









High Reliability High Rigidity High Precision Gear Reducers

Nabtesco



# 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.



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### 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 leading 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.

NABCO Ltd.
Established 1925

Teijin Seiki Co., Ltd. Established 1944

Business Merger in 2003

Motion control



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.

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deliver great potential!!

# RV<sup>TM</sup> reduction gears, already top sellers in the robotics industry, now evolved even further!! Compact N Series gears 60% share of the global market for

articulated) robot joints

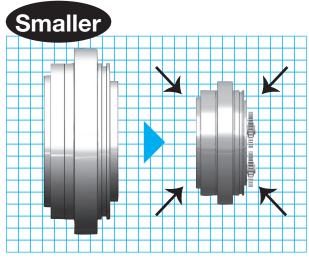
\* Based on Nabtesco studies

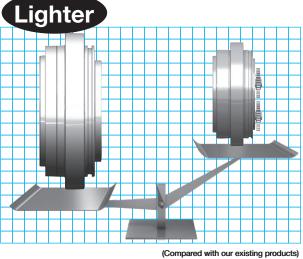
industrial (vertical-



Based on our RV reduction gears which achieve 4 million units already shipped, the new RV N SERIES models have been made even more compact and lightweight.

### **RV N** SERIES features





**External dimensions** 

8 to 20% smaller

Weight

# 16 to 36% lighter

### Model size comparison

Model	<b>RV-40</b>	E	<b>RV-42N</b>
Rated Torque (Nm)	412		412
Allowable moment (Nm)	1,666	<b>The same basic performance</b>	1,660
Allowable thrust (N)	5,194		5,220
Weight (kg)	9.3		6.3
Outside diameter (mm)	φ190		$\phi$ 159
		Compact and Lightweight	

**Compact and Lightweight** 

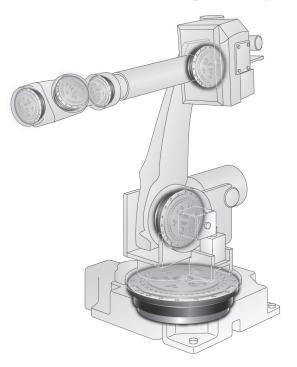


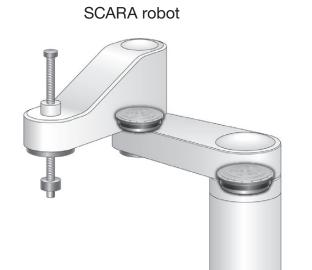
# **Space-saving design for a wide range of uses**



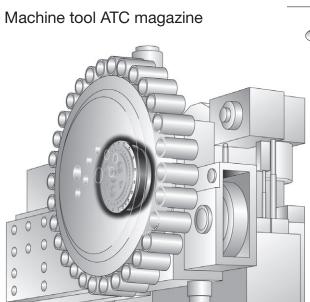
# **Examples of uses for the RV**<sup>™</sup> N SERIES

Vertical-articulated robot (joint shaft)



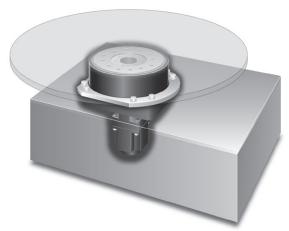


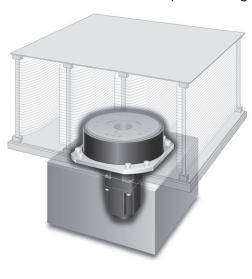
Machine tool (turret of lathe)



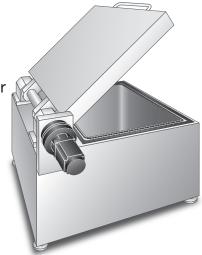
## Glass substrate/wafer rotation and positioning

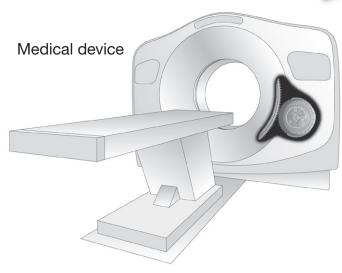
### Positioning turntable



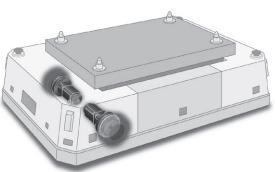


Cover open/close and reverser





AGV drive



# **Principle of speed reduction**

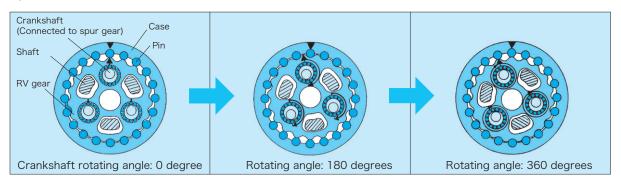
The RV is a 2-stage reduction gear.

