RV®

JAB CM009

JQA-EM7212

ISO 9001 JQA-1190

JQA-OH0278

# Precision Reduction Gear RV™

## Positioner Unit

# RVP®

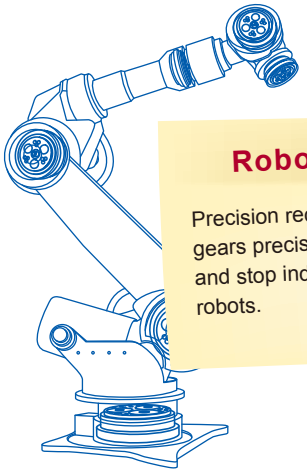
RVP® Series


Nabtesco®

Nabtesco's technologies supporting society

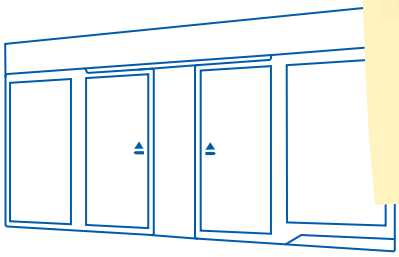
# Contributing to society with our 'Moving it. Stopping it.' technologies

Nabtesco manufactures products which are used in everyday life. Our high-accuracy components are essential for moving objects; they may be rarely visible, but are the foundation of everyday objects that you see moving and wonder how. Nabtesco's technologies are found throughout objects that move and stop people's lives.



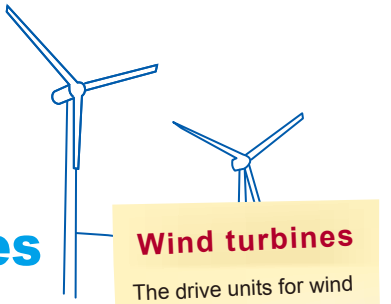
## Robots

Precision reduction gears precisely move and stop industrial robots.



## Doors

Nabtesco technology opens and closes automatic doors in buildings and platform doors at train stations.



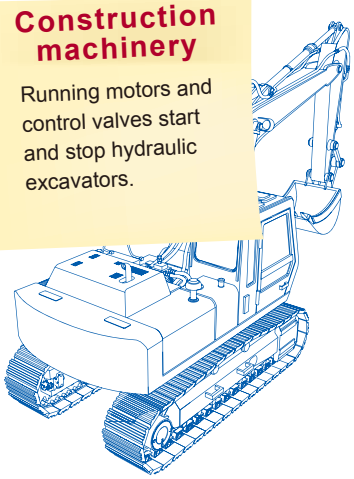
## Wind turbines

The drive units for wind turbine generators control the orientation of the wind turbine and the angle of the blades.

## Nabtesco technologies are at work in many areas of our daily lives.

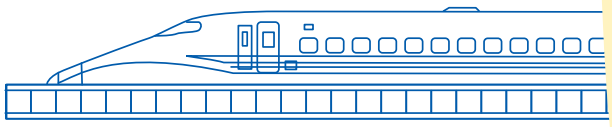
## Construction machinery

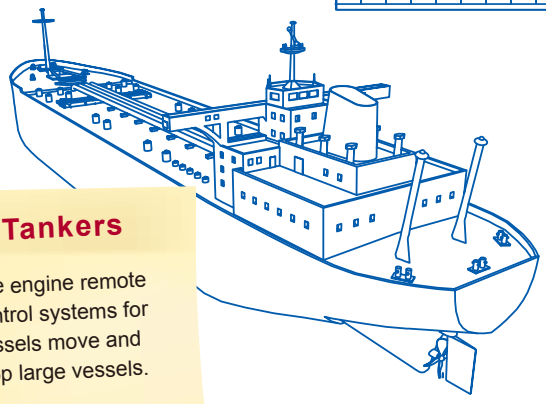
Running motors and control valves start and stop hydraulic excavators.



## Bullet trains

Brakes and doors ensure safety and comfort for the world-famous Shinkansen bullet trains.





## Tankers

The engine remote control systems for vessels move and stop large vessels.

## Airplanes

The flight control systems are crucial for the flight safety of aircraft.

# CONTENTS

## Who is Nabtesco?

The key words for Nabtesco are 'motion control'. We use our strengths in the fields of component and systems technologies to develop highly creative products. Through the Nabtesco Group as a whole, we can also utilize our advantage of expertise to maximum effect in order to further enhance these strengths.
In the air, on land and at sea, we have a large share in various fields of both international and domestic markets. Nabtesco will continue to evolve by utilizing its strengths in many fields and by exploring the possibilities of the future.


April 2002 Initiation of hydraulic equipment business alliance
October 2003 Business merger

The business alliance between Teijin Seiki and NABCO on hydraulic equipment projects was the beginning of a mutual confirmation by the companies of the other's product configuration, core technologies, corporate strategies and corporate culture. This led to a common recognition that a business merger would be an extremely effective means of increasing corporate value and achieving long-term development. Based on this mutual judgment, in 2003 an equity transfer was conducted to establish Nabtesco as a pure holding company, with both firms as wholly owned subsidiaries. After a year of preparation, both companies were absorbed and amalgamated by means of a short form merger, and Nabtesco was transitioned to an operating holding company.

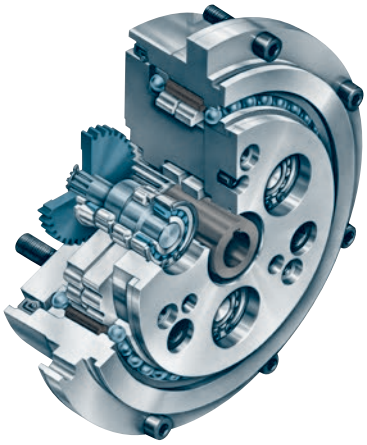
# What is the RVP® series?

The RVP series is a product line of positioner units that utilize the precision reduction gears RV™, which have a long history and outstanding reputation for use with industrial robots.
Major motors can be easily connected to these positioner units.
The RVP series contributes to the reduction of design, production and assembly times.

## Structure and Advantages of Precision Reduction Gears RV™

Precision reduction gears RV™ are equipped with a planocentric deceleration mechanism that enables extremely precise control. These gears feature a high number of simultaneously meshing teeth. This allows them to be compact and lightweight while still offering excellent rigidity and resistance to overloading. They also operate with minimal backlash, inertia and vibration during rotation, providing efficient acceleration, smooth operation and highly accurate positioning. RV™ series gears are well established as leading products for applications ranging from industrial robots and machine tools to assembly and transport systems.

- **High rigidity, high impact resistance**
- **High torque output, high durability**
- **Low vibration**
- **Wide range of reduction ratios**
- **Flat profile, compact**
- **Highly accurate positioning (precise rotation)**



