HUB BEARINGS

Third Generation

First Generation

Second Generation

CAT. No. 4601/E

NTN Hub Bearings

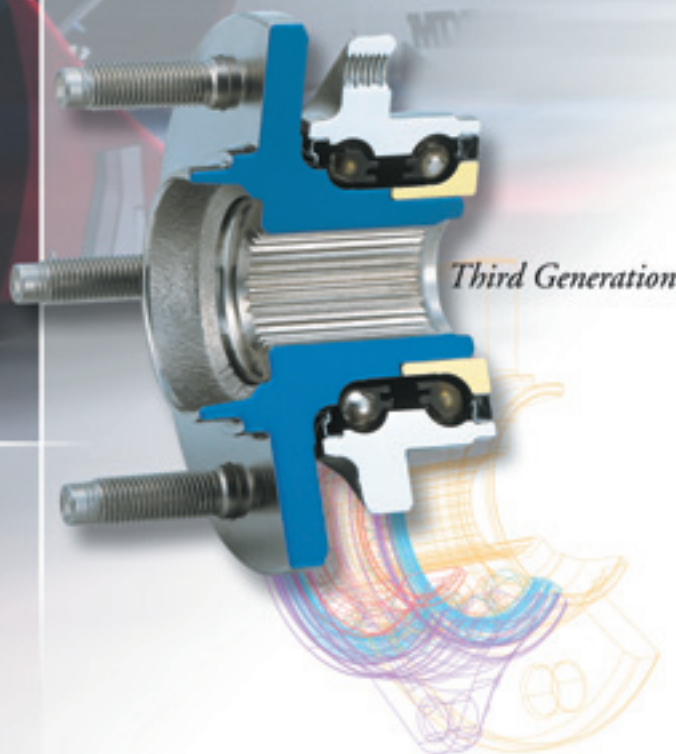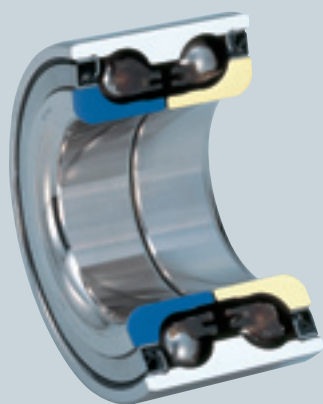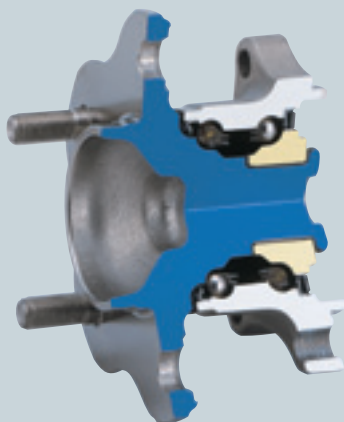**NTN hub bearings realize efficient traveling and improved fuel consumption. Aiming for higher quality, NTN is involved in creating and developing element technologies.**

GEN 1
(First Generation)

GEN 2
(Second Generation)

GEN 3
(Third Generation)

C O N T E N T S

Hub bearing types and configurations

Hub bearings are classified as ball type or roller type. The ball type includes GEN 1, GEN 2 and GEN 3, and the roller type GEN 1 and GEN 2. The bearings are further classified according to application as bearings for driven wheel and non driven wheel.

Hub bearing	
Ball type	
GEN 1	**GEN 2**
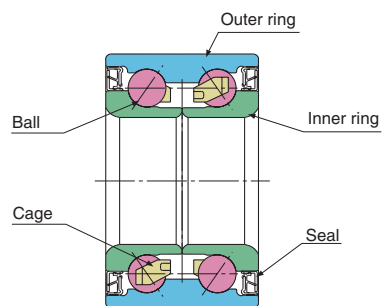
GEN 1

For driven wheel | For non driven wheel

- Outer ring
- Ball
- Inner ring
- Cage
- Seal

Fixed
Rotating

GEN 2

For driven wheel

For non driven wheel | Inner ring rotating type

- Outer ring with flange
- Ball
- Inner ring
- Cage
- Seal

For non driven wheel | Outer ring rotating type

- Hub bolt
- Hub/outer ring unit
- Cage
- Inner ring
- Ball
- Seal
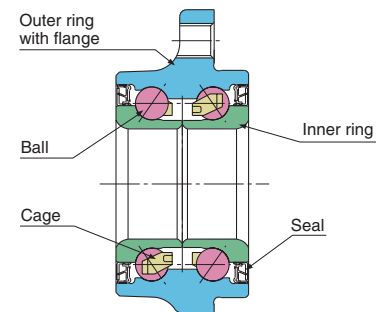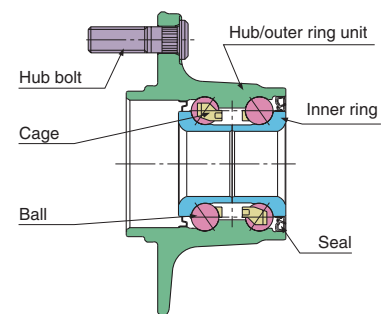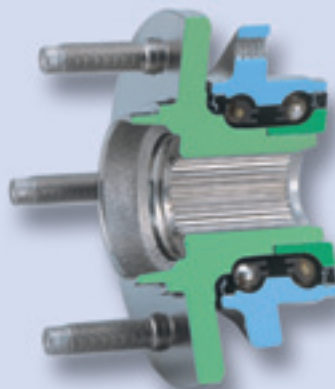
Hub bearing

Roller type

GEN 3	GEN 1	GEN 2

GEN 3

For driven wheel
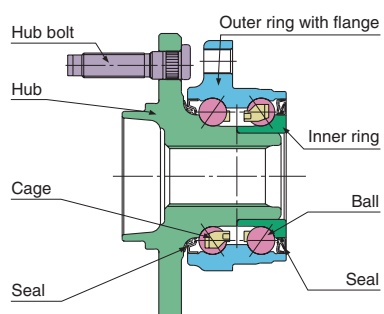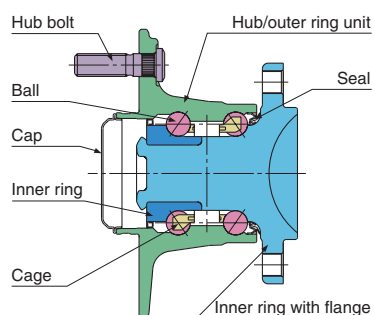
- Hub bolt
- Outer ring with flange
- Hub
- Inner ring
- Cage
- Ball
- Seal
- Seal

For non driven wheel — **Outer ring rotating type**

- Hub bolt
- Hub/outer ring unit
- Ball
- Seal
- Cap
- Inner ring
- Cage
- Inner ring with flange

For non driven wheel — **Inner ring rotating type**

- Hub bolt
- Outer ring with flange
- Hub
- Inner ring
- Cage
- Seal
- Seal

GEN 1

For driven wheel **For non driven wheel**

- Outer ring
- Cage
- Inner ring
- Roller
- Seal

GEN 2

For driven wheel

For non driven wheel — **Inner ring rotating type**

- Cage
- Outer ring with flange
- Inner ring
- Roller
- Seal

For non driven wheel — **Outer ring rotating type**

- Hub/outer ring unit
- Cage
- Seal
- Inner ring
- Roller
- Connector link
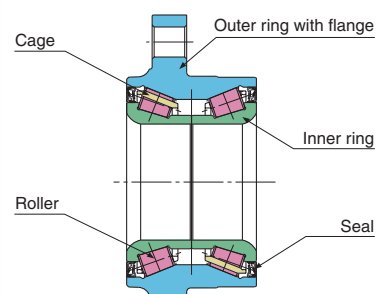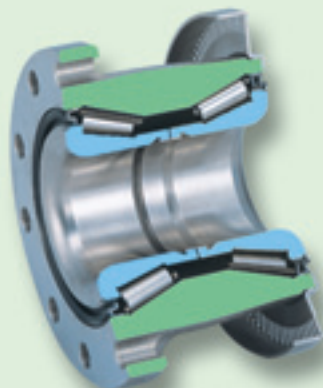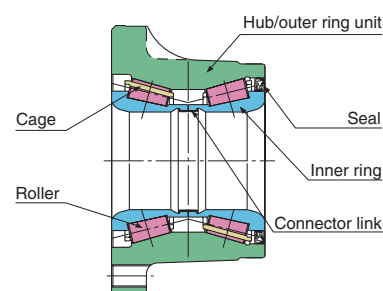
2 Bearing number

GEN 1 ball type

GEN 1 roller type
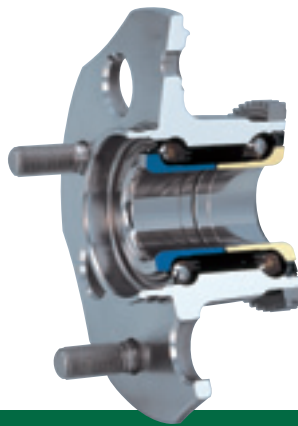
GEN 2 ball type
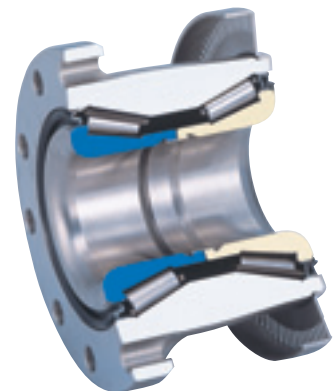
GEN 2 roller type
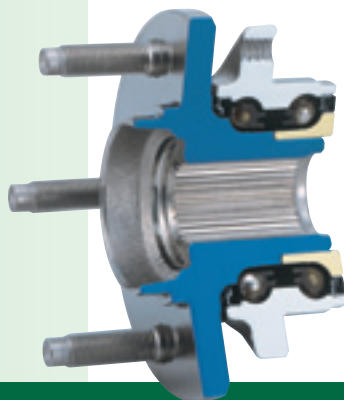
GEN 3 ball type (driven wheel)
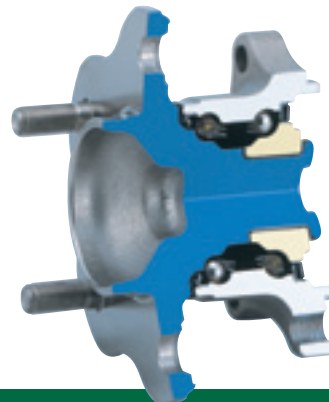
GEN 3 ball type (non driven wheel)

