4 -1	$0.215 \times 10^{-3}$	$0.02 \times 10^{-3}$	0.85	0.08
+ 4 -1	$0.215 \times 10^{-3}$	$0.02 \times 10^{-3}$	0.85	0.08
+ 5 -1	$0.980 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.1	0.19
+ 5 -1	$0.980 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.1	0.19
+ 7 -1	$2.15 \times 10^{-3}$	$0.19 \times 10^{-3}$	2.8	0.23
+ 7 -1	$2.15 \times 10^{-3}$	$0.19 \times 10^{-3}$	2.8	0.23
+ 9 -1	$3.70 \times 10^{-3}$	$0.27 \times 10^{-3}$	3.7	0.27
+ 9 -1	$3.70 \times 10^{-3}$	$0.27 \times 10^{-3}$	3.7	0.27
+11 -1	$9.30 \times 10^{-3}$	$0.62 \times 10^{-3}$	5.7	0.36
+11 -1	$9.30 \times 10^{-3}$	$0.62 \times 10^{-3}$	5.7	0.36
+15 -1	$36.0 \times 10^{-3}$	$2.13 \times 10^{-3}$	12	0.68
+15 -1	$36.0 \times 10^{-3}$	$2.13 \times 10^{-3}$	12	0.68
+16 -1	$70 \times 10^{-3}$	$3.4 \times 10^{-3}$	18	0.80
+20 -1	$170 \times 10^{-3}$	$8.54 \times 10^{-3}$	29	1.2
+26 -1	$415 \times 10^{-3}$	$17.8 \times 10^{-3}$	50	2.1

## Shaft connection series

### BT type, BT··C type (for high speed)

#### CAUTION

When the allowable expansion is exceeded, the splined shaft can come off. Strictly avoid this situation.



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
Static 20°  
Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm										
	General	High speed	$K$ <sup>2)</sup>	$D$	$C$	$U$ <sup>3)</sup>	$O$	$M$	$J$	$I$	$P$	$L$ <sup>4)</sup> min. max.	
8	TBJ 8BT	TBJ 8BT··C	8	18	20	25	3	4	10	18	22	245	450
	TBJ10BT	TBJ10BT··C	10	18	20	25	3	4	10	18	22	245	450
12	TBJ12BT	TBJ12BT··C	12	26	29	36	4	6	16	25.4	30	310	600
	TBJ14BT	TBJ14BT··C	14	26	29	36	4	6	16	25.4	30	310	600
16	TBJ16BT	TBJ16BT··C	16	32	38	45	6	8	18	31.8	36	345	1 000
	TBJ18BT	TBJ18BT··C	18	32	38	45	6	8	18	31.8	36	345	1 000
20	TBJ20BT	TBJ20BT··C	20	38	47	56	8	10	22	35	45	410	1 200
	TBJ22BT	TBJ22BT··C	22	38	47	56	8	10	22	35	45	410	1 200
25	TBJ25BT	TBJ25BT··C	25	50	58	68	10	12	28	45	58	500	1 500
	TBJ30BT	TBJ30BT··C	30	50	58	68	10	12	28	45	58	500	1 500
35	TBJ35BT	TBJ35BT··C	35	70	79	90	12	16	40	60.5	80	650	2 000
	TBJ40BT	TBJ40BT··C	40	70	79	90	12	16	40	60.5	80	650	2 000
42	TBJ42BT	TBJ42BT··C	42	80	92	105	14	25	55	70	105	830	2 000
50	TBJ50BT	TBJ50BT··C	50	90	110	125	16	30	65	89.1	120	1 000	2 000
60	TBJ60BT	TBJ60BT··C	60	110	137	160	18	35	80	101.6	150	1 150	2 000

**Notes** 1) Joint number is referred to as the basic number plus joint length ( $L$ ).  
(Example)  $L = 245$  : TBJ8BT245 ...General use  
TBJ8BT245C...For high speed

2) Bore tolerance : H7

3) Standard boot sizes. Make an approx. 5 mm clearance from the adjacent objects (structure, cover etc.) for the change in the boot size caused by rotation.

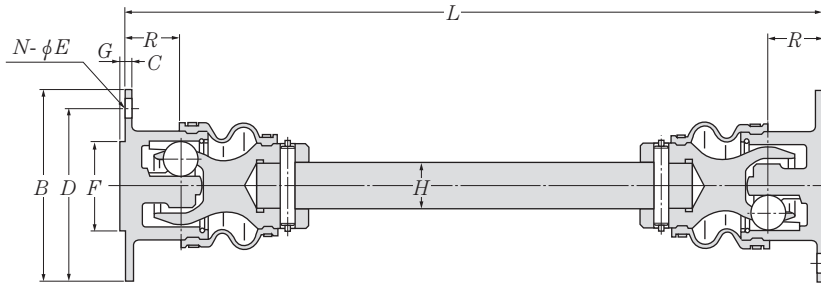
4) Joint length is of 5 mm interval.

**Remark** When intending to install this joint vertically, contact NTN engineering.

Allowable expansion against $L$ mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
	$L=1000$ mm	per additional length 100 mm	$L=1000$ mm	per additional length 100 mm
± 20	$0.26 \times 10^{-3}$	$0.02 \times 10^{-3}$	0.98	0.08
± 20	$0.26 \times 10^{-3}$	$0.02 \times 10^{-3}$	0.98	0.08
± 30	$1.00 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.3	0.19
± 30	$1.00 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.3	0.19
± 35	$2.15 \times 10^{-3}$	$0.19 \times 10^{-3}$	3.0	0.23
± 35	$2.15 \times 10^{-3}$	$0.19 \times 10^{-3}$	3.0	0.23
± 40	$3.80 \times 10^{-3}$	$0.27 \times 10^{-3}$	4.2	0.27
± 40	$3.80 \times 10^{-3}$	$0.27 \times 10^{-3}$	4.2	0.27
± 45	$9.50 \times 10^{-3}$	$0.62 \times 10^{-3}$	6.6	0.36
± 45	$9.50 \times 10^{-3}$	$0.62 \times 10^{-3}$	6.6	0.36
± 60	$38.5 \times 10^{-3}$	$2.11 \times 10^{-3}$	15	0.68
± 60	$38.5 \times 10^{-3}$	$2.11 \times 10^{-3}$	15	0.68
± 75	$75.5 \times 10^{-3}$	$3.40 \times 10^{-3}$	22	0.80
± 85	$200 \times 10^{-3}$	$8.54 \times 10^{-3}$	39	1.2
± 100	$420 \times 10^{-3}$	$17.3 \times 10^{-3}$	57	2.1

## Shaft connection series

### FB type, FB··C type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

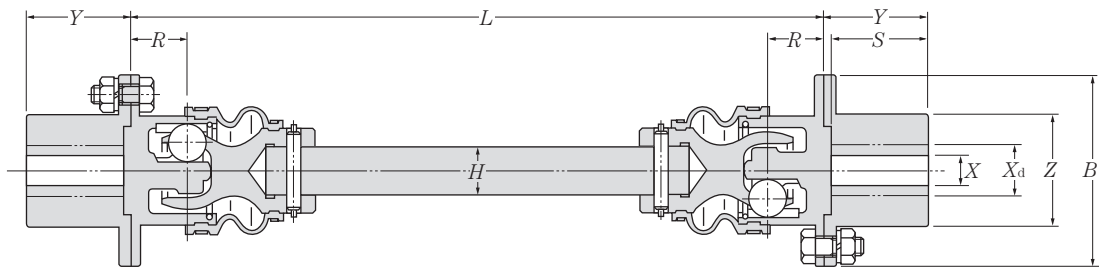
Series number	Basic number <sup>1)</sup>		Dimensions mm									
	General	High speed	$B$	$D$	$N-\phi E$	$F$ <sup>2)</sup>	$G$	$C$	$R$	$H$	$L$ <sup>3)</sup> min. max.	
8	TBJ 8FB	TBJ 8FB··C	44	34±0.1	3- 4.3	16	1.5	2	12	8	80	250
12	TBJ12FB	TBJ12FB··C	55	44±0.1	3- 5.3	24	2	2.5	14	12	110	300
16	TBJ16FB	TBJ16FB··C	70	56±0.15	3- 6.4	30	2	3	18	16	125	350
20	TBJ20FB	TBJ20FB··C	86	68±0.15	3- 8.4	38	2.5	3.5	23	20	160	400
25	TBJ25FB	TBJ25FB··C	102	82±0.15	3-10.5	48	2.5	4	30	25	200	450
35	TBJ35FB	TBJ35FB··C	132	110±0.2	3-12.5	68	3	5	40	35	280	550
42	TBJ42FB	TBJ42FB··C	152	126±0.2	3-14.5	88	3	15	60	42	370	600
50	TBJ50FB	TBJ50FB··C	180	150±0.25	6-14.5	104	4	15	70	50	440	700
60	TBJ60FB	TBJ60FB··C	198	170±0.25	6-14.5	140	5	15	85	60	540	800

- Notes**
- 1) Joint number is referred to as the basic number plus joint length ( $L$ ).  
 (Example)  $L = 80$  : TBJ8FB80 ···General use  
 TBJ8FB80C···For high speed
  - 2) Centering location's tolerance : h9
  - 3) Joint length is of 1 mm interval.
  - 4) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).
- Remark** Joint provided with bolts, washers and nuts are also available. Those product No. have a symbol **Z** after the symbol of length.