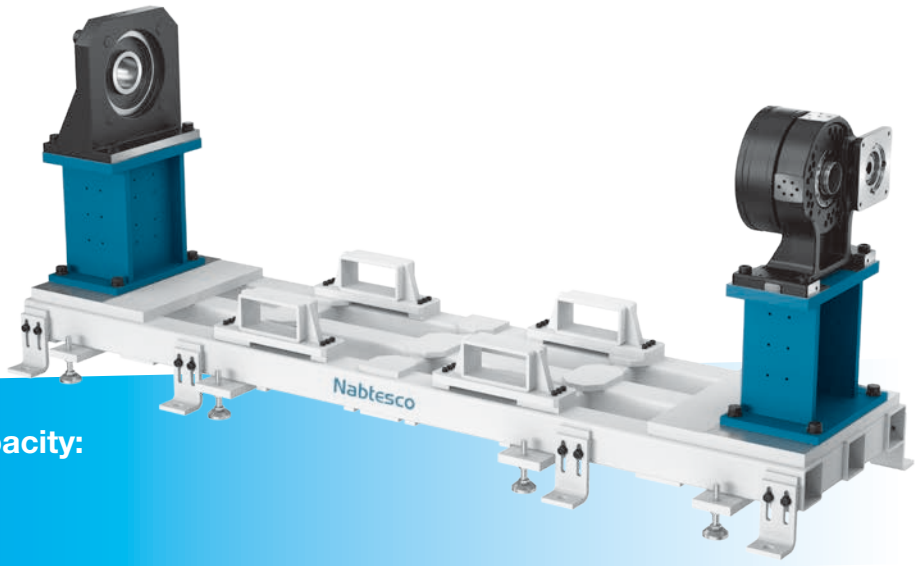
# RVP® series product line

## RVP-A

**Maximum carrying capacity: 500 kg**
**2-axis positioner unit**

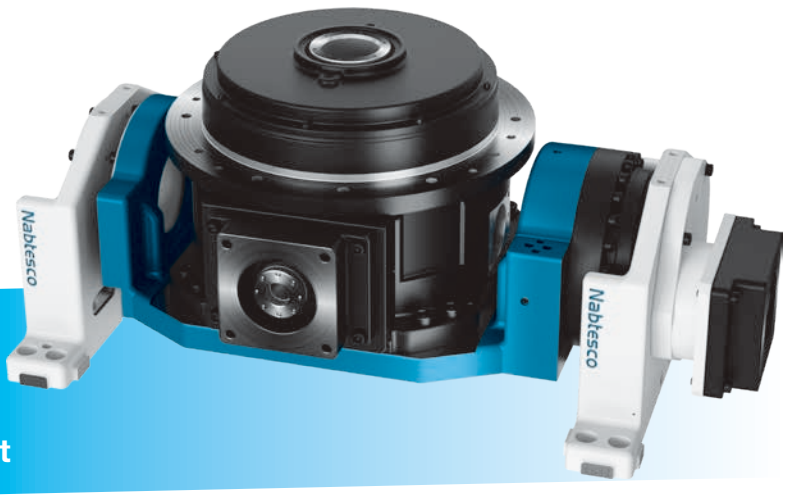

## RVP-B

**Maximum carrying capacity:**
**1,000 to 1,600 kg**
**BBQ positioner unit**



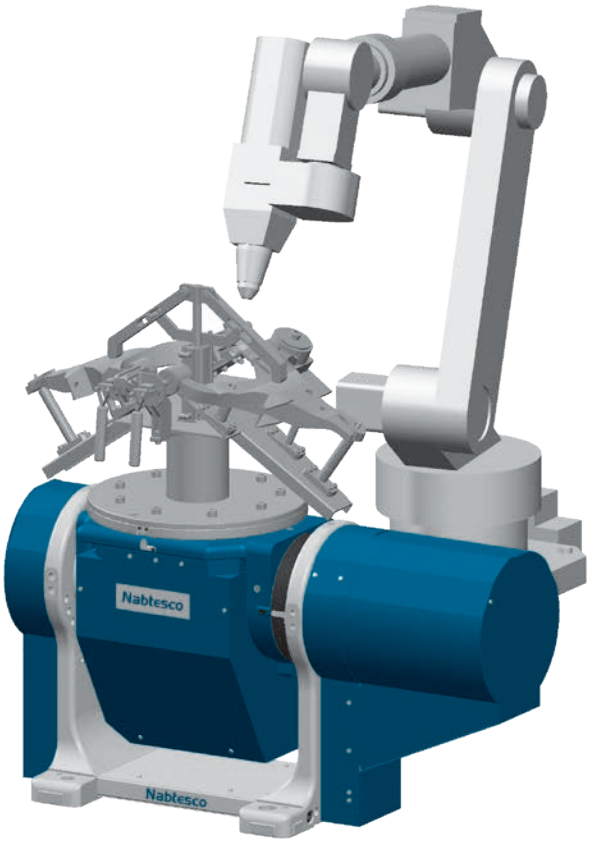

## RVP-C

**Maximum carrying capacity:**
**4,000 kg**
**Variable tilt angle turntable unit**

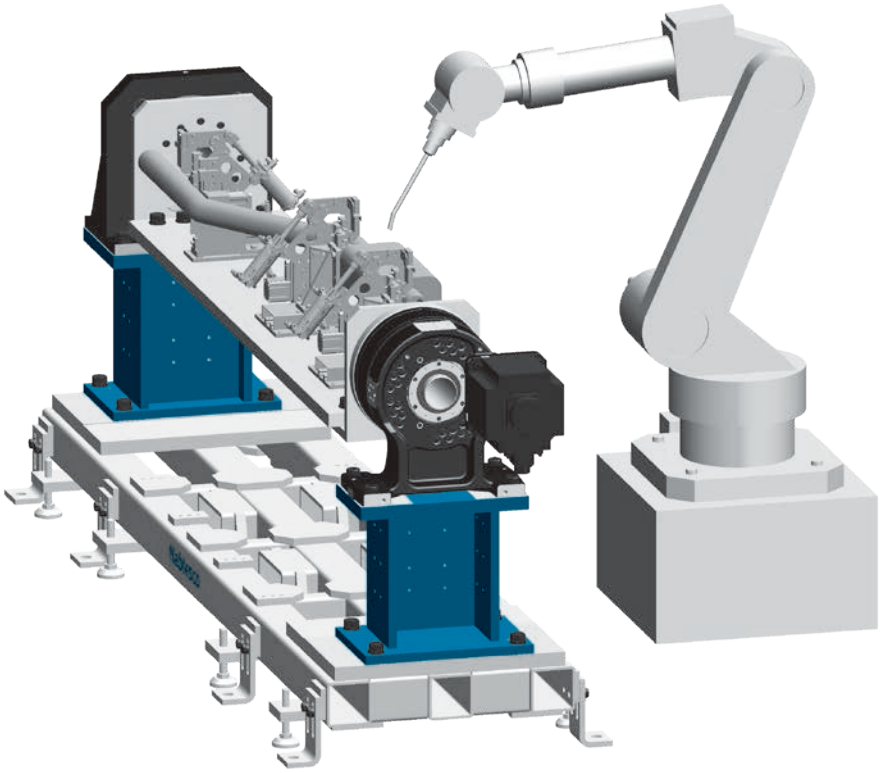


# Applications

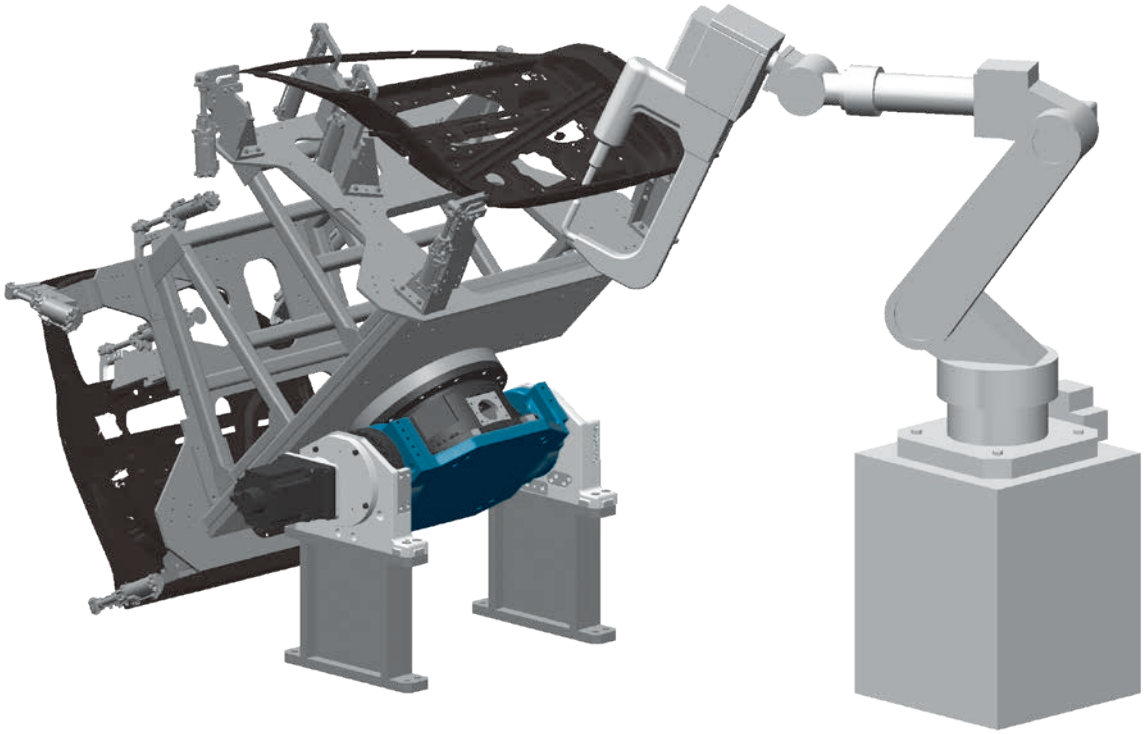
## RVP-A




## RVP-B



# RVP-C



# *Precision Reduction Gears RV™ RVP-A Series*

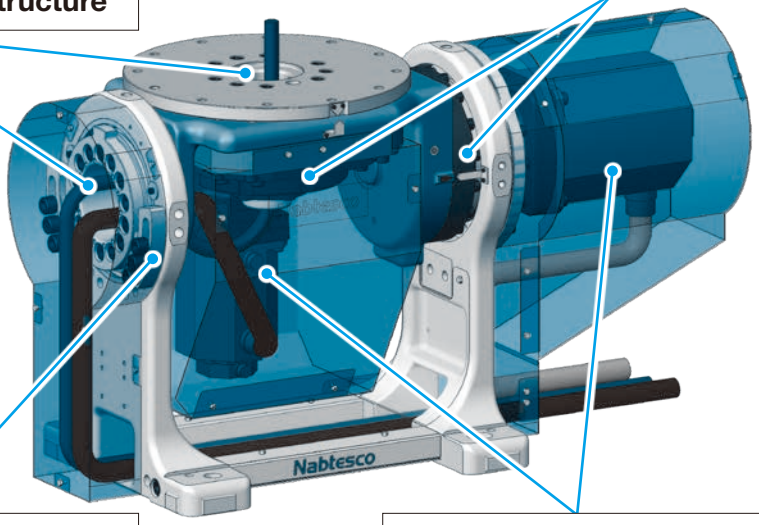
## Features and advantages

**Maximum carrying capacity: 500 kg**

**Pre-lubricated with grease for easy assembly**

**High speed type with faster speed ratio also available to reduce takt time**

**Easy routing of cabling and tubing with hollow structure**




**Mechanical stopper installed as a standard safety feature**

**Major motors can be installed.**

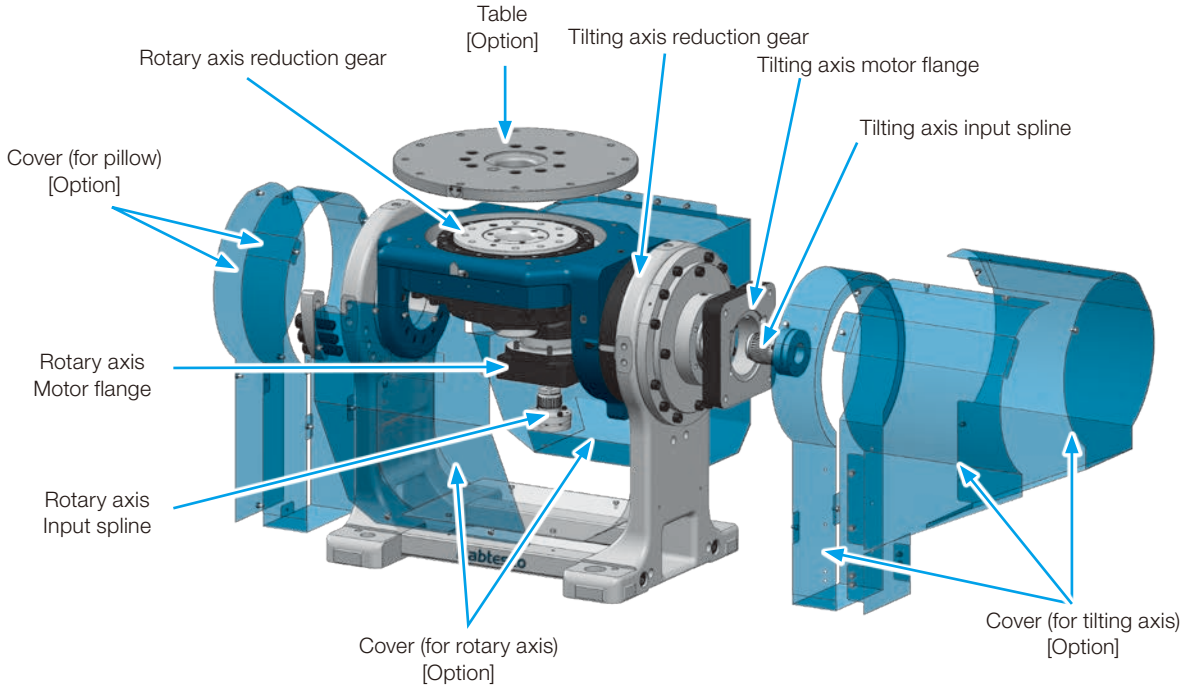
## Product code

RVP-A 05 – S – TXL – CG – UXL – GC – T – K

| Product series code | Carrying capacity code | Ratio code | Rotary axis input spline code | Rotary axis motor flange code | Tilting axis input spline code | Tilting axis motor flange code | Table code | Cover code |
|---|---|---|---|---|---|---|---|---|
| RVP-A | 05 : 500 kg | S : Rotary axis150 Tilting axis155<br>F : Rotary axis100.5 Tilting axis101.81 | Standard component : 3 alphabetic characters<br>Third character may be numerical.<br>(Code will differ depending on motor to be attached.)<br>ZZZ : None | Standard component : 2 alphabetic characters<br>(Code will differ depending on motor to be attached.)<br>ZZ : None | Standard component : 3 alphabetic characters<br>Third character may be numerical.<br>(Code will differ depending on motor to be attached.)<br>ZZZ : None | Standard component : 2 alphabetic characters<br>(Code will differ depending on motor to be attached.)<br>ZZ : None | T : With table<br>Z : None | K : With cover<br>Z : None |

Refer to pages 29 to 31 for details of the input spline and motor flange codes.

## Configuration drawing



# Specification table

| Model | | | RVP-A | |
|---|---|---|---|---|
| Type | | | Standard (Ratio code: S) | High speed (Ratio code: F) |
| Maximum carrying capacity | | kg | 500 | |
| Maximum center of gravity height Note 1 | | mm | 300 | |
| Maximum angle of tilt | | deg | ±135 | |
| Speed ratio | Rotary axis | | 150 | 100.5 |
| | Tilting axis | | 155 | 101.81 (1120/11) |
| Rated torque | Rotary axis | Nm | 980 | |
| | Tilting axis | Nm | 1,600 | |
| Allowable acceleration/ deceleration torque | Rotary axis | Nm | 2,450 | |
| | Tilting axis | Nm | 4,000 | |
| Momentary maximum allowable torque | Rotary axis | Nm | 4,900 | |
| | Tilting axis | Nm | 8,000 | |
| Rated output speed | Rotary axis | rpm | 15 | |
| | Tilting axis | rpm | 15 | |
| (Reference) Allowable output speed Note 2 | Rotary axis | rpm | 20 (2.0 sec/180 deg) | 30 (1.33 sec/180 deg) |
| | Tilting axis | rpm | 19 (1.0 sec/90 deg) | 29 (0.67 sec/90 deg) |
| Rated service life | | h | 6,000 | |
| Backlash | Rotary axis | arc.min. | 1.0 (Radius = 150: 0.04 mm) | |
| | Tilting axis | arc.min. | 1.0 (Radius = 150: 0.04 mm) | |
| Lost motion | Rotary axis | arc.min. | 1.0 | |
| | Tilting axis | arc.min. | 1.0 | |
| Allowable moment | | Nm | 2,450 | |
| Moment of inertia I (I=GD2/4) Input shaft conversion value Note 3 | Rotary axis | $kgm^2$ | $8.27 \times 10^{-4}$ | $1.15 \times 10^{-3}$ |
| | Tilting axis | $kgm^2$ | $9.86 \times 10^{-4}$ | $1.29 \times 10^{-3}$ |
| Mass Note 4 | | kg | 221 | |
| (Reference) Motor capacity Note 5 | Rotary axis | kW | 2.1 | |
| | Tilting axis | kW | 3.4 | |

Note: 1. If the height of the center of gravity exceeds 300 mm, the maximum allowable load varies For details, refer to the following figure.
2. The allowable output speed may be limited by heat depending on the operation rate.
Make sure that the surface temperature of the reduction gear does not exceed 60°C during use.
3. The inertia moment value is for the reduction gear.
It does not include the inertia moment for the input gear.
4. The mass value does not include the input spline and motor flange.
5. The motor capacity (kW) is calculated according to the following calculation formula:
Note: However, if a load is held by the servo lock, select a motor so that the holding torque does not exceed the rated torque of the motor.

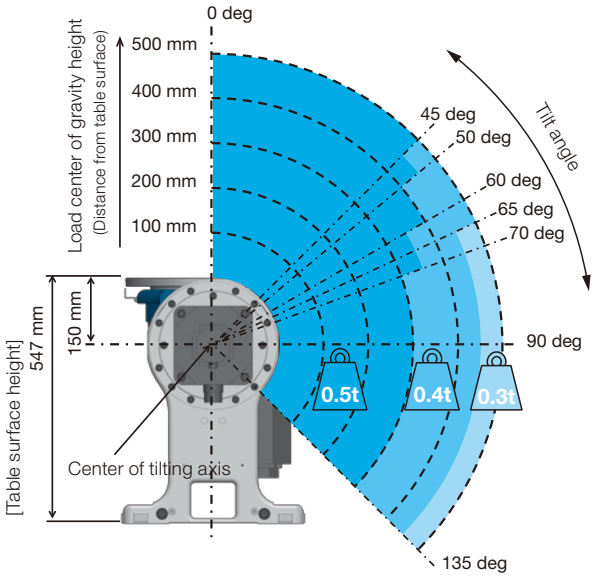
$$\text{Motor capacity (kW)(Reference)} = \frac{2\pi \cdot N \cdot T}{60 \cdot \frac{\eta}{100} \cdot 10^3}$$

N: Rated output speed (rpm)
T : Rated torque (Nm)
η =75: Reduction gear efficiency (%)

Note: The motor capacity is a reference value.

## Center of gravity height and allowable load range

Loading beyond this range will exceed the acceleration / deceleration torque and/or allowable moment of the reduction gear, and may damage the reduction gear. Loads given are reference values.

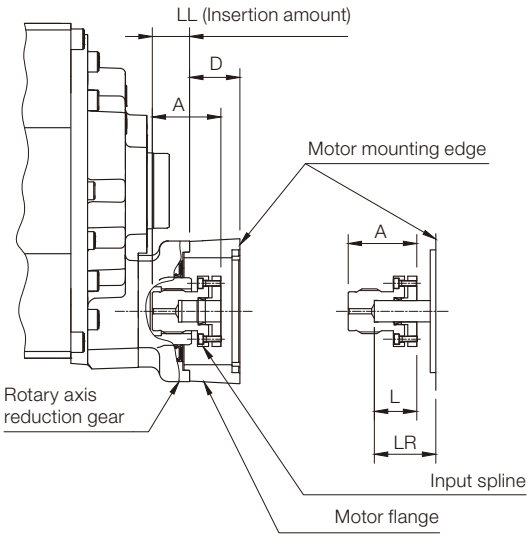


# Input spline and motor flange code selection

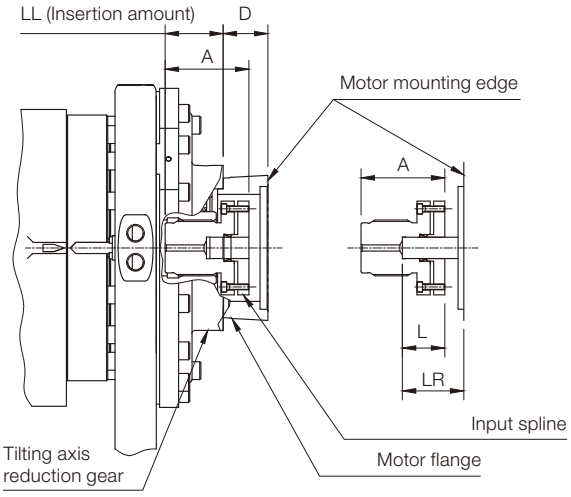
• Check the thickness of the motor flange according to the following equation:
**Thickness of motor flange D = (A + LR - L) - LL**

| Axis | LL<br>Input spline insertion amount (mm) |
|---|---|
| Rotary axis | $34^{0}_{-4.5}$ |
| Tilting axis | $52^{+2}_{-3}$ |

**Rotary axis**




**Tilting axis**




L (Input spline hole depth)
LR (motor shaft length)

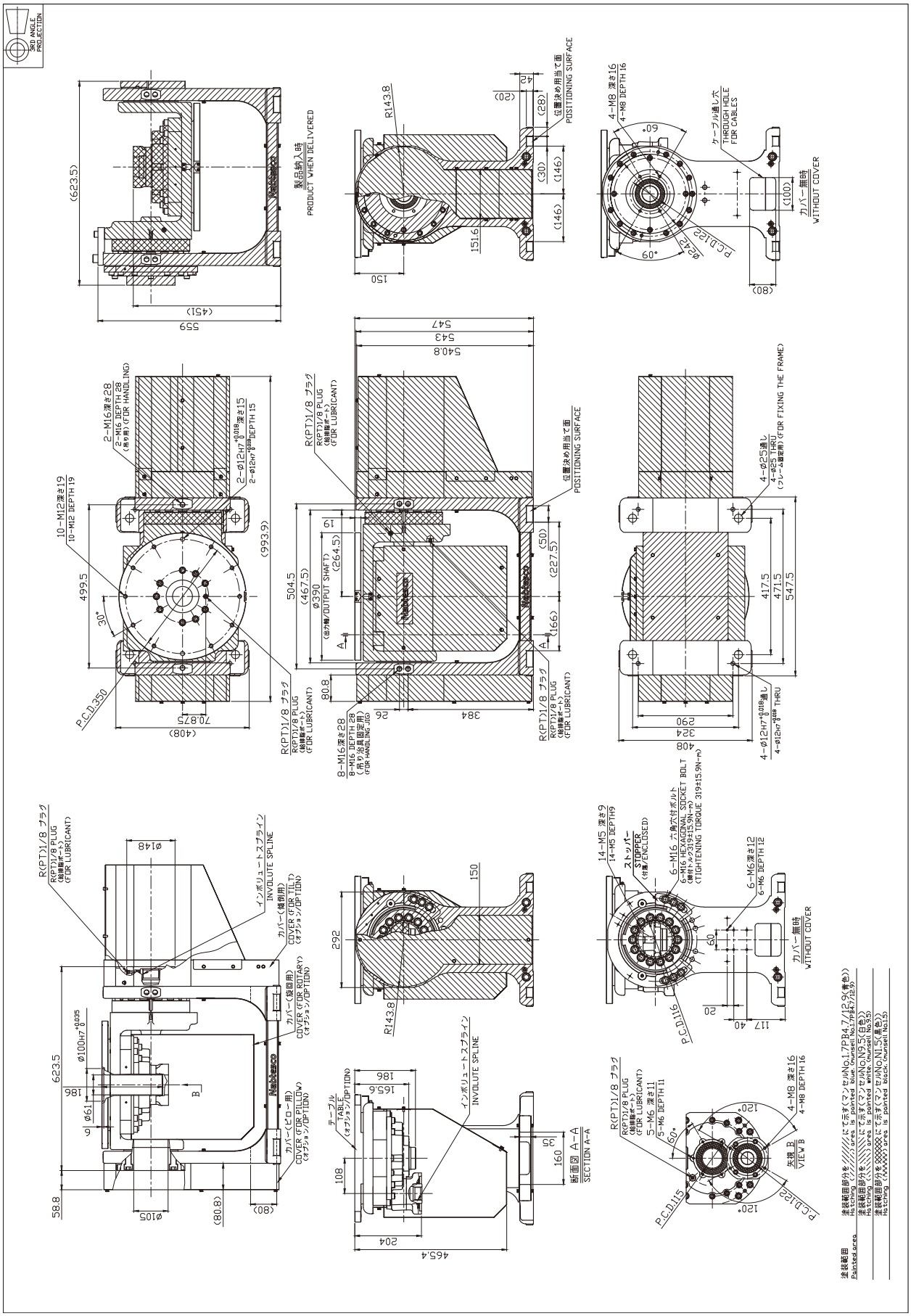
Note: Calculate the LR of the 1/10 taper shaft with the dimension excluding the threaded portion at the shaft tip.

## Combination of reduction gear and servomotor

1. The combinations that satisfy the following equation are recommended.
   (Rated torque of motor x 0.5) < {Rated torque of reduction gear/(Speed ratio x 0.75)} < (Rated torque of motor x 1.5)
2. Select the combinations that satisfy the following equation.
   (Maximum torque of motor) < {Momentary maximum torque of reduction gear/(Speed ratio x 0.75)}
3. Limitation must be imposed to the motor torque when the condition indicated in 1 and 2 above cannot be satisfied.
4. For more precise motor selection, the effective torque, load inertia moment, brake torque, regenerative ability, and so forth, must also be considered.