Bearing type	Code name	Bearing number	Configuration
GEN 1 **Ball type**	AU	**AU 08 04—1 LL ∕L260** Grease code Seal code Sequential number Inner diameter No. Type code	Consists of inner ring, outer ring, balls, cage and seal.
GEN 1 **Roller type**	TU	**TU 08 11—1 LXL ∕L244** Grease code Seal code Sequential number Inner diameter No. Type code	Consists of inner ring, outer ring, rollers, cage and seal.
GEN 2 **Ball type**	HUB	**HUB 227—1** Sequential number Type code	Consists of inner ring, outer ring, balls, cage and seal. Outer ring rotating type: Brake disc and wheel mounted on hub/outer ring unit. Inner ring rotating type: Outer ring with flange fastened to vehicle body.
GEN 2 **Roller type**	HUR	**HUR 040—2** Sequential number Type code	Consists of inner ring, outer ring, rollers, cage and seal. Outer ring rotating type: Brake disc and wheel mounted on hub/outer ring unit. Inner ring rotating type: Outer ring with flange fastened to vehicle body.
GEN 3 **Ball type**	HUB___T	**HUB 005T—1** Sequential number Type code	Consists of inner ring, outer ring, balls, cage and seal. Outer ring rotating type: Brake disc and wheel mounted on hub/outer ring unit, outer ring with flange fastened to vehicle body. Inner ring rotating type: Outer ring with flange fastened to vehicle body, Brake disc and wheel mounted on hub.

3 Hub bearing selection

3.1 Selection overview

Hub bearings are very important part in terms of vehicle safety. Selecting the type of bearing most suited to the vehicle ensures safety and is very important for exhibiting the required performance. To select the best bearing, one must consider and evaluate the bearings from a variety of angles. The procedure for selecting hub bearings is provided in the form of a flowchart.
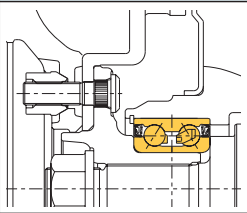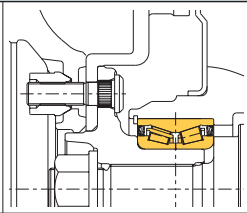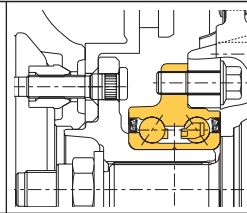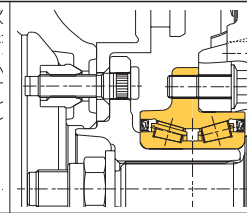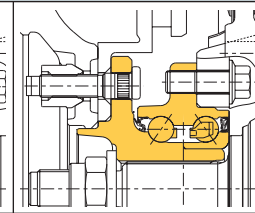
Hub bearing selection flowchart

Order	Check, study and evaluation items
Usage conditions check	• Vehicle model • Front/rear • Vehicle specifications • Custom specifications • Configuration of area surrounding bearing • Driven / non driven wheel • Traveling conditions • Evaluation test items / determination standards
Bearing type selection	• Allowable space for bearing • Rigidity • Whether or not equipped with ABS sensor • Cost • Inner/outer ring rotation • Whether or not equipped with seal • Ease of assembly, serviceability
Bearing type study	• Life calculation • Rigidity/strength • Shoulder protrusion (ball type) • Bearing materials • Flange PV value (roller type) • Grease • Seal type • ABS sensor • Tone wheel • Magnetic encoder • Allowable stress
Initial axial clearance study	• Axle/housing material and shape • Fitting • Nut fastening torque / axial force • Axial clearance reduction amount calculation (preload setting)
Sample fabrication	• Quality check

Evaluation by various tests	• Fitting test
	  ・ Axial clearance reduction amount measurement
	    (verification of set preload)
	• Bearing bench test
	  ・ Life evaluation test / seizure resistance evaluation test
	  ・ Seal performance evaluation test
	• Actual vehicle test

3.2 Hub bearing characteristics
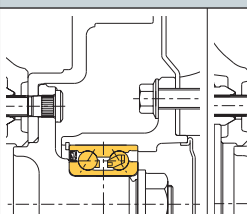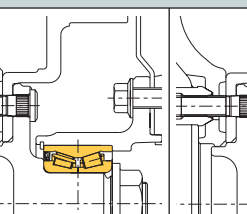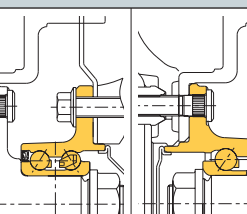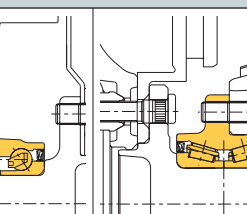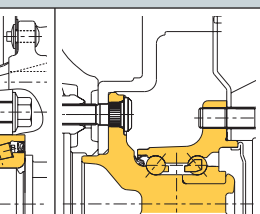
3.2.1 Driven wheel

For driven wheel				

Type	GEN 1		GEN 2		GEN 3
Rotation type	Inner ring rotation		Inner ring rotation		Inner ring rotation
Ease of assembly line assembly	☆		☆☆		☆☆☆
Serviceability	☆		☆☆		☆☆☆
Reliability when service is performed	☆		☆☆		☆☆☆
Compactness	☆		☆☆		☆☆☆
Rigidity	☆	☆☆	☆	☆☆☆	☆☆☆
Knuckle material applicability	☆		☆☆ Light alloy possible		☆☆ Light alloy possible
Integrated seal	☆☆	☆☆	☆☆	☆☆	☆☆
Integrated ABS	☆	☆	☆☆	☆☆	☆☆☆
Preload management	☆	☆	☆☆	☆☆	☆☆☆
Application	Passenger vehicle/RV	Passenger vehicle/RV/truck	Passenger vehicle/RV	Passenger vehicle/RV/truck	Passenger vehicle/RV

3.2.2 Non driven wheel

For non driven wheel					

Type	GEN 1		GEN 2			GEN 3
Rotation type	Inner ring rotation		Inner ring rotation	Outer ring rotation	Inner ring rotation	Inner ring rotation
Ease of assembly line assembly	☆		☆☆			☆☆☆
Serviceability	☆		☆☆			☆☆☆
Reliability when service is performed	☆		☆☆			☆☆☆
Compactness	☆		☆☆			☆☆☆
Rigidity	☆	☆☆	☆	☆☆☆	☆☆☆	☆☆☆
Knuckle material applicability	☆		☆☆ Light alloy possible	☆	☆	☆☆ Light alloy possible
Integrated seal	☆☆	☆☆	☆☆	☆☆	☆☆	☆☆
Integrated ABS	☆	☆	☆☆	☆☆	☆☆	☆☆☆
Preload management	☆	☆	☆☆	☆☆	☆☆	☆☆☆
Application	Passenger vehicle	Passenger vehicle/truck/trailer	Passenger vehicle	Passenger vehicle	Passenger vehicle/truck/trailer	Passenger vehicle

Hub bearing selection

3.3 Life calculation

Life of hub bearings is calculated by inputting reaction force (radial load and axial load) on the wheel given as set traveling conditions as load. Each bearing is a "unit bearing" consisting of two rows of bearings. Life of the bearings is calculated separately for the each of the bearings. Bearing life is calculated for the outer and inner bearings. The shorter of the calculated values is considered the calculated life of hub bearings.

1) Vehicle specifications

Front/rear wheel axle static load $\cdots W$ (N)

Front/rear wheel tread $\cdots\cdots\cdots\cdots T$ (mm)

Height of gravitational center $\cdots\cdots H$ (mm)

Effective radius of tires $\cdots\cdots\cdots R_s$ (mm)

Wheel offset $\cdots\cdots\cdots\cdots\cdots\cdots S$ (mm)