Allowable <sup>4)</sup> expansion against <i>L</i> mm	<i>GD</i> <sup>2</sup> kg · m <sup>2</sup>		Mass kg	
	<i>L</i> = 500 mm	per additional length 100 mm	<i>L</i> = 500 mm	per additional length 100 mm
+ 4 -1	0.07 × 10 <sup>-3</sup>	0.001 × 10 <sup>-3</sup>	0.35	0.04
+ 5 -1	0.3 × 10 <sup>-3</sup>	0.006 × 10 <sup>-3</sup>	0.77	0.09
+ 7 -1	0.95 × 10 <sup>-3</sup>	0.02 × 10 <sup>-3</sup>	1.5	0.16
+ 9 -1	2.70 × 10 <sup>-3</sup>	0.05 × 10 <sup>-3</sup>	2.4	0.25
+11 -1	6.70 × 10 <sup>-3</sup>	0.12 × 10 <sup>-3</sup>	4.2	0.39
+15 -1	26.7 × 10 <sup>-3</sup>	0.46 × 10 <sup>-3</sup>	9.1	0.76
+16 -1	86.5 × 10 <sup>-3</sup>	0.96 × 10 <sup>-3</sup>	17	1.1
+20 -1	200 × 10 <sup>-3</sup>	1.93 × 10 <sup>-3</sup>	27	1.5
+26 -1	430 × 10 <sup>-3</sup>	4.00 × 10 <sup>-3</sup>	43	2.2

**Shaft connection series**

**FB · F type, FB · FC type (for high speed)**



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm							
	General	High speed	B	Z	X <sup>2)</sup>	Maximum operating shaft size X <sub>d</sub> <sup>3)</sup>	Y	S <sub>min.</sub>	H <sub>max.</sub>	R
8	TBJ 8FB···F	TBJ 8FB···FC	44	25	0	10	24	22	8	12
12	TBJ12FB···F	TBJ12FB···FC	55	34	0	16	32.5	30	12	14
16	TBJ16FB···F	TBJ16FB···FC	70	42	10	22	42.5	40	16	18
20	TBJ20FB···F	TBJ20FB···FC	86	52	10	30	51	48	20	23
25	TBJ25FB···F	TBJ25FB···FC	102	60	15	38	57	54	25	30
35	TBJ35FB···F	TBJ35FB···FC	132	86	20	56	78.5	75	35	40
42	TBJ42FB···F	TBJ42FB···FC	152	95	20	62	94	90	42	60
50	TBJ50FB···F	TBJ50FB···FC	180	110	30	72	110	105	50	70
60	TBJ60FB···F	TBJ60FB···FC	198	136	30	90	131	125	60	85

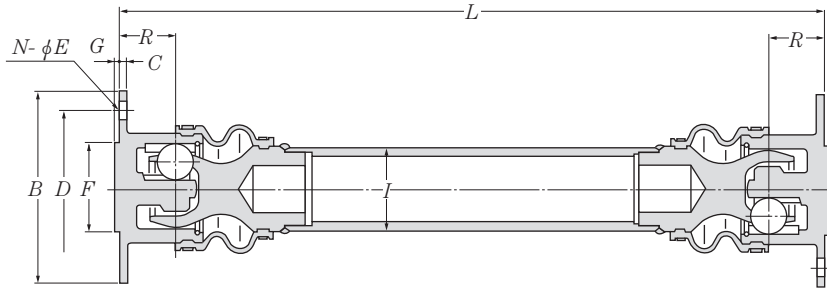
- Notes**
- 1) Joint number is referred to as the basic number plus joint length (L).  
 (Example) L = 80 : TBJ8FB80F ···General use  
 TBJ8FB80FC···For high speed
  - 2) These values show the diameter of the prepared holes.
  - 3) For machining, the concentricity relative to outside diameter Z must be dia. 0.1 mm or less.
  - 4) Joint length is of 1 mm interval.
  - 5) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).



Dimensions mm $L^4$		Allowable <sup>5)</sup> expansion against $L$ mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
min.	max.		$L=500$ mm	per additional length 100 mm	$L=500$ mm	per additional length 100 mm
80	250	+ 4 -1	$0.19 \times 10^{-3}$	$0.001 \times 10^{-3}$	0.59	0.04
110	300	+ 5 -1	$0.73 \times 10^{-3}$	$0.006 \times 10^{-3}$	1.3	0.09
125	350	+ 7 -1	$2.27 \times 10^{-3}$	$0.02 \times 10^{-3}$	2.5	0.16
160	400	+ 9 -1	$6.50 \times 10^{-3}$	$0.05 \times 10^{-3}$	4.4	0.25
200	450	+11 -1	$15.5 \times 10^{-3}$	$0.12 \times 10^{-3}$	7.3	0.39
280	550	+15 -1	$65.0 \times 10^{-3}$	$0.46 \times 10^{-3}$	17	0.76
370	600	+16 -1	$175 \times 10^{-3}$	$0.96 \times 10^{-3}$	30	1.1
440	700	+20 -1	$410 \times 10^{-3}$	$1.93 \times 10^{-3}$	48	1.5
540	800	+26 -1	$840 \times 10^{-3}$	$4.00 \times 10^{-3}$	76	2.2

Shaft connection series

FP type, FP··C type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm									
	General	High speed	$B$	$D$	$N-\phi E$	$F^{2)}$	$G$	$C$	$R$	$I$	$L^{3)}$ min. max.	
8	TBJ 8FP	TBJ 8FP··C	44	34 ±0.1	3- 4.5	16	1.5	2	12	18	125	500
12	TBJ12FP	TBJ12FP··C	55	44 ±0.1	3- 5.3	24	2	2.5	14	25.4	130	800
16	TBJ16FP	TBJ16FP··C	70	56 ±0.15	3- 6.4	30	2	3	18	31.8	145	1 200
20	TBJ20FP	TBJ20FP··C	86	68 ±0.15	3- 8.4	38	2.5	3.5	23	35	175	1 500
25	TBJ25FP	TBJ25FP··C	102	82 ±0.15	3-10.5	48	2.5	4	30	45	220	2 000
35	TBJ35FP	TBJ35FP··C	132	110 ±0.2	3-12.5	68	3	5	40	60.5	300	2 500
42	TBJ42FP	TBJ42FP··C	152	126 ±0.2	3-14.5	88	3	15	60	70	370	3 000
50	TBJ50FP	TBJ50FP··C	180	150 ±0.25	6-14.5	104	4	15	70	89.1	400	3 500
60	TBJ60FP	TBJ60FP··C	198	170 ±0.25	6-14.5	140	5	15	85	101.6	520	4 000

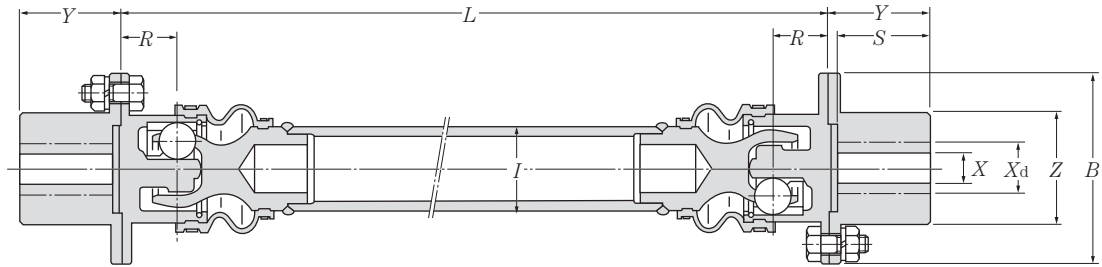
- Notes**
- 1) Joint number is referred to as the basic number plus joint length ( $L$ ).  
 (Example)  $L = 250$  : TBJ8FP250 ...General use  
 TBJ8FP250C...For high speed
  - 2) Centering location's tolerance : h9
  - 3) Joint length is of 1 mm interval.
  - 4) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).

**Remark** Joint provided with bolts, washers and nuts are also available. Those product No. have a symbol **Z** after the symbol of length.

Allowable <sup>4)</sup> expansion against <i>L</i> mm	<i>GD</i> <sup>2</sup> kg · m <sup>2</sup>		Mass kg	
	<i>L</i> =500 mm	per additional length 100 mm	<i>L</i> =500 mm	per additional length 100 mm
+ 4 -1	0.14 × 10 <sup>-3</sup>	0.02 × 10 <sup>-3</sup>	0.50	0.08
+ 5 -1	0.60 × 10 <sup>-3</sup>	0.09 × 10 <sup>-3</sup>	1.2	0.19
+ 7 -1	1.56 × 10 <sup>-3</sup>	0.19 × 10 <sup>-3</sup>	1.7	0.23
+ 9 -1	3.31 × 10 <sup>-3</sup>	0.27 × 10 <sup>-3</sup>	2.4	0.27
+11 -1	8.08 × 10 <sup>-3</sup>	0.62 × 10 <sup>-3</sup>	3.9	0.36
+15 -1	30.0 × 10 <sup>-3</sup>	2.13 × 10 <sup>-3</sup>	8.5	0.68
+16 -1	90.0 × 10 <sup>-3</sup>	3.4 × 10 <sup>-3</sup>	15	0.80
+20 -1	206 × 10 <sup>-3</sup>	8.54 × 10 <sup>-3</sup>	24	1.2
+26 -1	425 × 10 <sup>-3</sup>	17.8 × 10 <sup>-3</sup>	38	2.1

Shaft connection series

FP··F type, FP··FC type (for high speed)



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm							
	General	High speed	B	Z	X <sup>2)</sup>	X <sub>d</sub> <sup>3)</sup>	Y	S	I	R
8	TBJ 8FP··F	TBJ 8FP··FC	44	25	0	10	24	22	18	12
12	TBJ12FP··F	TBJ12FP··FC	55	34	0	16	32.5	30	25.4	14
16	TBJ16FP··F	TBJ16FP··FC	70	42	10	22	42.5	40	31.8	18
20	TBJ20FP··F	TBJ20FP··FC	86	52	10	30	51	48	35	23
25	TBJ25FP··F	TBJ25FP··FC	102	60	15	38	57	54	45	30
35	TBJ35FP··F	TBJ35FP··FC	132	86	20	56	78.5	75	60.5	40
42	TBJ42FP··F	TBJ42FP··FC	152	95	20	62	94	90	70	60
50	TBJ50FP··F	TBJ50FP··FC	180	110	30	72	110	105	89.1	70
60	TBJ60FP··F	TBJ60FP··FC	198	136	30	90	131	125	101.6	85

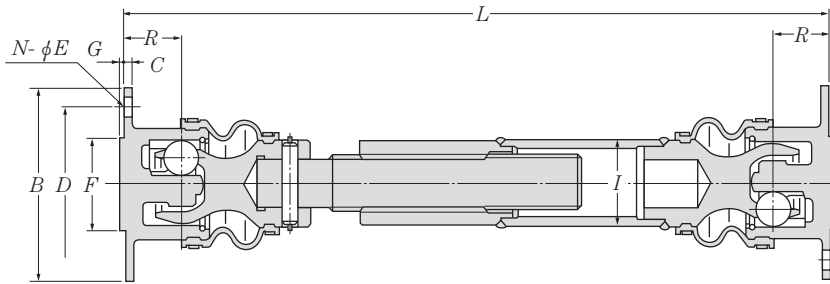
- Notes**
- 1) Joint number is referred to as the basic number plus joint length (L).  
 (Example) L = 250 : TBJ8FP250F ...General use  
 TBJ8FP250FC...For high speed
  - 2) These values show the diameter of the prepared holes.
  - 3) For machining, the concentricity relative to outside diameter Z must be dia. 0.1 mm or less.
  - 4) Joint length is of 1 mm interval.
  - 5) Based on the operating angle = 0°. Those values inversely vary with the operating angle (See Fig. 9 on page 8).