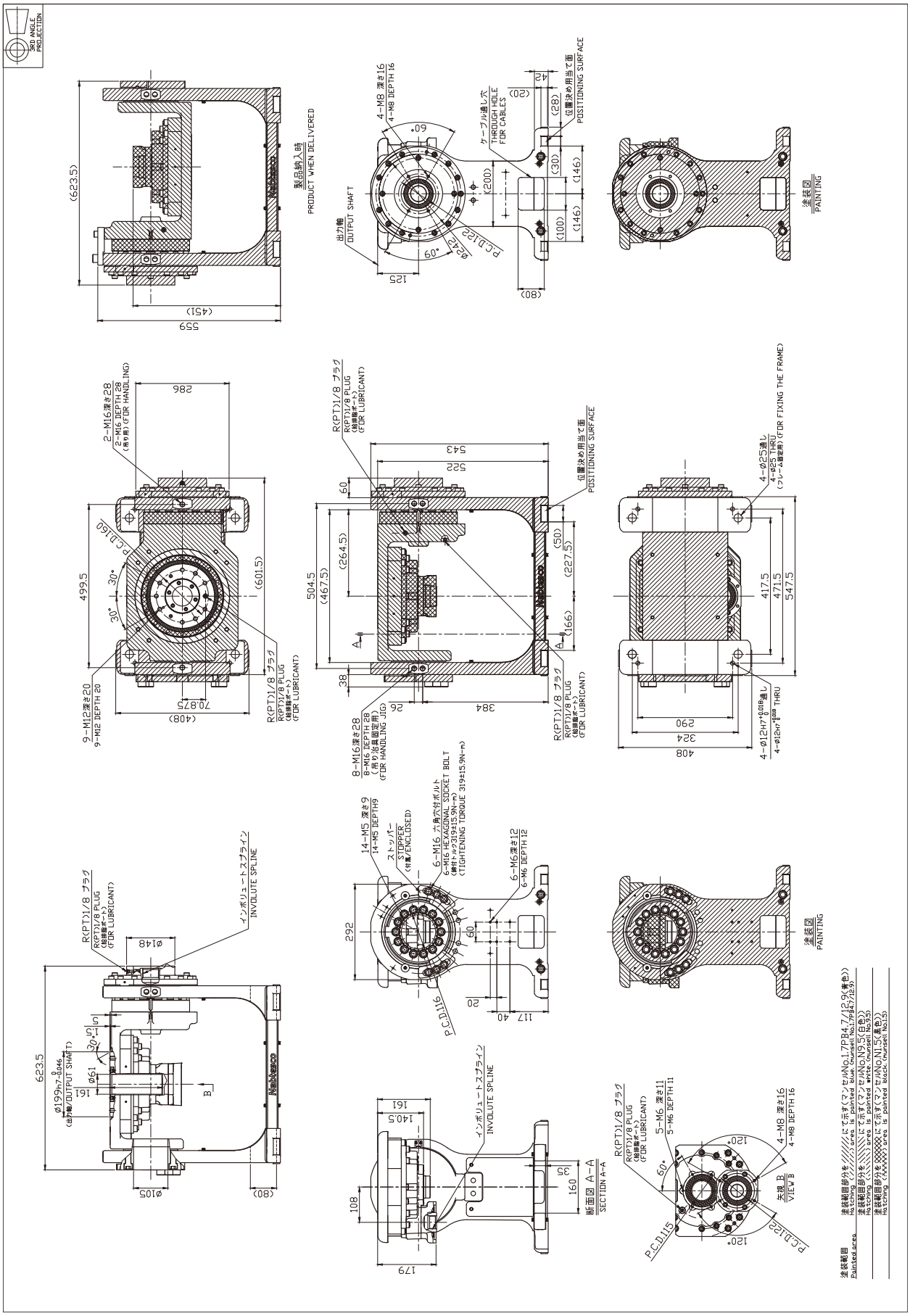
# External dimensions

## RVP-A05- □ - □□□ - □□ - □□□□ - □□□ -T-K　With optional components (table and cover)




Specifications and dimensions are subject to change without notice.

## RVP-A05- □ - □□□ - □□ - □□□ - □□ -Z-Z Without optional components




Specifications and dimensions are subject to change without notice.

# *Precision Reduction Gears RV™ RVP-B Series*

## Features and advantages

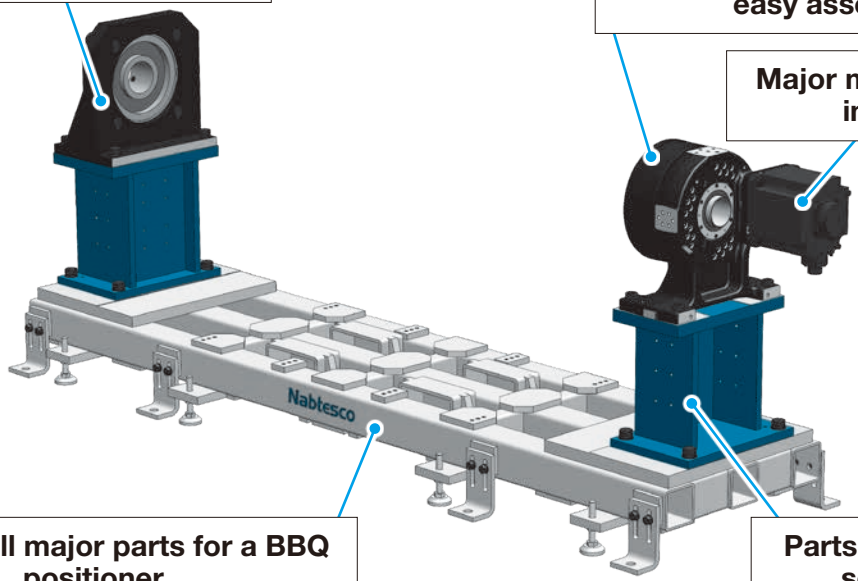
**Maximum carrying capacity: 1,000 to 1,600 kg**

**No centering alignment necessary by the customer**

**Hollow structure also available, easy routing of wiring and tubing**

**Pre-lubricated with grease for easy assembly**

**Major motors can be installed**




**Includes all major parts for a BBQ positioner**

**Parts are also sold separately**

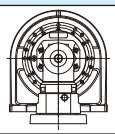
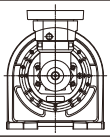
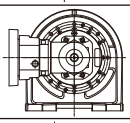
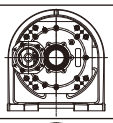
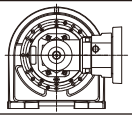
# RVP-B BBQ positioner unit: Product codes / Configuration diagram

## Product code

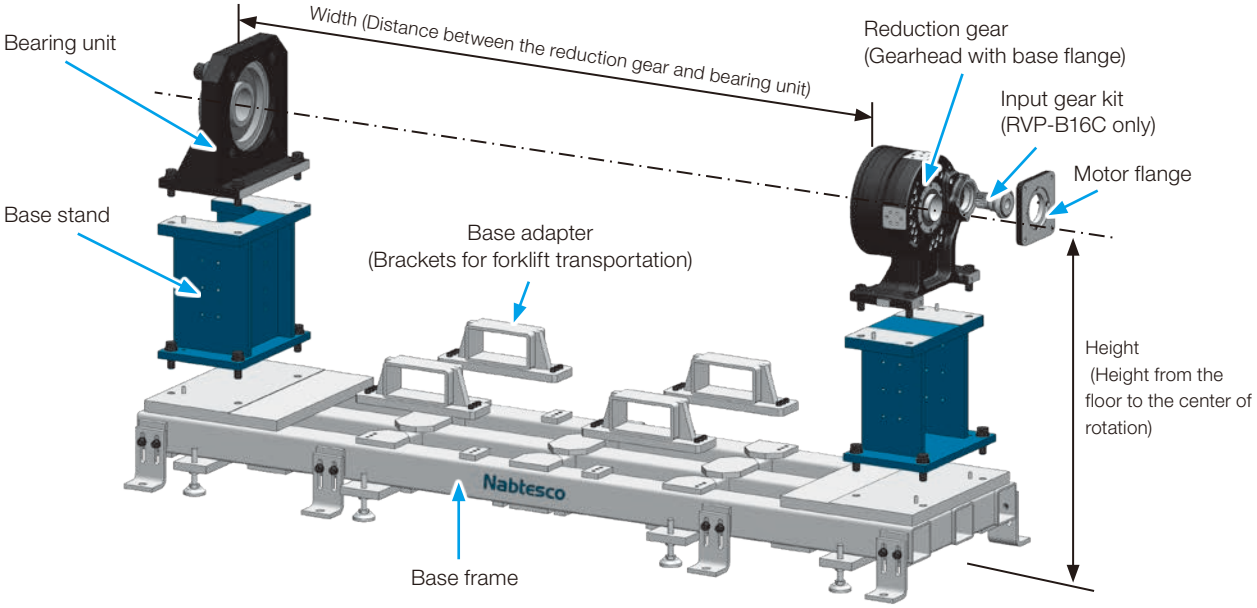
**RVP-B 10 C – 101 S D – 20 – Y – 08**

| Product series code | Carrying capacity code | Type code | Ratio code (Speed ratio) | Input type code | Input shaft position code | Width code | Bearing unit code | Hight code |
|---|---|---|---|---|---|---|---|---|
| RVP-B | 10: 1,000 kg | C: Hollow shaft | 101 (100.5), 150 (150)<br>210 (210), 258 (258) | S: Straight<br>R: Right angle | U: Upward<br>D: Downward<br>L: Leftward<br>R: Rightward | 20: 2,000 mm<br>25: 2,500 mm | X: Flange type<br>Y: Pillow type* | 08: 800 mm<br>10: 1,000 mm |
| | 16: 1,600 kg | E: Solid | 066 (66), 081 (81)<br>101 (101), 121 (121)<br>145 (145), 171 (171) | | | | | |
| | | C: Hollow shaft | 78 (78.3), 104 (104.4)<br>120 (120.46) | S: S traight | D: Downward<br>R: Rightward | | | |

Contact us for the supported input gears and motor flanges.
Note: The pillow type bearing requires centering alignment at the time of assembly.

| Input shaft position | | | |
|---|---|---|---|
| D | Downward input<br>or<br>Center input<br>(RVP-B16E-□□□S) |  |  |
| U | Upward input |  |  |
| L | Leftward input |  |  |
| R | Rightward input |  |  |

## Configuration drawing




Please contact us for customized solutions (user specified width, height, etc.).

# Specification table

| Model | | RVP-B10C | RVP-B16E | RVP-B16C |
|---|---|---|---|---|
| Type | | Hollow shaft | Solid | Hollow shaft |
| Maximum carrying capacity | kg | 1,000 | 1,600 | |
| Maximum center of gravity height Note 1 | mm | 250 | | 230 |
| Speed ratio | | 100.5, 150, 210, 258 | 66, 81, 101, 121, 145, 171 | 78.3, 104.4, 120.46 |
| Rated torque | Nm | 980 | 1,568 | 1,470 |
| Allowable acceleration/ deceleration torque | Nm | 2,450 | 3,920 | 3,675 |
| Momentary maximum allowable torque | Nm | 4,900 | 7,840 | 7,350 |
| Rated output speed | rpm | 15 | 15 | 15 |
| (Reference) Allowable output speed Note 2 | rpm | 30 (1.33 sec/180 deg) | 30 (1.33 sec/180 deg) | 51 (0.78 sec/180 deg) |
| Rated service life | h | 6,000 | | |
| Backlash | arc.min. | Input type: Straight 1.0 (Radius = 250: 0.07 mm)<br>Input type: Right angle 1.5 (Radius = 250: 0.11 mm) | | Input type: Straight 1.0 |
| Lost motion | arc.min. | Input type: Straight 1.0<br>Input type: Right angle 1.5 | | Input type: Straight 1.0 |
| Moment of inertia I(I=GD2/4) Input shaft conversion value Note 3 | $kgm^2$ | $8.23x10^{-4}$ to $2.16x10^{-3}$ | $8.94x10^{-4}$ to $6.68x10^{-3}$ | $2.72x10^{-4}$ to $6.45x10^{-4}$ |
| Mass Note 4 | kg | Axis interval of 2.0 m: 618 to 625<br>Axis interval of 2.5 m: 655 to 662 | Axis interval of 2.0 m: 624 to 650<br>Axis interval of 2.5 m: 661 to 687 | Axis interval of 2.0 m: 641<br>Axis interval of 2.5 m: 678 |
| (Reference) Motor capacity Note 5 | kW | 2.1 | 3.3 | 3.1 |

Note: 1. If the height of the center of gravity exceeds the reference value, the maximum allowable load varies. For details, refer to the following section.
2. The allowable output speed may be limited by heat depending on the operation rate.
Make sure that the surface temperature of the reduction gear does not exceed 60°C during use.
3. The inertia moment value of RVP-B16C does not include the inertia moment for the input gear.
4. The mass value does not include the motor flange.
5. The motor capacity (kW) is calculated according to the following calculation formula:
Note: However, if a load is held by the servo lock, select a motor so that the holding torque does not exceed the rated torque of the motor.

$$\text{Motor capacity (kW)(Reference)} = \frac{2\pi \cdot N \cdot T}{60 \cdot \frac{\eta}{100} \cdot 10^3}$$

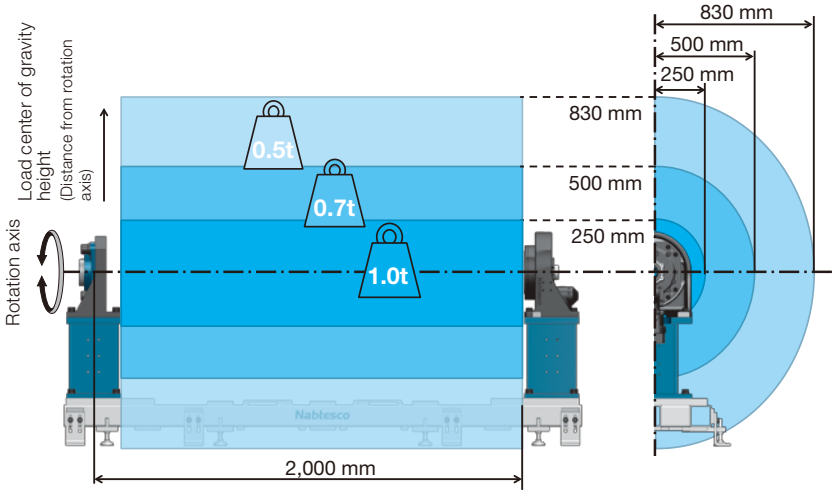
N: Rated output speed (rpm)
T : Rated torque (Nm)
$\eta$ =75: Reduction gear efficiency (%)

Note: The motor capacity is a reference value.

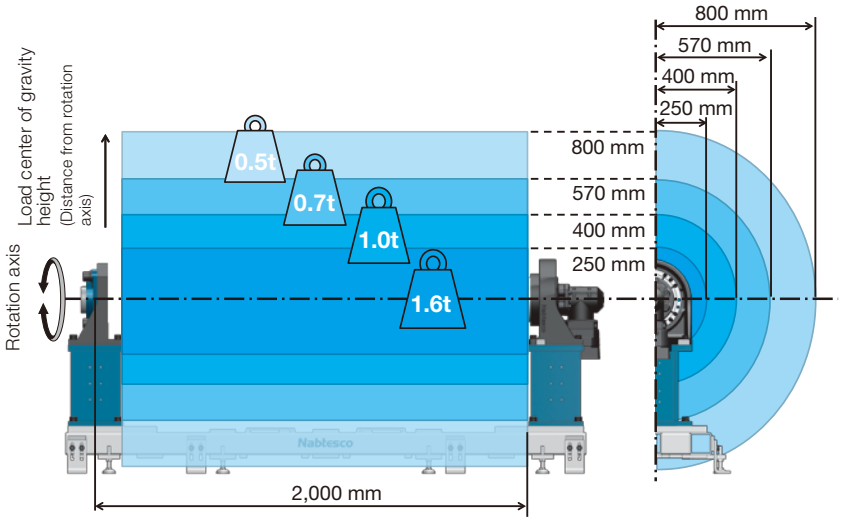
# Center of gravity height and allowable load range

Loading beyond this range will exceed the acceleration / deceleration torque and/or allowable moment of the reduction gear, and may damage the reduction gear.
Loads given are reference values.