(Vehicle outside positive relative to gravitational center of bearing)
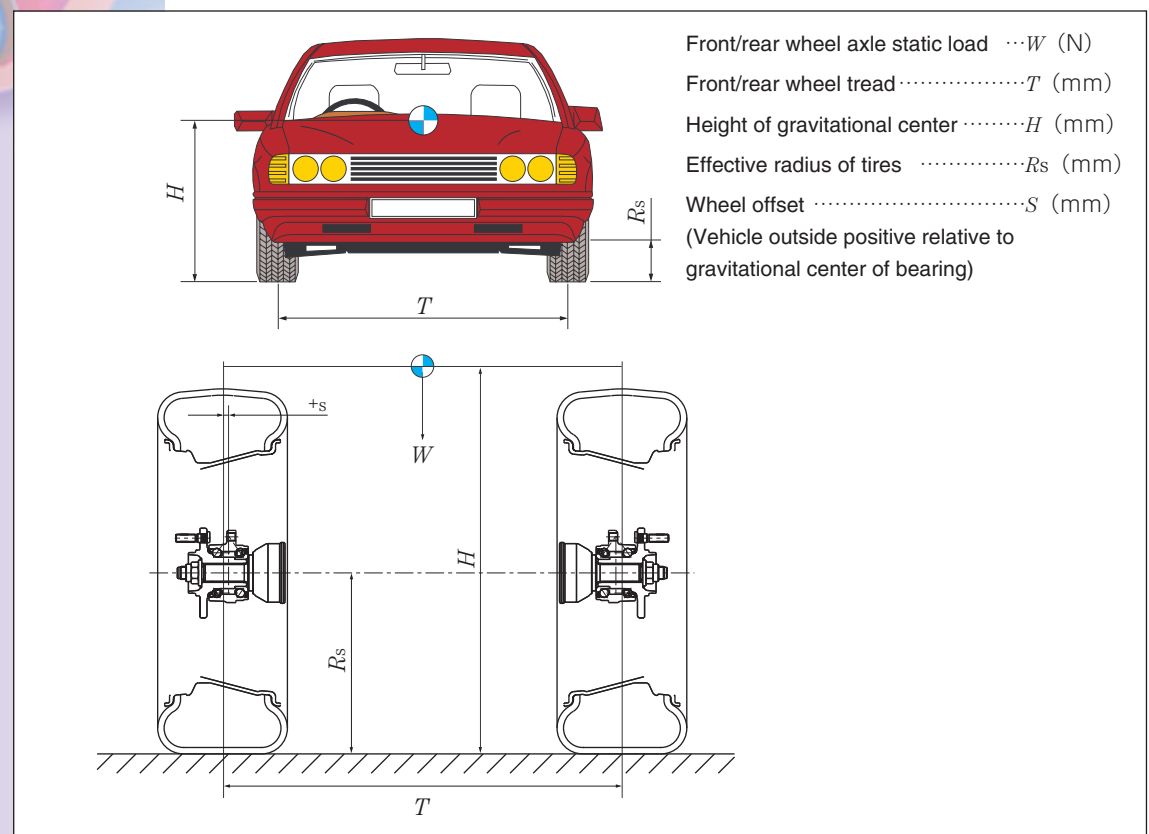
2) Calculation of road reaction force

First, we calculate road reaction force applied to the wheel by the road. Road reaction force in the axial and radial directions is calculated by the following formula.

$$W_r = f_w\ (W/2 + G \cdot W \cdot H/T)$$
$$W_t = G \cdot W_r$$

$\quad W_r$ ： Road reaction force in the radial direction (N)

$\quad W_t$ ： Road reaction force in the axial direction

$\quad f_w$ ： Load coefficient

$\quad G$ ： Turning acceleration (positive in case of turning outer wheel, negative in case of turning inner wheel)

3) Calculation of bearing load

Next, we calculate bearing load (radial/axial load) applied by road reaction force on the wheel.

(1) Radial load

Radial load applied to outer/inner bearing is determined by the following formula:

$$F_{ro} = \mid b/\ell \times W_r - R_s/\ell \times W_t \mid$$
$$F_{ri} = \mid a/\ell \times W_r + R_s/\ell \times W_t \mid$$

- F_{ro} : Outer bearing radial load (N)
- F_{ri} : Inner bearing radial load (N)
- ℓ : Distance between pressure cone apexes (mm)
- a : Distance from pressure cone apex of outer bearing to wheel center (mm)
- b : Distance from pressure cone apex of inner bearing to wheel center (mm)
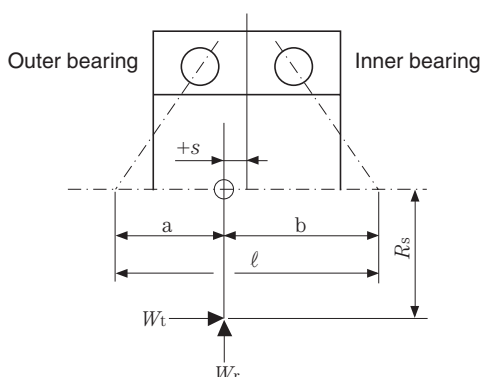
(2) Axial load

If an axial load is applied to the hub bearing, induced thrust is produced by the radial load. Induced thrust load when there is no clearance (no preload) is determined by the following formula. Induced thrust can be calculated by altering the clearance (preload), but such is extremely complicated. You may leave the calculation up to **NTN** in this case.

- $F_{ro}／(2Y)$: Outer bearing induced thrust load (N)
- $F_{ri}／(2Y)$: Inner bearing induced thrust load (N)
- Y : Axial load coefficient

(For the Y coefficient, use the value of $F_a/F_r > e$ of **tables 1** and **2**.)

Next, we compare large and small values of induced thrust load produced for the inner and outer bearings. In this case, you must take note of the direction of the induced thrust load and direction of outside force axial load.

Example: Axial load in the case of turning outer wheel (and $F_{ri}/(2Y) + W_t > F_{ro}/(2Y)$) is as follows:
Outer bearing axial load: $F_{ao} = F_{ri}/(2Y) + W_t$
Inner bearing axial load: $F_{ai} = O$

3) Equivalent radial load

Equivalent radial load if the inner and outer bearings is determined by the following formula:
$$P_r = XF_r + YF_a$$

At this time, X and Y are called the radial load coefficient and axial load coefficient respectively, and use a different value for each type of bearing. The X and Y coefficients are given in **tables 1** and **2**.

Table 1 X and Y coefficients of radial ball type

Contact angle α	X		Y		e
	$F_a/F_r \leqq e$	$F_a/F_r > e$	$F_a/F_r \leqq e$	$F_a/F_r > e$	
35	1	0.37	0	0.66	0.95
40	1	0.35	0	0.57	1.14

X=1 and Y=0 are used in the case of $F_a/F_r \leqq e$.

Table 2 X and Y coefficients of radial roller type

Contact angle α	X		Y		e
	$F_a/F_r \leqq e$	$F_a/F_r > e$	$F_a/F_r \leqq e$	$F_a/F_r > e$	
$\alpha \neq 0$	1	0.4	0	$0.4\cot\alpha$	$1.5\tan\alpha$

4) Bearing life calculation
(1) Rated life

Rated bearing life is determined by the following equation.

$$L_{10} = (C_r/P_r)^p$$

- L_{10} : Rated bearing life ($\times 10^6$ rotations)
- p : Constant (3 in case of ball type, 10/3 in case of roller type)
- C_r : Basic load rating (N) of radial bearing (single row)
- P_r : Equivalent radial load (N)

(2) General travel distance life

If you take several travel conditions into consideration, you can determine general travel distance life by the following formula integrating the respective calculated lives.

$$L = 100 / \Sigma \left[q_{(i)} / L_{(i)} \right]$$

L : General life ($\times 10^6$ rotations)

$q_{(i)}$: Frequency of each traveling condition (%)

$L_{(i)}$: Calculated life of each traveling condition ($\times 10^6$ rotations)

$$L_K = 2\pi \cdot R_s \cdot L / 10^6$$

L_K : General travel distance life (km)

R_s : Effective tire radius

An example of life calculation results is provided in **Fig. 1** for your reference.
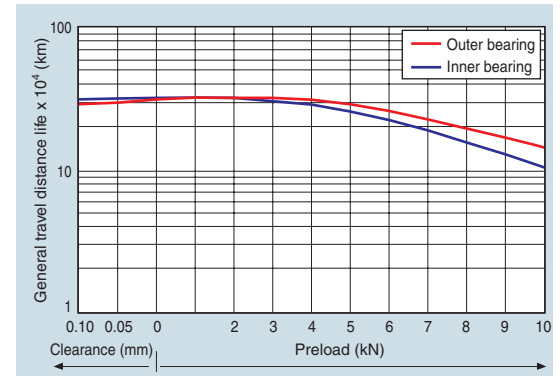
Fig. 1   Example of life calculation results

3.4 Allowable stress and shoulder protrusion

1) Allowable stress

When a load is placed on a bearing, contact stress at the center of the rolling elements and raceway where the maximum stress is received should be no greater than the following values:

Ball type   : 4,200 MPa
Roller type: 4,000 MPa

2) Shoulder protrusion

The contact surface of the rolling elements and raceway is generally elliptical in shape. If the radius of the major axis of the contact ellipse protrudes from the shoulder of the inner or outer ring, concentrated stress is produced at the shoulder. Because it could result in early damage, take measure to prevent the contact ellipse from protruding from the shoulders.
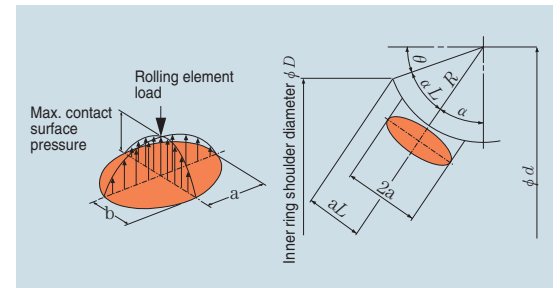
Fig. 2

3.5 Rigidity

Moment load is placed on hub bearings when the vehicle turns, which produces an inclination in the tire mounting surface. Variation in the angle of incline is called "rigidity" of the hub bearing.

Rigidity of the hub bearing is determined by the amount of elastic distortion of the rolling elements, hub or hub with outer ring. The amount of distortion is calculated by structural analysis (FEM).