Dimensions mm $L^4$		Allowable <sup>5)</sup> expansion against $L$ mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
min.	max.		$L=500$ mm	per additional length 100 mm	$L=500$ mm	per additional length 100 mm
125	500	+ 4 -1	$0.26 \times 10^{-3}$	$0.02 \times 10^{-3}$	0.72	0.08
130	800	+ 5 -1	$1.03 \times 10^{-3}$	$0.09 \times 10^{-3}$	1.7	0.19
145	1 200	+ 7 -1	$2.88 \times 10^{-3}$	$0.19 \times 10^{-3}$	2.7	0.23
175	1 500	+ 9 -1	$7.03 \times 10^{-3}$	$0.27 \times 10^{-3}$	4.3	0.27
220	2 000	+11 -1	$16.6 \times 10^{-3}$	$0.63 \times 10^{-3}$	6.8	0.36
300	2 500	+15 -1	$68.2 \times 10^{-3}$	$2.13 \times 10^{-3}$	16	0.68
370	3 000	+16 -1	$180 \times 10^{-3}$	$3.40 \times 10^{-3}$	27	0.80
400	3 500	+20 -1	$413 \times 10^{-3}$	$8.54 \times 10^{-3}$	44	1.2
520	4 000	+26 -1	$835 \times 10^{-3}$	$17.8 \times 10^{-3}$	71	2.1

## Shaft connection series

### FT type, FT··C type (for high speed)

**CAUTION** When the allowable expansion is exceeded, the splined shaft can come off. Strictly avoid this situation.



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm									
	General	High speed	B	D	N-φE	F <sup>2)</sup>	G	C	R	I	L <sup>3)</sup>	
											min.	max.
8	TBJ 8FT	TBJ 8FT··C	44	34±0.1	3- 4.3	16	1.5	2	12	18	225	400
12	TBJ12FT	TBJ12FT··C	55	44±0.1	3- 5.3	24	2	2.5	14	25.4	275	600
16	TBJ16FT	TBJ16FT··C	70	56±0.15	3- 6.4	30	2	3	18	31.8	305	1 000
20	TBJ20FT	TBJ20FT··C	86	68±0.15	3- 8.4	38	2.5	3.5	23	35	365	1 200
25	TBJ25FT	TBJ25FT··C	102	82±0.15	3-10.5	48	2.5	4	30	45	435	1 500
35	TBJ35FT	TBJ35FT··C	132	110±0.2	3-12.5	68	3	5	40	60.5	580	2 000
42	TBJ42FT	TBJ42FT··C	152	126±0.2	3-14.5	88	3	15	60	70	740	2 000
50	TBJ50FT	TBJ50FT··C	180	150±0.25	6-14.5	104	4	15	70	89.1	880	2 000
60	TBJ60FT	TBJ60FT··C	198	170±0.25	6-14.5	140	5	15	85	101.6	1 010	2 000

**Notes** 1) Joint number is referred to as the basic number plus joint length (L).  
 (Example) L = 225 : **TBJ8FT225** ...General use  
**TBJ8FT225C**...For high speed

2) Centering location's tolerance : h9  
 3) Joint length is of 5 mm interval.

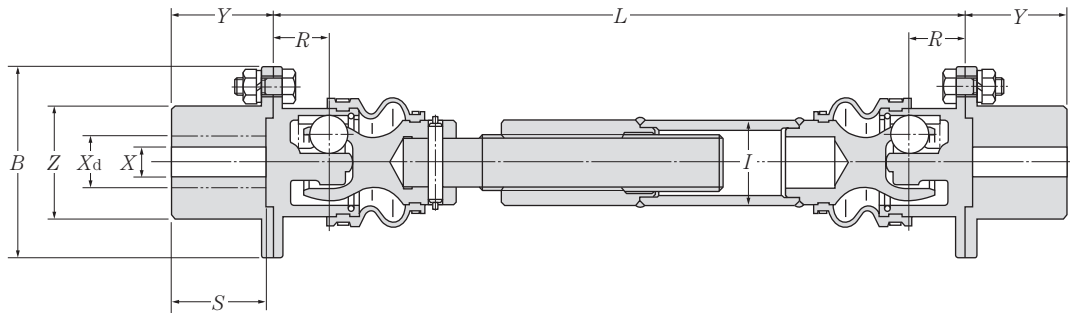
**Remarks** 1) Joint provided with bolts, washers and nuts are also available. Product nos. for these will include a "Z" following the length dimension.  
 2) When intending to install this joint vertically, contact NTN engineering.

Allowable expansion against $L$ mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
	$L=1000$ mm	per additional length 100 mm	$L=1000$ mm	per additional length 100 mm
± 20	$0.30 \times 10^{-3}$	$0.02 \times 10^{-3}$	1.0	0.08
± 30	$1.10 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.2	0.19
± 35	$2.55 \times 10^{-3}$	$0.19 \times 10^{-3}$	3.1	0.23
± 40	$4.90 \times 10^{-3}$	$0.27 \times 10^{-3}$	4.3	0.27
± 45	$11.5 \times 10^{-3}$	$0.62 \times 10^{-3}$	6.6	0.36
± 60	$45 \times 10^{-3}$	$2.11 \times 10^{-3}$	14	0.68
± 70	$110 \times 10^{-3}$	$3.40 \times 10^{-3}$	23	0.80
± 85	$265 \times 10^{-3}$	$8.54 \times 10^{-3}$	42	1.2
± 100	$515 \times 10^{-3}$	$17.8 \times 10^{-3}$	59	2.1

## Shaft connection series

### FT··F type, FT··FC type (for high speed)

**CAUTION** When the allowable expansion is exceeded, the splined shaft can come off. Strictly avoid this situation.



Series number 8 to 35 Allowable operating angle  $\theta$  Dynamic 18°  
 Static 20°  
 Series number 42 to 60 Allowable operating angle  $\theta$  Dynamic 16°  
 Static 18°

Series number	Basic number <sup>1)</sup>		Dimensions mm							
	General	High speed	B	Z	X <sup>2)</sup>	X <sub>d</sub> <sup>3)</sup>	Y	S	I	R
8	TBJ 8FT··F	TBJ 8FT··FC	44	25	0	10	24	22	18	12
12	TBJ12FT··F	TBJ12FT··FC	55	34	0	16	32.5	30	25.4	14
16	TBJ16FT··F	TBJ16FT··FC	70	42	10	22	42.5	40	31.8	18
20	TBJ20FT··F	TBJ20FT··FC	86	52	10	30	51	48	35	23
25	TBJ25FT··F	TBJ25FT··FC	102	60	15	38	57	54	45	30
35	TBJ35FT··F	TBJ35FT··FC	132	86	20	56	78.5	75	60.5	40
42	TBJ42FT··F	TBJ42FT··FC	152	95	20	62	94	90	70	60
50	TBJ50FT··F	TBJ50FT··FC	180	110	30	72	110	105	89.1	70
60	TBJ60FT··F	TBJ60FT··FC	198	136	30	90	131	125	101.6	85

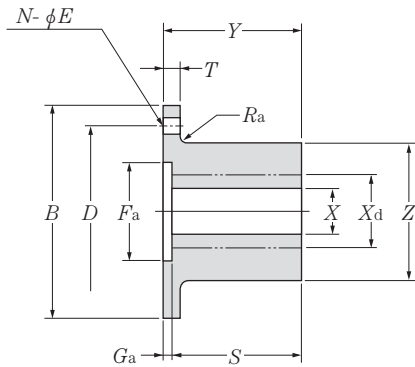
- Notes**
- 1) Joint number is referred to as the basic number plus joint length (L).  
 (Example) L = 225 : TBJ8FT225F ...General use  
 TBJ8FT225FC...For high speed
  - 2) These values show the diameter of the prepared holes.
  - 3) For machining, the concentricity relative to outside diameter Z must be dia. 0.1 mm or less.
  - 4) Joint length is of 5 mm interval.