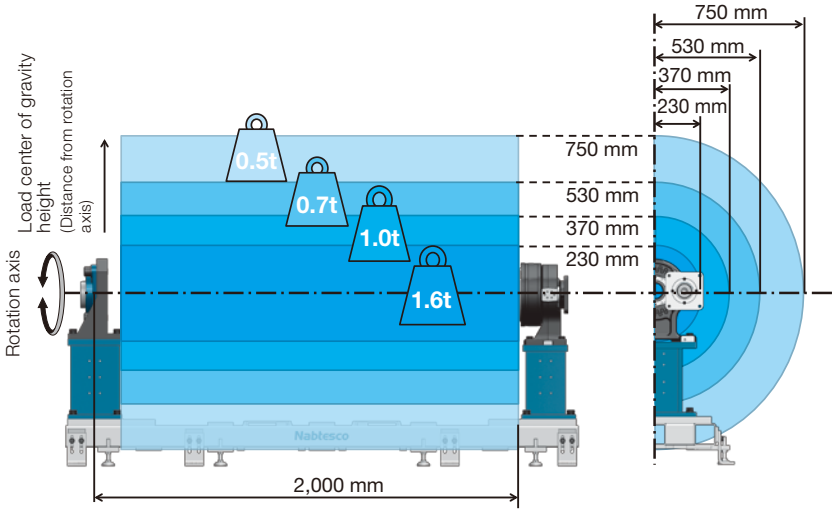
## RVP-B10C




## RVP-B16E

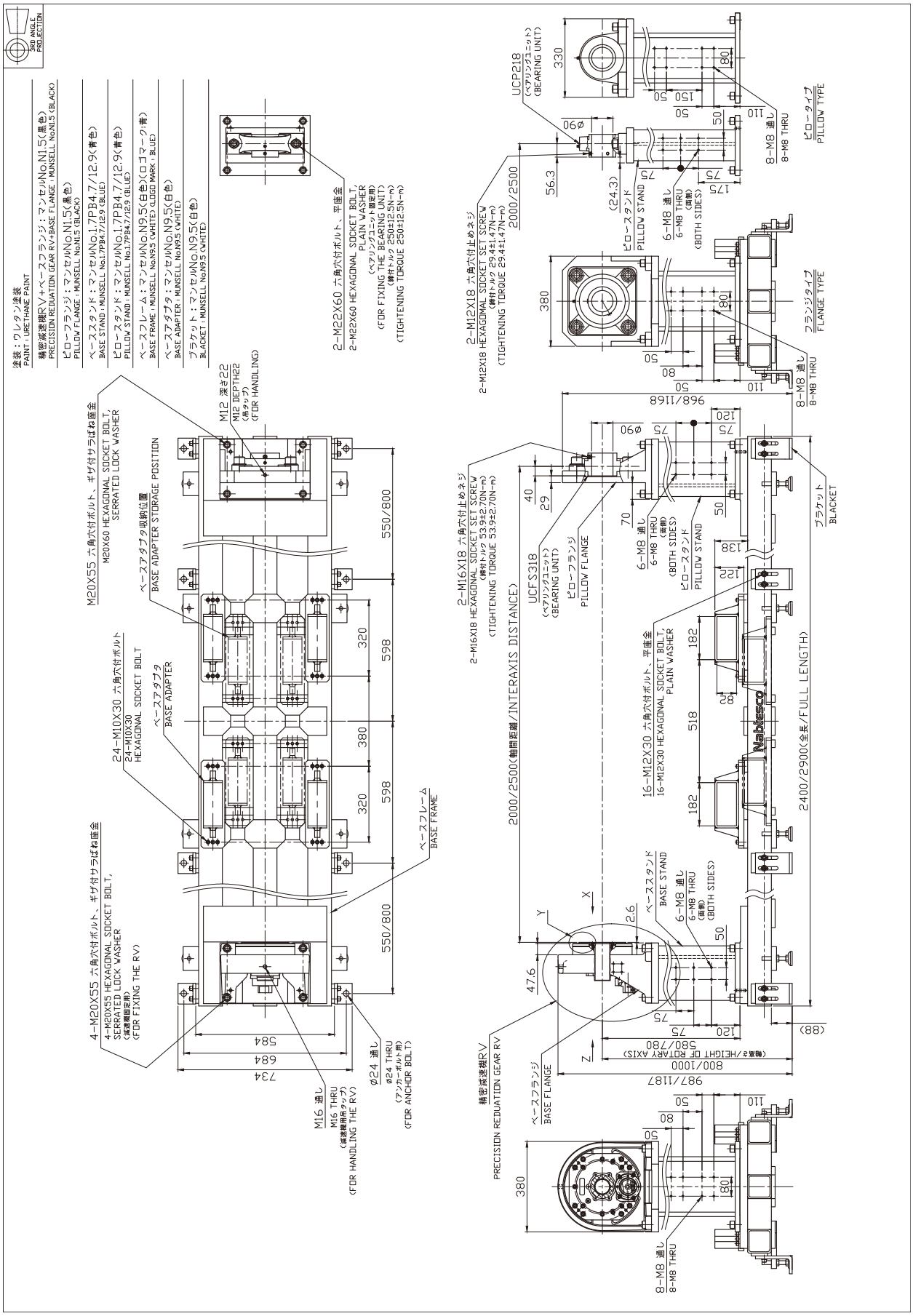



## RVP-B16C



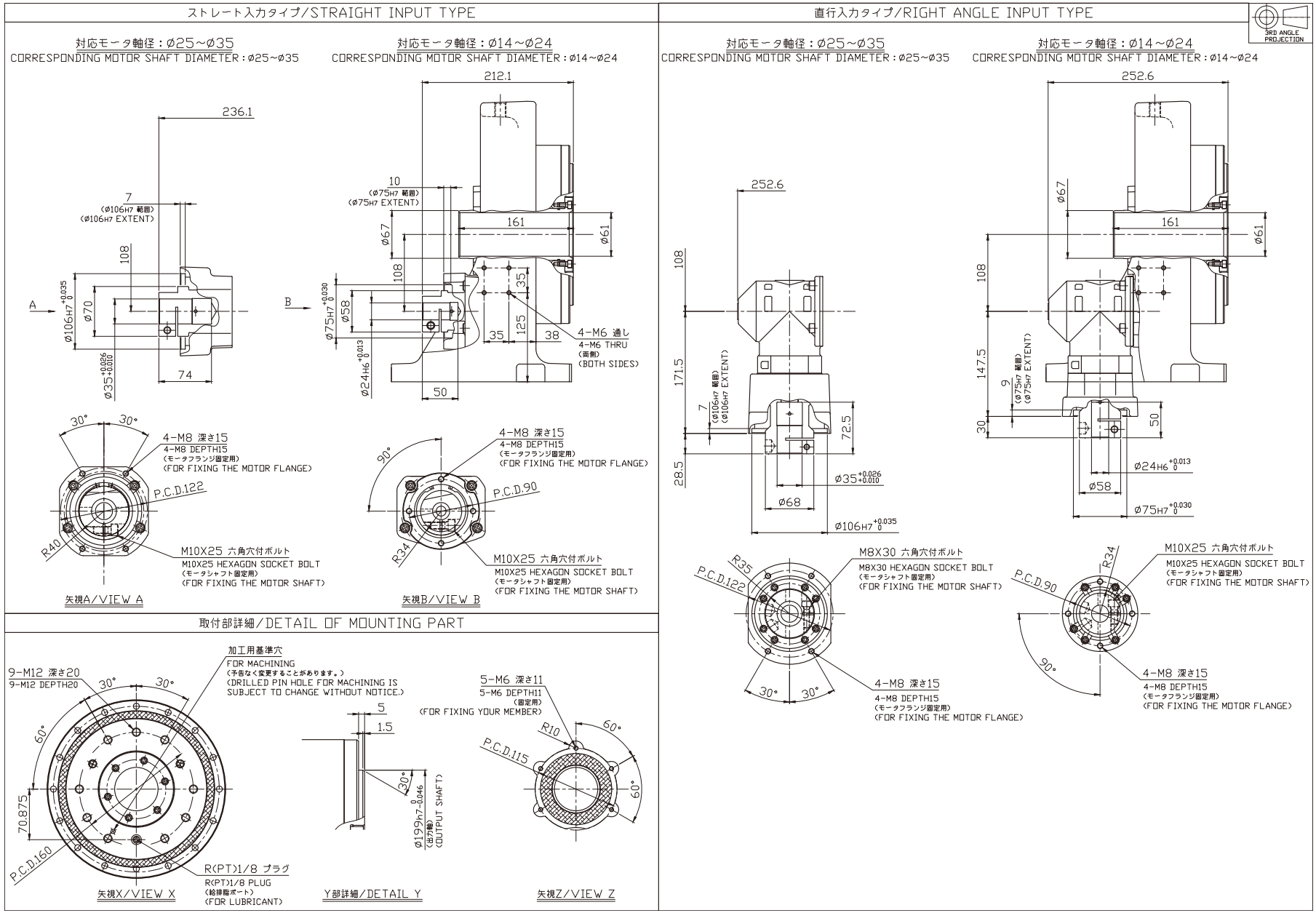
# External dimensions

**RVP-B10C-□□□□□□-□□-□-□□**



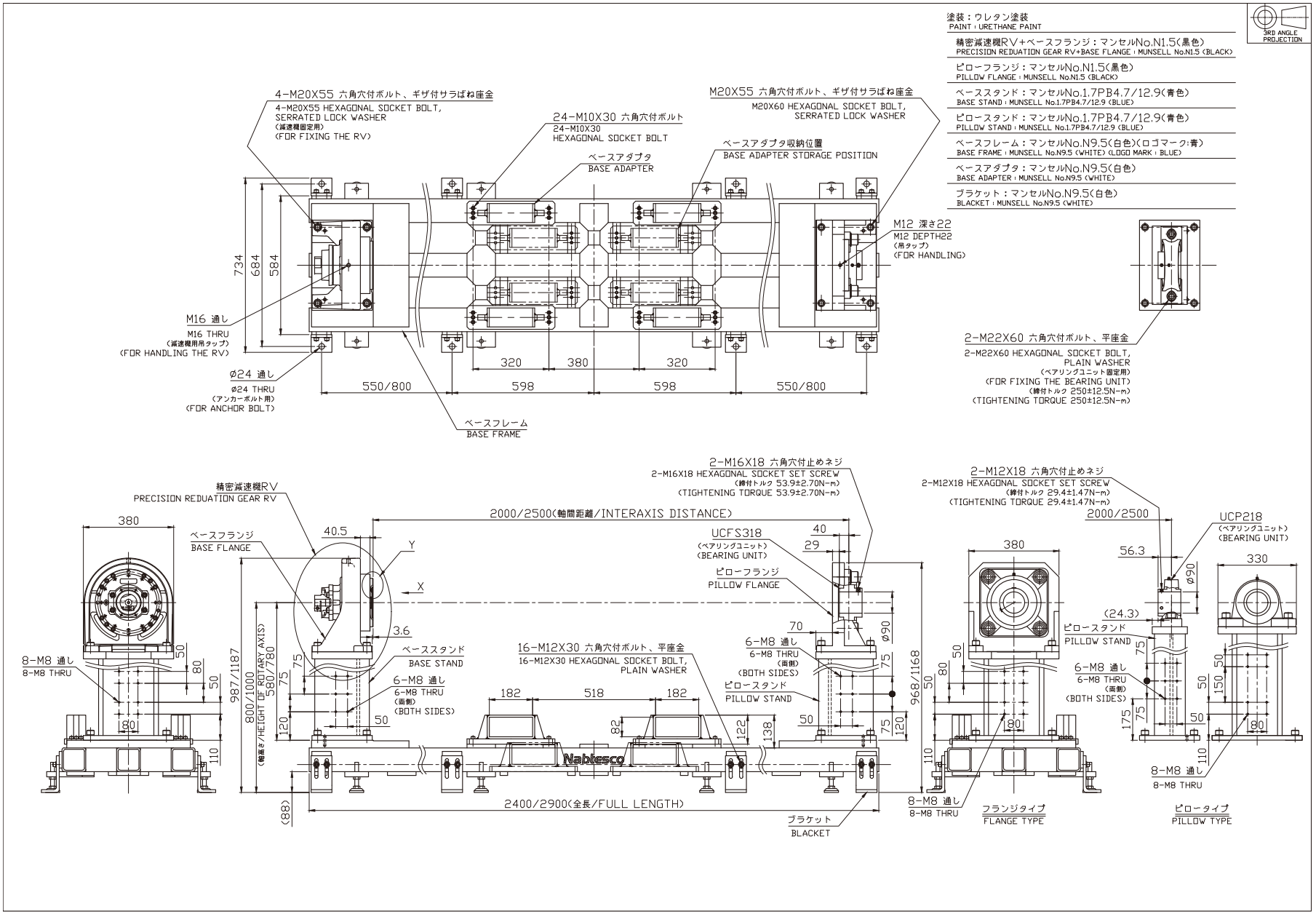

Specifications and dimensions are subject to change without notice.

## RVP-B10C reduction gear unit details



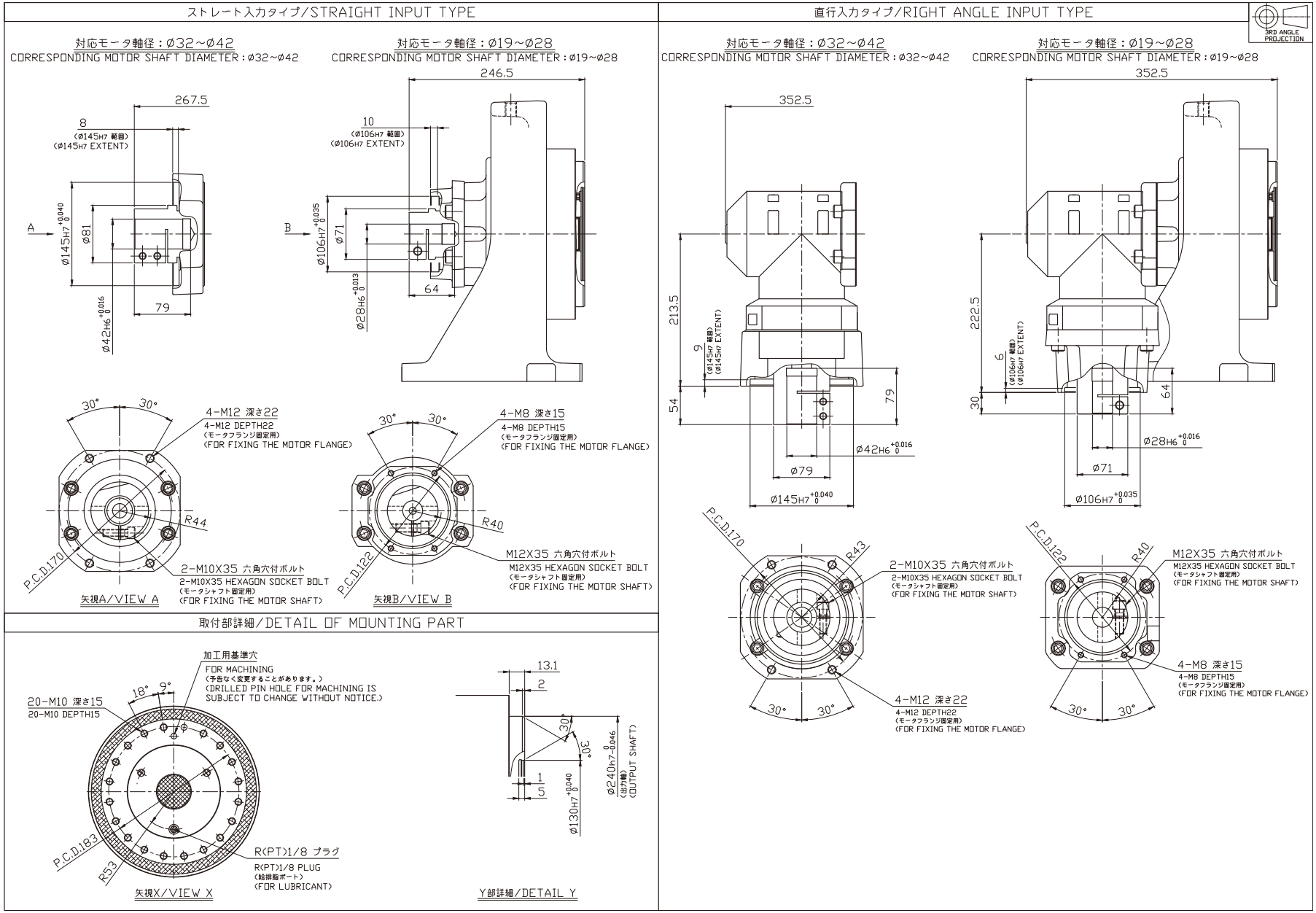

Specifications and dimensions are subject to change without notice.