Elastic distortion of the rolling elements is affected by internal clearance of the hub bearing. A comparison of angle of housing incline for clearance and preload (negative clearance) is given in **Fig. 3**.
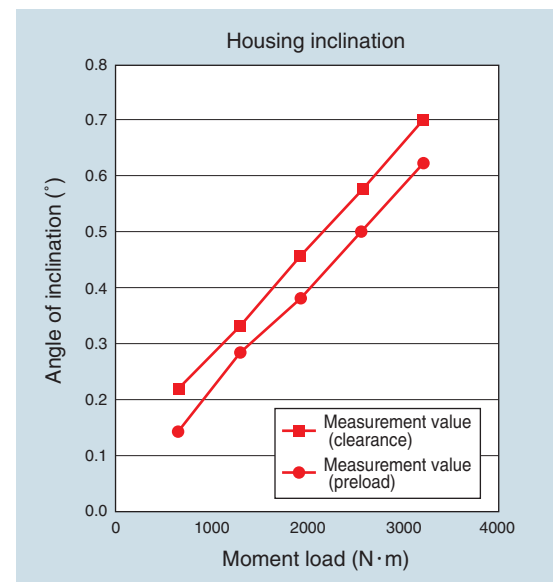
Fig. 3: Housing incline rigidity measurement example

3.6 Strength

When inclination rigidity and strength of a hub bearing is analyzed by FEM, the optimal shape taking weight reduction into account must be decided.
Fig. 4 gives an example of housing strength analysis and **Fig. 5** gives an example of a study of weight reduction.

3.7 Fitting and preload

Bearings are generally provided with a slight internal clearance during operation. Hub bearings use the preload method whereby a negative axial clearance is provided after assembly. The effects of preload are as follows:

(1) Internal clearance does not tend to be produced by elastic distortion when a load is placed on the bearing and rigidity is high.
(2) Axle run-out is suppressed and rotation precision is enhanced.
(3) Prevents fretting from being produced on the raceway by external vibration.

If excessive preload is applied, however, it can invite reduction of life, abnormal heating, or increase in rotational torque. With hub bearings, therefore, fitting and initial axial clearance are decided to produce suitable preload.

Axial clearance of hub bearings is reduced by fitting with other parts and nut fastening. This reduction in clearance is taken into account when initial axial clearance is established. The amount of reduction is confirmed by fitting test using the actual parts. If fastening due to fitting of the bearing inner ring is too tight, undesired conditions such as galling of the press fitting surface, distortion and inner ring cracking may be produced. Fitting is decided by calculating maximum stress on the inner ring when fitting.
For fitting and stress, you should consult with **NTN**. Recommended fitting for each type of bearing is given in **Table 3**.

Table 3   Recommended fitting

Bearing type		Axle	Housing
GEN 1	Inner ring rotation	m6	R7
	Outer ring rotation	m6	R7
GEN 2	Inner ring rotation	m6	——
	Outer ring rotation	Loose	——
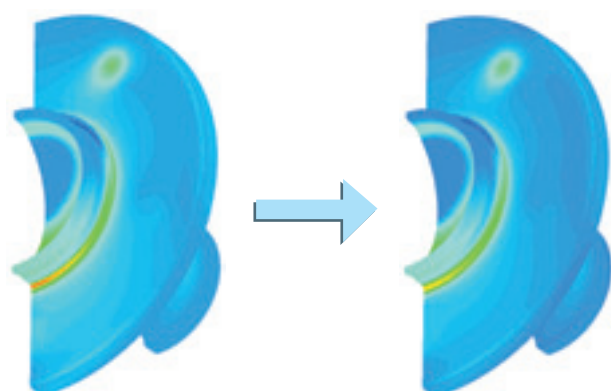
The corner R dimension is decided by studying housing corner R stress.

Fig. 4 Example of strength analysis of housing
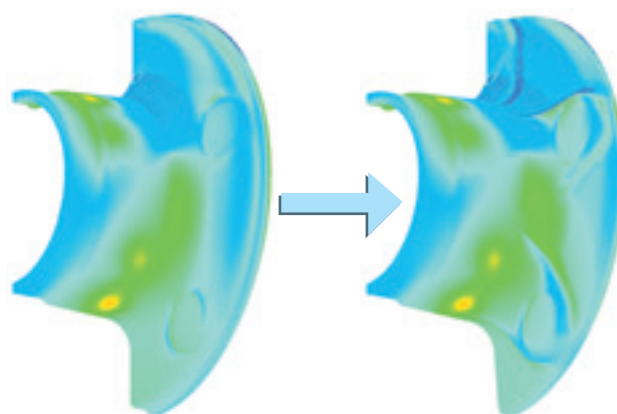
Weight is reduced without excessively reducing strength by changing type of flange for hub with outer ring.

Small   Large

Fig. 5 Example of weight reduction

4 Bearing materials

4. Hub bearing materials

4.1 Raceway and rolling element materials

Innovations in steel manufacturing technologies such as vacuum gas removal, out-of-furnace smelting and continuous casting have notably reduced harmful non-metallic inclusion, thus realizing longer bearing life. **NTN** selects quality materials that best suit each type of bearing.

(1) NKJ65M

Based on carbon steel, NKJ65M was developed as a substitute for SUJ2. NKJ65M is high quality clean carbon steel that offers lower cost and better rolling fatigue life. NKJ65M is used for the inner and outer rings of the GEN 1 and inner rings of the GEN 2 and GEN 3 ball types.

(2) SUJ2 (equivalent of SAE52100)

The most commonly used material, SUJ2 is a quality material having minimal non-metallic inclusion.
SUJ2 is used for balls, the inner and outer rings of the GEN 1 and balls and inner rings of the GEN 2 and GEN 3 ball types.

(3) S53C (equivalent of SAE1053)

Raceways are made of induction hardened S53C, a highly forgeable carbon steel. S53C offers superior characteristics such as rotational bending fatigue strength and impact resistance as well as long rolling fatigue life.
S53C is used for the hub, outer ring of GEN 2 and GEN 3 ball types and outer ring of GEN 2 roller type.

(4) ET material (equivalent of SCr4435)

Hardened from the surface to a suitable depth, ET material forms a comparatively soft core. Offering a combination of hardness and toughness, ET material is long-life case hardened steel with superior impact resistance.
ET material is used for the rollers, inner and outer rings of the GEN 1 roller type, and the rollers and inner ring of the GEN 2 roller type.
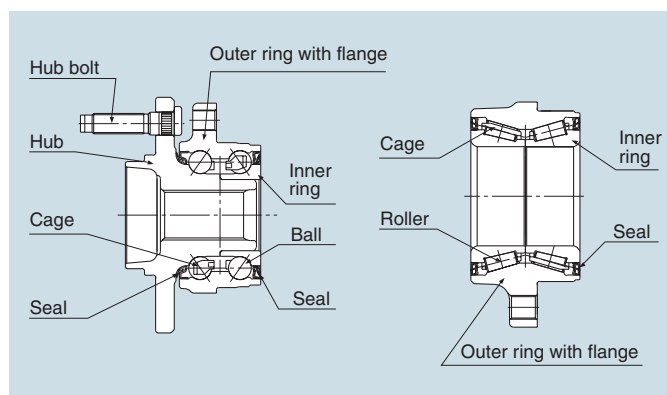
Fig. 6　Material part names

(5) ETA material

ETA material is a long-life case hardened steel that is specially heat-treated (carbonitriding) to enhance toughness of the surface layer structure. It is particularly effective for suppressing cracking caused by contaminated lubrication. ETA material is used for the rollers, inner and outer rings of the GEN 1 roller type, and the inner ring of the GEN 2 roller type.

4.2 Cage material

Cages are made of polyamide resin reinforced with fiberglass, except the roller type for use in high temperature environments, which is made of cold rolled steel.

5 Lubrication

5. Lubrication

The objective of lubricating bearings is to form a film of oil on rolling or sliding surfaces to prevent the metals from making direct contact with each other. Lubrication has the following effects:

(1) Reduces friction and wear.
(2) Extends bearing life.
(3) Prevents rusting.
(4) Prevents penetration of foreign matter.

Fretting wear particularly tends to occur on the raceway of hub bearings during transport of finished automobiles. Fretting resistance must therefore be taken into account for hub bearings.
Grease is used for hub bearings because it is economical, easy to use, and it facilitates design of sealed equipment.
Table 4 gives characteristics of greases currently used for hub bearings.

Table 4　Characteristics of grease

Characteristics	Resists fretting, enhances rust prevention performance.	Resists fretting, extends life at high temperatures.
Maker	Nisseki Mitsubishi	Kyodo Yushi
Name	PYRONOC Universal N6C	Raremax 9B367
Thickener	Urea	Urea
Base oil	Mineral oil	Mineral oil and synthetic oil
Working temperature (˚)	-30 to 150	-30 to 150
Color	Cream	Yellow
Remarks	Recommended grease for passenger vehicles	HUR/TU recommended grease for trucks and passenger vehicles.

6. Seals

Hub bearing seals prevent water ingress and have low torque. The shape and characteristics of currently used seals are given in **Table 5**.

7. Orbital forming

Nuts were used to fasten the inner ring of the GEN 3 ball type, but we have recently switched to forming the end of the hub with cold plastic working (orbital forming) to fasten the inner ring. This method is more reliable than fastening with nuts. It also weighs less, costs less, and is more compact.
Fig. 7 shows the orbital forming method and **Fig. 8** gives examples of the forming structures for the driven and non driven wheels.