**Remark** When intending to install this joint vertically, contact NTN engineering.

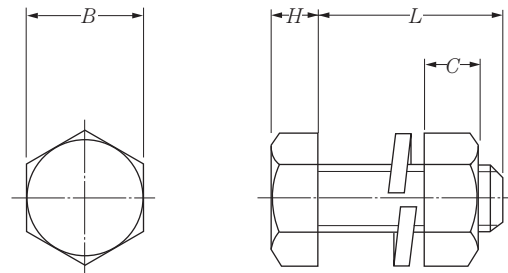


Dimensions mm $L^4$		Allowable expansion against $L$ mm	$GD^2$ kg · m <sup>2</sup>		Mass kg	
min.	max.		$L=1000$ mm	per additional length 100 mm	$L=1000$ mm	per additional length 100 mm
225	400	± 20	$0.42 \times 10^{-3}$	$0.02 \times 10^{-3}$	1.3	0.08
275	600	± 30	$1.55 \times 10^{-3}$	$0.09 \times 10^{-3}$	2.8	0.19
305	1 000	± 35	$3.90 \times 10^{-3}$	$0.19 \times 10^{-3}$	4.2	0.23
365	1 200	± 40	$8.56 \times 10^{-3}$	$0.27 \times 10^{-3}$	6.2	0.27
435	1 500	± 45	$20.0 \times 10^{-3}$	$0.62 \times 10^{-3}$	9.5	0.36
580	2 000	± 60	$85.0 \times 10^{-3}$	$2.11 \times 10^{-3}$	22	0.68
740	2 000	± 75	$200 \times 10^{-3}$	$3.40 \times 10^{-3}$	36	0.80
880	2 000	± 85	$475 \times 10^{-3}$	$8.54 \times 10^{-3}$	62	1.2
1 010	2 000	± 100	$925 \times 10^{-3}$	$17.8 \times 10^{-3}$	91	2.1

**Semi-finished flange**



**Hexagonal headed bolt, Spring washer, Hexagon nut**



**Semi-finished flange**

Series number	Parts number	Dimensions mm											Maximum operating shaft size	Mass kg
		B	D	N-E	Fa	T	Ga	S	Y	Z	Ra	X <sup>1)</sup>		
8	18-10#TBJ 8	44	34±0.1	3- 4.3	16 <sup>+0.043</sup> <sub>0</sub>	3	2	22	24	25	0.5	0	10	0.11
12	18-10#TBJ12	55	44±0.1	3- 5.3	24 <sup>+0.052</sup> <sub>0</sub>	3.5	2.5	30	32.5	34	0.5	0	16	0.26
16	18-10#TBJ16	70	56±0.15	3- 6.4	30 <sup>+0.052</sup> <sub>0</sub>	4	2.5	40	42.5	42	0.5	10	22	0.48
20	18-10#TBJ20	86	68±0.15	3- 8.4	38 <sup>+0.062</sup> <sub>0</sub>	5	3	48	51	52	0.5	10	30	0.92
25	18-10#TBJ25	102	82±0.15	3-10.5	48 <sup>+0.062</sup> <sub>0</sub>	7	3	54	57	60	1.0	15	38	1.4
35	18-10#TBJ35	132	110±0.2	3-12.5	68 <sup>+0.074</sup> <sub>0</sub>	8	3.5	75	78.5	86	2.0	20	56	3.7
42	18-10#TBJ42	152	126±0.2	3-14.5	88 <sup>+0.087</sup> <sub>0</sub>	15	4	90	94	95	2.5	20	62	6.0
50	18-10#TBJ50	180	150±0.25	6-14.5	104 <sup>+0.087</sup> <sub>0</sub>	20	5	105	110	110	3.0	30	72	9.6
60	18-10#TBJ60	198	170±0.25	6-14.5	140 <sup>+0.1</sup> <sub>0</sub>	20	6	125	131	136	3.5	30	90	16

Notes: 1) These values show the diameter of the prepared holes.  
 2) For machining, the concentricity relative to outside diameter Z must be a dia. of 0.1 mm or less.

**Hexagonal headed bolt, Spring washer, Hexagon nut**

Series number	Hexagonal headed bolt			Spring washer		Hexagon nut		Set parts number
	Parts number	Size	Dimensions mm L H B	Parts number	Dimensions mm Outer dia. Thickness	Parts number	Dimensions mm C	
8	19-1#TBJ 8	M 4×12	12 2.8 7	23-1#TBJ 8	7.6 1.0	20-1#TBJ 8	3.2	50-50#TBJ 8
12	19-1#TBJ12	M 5×14	14 3.5 8	23-1#TBJ12	9.2 1.3	20-1#TBJ12	4	50-50#TBJ12
16	19-1#TBJ16	M 6×16	16 4 10	23-1#TBJ16	12.2 1.5	20-1#TBJ16	5	50-50#TBJ16
20	19-1#TBJ20	M 8×20	20 5.5 13	23-1#TBJ20	15.4 2.0	20-1#TBJ20	6.5	50-50#TBJ20
25	19-1#TBJ25	M10×25	25 7 17	23-1#TBJ25	18.4 2.5	20-1#TBJ25	8	50-50#TBJ25
35	19-1#TBJ35	M12×30	30 8 19	23-1#TBJ35	21.5 3.0	20-1#TBJ35	10	50-50#TBJ35
42	19-1#TBJ50	M14×54×26	54 9 22	23-1#TBJ50	24.5 3.5	20-1#TBJ50	11	50-50#TBJ50
50								
60								

## 7. Handling for Joint

### 7.1 Installation / mounting of TRI-BALL Joint

Care should be taken on the following points.

- No larger working angles than the tolerance limits.
- No larger expansion than the tolerance limits.
- Do not damage the boot.
- For the cotter pin, drill the pin hole with the tolerances given in **Table 7**.
- After installation, do not put anything on the joint, and do not use the joint for scaffold.
- Be sure to cover the joint for safety.
- Do not inflict impact force on the joint.

Pin hole dia.	Allowable deviation
3	0.05
4	0.05
6	0.05
8	0.1
10	0.1
12	0.1
14	0.1
16	0.1
18	0.1

### 7.2 Allowance for installation distance

The total length of joints given in the dimension table varies with the values shown in **Fig. 7, 8, and 9** on page 8, depending on the operating angles.

When connecting the joint to the opposite shaft avoid length variations. When using the DB or DF series the installation must be made within the permissible offset amount,  $S_c$  (or  $\theta \leq 8^\circ$ ).

### 7.3 Tightening torque

**Table 8** shows standard tightening torque.

**Table 8. Bolts size and tightening torque**

Series number	Bolts size	Tightening torque N · m
8	M 4	2.45 ~ 2.94
12	M 5	4.90 ~ 5.88
16	M 6	8.33 ~ 9.81
20	M 8	19.6 ~ 24.5
25	M10	39.2 ~ 49.0
35	M12	73.5 ~ 83.3
42, 50, 60	M14	118.0 ~ 127.0

- After commissioning or during regular inspection, retighten the bolts.

### 7.4 Circumferential moment of joints (backlash)

**Table 9** shows the circumferential movement of simple joints. Values for double type are about double the values in **Table 9**. Depending on the connecting method of joints, the circumferential movement may be increased.

**Table 9. Circumferential movement (backlash)**

Series number	Circumferential movement ( $\theta$ )
8~16	0°30'~1°05'
20~35	0°35'~1°10'
42~60	0°40'~1°15'

### 7.5 Allowable temperature

The allowable temperature of the grease and rubber boot ranges from -20°C to +100°C.

When using under temperatures exceeding the above, or under a special atmosphere, refer to NTN engineering.

### 7.6 Lubrication

Use the grease dedicated to NTN constant velocity joints. Contact NTN engineering.

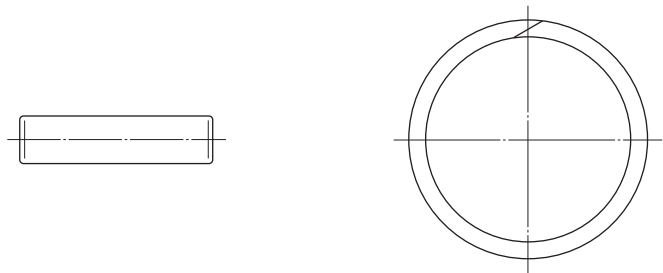
### 7.7 Storage

The store NTN joints, observe the following instructions.

- 1) Do not store the joint in a damp location.
- 2) Store the joint in horizontal position. Avoid storage that permits the foot to rest unevenly or the boot may be permanently deformed.
- 3) Cover the joint to protect its boot, etc.
- 4) When storing the joints in cardboard boxes, do not pile up the boxes. Otherwise, the boxes can be deformed or damaged owing to the weight of joints, possibly leading to damaged joints (in particular, boots).
- 5) When using TRI-BALL Joint that has been stored for a prolonged period, elaborately inspect the state of boot and grease.

## 8. Part number for component

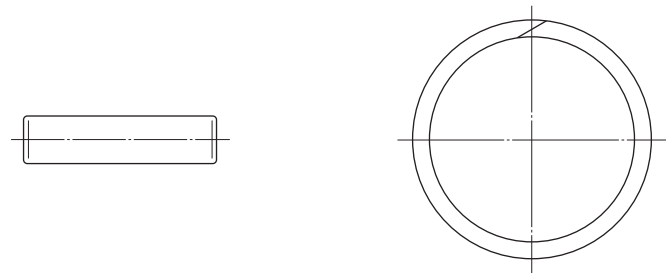
### Parallel pin, Dual snap ring (for torque tube)



Series number	Applicable joint	Parallel pin part number	Dual snap ring part number	Set part number <sup>1)</sup>
8	TBJ8	11-1#TBJ8	25-10#TBJ8	50-59#TBJ8
	TBJ10			
	TBJ12M	11-3#TBJ8	25-11#TBJ8	50-1#TBJ12M
12	TBJ12	11-1#TBJ12	25-10#TBJ12	50-59#TBJ12
	TBJ14			
	TBJ16M	11-3#TBJ12	25-10#TBJ12	50-1#TBJ16M
16	TBJ16	11-1#TBJ16	25-10#TBJ16	50-59#TBJ16
	TBJ18			
	TBJ20M	11-3#TBJ16	25-10#TBJ16	50-1#TBJ20M
20	TBJ20	11-1#TBJ20	25-10#TBJ20	50-59#TBJ20
	TBJ22			
	TBJ25M	11-3#TBJ20	25-10#TBJ20	50-1#TBJ25M
25	TBJ25	11-1#TBJ25	25-10#TBJ25	50-59#TBJ25
	TBJ30			
	TBJ35M	11-3#TBJ25	25-10#TBJ25	50-1#TBJ35M
35	TBJ35	11-1#TBJ35	25-10#TBJ35	50-59#TBJ35
	TBJ40			
42	TBJ42	11-10#TBJ42	25-11#TBJ35	50-59#TBJ42
50	TBJ50	11-10#TBJ50	25-10#TBJ50	50-59#TBJ50
60	TBJ60	11-10#TBJ60	25-10#TBJ60	50-59#TBJ60

1) One set includes one parallel pin and one dual snap ring.