**RVP-B16E-□□□□□-□□-□-□□**



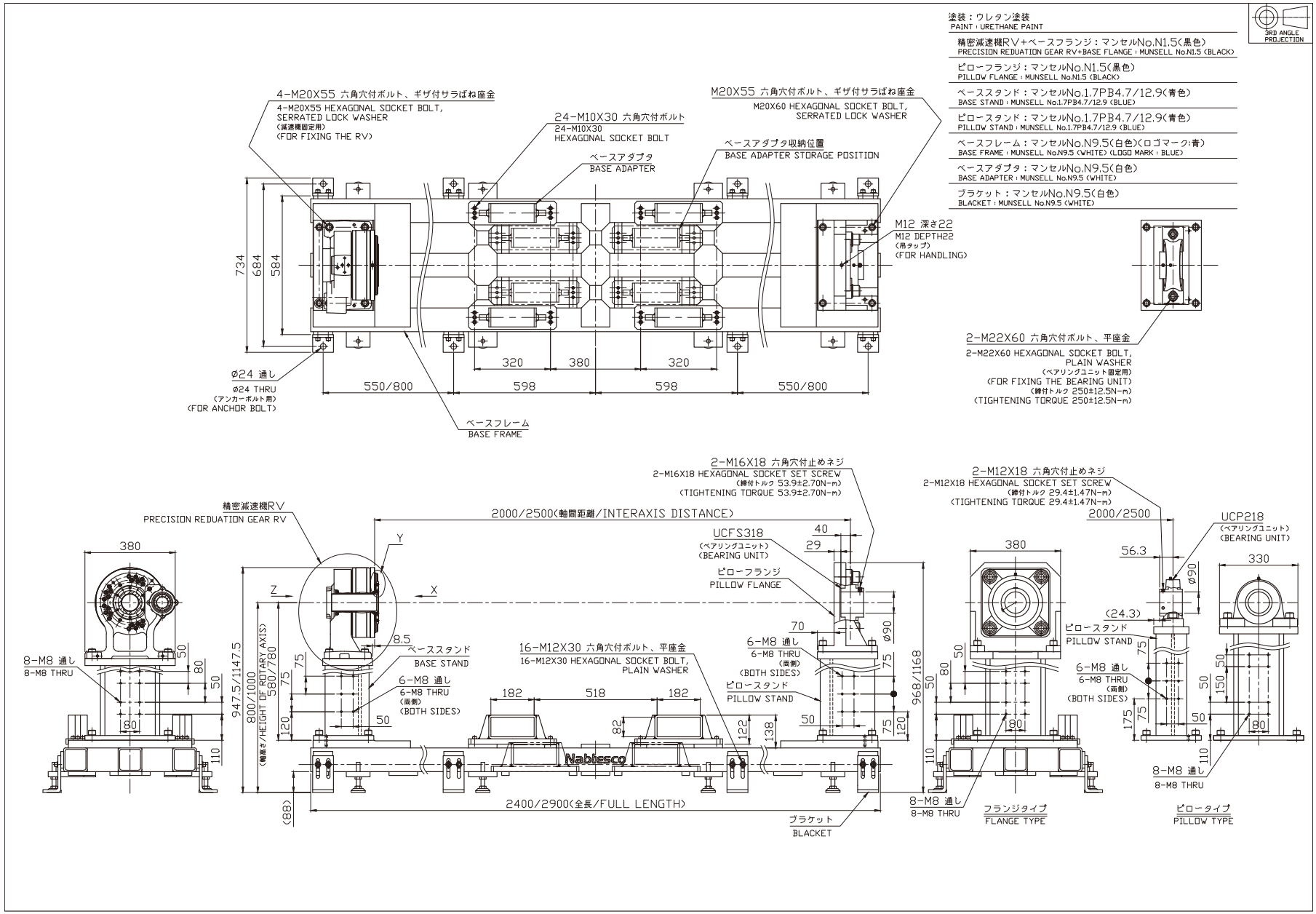

Specifications and dimensions are subject to change without notice.

## RVP-B16E reduction gear unit details



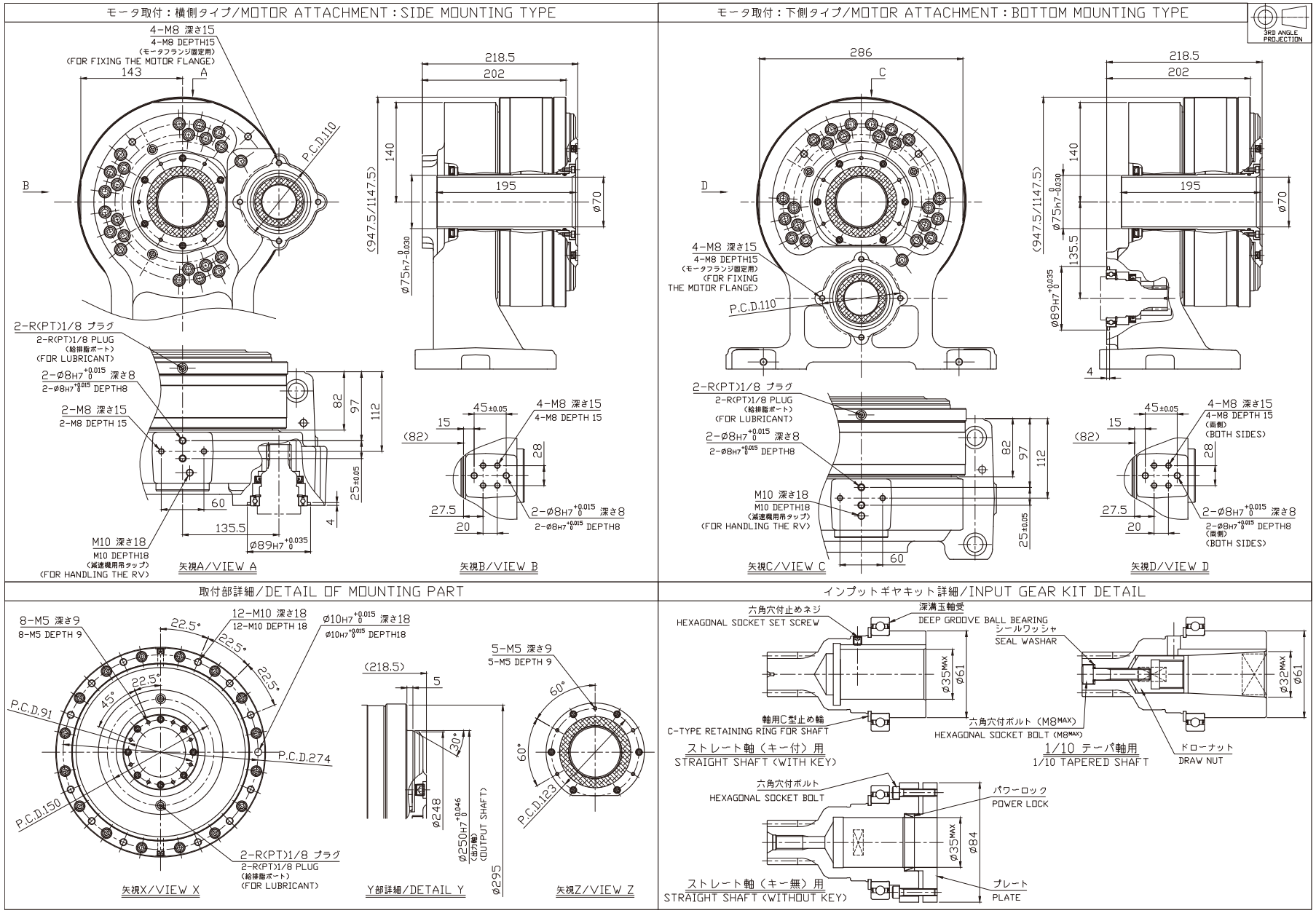

Specifications and dimensions are subject to change without notice.

**RVP-B16C-□□□□□-□□-□-□□**




Specifications and dimensions are subject to change without notice.

## RVP-B16C reduction gear unit details

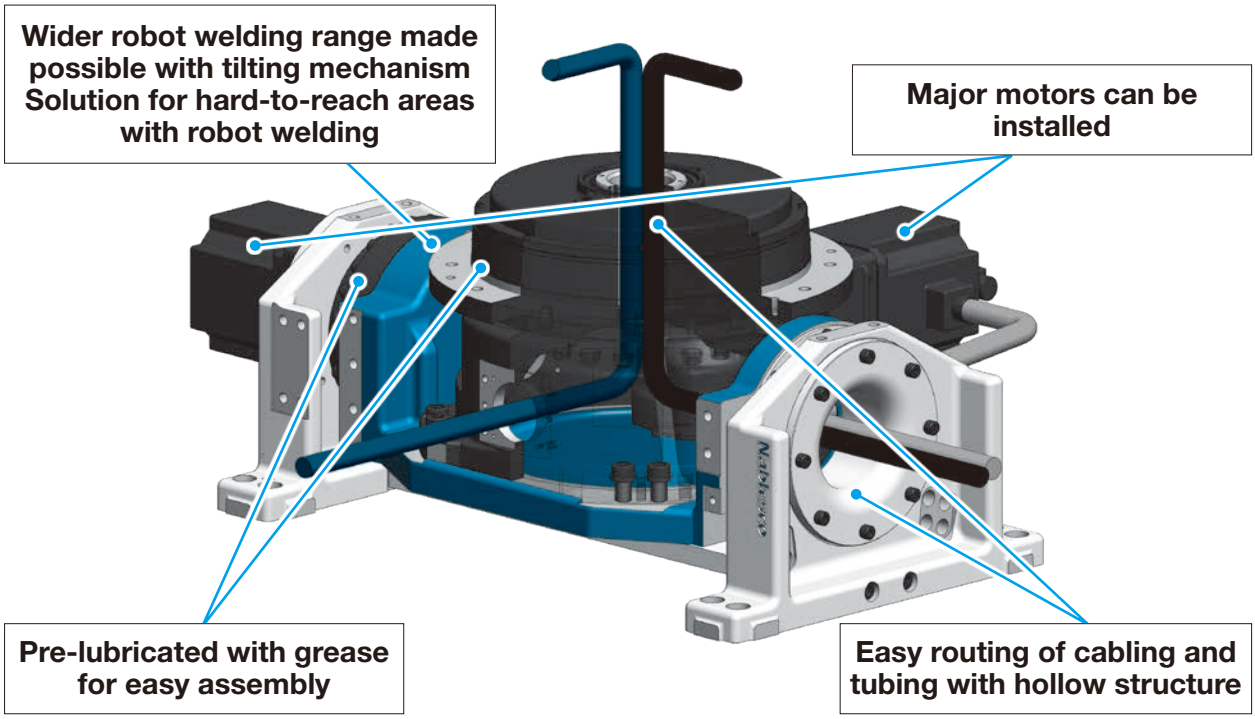



Specifications and dimensions are subject to change without notice.

# *Precision Reduction Gears RV™ RVP-C Series*

## Features and advantages

**Maximum carrying capacity: 4,000kg**



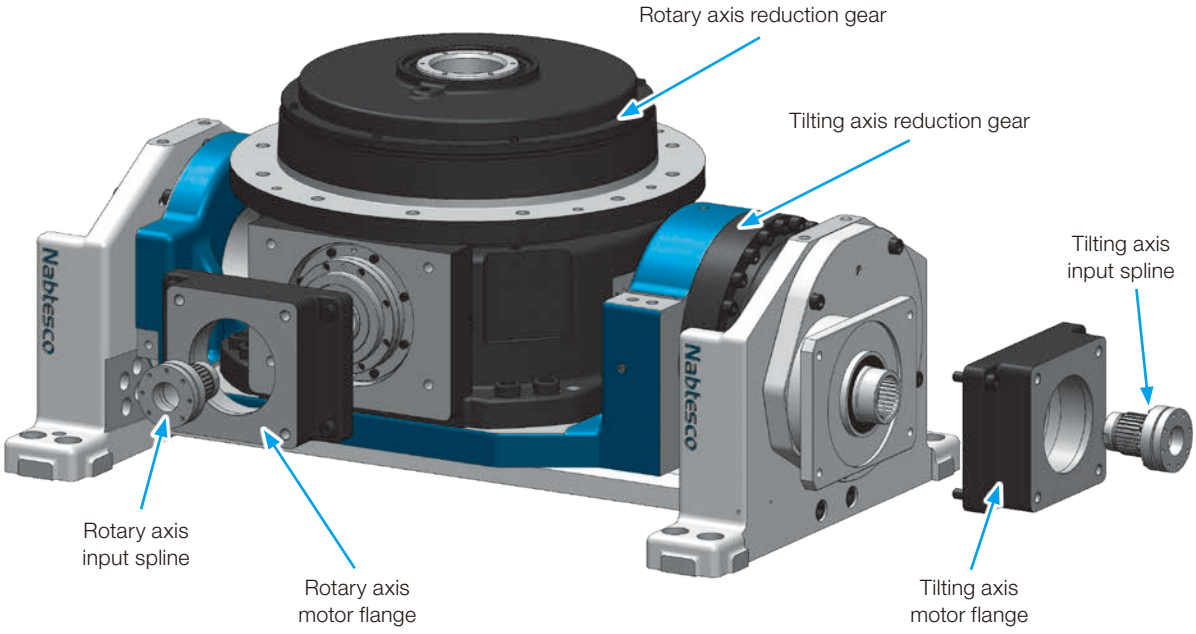
## Product code

RVP-C 40 – A – S – YXL – GC – YXL – GC

| Product series code | Carrying capacity code | Rotary axis reduction gear code | Ratio code | Rotary axis Input spline code | Rotary axis motor flange code | Tilting axis input spline code | Tilting axis motor flange code |
|---|---|---|---|---|---|---|---|
| RVP-C | 40: 4,000 kg | A: Standard type (RS-320A)<br>B: Low floor type (RS-320B) | S: Rotary axis 170<br>Tilting axis 706.5 | Standard component:<br>3 alphabetic characters<br>Third character may be numerical.<br>(Code will differ depending on motor to be attached.)<br>ZZZ: None | Standard component:<br>2 alphabetic characters<br>(Code will differ depending on motor to be attached.)<br>ZZ: None | Standard component:<br>3 alphabetic characters<br>Third character may be numerical.<br>(Code will differ depending on motor to be attached.)<br>ZZZ: None | Standard component:<br>2 alphabetic characters<br>(Code will differ depending on motor to be attached.)<br>ZZ: None |

Refer to pages 29 to 31 for details of the input spline and motor flange codes.

## Configuration drawing



# Specification table

| Model | | | RVP-C |
|---|---|---|---|
| Maximum carrying capacity | | kg | 4,000 |
| Maximum center of gravity height | | mm | 500 |
| Maximum tilt angle | | deg | ±16 Note 1 |
| Speed ratio | Rotary axis | | 170 |
| | Tilting axis | | 706.5 |
| Rated torque | Rotary axis | Nm | 3,136 |
| | Tilting axis | Nm | 3,724 |
| Allowable acceleration/ deceleration torque | Rotary axis | Nm | 7,840 |
| | Tilting axis | Nm | 9,310 |
| Momentary maximum allowable torque | Rotary axis | Nm | 15,680 |
| | Tilting axis | Nm | 18,620 |
| Rated output speed | Rotary axis | rpm | 15 |
| | Tilting axis | rpm | 15 |
| (Reference) Allowable output speed Note 2 | Rotary axis | rpm | 17.6 (1.78 sec/180 deg) |
| | Tilting axis | rpm | 4.2 (1.78 sec/16 deg) |
| Rated service life | | h | 6,000 |
| Backlash | Rotary axis | arc.min. | 1.0 (Radius = 500: 0.15 mm) |
| | Tilting axis | arc.min. | 1.0 (Radius = 500: 0.15 mm) |
| Lost motion | Rotary axis | arc.min. | 1.0 |
| | Tilting axis | arc.min. | 1.0 |
| Allowable moment | | Nm | 9,310 |
| Moment of inertia I(I=GD2/4) Input shaft conversion value Note 3 | Rotary axis | $kgm^2$ | $3.40x10^{-3}$ |
| | Tilting axis | $kgm^2$ | $3.21x10^{-3}$ |
| Mass Note 4 | | kg | 609 |
| (Reference) Motor capacity Note 5 | Rotary axis | kW | 6.6 |
| | Tilting axis | kW | 2.2 |

Note: 1. The maximum tilt angle ±45 degrees. However, the allowable loading capacity and the maximum height of the center of gravity varies. For details, refer to the following figure.
2. The allowable output speed may be limited by heat depending on the operation rate. Make sure that the surface temperature of the reduction gear does not exceed 60°C during use.
3. The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.
4. The mass value does not include the input spline and motor flange.
5. The motor capacity (kW) is calculated according to the following calculation formula:
Note: The motor capacity for the tilting axis is calculated using the allowable output speed.
Note: However, if a load is held by the servo lock, select a motor so that the holding torque does not exceed the rated torque of the motor.