Fig. 7: Orbital forming method

For non driven wheel
- Improves reliability
- Reduces weight
- Reduces size
- Lowers cost
- Reduces preload disparity

For driven wheel
- Facilitates preload management
- Improves NVH
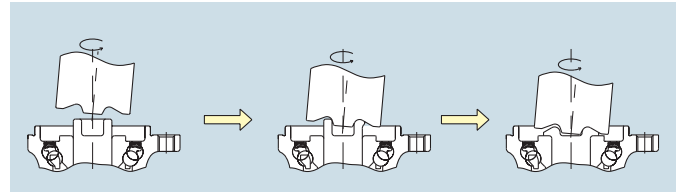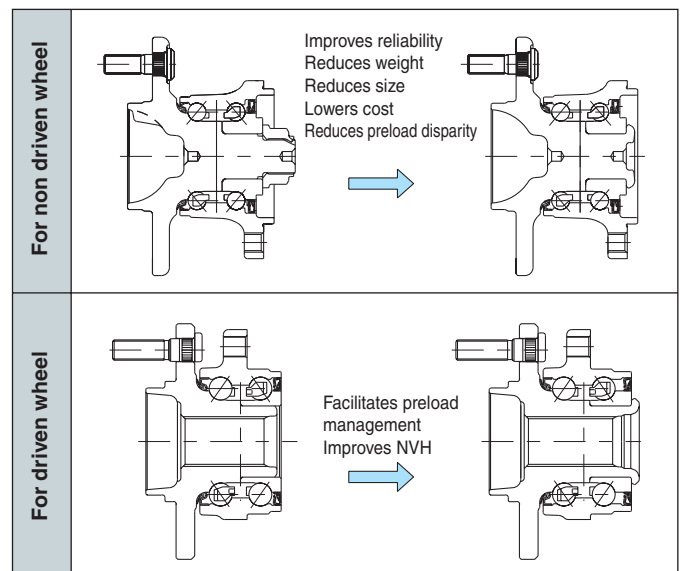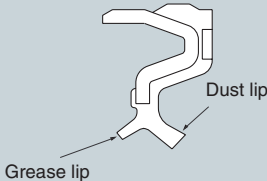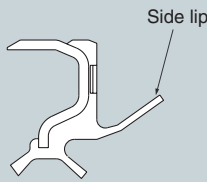
Fig. 8: Examples of fastening configuration for driven/non driven wheel inner ring forming

Table 5   Seal shape and characteristics

Superiority ranking order   ☆☆☆＞☆☆＞☆

Shape / Characteristics			2-lip seal (Grease lip, Dust lip)	3-lip seal (Side lip)	Highpack seal (Slinger)
Design specifications	*1) Name		2-lip seal	3-lip seal	Highpack seal
	Features		2-lip seals consist of a grease lip and a dust lip. The outer diameter is fitted with rubber/metal to provide tight sealing and disattachment resistance.	A side lip is added to the 2-lip seal; dramatically enhances sealing performance.	A stainless steel slinger is added to the 3-lip seal sliding part; dramatically enhances rust resistance of the sliding part of the lips.
	Rubber *1) material	Ordinary	Nitrile rubber (NBR)	←	←
		High temperature	Hydrogenated nitrile rubber (HNBR) Fluorine rubber (FKM)	←	←
Performance	Resistance to water ingress (number of cycles) *2)		☆ (3 to 5 cycles)	☆☆☆ (15 to 20 cycles)	☆☆☆ (15 to 20 cycles)
	Grease leakage		☆☆☆	☆☆☆	☆☆☆
	Torque characteristics		☆☆☆	☆☆	☆☆
	Rust resistance		☆	☆	☆☆☆
	Cost		☆☆☆	☆☆	☆

＊1）Consult with **NTN** if rubber must be conductive.   ＊2）Dirty water test conditions   Rotational speed: 1,100 min⁻¹
1 cycle: Running with water injected + dry stop
Dirty water: Kanto loam powder JIS 8 type 10 wt%

Hub bearing for active ABS sensor

8. Hub bearing for active ABS sensor

8.1 Magnetic encoder for active sensor

In the past electromagnetic sensors and magnetic tone wheels (passive type) have been used to detect wheel rotational speed for antilock brake systems (ABS). In recent years, however, makers have begun to use sensors equipped with a semiconductor element that can detect extremely low speed ranges (active type).

Some active type semiconductor sensors are equipped with a built-in bias magnet and some are not. The former uses a conventional tone wheel, and the latter requires a multipolar magnetized encoder.

(1) Types
There are two types of magnetized encoder: axial and radial type according to sensing direction (see **Fig. 9**).

(2) Features
Conventional sintered tone wheels are designed with a large diameter. Magnetic encoders enable smaller outer diameter and more compact size. **Fig. 10** shows an example of more compact construction.

Radial type	Axial type
Magnetic encoder	Magnetic encoder
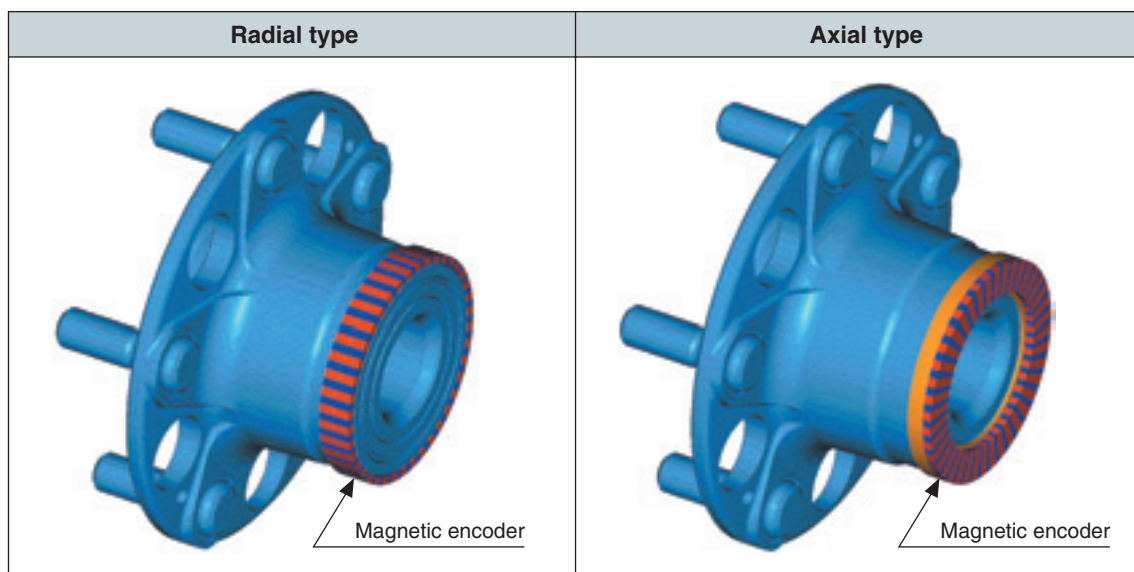
Fig. 9 Configuration of radial and axial type encoders

$$\phi D > \phi D_{m}$$
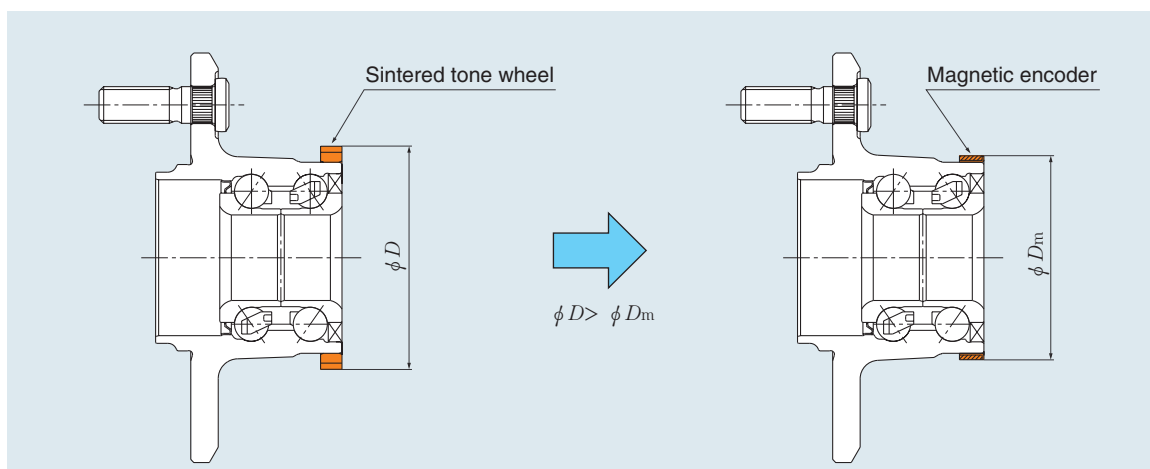
Fig. 10 More compact construction (comparison with GEN 2 ball type for non driven wheel)

8.2 Hub bearing with integrated ABS sensor

(1) Configuration

With GEN 2 and GEN 3 hub bearings, the ABS sensor and magnetic encoder can be unified with the axle. The ones for the driven wheel are provided with the ABS sensor and magnetic encoder between two rows of raceway surfaces, and the ones for the non driven wheel are provided with the ABS sensor and magnetic encoder on the inner side, and are unified with the bearing as a single unit.

Fig. 11 shows examples of the configuration of the GEN 3 ball type with integrated ABS sensor.

(2) Features

1. Less weight, more compact: Unifying the magnetic encoder and seal as a single unit enables more compact configuration in the axial direction.
2. Enhanced reliability relative to the outside environment: Housing the ABS sensor and magnetic encoder within the bearing prevents damage from small stones and rust due to dirty water or saltwater and enhances reliability.
3. Doesn't require air gap adjustment: Housing the ABS sensor and magnetic encoder within the bearing eliminates the need to adjust the air gap (distance between ABS sensor and magnetic encoder) when mounting the bearing.