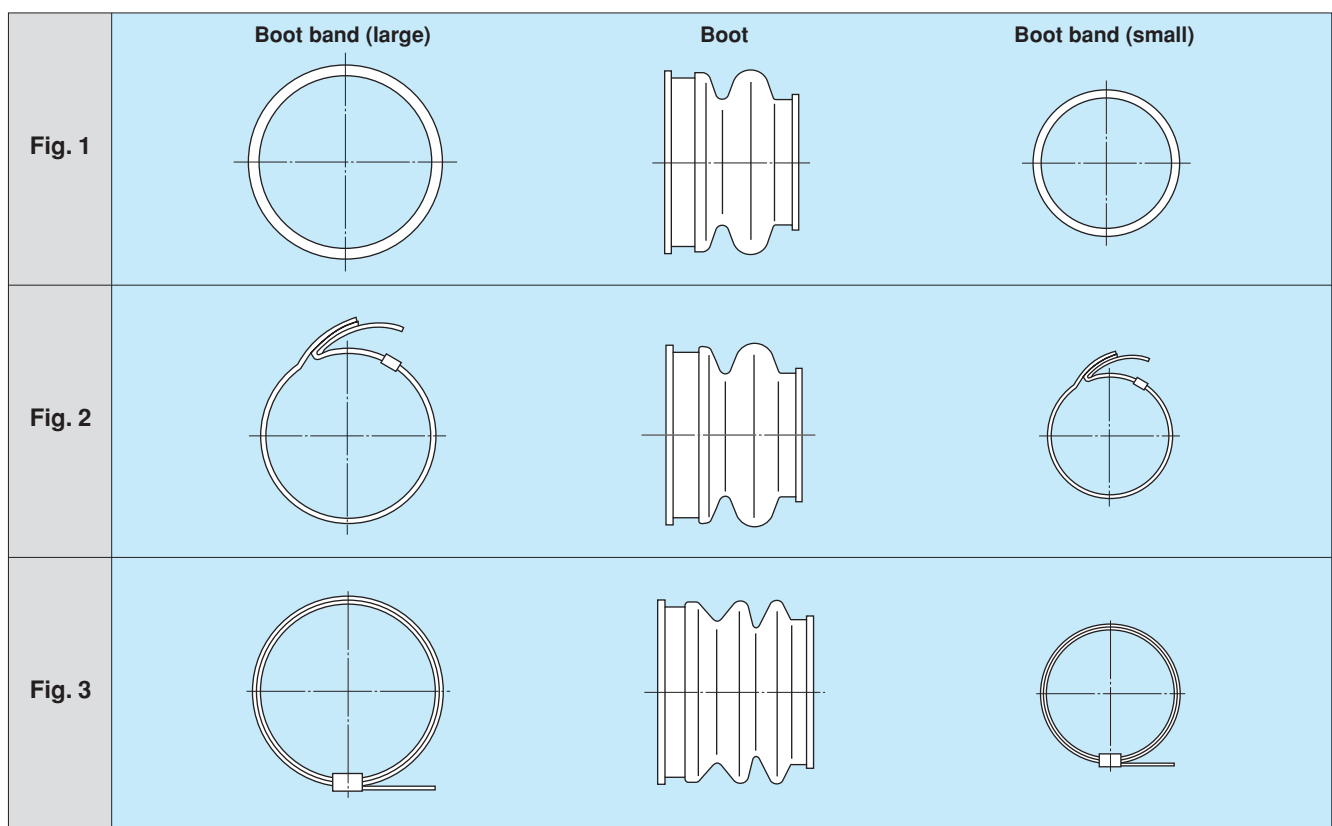
**Parallel pin, Dual snap ring (for outer race)**



Series number	Applicable joint	Parallel pin part number	Dual snap ring part number	Set part number <sup>1)</sup>
8	TBJ8	11-2#TBJ8	25-11#TBJ8	50-60#TBJ8
	TBJ10			
	TBJ12M	11-4#TBJ8	25-12#TBJ8	50-2#TBJ12M
12	TBJ12	11-2#TBJ12	25-11#TBJ12	50-60#TBJ12
	TBJ14			
	TBJ16M	11-4#TBJ12	25-12#TBJ12	50-2#TBJ16M
16	TBJ16	11-1#TBJ16	25-11#TBJ16	50-60#TBJ16
	TBJ18			
	TBJ20M	11-2#TBJ20	25-11#TBJ20	50-2#TBJ20M
20	TBJ20	11-2#TBJ20	25-11#TBJ20	50-60#TBJ20
	TBJ22			
	TBJ25M	11-1#TBJ25	25-12#TBJ20	50-2#TBJ25M
25	TBJ25	11-2#TBJ25	25-11#TBJ25	50-60#TBJ25
	TBJ30			
	TBJ35M	11-4#TBJ25	25-12#TBJ25	50-2#TBJ35M
35	TBJ35	11-2#TBJ35	25-11#TBJ35	50-60#TBJ35
	TBJ40			
42	TBJ42	11-11#TBJ42	25-11#TBJ42	50-60#TBJ42
50	TBJ50	11-10#TBJ50	25-10#TBJ50	50-60#TBJ50
60	TBJ60	11-11#TBJ60	25-11#TBJ60	50-60#TBJ60

1) One set includes one parallel pin and one dual snap ring.

Boot, Boot band (for SB, SF, BB, BP, BT, FB, FP, FT)

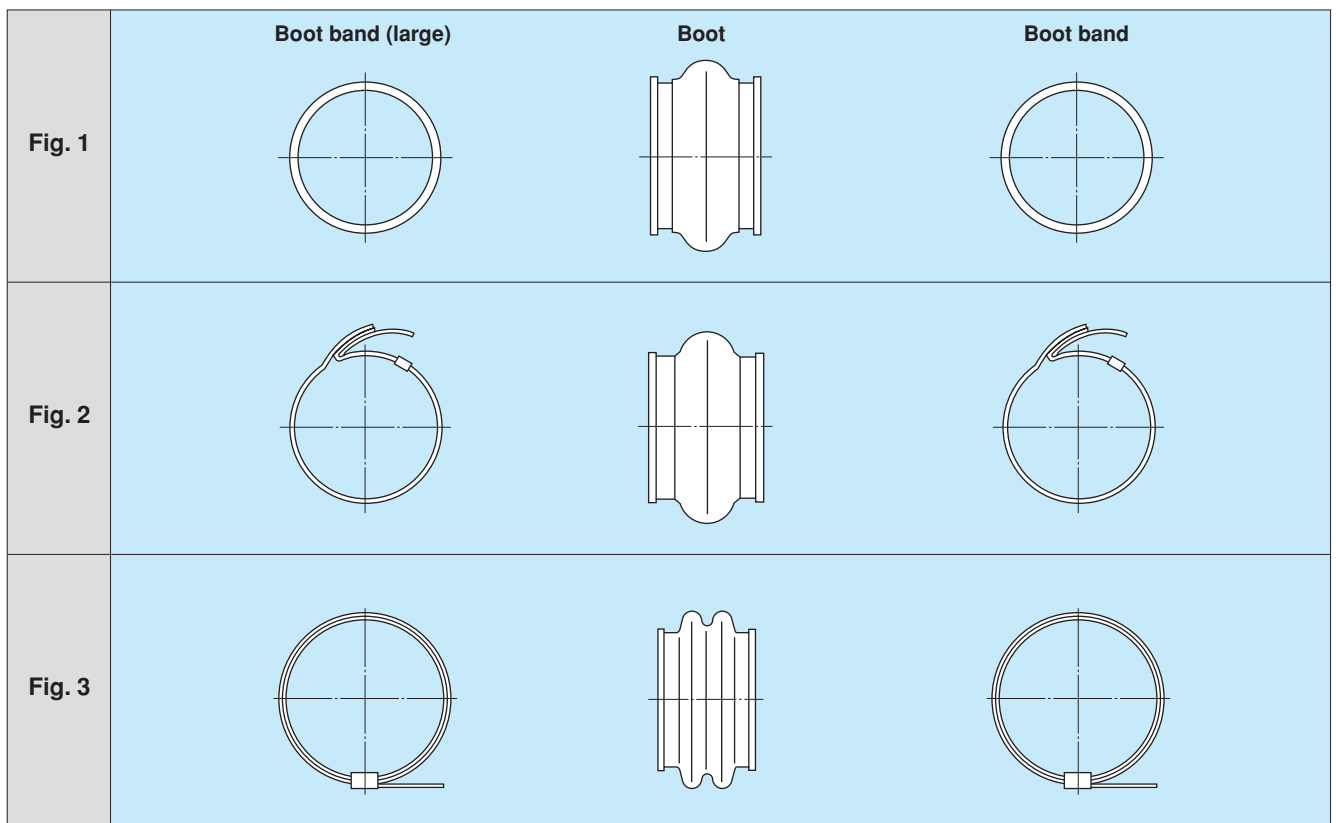


Series number	Figure	Boot part number	Boot band (large) part number	Boot band (small) part number	Set part number <sup>2)</sup>
8	1	7-1#TBJ8	8-1#TBJ8	8-2#TBJ8	50-56#TBJ8
				8-3#TBJ8 <sup>1)</sup>	50-56#TBJ12M <sup>1)</sup>
12	1	7-1#TBJ12	8-1#TBJ12	8-2#TBJ12	50-56#TBJ12
16	2	7-1#TBJ16	38-11#TBJ16	38-12#TBJ16	50-56#TBJ16
20	2	7-1#TBJ20	38-10#TBJ20	38-12#TBJ20	50-56#TBJ20
25	2	7-1#TBJ25	38-11#TBJ25	38-12#TBJ25	50-56#TBJ25
35	2	7-1#TBJ35	38-11#TBJ35	38-12#TBJ35	50-56#TBJ35
42	3	7-1#TBJ42	38-2#TBJ50	38-2#TBJ50	50-56#TBJ42
50	3	7-3#TBJ50	20-1#BJ150	38-2#TBJ50	50-56#TBJ50
60	3	7-1#TBJ60	20-1#BJ150	20-1#BJ150	50-56#TBJ60

1) Part number for TBJ12SBM and TBJ12SFM.