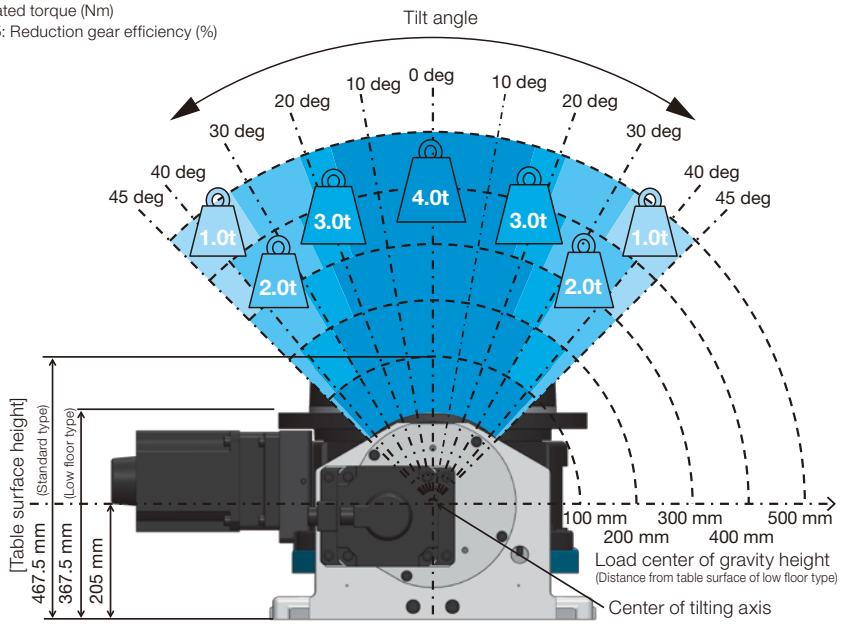
$$\text{Motor capacity (kW)=(Reference)} \quad \frac{2\pi \cdot N \cdot T}{60 \cdot \frac{\eta}{100} \cdot 10^3}$$

N: Rated output speed (rpm)
T : Rated torque (Nm)
η =75: Reduction gear efficiency (%)

Note: The motor capacity is a reference value.

## Center of gravity height and allowable load range

Loading beyond this range will exceed the acceleration / deceleration torque and/or allowable moment of the reduction gear, and may damage the reduction gear.
Loads given are reference values.

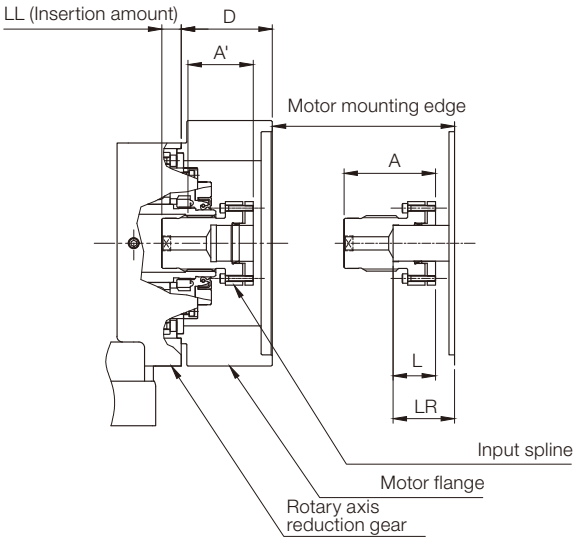


# Input spline and motor flange code selection

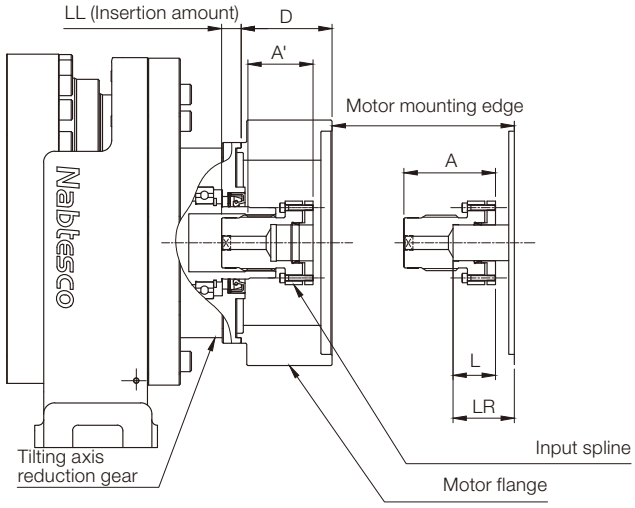
• Check the thickness of the motor flange according to the following equation:
**Thickness of motor flange D = (A' + LR – L) – LL**

| Axis | LL<br>Input spline insertion amount (mm) |
|---|---|
| Rotary axis | 20.5 |
| Tilting axis | 20.5 |

**Rotary axis**




**Tilting axis**




Note: For dimension A', refer to pages 29 to 30 and select a spline within the range.

L (Input spline hole depth)
LR (motor shaft length)

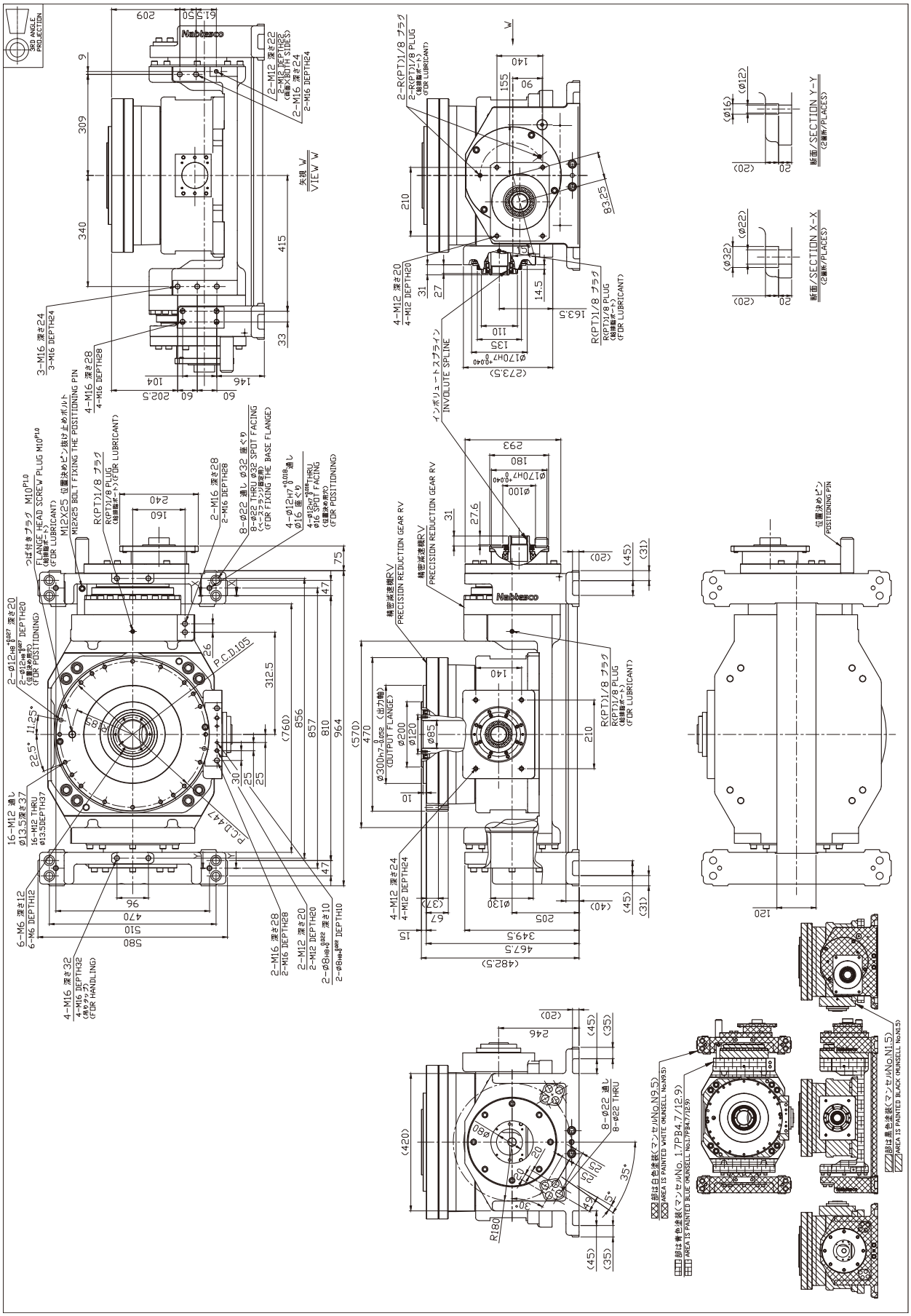
Note: Calculate the LR of the 1/10 taper shaft with the dimension excluding the threaded portion at the shaft tip.

## Combination of reduction gear and servomotor

1. The combinations that satisfy the following equation are recommended.
   (Rated torque of motor x 0.5) < {Rated torque of reduction gear/(Speed ratio x 0.75)} < (Rated torque of motor x 1.5)
2. Select the combinations that satisfy the following equation.
   (Maximum torque of motor) < {Momentary maximum torque of reduction gear/(Speed ratio x 0.75)}
3. Limitation must be imposed to the motor torque when the condition indicated in 1 and 2 above cannot be satisfied.
4. For more precise motor selection, the effective torque, load inertia moment, brake torque, regenerative ability, and so forth, must also be considered.

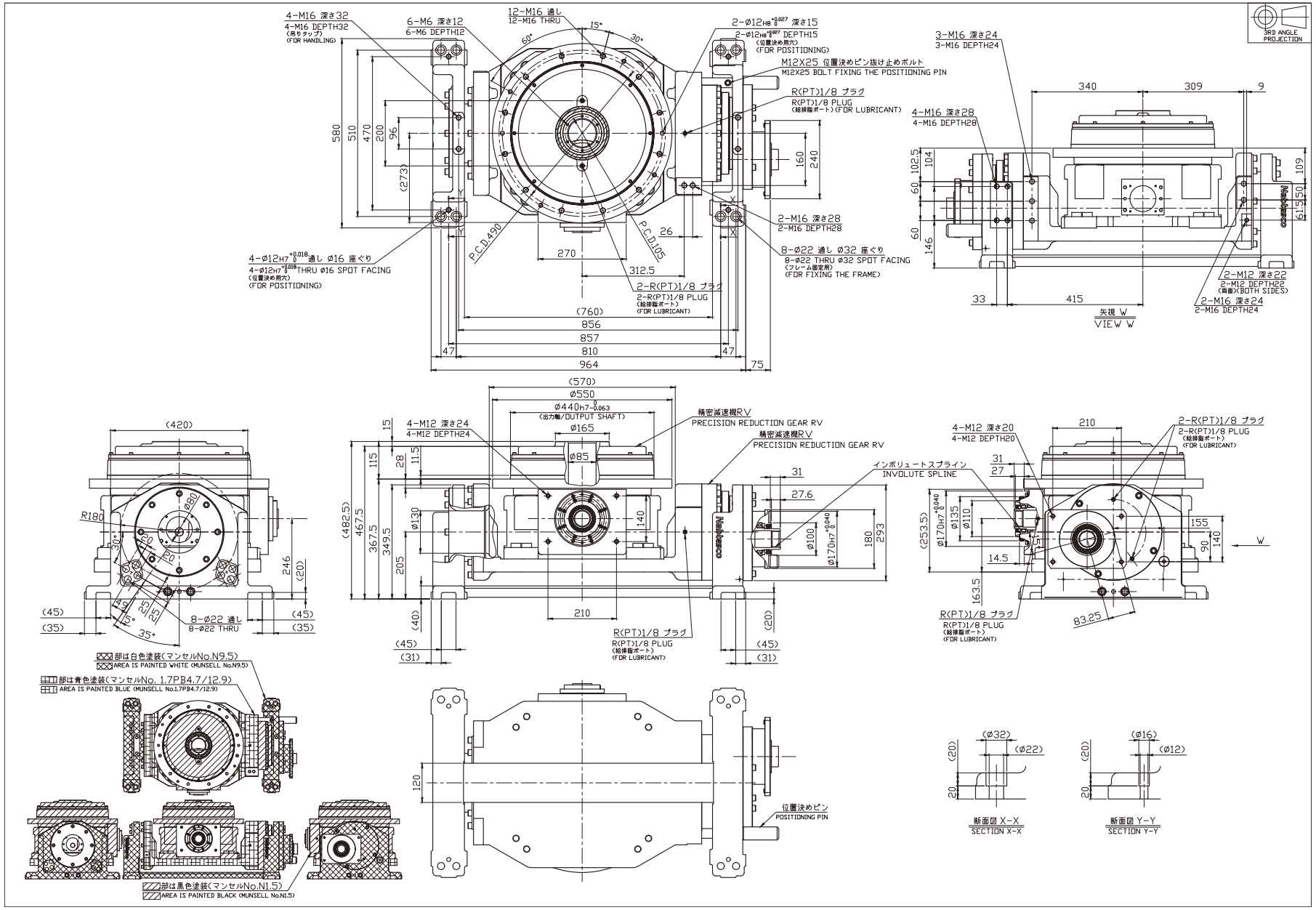
# External dimensions

**RVP-C40-A-** □ **-** □□□ **-** □□ **-** □□ **-** □□□ **-** □□




Specifications and dimensions are subject to change without notice.

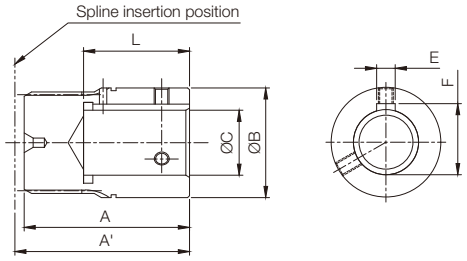
**RVP-C40-B-□-□□□-□□-□□□-□□**




Specifications and dimensions are subject to change without notice.

# Input Spline / Motor Flange

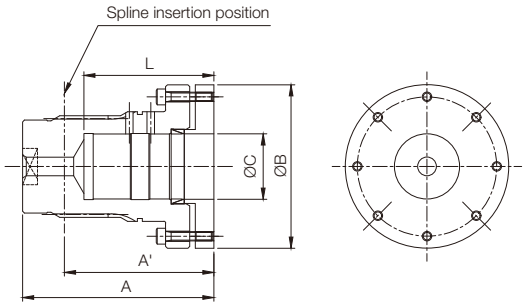
## Straight shaft (with key)




| | Code | Item No. | Input spline dimensions (mm) | | | | | | | | Moment of inertia I (I=GD²/4) Input shaft conversion value (kgm²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | A' | øB | øC | | L | E | | F | |
| RVP-A Rotary axis | SXD | 05AP401D* | 54 | - | 35 | 17H7 | +0.018 0 | 30 | 6 | ±0.015 | 19.8 | $7.90\times10^{-5}$ |
| | SXE | 05AP401E* | 58 | - | 40 | 22H7 | +0.021 0 | 34 | 8 | ±0.018 | 25.3 | $1.22\times10^{-4}$ |
| | SXW | 05AP401W* | 66.5 | - | 35 | 16H7 | +0.018 0 | 28 | 5 | ±0.015 | 18.3 | $8.43\times10^{-5}$ |
| RVP-A Tilting axis | TXD | 05AP402D* | 92.5 | - | 54 | 32H7 | +0.025 0 | 45 | 10 | ±0.018 | 35.3 | $5.03\times10^{-4}$ |
| | TXE | 05AP402E* | 67.5 | - | 45 | 22H7 | +0.021 0 | 34 | 8 | ±0.018 | 25.3 | $2.76\times10^{-4}$ |
| | TXG | 05AP402G* | 82 | - | 45 | 17H7 | +0.018 0 | 30 | 6 | ±0.015 | 19.8 | $3.02\times10^{-4}$ |
| | TXN | 05AP402N* | 78 | - | 45 | 28H7 | +0.021 0 | 49 | 8 | ±0.018 | 31.3 | $2.64\times10^{-4}$ |
| RVP-C | YXA | 67WA422A* | 68 | 64 to 72 | 45 | 28H7 | +0.021 0 | 52 | 8 | ±0.018 | 31.3 | $2.44\times10^{-4}$ |
| | YXD | 67WA422D* | 68 | 64 to 72 | 45 | 28H7 | +0.021 0 | 52 | 10 | ±0.018 | 31.3 | $2.44\times10^{-4}$ |
| | YXF | 67WA140F* | 145 | 150 to 159 | 56 | 38H7 | +0.025 0 | 66.5 | 10 | ±0.018 | 41.3 | $7.47\times10^{-4}$ |
| | YXG | 67WA140G* | 95 | 113.5 to 120.5 | 55 | 32H7 | +0.025 0 | 45 | 10 | ±0.018 | 35.3 | $5.01\times10^{-4}$ |
| | YXK | 67WA140K* | 109 | 126.5 to 133.5 | 60 | 35H7 | +0.025 0 | 55 | 10 | ±0.018 | 38.3 | $7.11\times10^{-4}$ |
| | YXL | 67WA140L* | 81 | 98.5 to 105.5 | 55 | 32 | +0.043 +0.018 | 31 | 10 | ±0.018 | 35.3 | $4.17\times10^{-4}$ |
| | YXM | 67WA140M* | 57 | 74.5 to 81.5 | 45 | 24 | +0.034 +0.013 | 23 | 8 | ±0.018 | 27.3 | $2.26\times10^{-4}$ |
| | YXN | 67WA140N* | 109 | 126.5 to 133.5 | 60 | 35 | +0.035 +0.010 | 55 | 10 | ±0.018 | 38.3 | $7.11\times10^{-4}$ |
| | YXP | 67WA140P* | 89 | 106.5 to 113.5 | 45 | 24H7 | +0.021 0 | 55 | 8 | ±0.018 | 27.3 | $3.18\times10^{-4}$ |
| | YXQ | 67WA140Q* | 144.5 | 162 to 169 | 60 | 35H7 | +0.025 0 | 55 | 10 | ±0.018 | 38.3 | $9.38\times10^{-4}$ |
| | YXR | 67WA140R* | 125 | 142.5 to 149.5 | 60 | 35 | +0.035 +0.010 | 70 | 10 | ±0.018 | 38.3 | $8.43\times10^{-4}$ |
| | YS2 | 67WA140S* | 142 | 159.5 to 166.5 | 60 | 42H7 | +0.025 0 | 80 | 12 | ±0.0215 | 45.3 | $8.89\times10^{-4}$ |

Note: Ensure that length A' of the spline insertion position is within the range indicated in the table above.