Fig. 11　Example configuration of GEN 3 ball type with integrated ABS sensor

Hub bearing dimensions

GEN 1 ball type

For driven/non driven wheel

Type without seal   Type with integrated seal

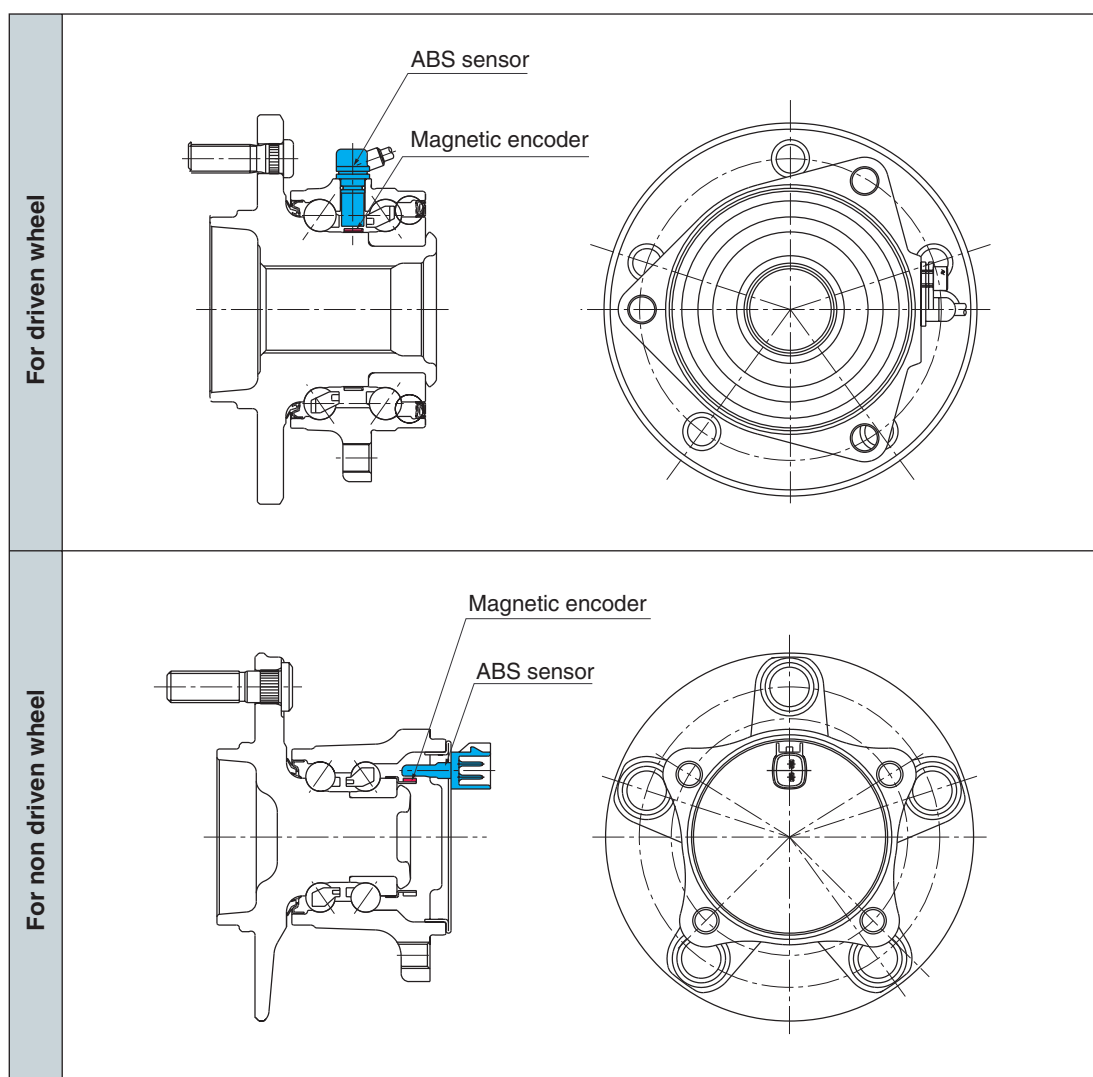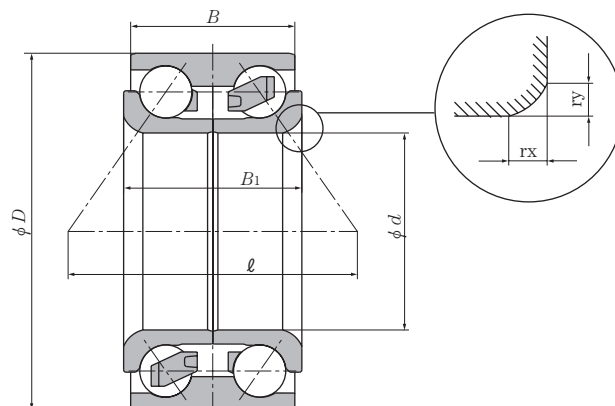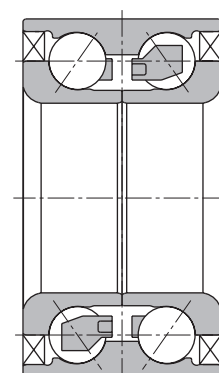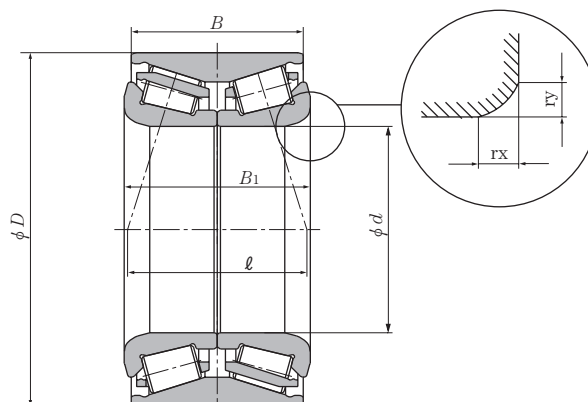| Main dimensions (mm)						Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Type with integrated seal	Mass (kg) (Reference)
d	D	B	B_1	rx (min.)	ry (min.)			C	C_0		
25	52	42	42	3.5	2.5	50.6	AU0501-4L/L260	19.1	12.7	○	0.36
27	60	50	50	3.5	3.5	50.7	DE0565LZCS34PX1/L244	26.2	16.5	○	0.57
30	50	20	20	1.5	1.5	38.3	DE0678CS12/5A	12.4	9.85	×	0.13
	54	24	24	1.8	1.3	42.4	DE0681CS18PX1/L260	17.4	12.9	×	0.20
	68	45	45	4.6	4.6	53.5	DE0690LZCS12PX1/L244	35.5	23.7	○	0.73
32	67	40	40	3.5	2.5	53.6	AU0603-2LLX/L260	26.9	19.9	○	0.61
34	64	34	34	3.5	3	51.8	DE0776CS46/5A	24.3	18.5	×	0.43
	64	37	37	3.5	2.5	52.8	AU0701-4LL/L588	24.3	18.5	○	0.47
	68	36	37	4	3	50.8	DE0745LLCS32PX1/5A	28.2	21.6	○	0.56
	68	42	42	3.5	3	52.9	DE0787LLCS54/5A	29.3	20.9	○	0.61
35	61.8	40	40	3.5	3.5	54.7	AU0706-3LXL/L260	21.5	17	○	0.43
	64	37	37	4	3.3	50.8	AU0704-1LL/L260	24.3	18.5	○	0.39
	65	37	35	3.5	3.2	55.4	2B-DE07A34CS30/L260	24.2	18.6	×	0.44
	72	34	34	3	2.8	55.1	DE0763CS46PX1/5A	32	25	×	0.58
36	65	48	52	3.5	3	70.2	TM-DE08A74CS10PX1/L260	23.2	19.5	×	0.58
	72	34	34	3	3	55.1	DE0769CS46PX1/5A	32	25	×	0.57
	72	42	42	3.5	3	60.4	2B-DE07A37CS22/L260	33.5	23.9	×	0.72
37	74	45	45	2.4	2.4	59.3	DE07A02LLCS46/L109	36.5	28.3	○	0.79
38	70	38	38	4	3.3	54.0	7B-DE08A32LLX3CS30/L260	28	21.8	○	0.55
	72	34	34	3	3	55.1	DE0869CS46PX2/5A	32	25	×	0.54
	72	40	40	3.5	2.5	54.7	AU0810-1LXL/L260	32.5	24.9	○	0.60
	73	40	40	3.5	2.5	54.7	AU0811-6LXL/588	32.5	24.9	○	0.69
	74	33	36	3.5	3.5	53.2	2B-DE08A33CS38PX1/L260	33	20.8	×	0.61
	74	36	36	4.5	3.5	54.7	AU0814-1LLX/L260	32	25.1	○	0.63
	74	40	40	3.5	2.5	56.8	AU0818-1LXL/L260	35	26.1	○	0.71
	74	50	50	4.5	3.6	57.4	DE0892LLCS43/L244	36	26.8	○	0.85
	79	45	45	5	4	76.7	AU0826-1LL/L588	32.5	27.9	○	0.99
39	68	37	37	3.8	3.8	55.6	DE0819LLCS38/5C	25.1	20.2	○	0.46
40	74	36	36	4	3	62.7	AU0817-5LL/L260	30.5	23.9	○	0.62
	74	40	40	3.8	3.8	56.5	DE08A78LLCS56PX1/L260	32	25.1	○	0.67
	76	28	33	4.1	3.9	41.3	TM-DE0863LLCS43PX1/L260	36.5	29.3	○	0.54
	76	37	37	4.5	4.5	56.4	TM-DE08A63LLCS88/L260	35	26.4	○	0.66
	76	38	41	3	1.8	56.8	DE0891LLCS32PX2/5A	35	26.4	○	0.70
	80	34	36	2.6	2.6	59.7	AU0823-1/L588	36.5	28.9	×	0.76
	80	40	40	4	3	69.5	AU0822-2LL/L588	39	30.5	○	0.88
42	76	35	38	3.5	3.5	61.7	AU0815-2/L260	33.5	27.2	×	0.65
	76	37	40	3.5	3.5	55.9	AU0816-1LL/L260	33.5	27.2	○	0.66
	78	38	38	3.5	3	59.2	DE08A06LLCS58PX2/5A	36.5	28.7	○	0.69
	78	38	41	4	3	58.7	DE0829LLCS32PX1/5A	36.5	28.8	○	0.75
	80	42	42	2.6	2.6	63.5	DE08A30LLCS67PX2/L170	39	30	○	0.82
	80	45	45	3.8	3.8	62.4	AU0804-4LL/L260	41	32.5	○	0.90
43	76	43	43	5	4	72.5	AU0908-3LLX2/L260	31.5	25.9	○	0.73
	79	38	41	4	3.5	58.7	AU0907-7LXL/588	27.5	22.4	○	0.76
	79	45	45	5	3.1	76.2	AU0911-3LL/L260	32.5	27.9	○	0.84
44	84	40	42	3.5	3	62.2	DE0978LLCS64PX1/L260	43.5	34	○	0.91
45	83	45	45	3.8	3.8	63.7	2B-DE0989LLCS28/L260	41	32.5	○	0.60
	84	40	42	4.5	3.5	62.9	AU0901-12LL/L260	41	32.5	○	0.94
48	89	42	44	3.5	2.5	67.2	AU1001-5LLX/L260	45.5	37	○	1.07
65	110	46	46	5	4	86.3	DE1353LLACS41PX1/L260	51.5	50.5	○	1.62

※Old bearing number given in blue.