2) One set includes one boot, one boot band (large) and one boot band (small).

Boot, Boot band (for DB, DF)

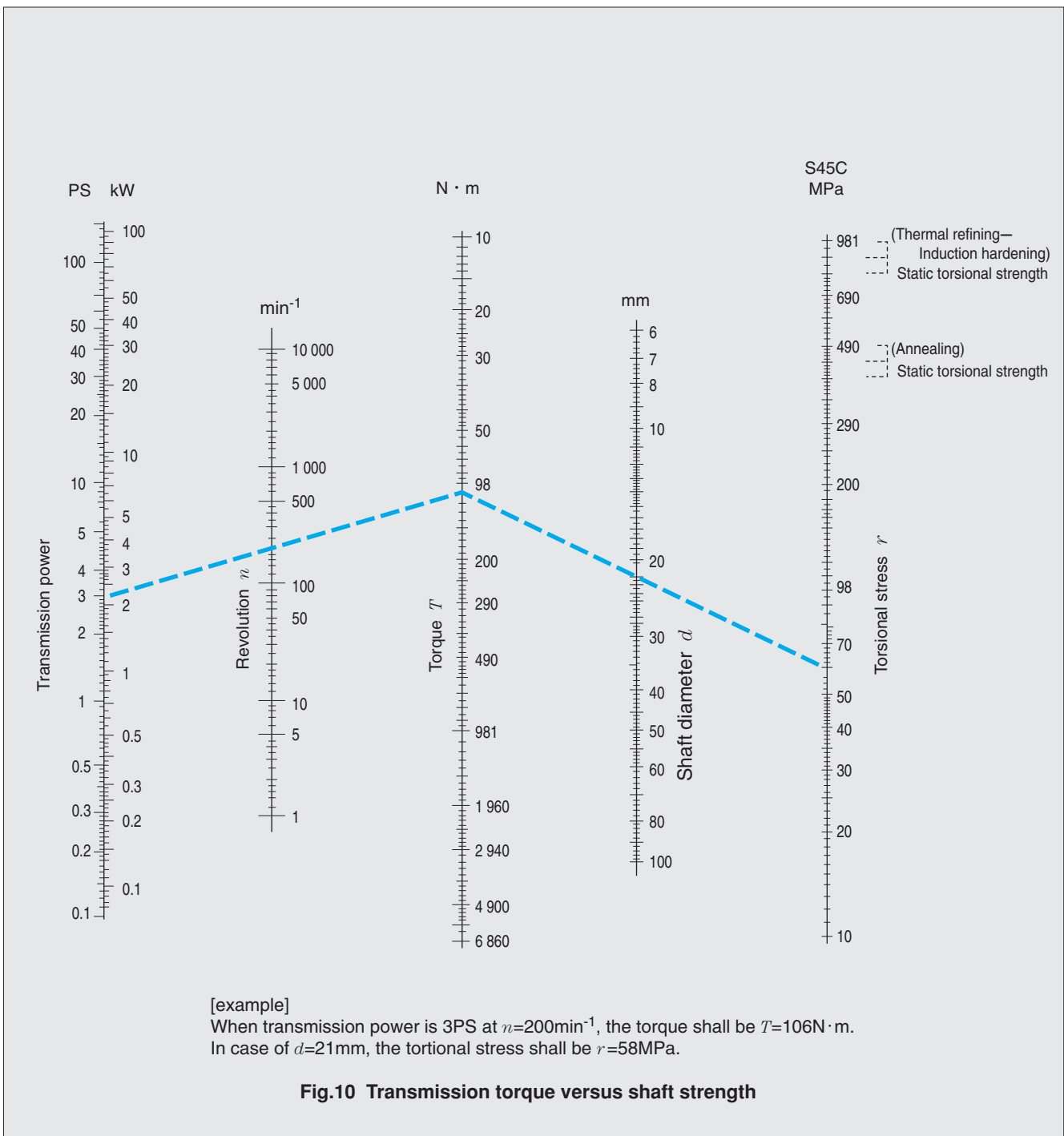


Series number	Figure	Boot part number	Boot band part number	Set part number <sup>1)</sup>
8	1	7-2#TBJ8	8-1#TBJ8	50-58#TBJ8
12	1	7-2#TBJ12	8-1#TBJ12	50-58#TBJ12
16	2	7-2#TBJ16	38-11#TBJ16	50-58#TBJ16
20	2	7-2#TBJ20	38-11#TBJ20	50-58#TBJ20
25	2	7-2#TBJ25	38-11#TBJ25	50-58#TBJ25
35	2	7-2#TBJ35	38-11#TBJ35	50-58#TBJ35
42	3	7-2#TBJ42	38-2#TBJ50	50-58#TBJ42
50	3	7-2#TBJ50	38-1#TBJ50	50-58#TBJ50
60	3	7-2#TBJ60	38-1#TBJ50	50-58#TBJ60

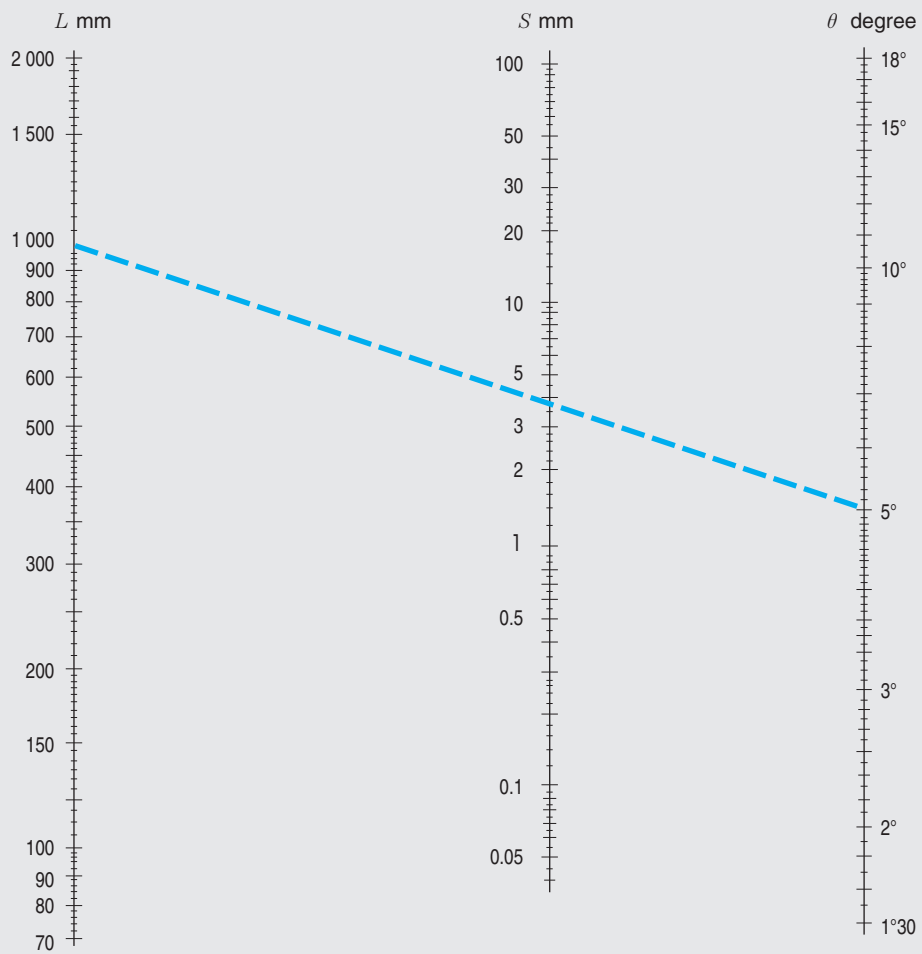
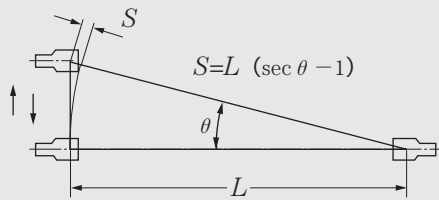
1) One set includes one boot and two boot bands.

## 9. Reference information for design

The correlation between transmission torque and shaft strength is given in **Fig. 10**, and that between joint angle and sliding length is given in **Fig. 11**.







[example]  
When TRI-BALL JOINT with center distance  $L=1000\text{mm}$  moves  $5^{\circ}$ , the slide amount shall be  $S=3.7\text{mm}$ .

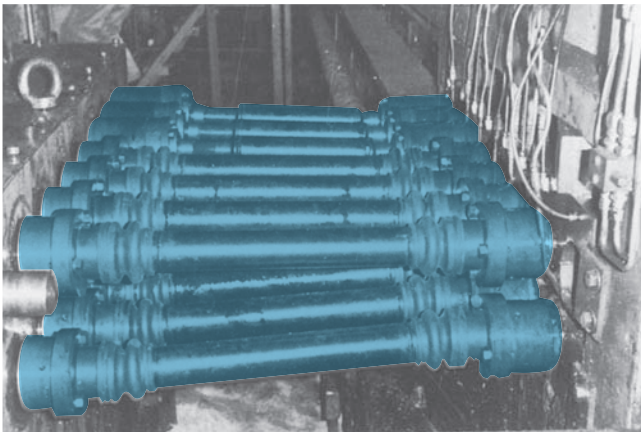
Fig.11 Joint angle versus sliding length

## 8. Application

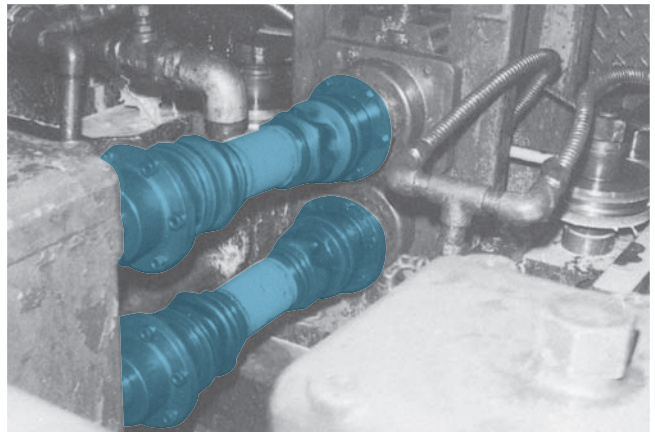
### STEEL

Connection of power transmission parts for roll driving, auxiliary equipment and conveyor table driving.