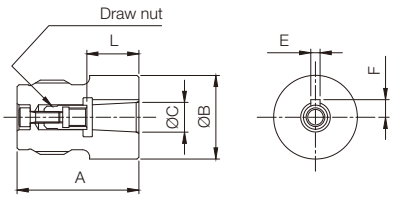
## Straight shaft (without key)




| | Code | Item No. | Input spline dimensions (mm) | | | | | | Moment of inertia I ($I=GD^2/4$) Input shaft conversion value ($kgm^2$) | Transmission torque N-m |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | A' | øB | øC | | L | | |
| RVP-A Rotary axis | SXA | 05AP401A* | 63 | - | 68 | 24H7 | +0.021 0 | 37 | $4.13\times10^{-4}$ | 77.8 |
| | SXB | 05AP401B* | 61.5 | - | 63 | 19H7 | +0.021 0 | 38 | $2.71\times10^{-4}$ | 52.4 |
| RVP-A Tilting axis | TXA | 05AP402A* | 86 | - | 75 | 35 | +0.035 +0.010 | 73 | $7.36\times10^{-4}$ | 251.7 |
| | TXB | 05AP402B* | 75 | - | 84 | 19H7 | +0.021 0 | 38 | $1.04\times10^{-3}$ | 52.4 |
| | TXF | 05AP402F* | 75 | - | 84 | 24H7 | +0.021 0 | 38 | $1.03\times10^{-3}$ | 77.8 |
| RVP-C | YXB | 67WA421B* | 86 | 86 to 92 | 75 | 35 | +0.035 +0.010 | 73 | $7.34\times10^{-4}$ | 106.5 |
| | YXC | 67WA421C* | 82 | 84.5 to 87 | 75 | 32H7 | +0.025 0 | 33 | $7.55\times10^{-4}$ | 170.8 |
| | YE2 | 67WA421E* | 86 | 86 to 92 | 75 | 35 | +0.035 +0.010 | 58 | $7.48\times10^{-4}$ | 106.5 |
| | YXH | 67WA421H* | 144 | 140.5 to 149.5 | 77 | 42H7 | +0.025 0 | 62 | $9.73\times10^{-4}$ | 277.3 |

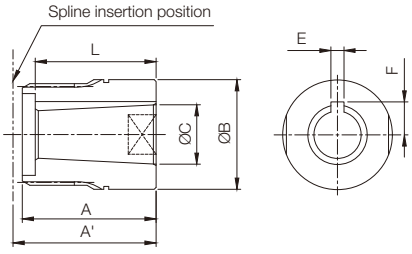
Note: Ensure that length A' of the spline insertion position is within the range indicated in the table above.

## 1/10 tapered shaft




Note: No draw nut for SXR and TXS

For RVP-A

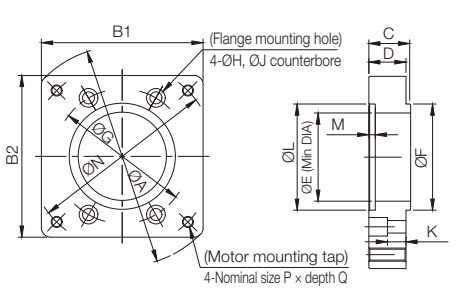



For RVP-C

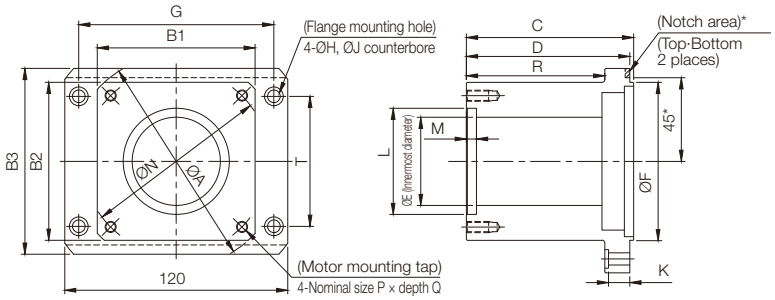
| | Code | Item No. | Input spline dimensions (mm) | | | | | | | | | Moment of inertia I ($I=GD^2/4$) Input shaft conversion value ($kgm^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | A' | øB | øC | | L | E | | F | |
| RVP-A Rotary axis | SXR | 05AP401R* | 67.5 | - | 45 | 24 | +0.10 0 | 44 | 5 | +0.2 +0.1 | 13.4 | $1.31\times10^{-4}$ |
| | SXS | 05AP401S* | 65.5 | - | 40 | 16 | +0.10 0 | 28 | 5 | +0.040 +0.010 | 9.5 | $1.35\times10^{-4}$ |
| RVP-A Tilting axis | TXS | 05AP402S* | 86 | - | 45 | 24 | +0.10 0 | 44 | 5 | +0.2 +0.1 | 13.4 | $3.04\times10^{-4}$ |
| | TXT | 05AP402T* | 74 | - | 45 | 16 | +0.10 0 | 28 | 5 | +0.040 +0.010 | 9.5 | $2.78\times10^{-4}$ |
| RVP-C | YXS | 67WA140-* | 60 | 54 to 69.5 | 50 | 32 | +0.10 0 | 60 | 7 | +0.08 +0.043 | 17.75 | $2.06\times10^{-4}$ |
| | YXE | 67WA140E* | 81 | 81.5 to 87.5 | 50 | 35 | +0.10 0 | 55 | 6 | +0.040 +0.010 | 18.55 | $2.74\times10^{-4}$ |

Note: Ensure that length A' of the spline insertion position is within the range indicated in the table above.

# External dimensions Motor flange




For RVP-A




For RVP-C

| Model | Code | Item No. | Flange outer dimensions (mm) | | | | | | | | Reduction gear mounting dimensions (mm) | | | | | | Motor mounting dimensions (mm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øA | B1 | B2 | B3 | R | C | D | øE | øF | | G | T | øH | øJ | K | øL | | M | øN | P | Q |
| RVP-A | GA | 35PA203GA* | 144 | □129 | | | | 43 | 38 | | | | | | | | | 95 | +0.038 +0.013 | 7 | 115 | M8 | 15 |
| | GB | 35PA203GB* | 176 | □130 | | | | 45 | 40 | | | | | | | | | 110 | +0.038 +0.013 | 7 | 135 | M8 | 15 |
| | GC | 35PA203GC* | 176 | □130 | | | | 45 | 40 | | | | | | | | | 110 | +0.038 +0.013 | 7 | 145 | M8 | 15 |
| | GD | 35PA203GD* | 233 | □176 | | | | 45 | 40 | | | | | | | | | 114.3 | +0.038 +0.013 | 5 | 200 | M12 | 22 |
| | GE | 35PA203GE* | 233 | □176 | | | | 45 | 40 | | | | | | | | | 130 | +0.039 +0.014 | 6 | 165 | M10 | 18 |
| | GF | 35PA203GF* | 295 | □220 | | | | 45 | 40 | | | | | | | | | 200 | +0.040 +0.015 | 6 | 235 | M12 | 22 |
| | GG | 35PA203GG* | 170 | □130 | | - | - | 55 | 50 | 96 | 106h7 | 0 -0.035 | ø122 | - | 9 | 14 | 22 | 110 | +0.038 +0.013 | 7 | 145 | M8 | 15 |
| | GH | 35PA203GH* | 226 | □176 | | | | 55 | 50 | | | | | | | | | 114.3 | +0.038 +0.013 | 5 | 200 | M12 | 22 |
| | GJ | 35PA203GJ* | 170 | □130 | | | | 50 | 45 | | | | | | | | | 110 | +0.038 +0.013 | 7 | 145 | M8 | 15 |
| | GK | 35PA203GK* | 176 | □130 | | | | 45 | 40 | | | | | | | | | 110 | +0.038 +0.013 | 7 | 130 | M8 | 15 |
| | GS | 35PA203GS* | 180 | □135 | | | | 45 | 40 | | | | | | | | | 114.3 | +0.038 +0.013 | 7 | 160 | M10 | 18 |
| | HB | 35PA203HB* | 226 | □176 | | | | 60 | 55 | | | | | | | | | 114.3 | +0.038 +0.013 | 5 | 200 | M12 | 22 |
| RVP-C | YS | 67WA203-* | 238 | □174 | | 174 | 34.5 | 65.5 | 61.5 | 114.3 | | | | | | | 25 | 114.3H7 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YA | 67WA203A* | 238 | □174 | | 174 | 44.5 | 75.5 | 71.5 | 114.3 | | | | | | | | 114.3H7 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YB | 67WA203B* | 318 | 240 | 220 | | - | 75.5 | 71.5 | 148 | | | | | | | 25.5 | 200H7 | +0.046 0 | 10 | 235 | M12 | 24 |
| | YC | 67WA203C* | 318 | 240 | 220 | | - | 85.5 | 81.5 | 148 | | | | | | 20 | | 200H7 | +0.046 0 | 10 | 235 | M12 | 24 |
| | YD | 67WA203D* | 245 | □180 | | 200 | 149 | 180 | 176 | 114.3 | | | | | | | | 114.3H7 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YE | 67WA203E* | 318 | 240 | 220 | | - | 124 | 120 | 148 | | | | | | | | 200H7 | +0.046 0 | 10 | 235 | M12 | 24 |
| | YG | 67WA203G* | 318 | 240 | 220 | | - | 80 | 76 | 148 | 170h7 | 0 -0.040 | 210 | 140 | 13 | | | 200H7 | +0.046 0 | 10 | 235 | M12 | 24 |
| | YH | 67WA203H* | 306 | 240 | 200 | | - | 110 | 106 | 114.3 | | | | | | | | 114.3H7 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YJ | 67WA203J* | Ø180 | | | 220 | 75 | 104 | 100 | 110 | | | | | | - | 25 | 110H7 | +0.035 0 | 10 | 145 | M8 | 16 |
| | YK | 67WA203K* | 306 | 240 | 200 | | - | 139 | 135 | 114.3 | | | | | | | | 114.3H7 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YL | 67WA203L* | 245 | □180 | | 200 | 134 | 165 | 161 | 114.3 | | | | | | 20 | | 114.3 | +0.035 0 | 10 | 200 | M12 | 24 |
| | YM | 67WA203M* | 198 | □145 | | 200 | 5 | 79.5 | 75.5 | 130 | | | | | 13.5 | | | 130 | +0.054 +0.014 | 10 | 165 | M10 | 18 |

# Technical Information

# Considering the use of RVP® series

This product features high precision and high rigidity, however, it is necessary to strictly comply with various restrictions and make considerations to maximize the product's features. Please read this technical document thoroughly and select and adopt an appropriate model based on the actual operating environment, method, and conditions at your facility.

## Export

- When this product is exported from Japan, it may be subject to the export regulations provided in the "Foreign Exchange Order and Export Trade Control Order". Be sure to take sufficient precautions and perform the required export procedures in advance if the final operating party is related to the military or the product is to be used in the manufacture of weapons, etc.

## Application

- If failure or malfunction of the product may directly endanger human life or if it is used in units which may injure the human body (atomic energy facilities, space equipment, transportation equipment, medical equipment, safety units, etc.), examination of individual situations is required. Contact our agent or nearest business office in such a case.

## Safety measures

- Although this product has been manufactured under strict quality control, a mistake in operation or misuse can result in breakdown or damage, or an accident resulting in injury or death.
  Be sure to take all appropriate safety measures, such as the installation of independent safeguards.

## Product specifications indicated in this catalog

- The specifications indicated in this catalog are based on Nabtesco evaluation methods. This product should only be used after confirming that it is appropriate for the operating conditions of your system.

## Operating environment

Use the reduction gear under the following environment:
- · Location where the ambient temperature is between -10°C to 40°C.
- · Location where the humidity is less than 85% and no condensation occurs.
- · Location where the altitude is less than 1000 m.
- · Well-ventilated location

Do not install this product at the following locations.
- · Locations where a lot of dust is collected.
- · Outdoor areas that are directly affected by wind and rain
- · Location near to areas that contain combustible, explosive, or corrosive gases and flammable materials.
- · Locations that are heated due to heat transfer and radiation from peripherals and direct sun.
- · Locations where the performance of the motor can be affected by magnetic fields or vibration.

**Note: 1 If the required operating environment cannot be established/met, contact us in advance.**
**2 When using the product under special conditions (clean room, equipment for food, concentrated alkali, high-pressure steam, etc.), contact our agent or nearest business office in advance.**

## Maintenance

- The standard replacement time for lubricant is 20,000 hours. However, when operation involves a reduction gear surface temperature above 40°C, the state of degradation of the lubricant should be checked in advance of that and the lubricant replaced earlier as necessary.

## Reduction gear temperature

- When the reduction gear is used under high load and at a high duty ratio, it may overheat and the surface temperature may exceed the allowable temperature. Be aware of conditions so that the surface temperature of the reduction gear does not exceed 60°C while it is in operation. There is a possibility of damage (to the product) if the surface temperature exceeds 60°C.

## Reduction gear output rotation angle

- When the range of the rotation angle is small (10 degrees or less), the rated service life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

  Note: Contact us in case the rotation angle is 10 degrees or less.

## Manuals

- Safety information and detail product instructions are indicated in the operation manual.

# Glossary

## Rated service life

The lifetime resulting from the operation with the rated torque and the rated output speed is referred to as the “rated service life”.

## Allowable acceleration/deceleration torque

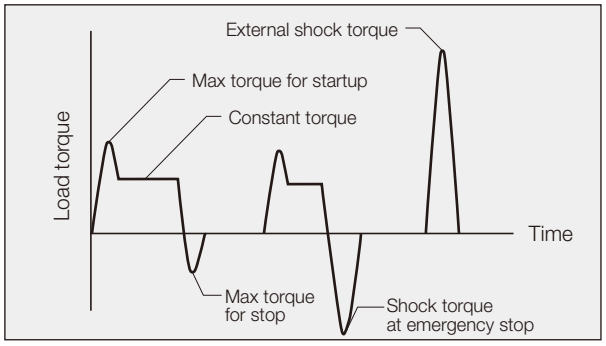
When the machine starts or stops, the load torque to be applied to the reduction gear is larger than the constant-speed load torque due to the effect of the inertia torque of the rotating part. In such a situation, the allowable torque during acceleration/deceleration is referred to as “allowable acceleration/deceleration torque”.

**Note: Be careful that the load torque, which is applied at startup and stop, does not exceed the allowable acceleration/deceleration torque.**

## Momentary maximum allowable torque

A large torque may be applied to the reduction gear due to execution of emergency stop or by an external shock. In such a situation, the allowable value of the momentary applied torque is referred to as “momentary maximum allowable torque”.

**Note: Be careful that the momentary excessive torque does not exceed the momentary maximum allowable torque.**




## Allowable output speed

The allowable value for the reduction gear’s output speed during operation without a load is referred to as the “allowable output speed”.