GEN 1 roller type
For driven/non driven wheel

Type without seal
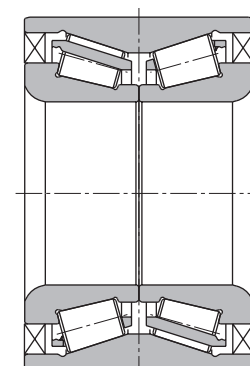

Type with integrated seal

Main dimensions (mm)						Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Multiple rows		Type with integrated seal	Mass (kg) (Reference)
d	D	B	B_1	rx (min.)	ry (min.)			C	C_0		
25	52	37	37	2	2	25.3	4T-CRI-0574LLCS150/L260	35	38	○	0.36
27	52	43	45	3.5	3.5	35.4	4T-CRI-0569CS83/5A	32	38.5	×	0.40
30	55	56	56	0.6	0.6	45.3	TU0601-1LL/L260	37.5	46	○	0.54
	58	42	42	2	2	32	ET-CRI-0678LLCS70/L260	38.5	44	○	0.49
32	58	57	65	1	1	59.5	4T-CRI-0685CS110	37	46.5	×	0.64
35	64	37	37	4.75	3.66	30.2	4T-CRI-0760LLCS200/5C	34	41	○	0.50
36	64	42	42	2.5	2.5	34.5	ET-CRI-0787LLCS90/L260	34	41	○	0.56
38	65	48	52	3	3	48.7	4T-CRI-08A05CS95/L244	35	45	×	0.64
	76	40	43	5	4	39.2	TU0808-1/L260	53	69.5	×	0.93
39	68	37	37	3.8	3.8	33.2	4T-CRI-0868LLCS150/L260	36	45.5	○	0.54
40	80	38	38	3.5	3.5	34.2	TU0807-1/L244	55.5	68.5	×	0.89
42	72	35	38	4.75	3.56	36.5	4T-CRI-08A01CS110/L244	43.5	52.5	×	0.58
	72	38	38	3.8	3.8	33.8	4T-CRI-0822LLXCS145/L260	44	52.5	○	0.60
	72	48	52	3.5	3.5	53.3	4T-CRI-08A02CS96/L244	33.5	40	×	0.75
	73	38	38	3.5	3.5	34.2	4T-CRI-08A24CS175/L260	55	68.5	×	0.82
	76	39	39	3.8	3.8	35.2	TU0802-4LLX/L588	48	56.5	○	0.73
43	73	41	45	4.75	3.76	42.4	TU0902-2/L260	43.5	52.5	×	0.67
	76	40	43	4.75	3.56	39.3	TU0904-1/L260	55.5	69	×	0.75
45	90	51	54	1	1	44.2	4T-CRI-0966CS130PX1/L260	90	112	×	1.53
46	77	41	45	4.75	3.76	42.5	4T-CRI-0992CS136/L260	46.5	62	×	0.81
	78	49	49	4.9	3.8	43.5	4T-CRI-0988LLXCS98/L260	54.5	74	○	0.91
	80	40	43	3.5	3.5	39.4	4T-CRI-0994CS176/L260	54.5	74	×	0.91

※Old bearing number given in blue.

Hub bearing dimensions

GEN 2 ball type

Inner ring rotating type for driven wheel

Main dimensions (mm)										Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of tapped holes in outer ring	Mass (kg) (Reference)
d	D	B	B_1	d_1	T	B_i	P_t	rx (min.)	ry (min.)			C	C_0		
28	62	40.5	42.5	43	8	21	86.1	3.5	2.5	53.7	HUB003-1	23.4	17.0	-	0.85
	65	37	37	42.9	10	20	91.214	3	2	54.0	HUB204-5	26.6	17.5	4	0.70
29	62	40.5	42.5	43	8	21	86.1	3.5	2.5	53.5	HUB009-2	23.4	17.0	-	0.84
34	69	37	37	48.4	10	20.4	93	3.5	2.5	50.7	HUB212-5	27.2	19.1	4	0.75
39	75	62.8	46.8	52.5	13.3	14.4	-	3.5	2.5	61.5	HUB166-4	32.5	24.9	4	1.80
	75	62.8	46.8	52.5	14.1	8.5	120	3.5	2.5	61.5	HUB147-28	32.5	24.9	3	1.70
	75	62.8	46.8	52.5	14.1	9.6	120	3.5	2.5	61.5	HUB223-6	32.5	24.9	3	1.69
	80.6	65.3	46.8	52.5	14.1	11	120	3.5	2.5	61.5	HUB147-32	32.5	24.9	3	1.86
40	84	49.5	43	55.4	10	10	-	2.6	2.6	58.5	HUB111	32.0	25.1	4	1.23
	84	56	56	59.3	12	13	-	4.5	3.5	76.3	HUB175-14	36.5	28.9	4	1.51
42	84	39.5	41	59.4	13	15	106	5	4	58.7	HUB089-11	36.5	28.8	-	1.74
43	80.6	66	46.5	59.4	14.1	11	120	4	3	64.2	HUB189-2	36.5	28.8	3	1.89
	83	42.5	44	59.4	14	16.5	102	5	3.5	58.7	HUB081-45	36.5	28.8	4	1.22
	83	47.5	49	59.4	14	21.5	102	5	3.5	63.7	HUB100-7	36.5	28.8	4	1.29
	84	56	56	58.6	15	11	110.009	4.5	3.5	67.7	HUB030-20	36.5	28.9	4	1.55
45	86	47.5	49	62	14	21.5	105	5	3.5	65.0	HUB132-2	41.0	32.5	4	1.39
46	90	49	49	65.1	14	19	151.38	4.5	3.5	65.8	HUB098-14	43.5	34.0	4	1.91