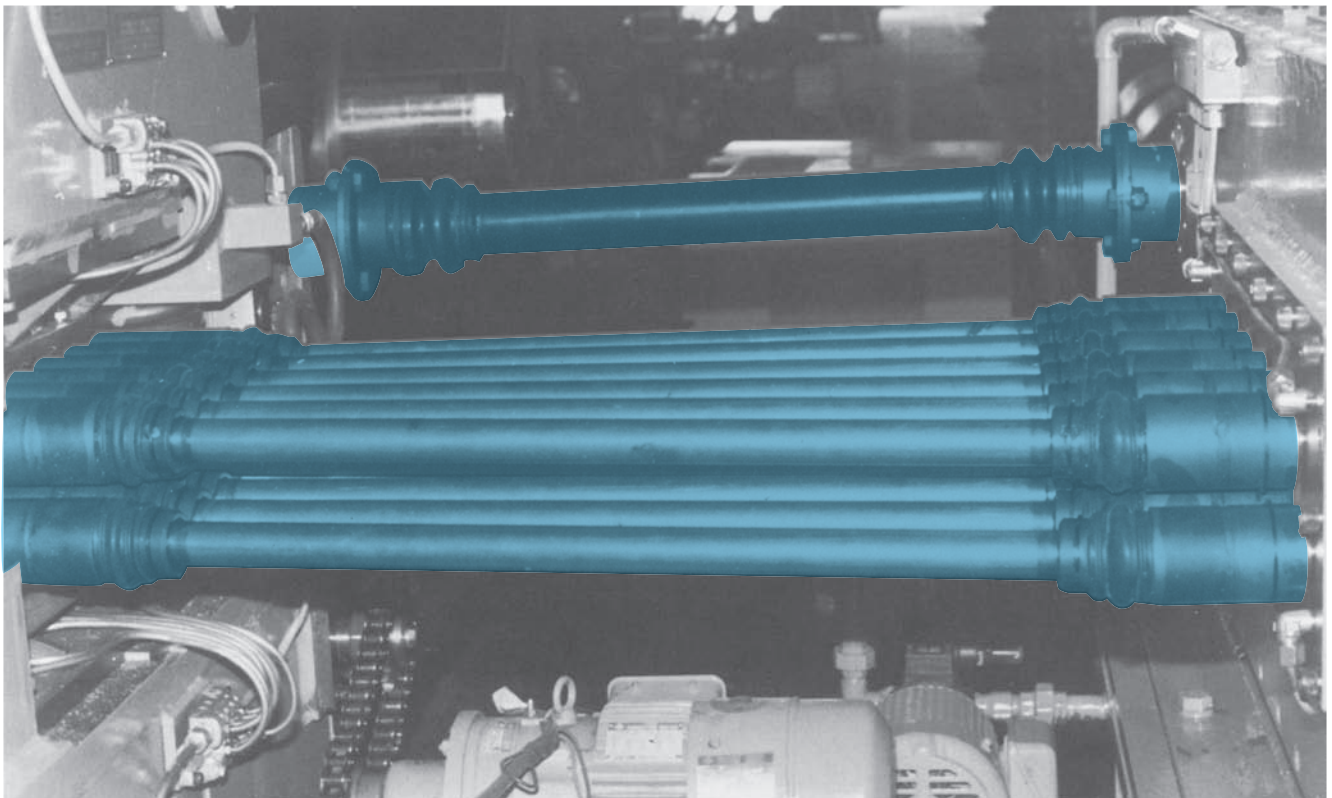
**Example:** Pinch roll, leveller roll, forming roll, brush roll, back-up roll, feed roll, measuring roll, tachogenerator, steering roll etc.



▲Driving area of a large size leveller roll



▲Driving area of a forming roll

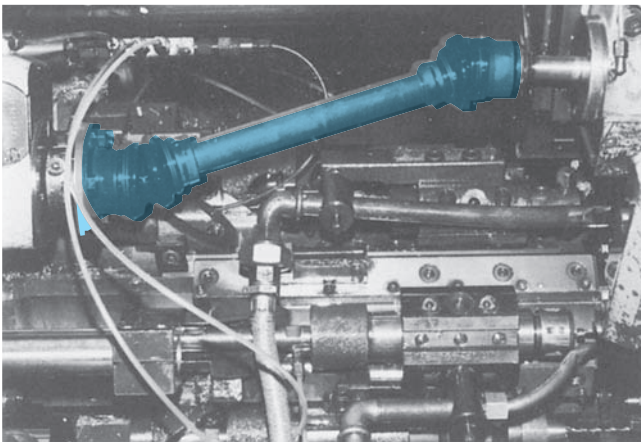


▲TBJ25SB used for a leveller

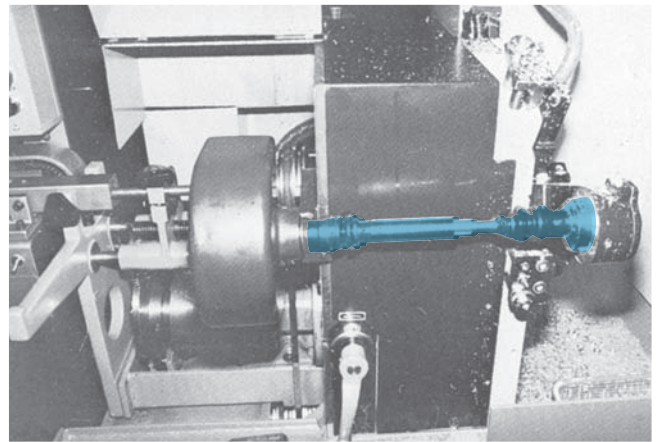
## Machine tools

Cutter driving, table driving, feeding mechanism, etc.

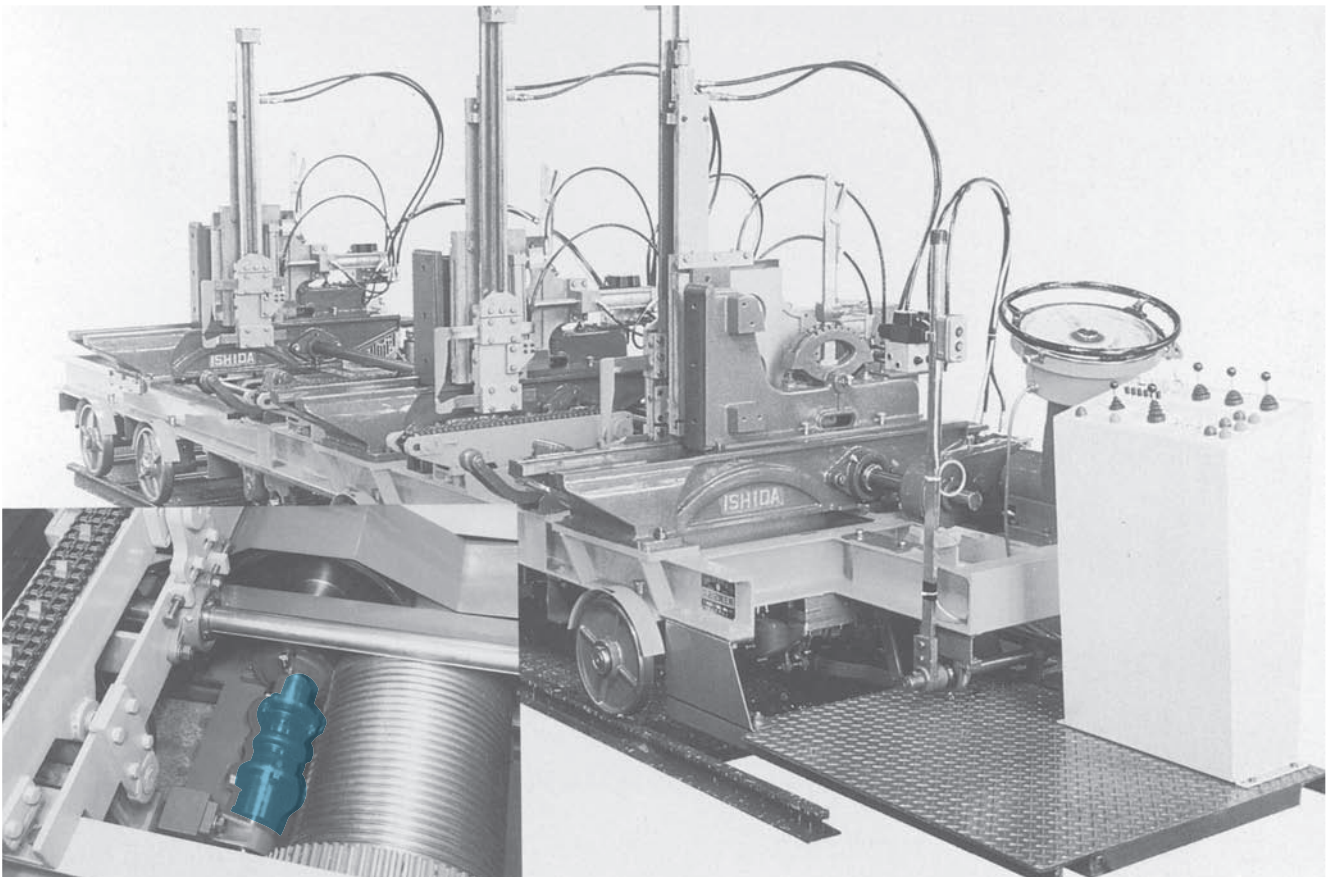
**Example:** Tool cutter driving of multiple spindle drilling machine, feeding mechanism of press, work drive and table driving of gear cutter, work driving of threading machine etc.