**Note: Depending on the conditions of use (duty ratio, load, ambient temperature), the reduction gear temperature may exceed 60°C even when the speed is under the allowable output speed. In such a case, either take cooling measures or use the reduction gear at a speed that keeps the surface temperature at 60°C or lower.**

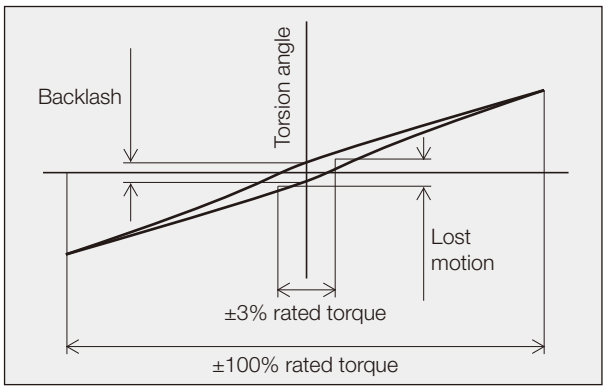
## Duty ratio

The duty ratio is defined as the ratio of the sum total time of acceleration, constant speed, and deceleration to the cycle time of the reduction gear.

## Lost motion, backlash

When torque is applied to the output shaft while the input shaft is fixed, torsion is generated according to the torque value. The torsion can be shown in the hysteresis curves. The torsion angle at the mid point of the hysteresis curve width within ±3% of the rated torque is referred to as “lost motion”. The torsion angle when the torque indicated by the hysteresis curve is equal to zero is referred to as “backlash”.

<Hysteresis curve>



## Installation of the RVP series and mounting details for the output shaft

When installing the RVP series and mounting additional components to the output shaft of the RVP series, use hexagon socket head cap screws and tighten them at the tightening torque shown below in order to satisfy the momentary maximum allowable torque, which is noted in the specification table.
The use of the serrated lock washers are recommended to prevent the hexagon socket head cap screws from loosening and to protect the seat surface from flaws.

**• Hexagon socket head cap screw**

<Bolt tightening torque and tightening force>

| Hexagon socket head cap screw nominal size x pitch (mm) | Tightening torque (Nm) | Tightening force F (N) | Bolt specification |
|---|---|---|---|
| M5 × 0.8 | 9.01 ± 0.49 | 9,310 | Hexagon socket head cap screw JIS B 1176 : 2006 Strength class JIS B 1051 : 2000 12.9 Thread JIS B 0209 : 2001 6g |
| M6 × 1.0 | 15.6 ± 0.78 | 13,180 | |
| M8 × 1.25 | 37.2 ± 1.86 | 23,960 | |
| M10 × 1.5 | 73.5 ± 3.43 | 38,080 | |
| M12 × 1.75 | 129 ± 6.37 | 55,100 | |
| M16 × 2.0 | 319 ± 15.9 | 103,410 | |
| M18 × 2.5 | 441 ± 22.0 | 126,720 | |
| M20 × 2.5 | 493 ± 24.6 | 132,170 | |

**Note: 1. The tightening torque values listed are for steel or cast iron material.**
**2. If softer material, such as aluminum or stainless steel, is used, limit the tightening torque. Also take the transmission torque and load moment into due consideration.**

<Calculation of allowable transmission torque of bolts>

$$T = F \times \mu \times \frac{D}{2 \times 1{,}000} \times n$$

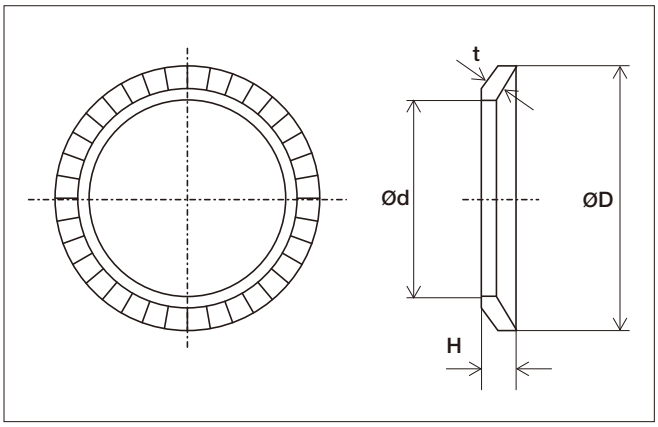
| | |
|---|---|
| T | Allowable transmission torque by tightening bolt (Nm) |
| F | Bolt tightening force (N) |
| D | Bolt mounting P.C.D. (mm) |
| μ | Friction factor<br>μ=0.15: When lubricant remains on the mating face.<br>μ=0.20: When lubricant is removed from the mating face. |
| n | Number of bolts (pcs.) |

**• Serrated lock washer for hexagon socket head cap screw**

Name: Belleville spring washer (made by Heiwa Hatsujyo Industry Co., Ltd.)
Corporation symbol: CDW–H
CDW-L (Only for M5)
Material: S50C to S70C
Hardness: HRC40 to 48

(Unit: mm)

| Nominal size | ID and OD of Belleville spring washer | | t | H |
|---|---|---|---|---|
| | Ød | ØD | | |
| 5 | 5.25 | 8.5 | 0.6 | 0.85 |
| 6 | 6.4 | 10 | 1.0 | 1.25 |
| 8 | 8.4 | 13 | 1.2 | 1.55 |
| 10 | 10.6 | 16 | 1.5 | 1.9 |
| 12 | 12.6 | 18 | 1.8 | 2.2 |
| 16 | 16.9 | 24 | 2.3 | 2.8 |
| 18 | 18.9 | 27 | 2.6 | 3.15 |
| 20 | 20.9 | 30 | 2.8 | 3.55 |




**Note: When using any equivalent washer, select it with special care given to its outside diameter D.**

## Lubrication

• The standard lubricant for RVP series is grease.
RVP series are pre-lubricated with our recommended RV GREASE LB00 grease when shipped. When RVP series reduction gears are operated while they are filled with an appropriate amount of lubricant, the standard lubricant replacement time due to lubricant degradation is 20,000 hours. However, if they are operated under unfavorable conditions (that may deteriorate the lubricant more quickly or that cause ambient temperature above 40°C), the state of lubricant degradation should be checked and the lubricant replaced earlier as necessary.

• Nabtesco-specified lubricant

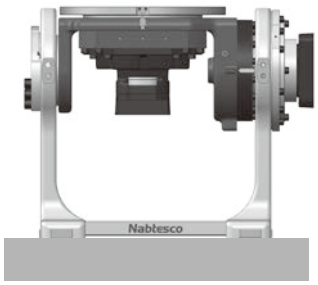
| Brand | RV GREASE LB00 |
|---|---|
| Manufacturer | Nabtesco |
| Ambient temperature | -10 to 40°C |

• It is recommended that the running-in operation is performed.

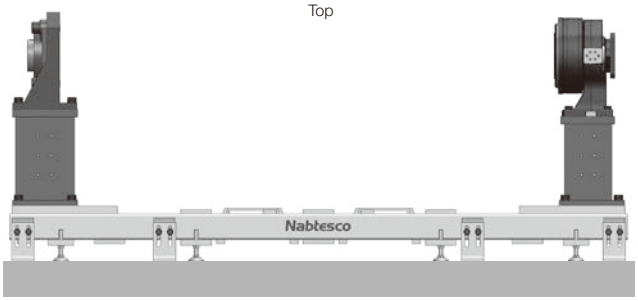
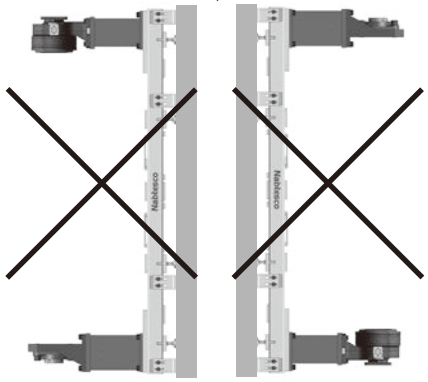
## Installation orientation

- Do not install the RVP series on a ceiling or hung on a wall.
  Contact us when installing the RVP series in different orientations.

### RVP-A

| Example of correct installation | Example of incorrect installation |
|---|---|
| <Horizontal installation><br>Top<br>  <br><br>Bottom | Top<br>  <br><br>Bottom |

### RVP-B

| Example of correct installation | Example of incorrect installation |
|---|---|
| <Horizontal installation><br>Top<br>  <br><br>Bottom | Top<br>  <br><br>Bottom |

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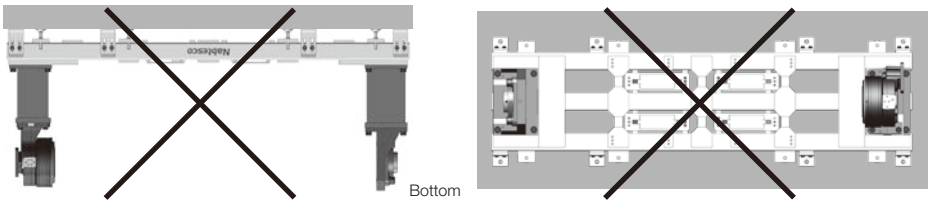
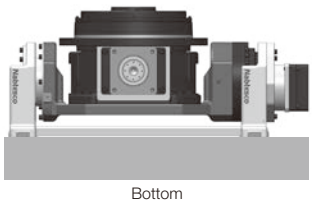
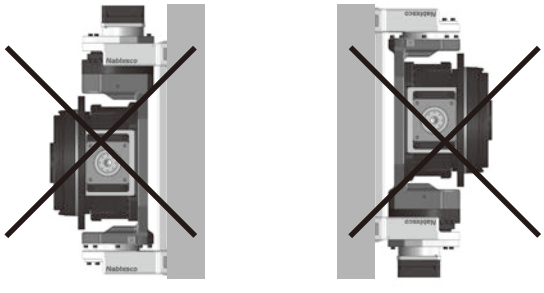



Bottom

### RVP-C

| Example of correct installation | Example of incorrect installation |
|---|---|
| <Horizontal installation><br>Top<br>  <br><br>Bottom | Top<br>  <br><br>Bottom |

# Troubleshooting checksheet

Check the following items in the case of trouble like abnormal noise, vibration, or malfunctions.
When it is not possible to resolve an abnormality even after verifying the corresponding checkpoint, obtain a “Reduction Gear Investigation Request Sheet” from our Website, fill in the necessary information, and contact our Customer Support Center.

[URL] **https://precision.nabtesco.com/**

### The trouble started immediately after installation of the reduction gear

| Checked | Checkpoint |
|---|---|
| | Make sure the equipment’s drive section (the motor side or the reduction gear output surface side) is not interfering with another component. |
| | Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load). |
| | Make sure the required number of bolts are tightened uniformly with the specified tightening torque. |
| | Make sure the reduction gear, motor, or your company’s components are not installed at a slant. |
| | Make sure the specified amount of Nabtesco-specified lubricant has been added. |
| | Make sure there are no problems with the motor’s parameter settings. |
| | Make sure there are no components resonating in unity. |
| | Make sure the input spline or input gear is appropriately installed on the motor. |
| | Make sure there is no damage to the surface of the input spline or input gear teeth. |

### The trouble started during operation

| Checked | Checkpoint |
|---|---|
| | Make sure the equipment has not been in operation longer than the calculated service life. |
| | Make sure the surface temperature of the reduction gear is not higher than normal during operation. |
| | Make sure the operation conditions have not been changed. |
| | Make sure there are no loose or missing bolts. |
| | Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load). |
| | Make sure the equipment’s drive section is not interfering with another component. |
| | Make sure an oil leak is not causing a drop in the amount of lubricant. |
| | Make sure there are no external contaminants in the gear, such as moisture or metal powder. |
| | Make sure no lubricant other than that specified is being used. |

▶ **Area** In North and South America / In Europe and Africa / In Asia and others
▶ **FAX** USA: / Germany: / Nagoya Office:
1-248-553-3070 / 49-211-364677 / 81-52-582-2987

# *Order Information Sheet* (Please complete the form below and send it with your order.) Date.

Company Name: Dept. Name:

Name: E-mail:

TEL. - - FAX. - -

## ◆ System configuration and selected motor

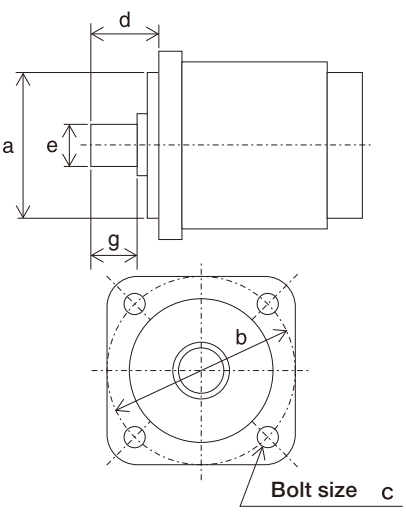
We would appreciate if you could provide a system configuration drawing that helps us to understand the speed, constant torque, and load inertia that the output shaft of the unit will be subject to for your application. For RVP-A and RVP-C, indicate the rotary axis and tilting axis motors and operation pattern. For RVP-B, indicate only the tilting axis motor and operation pattern.

### System configuration

### Product code or model:

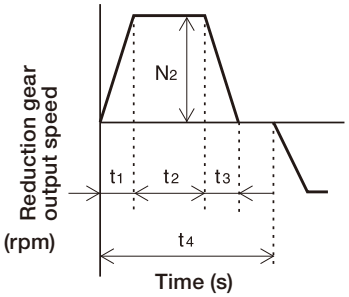
| |
|---|
| Rotary axis motor model: |
| Tilting axis motor model: |

| | | | Rotary axis | Tilting axis |
|---|---|---|---|---|
| P | Motor rated output | (kW) | | |
| $T_{M0}$ | Motor rated torque | (Nm) | | |
| $T_{M1}$ | Motor momentary maximum torque | (Nm) | | |
| $N_{M0}$ | Motor rated speed | (rpm) | | |
| a | Motor mounting pilot diameter | (mm) | | |
| b | Motor mounting bolt P.C.D. | (mm) | | |
| c | Motor mounting bolt size | (mm) | | |
| d | Motor shaft length | (mm) | | |
| e | Motor shaft diameter | (mm) | | |
| g | Motor shaft effective length | (mm) | | |
| | Key availability (dimensions) | (mm) | | |




## ◆ Operation pattern

| | | | Rotary axis | Tilting axis |
|---|---|---|---|---|
| $t_1$ | Acceleration time | (s) | | |
| $t_2$ | Constant speed operation time | (s) | | |
| $t_3$ | Deceleration time | (s) | | |
| $t_4$ | One operation cycle time | (s) | | |
| $Q_1$ | Number of operation cycles per day | (times) | | |
| $Q_2$ | Number of operating days per year | (days) | | |
| $N_2$ | Constant speed | (rpm) | | |
| $T_1$ | Max. torque for startup | (Nm) | | |
| $T_2$ | Constant torque | (Nm) | | |
| $T_3$ | Max. torque for stop | (Nm) | | |



MEMO

## Warranty

1. In the case where Nabtesco confirms that a defect of the Product was caused due to Nabtesco's design or manufacture within the Warranty Period of the Product, Nabtesco shall repair or replace such defective Product at its cost. The Warranty Period shall be from the delivery of the Product by Nabtesco or its distributor to you ("Customer") until the end of one (1) year thereafter, or the end of two thousand (2,000) hours from the initial operation of Customer's equipment incorporating the Product at end user's production line, whichever comes earlier.
2. Unless otherwise expressly agreed between the parties in writing, the warranty obligations for the Product shall be limited to the repair or replacement set forth herein. OTHER THAN AS PROVIDED HEREIN, THERE ARE NO WARRANTIES ON THE PRODUCT, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.
3. The warranty obligation under Section 1 above shall not apply if:
   a) the defect was caused due to the use of the Product deviated from the Specifications or the working conditions provided by Nabtesco;
   b) the defect was caused due to exposure to foreign substances or contamination (dirt, sand, etc.)
   c) lubricant or spare parts other than the ones recommended by Nabtesco was used in the Product;
   d) the Product was used in an unusual environment (such as high temperature, high humidity, a lot of dust, corrosive/volatile/inflammable gas, pressurized/depressurized air, under water/liquid or others except for those expressly stated in the Specifications);
   e) if the Product was disassembled, re-assembled, repaired or modified by anyone other than Nabtesco; (other except for those expressly stated in the Specifications)
   f) the defect was caused due to the equipment into which the Product was installed;
   g) the defect was caused due to an accident such as fire, earthquake, lightning, flood or others; or
   h) the defect was due to any cause other than the design or manufacturing of the Product.
   i) proper transportation defined by Nabtesco in the operation manual was not performed.
4. The warranty period for the repaired/replaced Product/part under Section 1 above shall be the rest of the initial Warranty Period of the defective Product subjected to such repair/replace.

Rev. 002

Nabtesco®

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