GEN 2 ball type
Outer ring rotating type for driven wheel
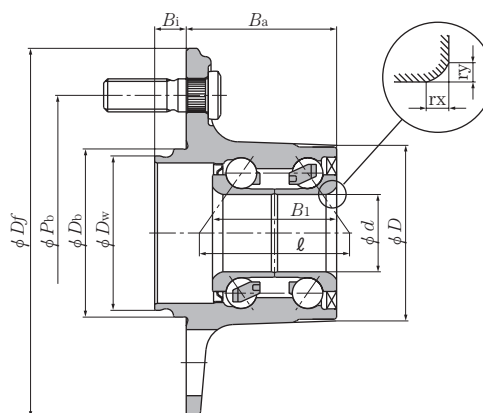
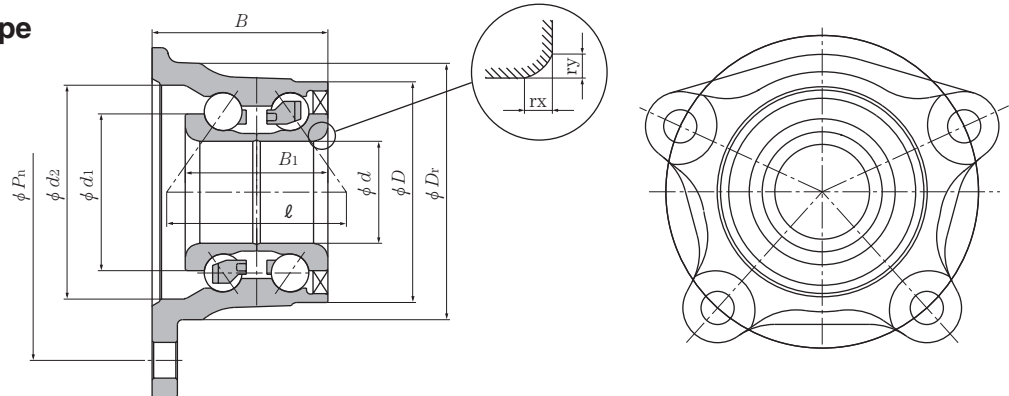| Main dimensions (mm)											Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of hub bolts	Mass (kg)
d	D	B_i	B_1	B_a	D_f	D_w	D_b	P_b	r_x (min.)	r_y (min.)			C	C_0		(Reference)
23	55.5	11.5	40	49.5	134	56	61	100	3.5	2.5	46.1	HUB214-9	21.1	13.3	4	1.33
25	61	11.5	40	49.5	134	56	61	100	3.5	2.5	47.6	HUB002-6	26.1	16.1	4	1.44
	61	14.5	54	51.5	122	59	60	100	3.1	2.6	58.8	HUB076-9	29.5	18.2	4	1.54
	62	18	40	48	134	60	64	114.3	3.5	2.5	47.6	HUB109-4	26.1	16.1	4	1.53
27	63	15	40	45	134	59	61	100	4.5	3.5	47.2	HUB048-35	22.3	15.1	4	1.39
	64.8	15	50	52.5	134	59	68	100	4.5	3.5	57.9	HUB080-26	24.4	16.0	4	1.45
	65.4	15.5	50	52.5	148	66	68	114.3	4.5	3.5	57.9	HUB184-4	24.4	16.0	4	1.50
28	62	13.5	47	54	122	54	55	100	3.8	3.8	54.5	HUB200-5	24.4	16.1	4	1.62
	63.5	11.5	40	49.5	134	56	61	100	3.5	2.5	49.5	HUB008-48	26.2	16.5	4	1.56
	64	16	40	49.5	120	54	58	100	3.5	2.5	49.7	HUB254-3	26.2	16.5	4	1.41
	64	18	40	49.5	130	54	58	100	3.5	2.5	49.7	HUB144-11	26.2	16.5	4	1.59
	64	18	40	49.5	134	60	64	114.3	3.5	2.5	49.7	HUB065-14	26.2	16.5	4	1.64
30	64.5	14.5	59	64.5	126	56	58	100	3.5	2.5	62.8	HUB038-30	27.9	18.5	5	1.83
	66	13.5	47	56	122	54	55	100	3.7	3.5	52.2	HUB053-50	27.9	18.5	4	1.50
	66	14.5	47	56	140	67	72	114.3	3.7	3.4	52.2	HUB122-12	27.9	18.5	5	1.97
	66.8	15.5	55	57.5	148	66	68	114.3	4.5	3.5	62.8	HUB145-9	27.9	18.5	4	1.70
	67	11.5	40	54.5	136	56	61	100	3.5	2.5	51.4	HUB005-36	27.9	18.5	4	1.67
	67	11.5	41	54.5	136	56	61	100	3.5	2.5	51.4	HUB005-64	27.9	18.5	4	1.79
	67	11.5	41	59.7	139	64	64	114.3	3.5	2.5	51.4	HUB082-13	27.9	18.5	4	1.75
	67	11.5	41	56	152	64	64	114.3	3.5	2.5	51.4	HUB083-64	27.9	18.5	4	1.60
	67	11.5	46	56	152	64	64	114.3	3.5	2.5	56.4	HUB167-9	27.9	18.5	5	1.75
	67	11.5	51	55	136	56	61	100	3.5	2.5	61.4	HUB155-5	27.9	18.5	4	1.64
	67	11.5	56	56	139	56	61	100	3.5	2.5	66.4	HUB227-24	29.5	20.2	4	1.71
	67	11.5	56	71	152	64	64	114.3	3.5	2.5	66.4	HUB112-14	27.9	18.5	5	2.33
	67	12.5	51	56	139	64	64	114.3	3.5	2.5	61.4	HUB157-17	27.9	18.5	4	1.77
	67	12.5	51	56	139	64	64	114.3	3.5	2.5	61.4	HUB186-6	29.5	20.2	5	1.80
	67	12.5	51	56	152	64	64	114.3	3.5	2.5	61.4	HUB156-37	27.9	18.5	4	1.89
	67	12.5	51	56	152	64	64	114.3	3.5	2.5	61.4	HUB156-39	27.9	18.5	5	1.86
	67	12.5	59	56	152	64	64	114.3	3.5	2.5	69.4	HUB181-29	29.5	20.2	4	1.96
	67	12.5	59	56	152	64	64	114.3	3.5	2.5	69.4	HUB195-7	29.5	20.2	5	1.96
	67	12.5	59	63	152	64	64	114.3	3.5	2.5	69.4	HUB208-3	29.5	20.2	5	2.08
	67	12.5	59	71	152	64	64	114.3	3.5	2.5	69.4	HUB199-13	29.5	20.2	4	2.14
	67	12.5	59	71	152	64	64	114.3	3.5	2.5	69.4	HUB199-14	29.5	20.2	5	2.13
	71	12.5	59	56	152	64	64	114.3	3.5	2.5	69.6	HUB215-9	33.5	23.2	5	2.24
	73.3	15.5	48	49	148	59	68	100	4.5	3.5	56.1	HUB042-47	37.0	23.8	4	1.95
	73.3	15.5	48	49	148	66	68	114.3	4.5	3.5	56.1	HUB042-55	37.0	23.8	4	2.08
31.77	75	13.3	52	58.56	139	63.22	64.38	107.95	2	2	63.4	HUB059-70	39.5	26.8	5	2.17
33	73	14.5	51	59	140	67	72	114.3	3.7	3.5	60.1	HUB066-46	35.5	24.0	5	2.14
34	72	11.5	42	56	152	64	64	114.3	3.5	2.5	56.7	HUB094-19	29.3	20.9	4	2.17
	72	15	42	55	139	64	64	114.3	3.5	2.5	56.7	HUB028-16	29.3	20.9	4	2.08
	74	12	58	62	152	64	64	114.3	3.5	2.5	72.1	HUB198-7	37.5	26.3	5	2.23
	74	13	48	62	146.5	64	70	114.3	3.5	2.5	62.0	HUB142-11	33.5	23.6	5	2.33
	74	13	58	62	146.5	64	64	114.3	3.5	2.5	72.0	HUB249-4	33.5	23.6	5	2.29
	74	13	58	62	146.5	64	70	114.3	3.5	2.5	72.0	HUB150-5	33.5	23.6	5	2.37
	76	17.7	53	58.8	140	66	68	114.3	4.5	3.5	65.4	HUB161-11	33.5	23.6	5	1.97
	79	17.7	53	58.8	148	66	68	114.3	5.5	4.5	67.3	HUB182-4	39.5	27.0	5	2.19
36	80	18.7	62	61	140	67	72	114.3	3.7	3.5	72.2	HUB226-3	39.5	27.3	5	2.69
38	76	15	52	62	146.5	70	70	114.3	3.5	2.5	63.9	HUB091-18	32.0	25.0	5	2.35

GEN 2 ball type

Inner ring rotating type for non driven wheel

Main dimensions (mm)										Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of outer ring holes	Mass (kg) (Reference)
d	D	B	B_1	D_r	d_1	d_2	P_h	r_x (min.)	r_y (min.)			C	C_0		
30	65	51.8	42	76	46.2	63	99	3.7	3.6	53.0	HUB121-4	29.5	20.4	4	1.00

GEN 2 roller type

Inner ring rotating type for non driven wheell

Main dimensions (mm)										Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of tapped holes in outer ring	Mass (kg) (Reference)
d	D	B	B_1	d_1	T	B_0	P_t	D_f	r_x (min.)	r_y (min.)			C	C_0	
65	143.1	130	130	103.5	24	128	165	194	12	11	107	HUR042-27	21.9	31	10	13.9
70	141.5	110	110	100	25	110	165	194	12	7	84.2	HUR040-11	19.3	27.9	10	11.3

GEN 3 ball type
Inner ring rotating type for driven wheel

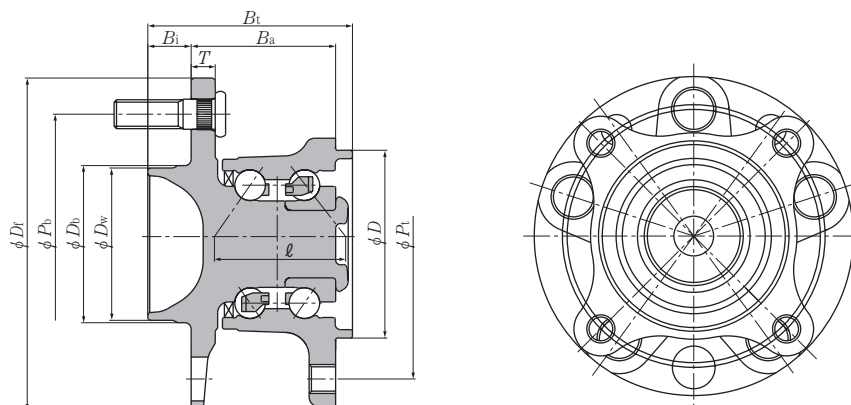| Main dimensions (mm)												Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of hub bolts	Number of tapped holes in outer ring	Mass (kg) (Reference)
d	D	B_t	B_f	d_c	D_w	D_b	T	B_i	P_b	P_t	D_f			C	C_0			
24.4	84	94.3	65.5	50	56	58	10	14	100	107	124	75.3	HUB266-1	27.6	22.3	5	4	3.65
	90	84.2	60.4	57	67	69	10	16	114.3	110	138	69.9	HUB267-1	27.7	24.9	5	4	3.64
26.4	87	74.5	38.5	57	67	69	11.5	15.5	114.3	112	139	74.6	HUB251-4	43.5	34.5	5	4	3.2
27.52	85.5	79.83	35.9	56.9	63.23	70.97	11	17.83	107.95	112	139	67.2	HUB211-7	44	33.5	5	3	2.8
28.4	84	95.5	69	58	66	68	10.5	15.5	114.3	107.004	148	80.8	HUB012T-1	40.5	33.5	5	4	3.41

※Old bearing number given in blue.

GEN 3 ball type
Inner ring rotating type for non driven wheell

Main dimensions (mm)									Distance between pressure cone apexes ℓ (mm)	Bearing No.	Basic rated load (kN) Single row		Number of hub bolts	Number of tapped holes in outer ring	Mass (kg) (Reference)
D_w	D	D_b	B_a	T	B_i	P_b	P_t	D_f			C	C_0			
64	74	64	58.8	8	12.5	114.3	-	139.5	68.8	HUB262-8	29.4	20.8	5	4	2.92
	76	64	53	10	12	114.3	100	146.5	78.5	HUB270-1	32.5	24.9	5	4	3.81
66	84	68	69	10.5	15.5	114.3	107.004	148	70.4	HUB231-10	30.5	23.7	5	4	3.08
	84	68	40.7	10	17.7	114.3	107.004	136	64.4	HUB232-8	35.5	25.3	5	4	2.97
67	90	69	60.4	10	16	114.3	110	138	69.9	HUB004T-1	27.7	25	5	4	3.4

※Old bearing number given in blue.