▲Driving area of multiple spindle automatic lathe



▲TBJ20DB used for driving area of single spindle



▲Friction device of a band sawing machine provided with automatic feeding wheel

### Transport machine

Hydraulic pump driving area, steering connection area and axle area of fork lift.

Transportation system driving area of vertical warehouse.

Conveyor line driving area of distribution warehouse etc.

### Food, Hygiene

Rotating power transmission area of production equipment and of transportation conveyor line for foodstuffs, drinks, medicine, cosmetics etc.

**Example:** Bottle washing machine, bottling machine, stopper machine, mixer, fruit/farm products sorting machine, fruit/vegetables pick-up machine etc.

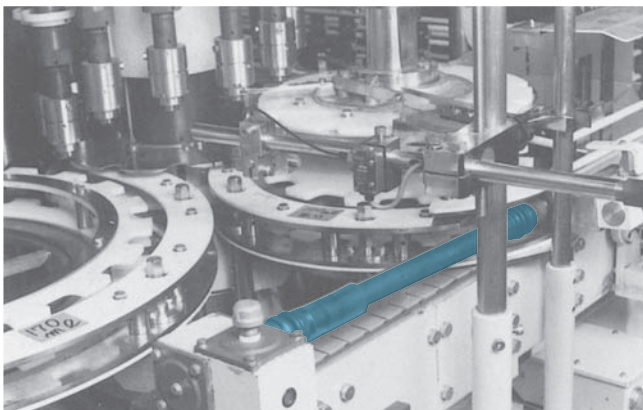
### Packing, Measuring

Mechanism driving area of packing machines.

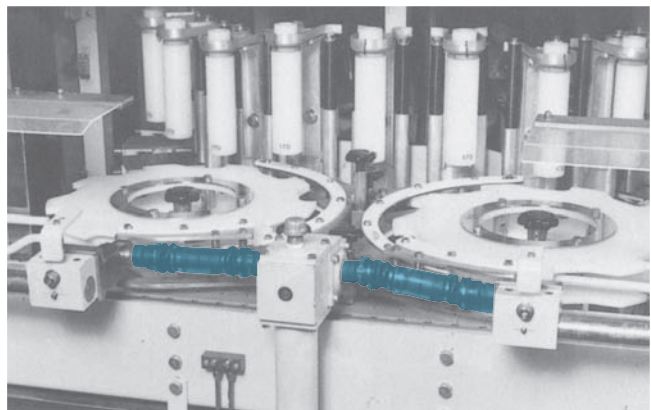
Feeding roll driving of packing paper or packing film.

Feeding roll driving area of packaged products or measured products etc.

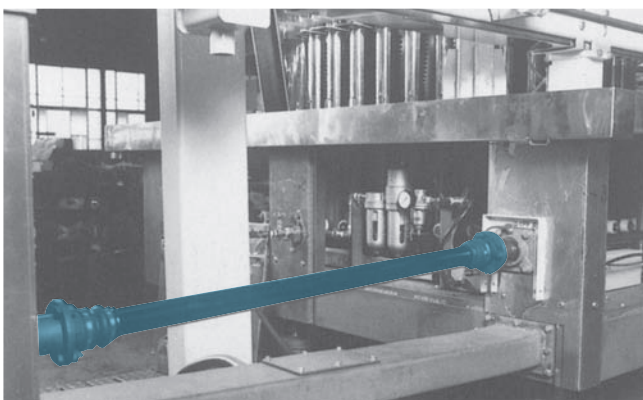
**Example:** Packaging machines and measuring machines for medicine, foodstuffs, cosmetics, sanitary goods and daily necessities.



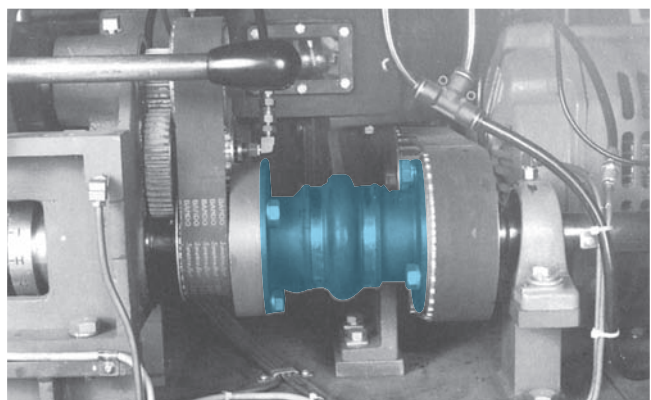
▲Screw driving area of a stoppering machine



▲Screw driving area of a bottle washing machine



▲TBJ25FP used for a synchro driving area



▲TBJ35DF used for a prime mover driving area

**Textile, Chemical**

Roll driving area, line shaft driving area, feeding area and wind up driving area etc. of textile machine.

Feeding area of sewing machine.

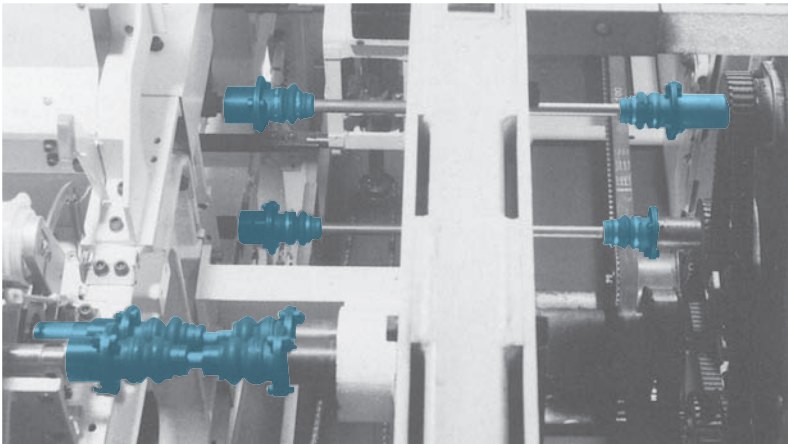
Driving part of pumps, cooling equipment for chemical industry.

**Example:** Spinning machine, false-twisting machine, stretching machine, winding machine.

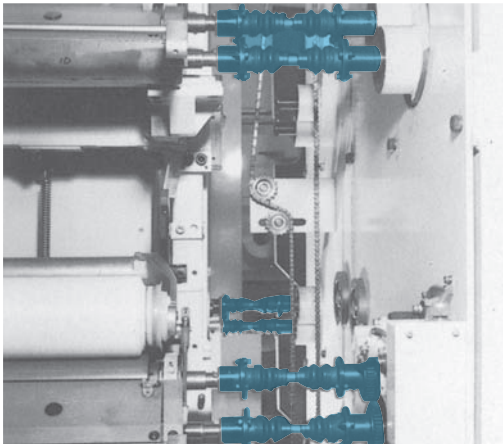
Gear pump, screw pump and cooling fan driving of chemical plants.



▲False-twisting machine



▲Roll driving area



Others



▲Driving area of a water wheel in an eel farm.

# NTN TRI-BALL JOINT Service Condition Confirmation Sheet

Company Name: Messrs. _____		Date: _____
Machine: _____		Area: _____
<b>Service condition</b>		
<b>1. Kind of prime motor</b>	• Motor AC, DC Output; <input type="text"/> kW • Engine Gasoline Diesel No. of cylinder; <input type="text"/> Output; <input type="text"/> PS	
<b>2. Number of joints to be driven per unit;</b>	<input type="text"/>	
<b>3. Joint rotating speed</b>	• Constant <input type="text"/> min <sup>-1</sup> • Variable <input type="text"/> ~ <input type="text"/> min <sup>-1</sup>	
<b>4. Rotating direction</b>	• One direction • Forward / reverse	
<b>5. Transmitting torque</b>	• Constant <input type="text"/> N · m • Variable Max. <input type="text"/> ~ Normal <input type="text"/> ~ Min. <input type="text"/> N · m	
<b>6. Shock</b>	• None • Approx. <input type="text"/> % against the rated torque of driving source	
<b>7. Normal load (torque/rotating speed)</b>	• 24 hrs./day constantly <input type="text"/> hrs./day • Others <input type="text"/>	
<b>8. Joint installation drawing</b>		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">                     Driving end ( _____ )                      Key groove width <input type="text"/> X depth <input type="text"/> </div> <div style="width: 45%;">                     Follower end ( _____ )                      Key groove width <input type="text"/> X depth <input type="text"/> </div> </div> <p>                 Remarks: • When the above drawing is not applicable, make a special study.                  • When the installation/operation position (<math>L</math> and <math>X</math>, <math>Y</math>) is changed, confirm the changed position (amount) and the loading condition at that position.             </p>		
<b>9. Installation direction</b>	• Horizontal • Vertical	
<b>10. Expansion during transmission of torque</b>	• No • Yes	
<b>11. Outside diameter limit</b>	• No • Yes up to <input type="text"/> mm	
<b>12. Place and atmosphere</b>	• Indoor • Outdoor, Temp <input type="text"/> °C Others <input type="text"/>	
<b>13. Kind and style No. of the joints in present use</b>	• None • Kind and style No. <input type="text"/>	
<b>14. Special notes:</b>		
_____ _____ _____ _____		

Notes: 1) NTN selects the best suitable joint style No. upon receipt of your service condition.  
 2) Upon receiving the user's instructions about the dimensions of mounting flange hub (inside dia. key groove dimensions, etc.), NTN will machine the hub.