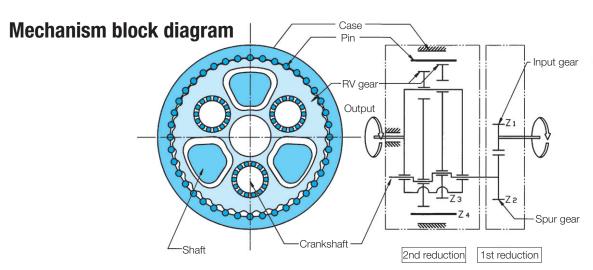
### 1st stage ... Spur gear reduction

• An input gear engages with and rotates spur gears that are coupled to crankshafts. Several overall gear ratios can be provided by selecting various first stage ratios.

### 2nd stage · · · Epicyclic gear reduction

- Crankshafts driven by the spur gears cause an eccentric motion of two epicyclic gears called RV gears that are offset 180 degrees from one another to provide a balanced load.
- The eccentric motion of the RV gears causes engagement of the cycloidal shaped gear teeth with cylindrically shaped pins located around the inside edge of the case.
- In the course of one revolution of the crankshafts the teeth of the RV gear move the distance of one pin in the opposite direction of the rotating cranks. The motion of the RV gear is such that the teeth remain in close contact with the pins and multiple teeth share the load simultaneously.
- The output can be either the shaft or the case. If the case is fixed, the shaft is the output. If the shaft is fixed, the case is the output.





### **Speed Ratio**

The speed ratio is calculated using the formula to the right.

$$R = 1 + \frac{Z2}{Z1} \cdot Z4$$

$$i = \frac{1}{R}$$

R: Speed ratio

Z1: Number of teeth on input gear

Z2: Number of teeth on spur gear

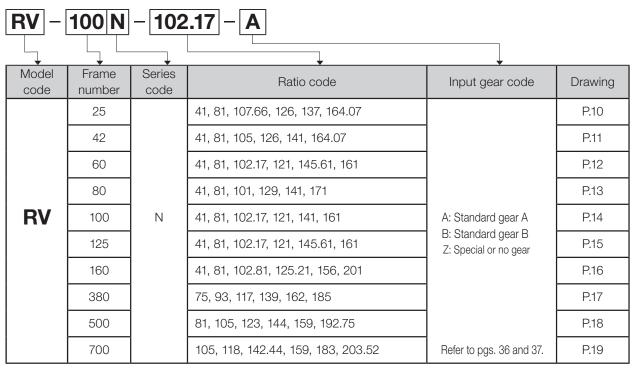
Z3: Number of teeth on RV gear

Z4: Number of pins

i : Reduction ratio

# **RV**<sup>™</sup> N series model code

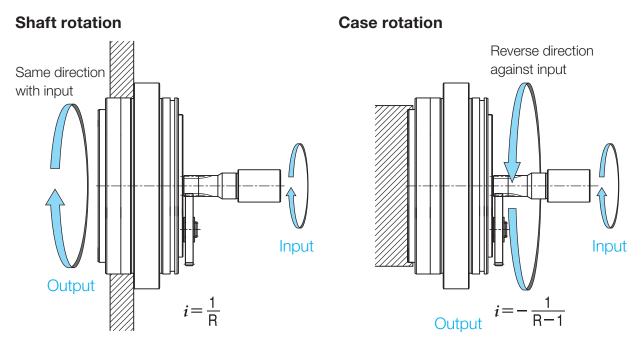
### **Product code**



<sup>\*</sup>Contact us for more information on this model.

### **Direction of rotation and gear ratio**

The overall speed ratio i (of the First and Second reduction stages) will differ between shaft rotation and case rotation, and can be calculated from the speed ratio.



The sign "i" in the above equations signifies the output shaft rotation in the same direction as the input shaft."-" signifies the same in the reverse direction.

# **Rating table**

			R	T <sub>0</sub>	N <sub>o</sub>	K (L <sub>10</sub> )	T <sub>S1</sub>	T <sub>S2</sub>
		Spee	d ratio	Rated torque	Rated output	Rated service life	Allowable	Momentary
Model	Ratio code			(Note 5)	Speed		acceleration/ deceleration torque	maximum allowable torque
		Shaft rotation	Case rotation	(Nm)	(rpm.)	(h)	(Nm)	(Nm)
	41	41	40		(1 /	.,	,	` /
	81	81	80	1				
RV-25N	107.66	323/3	320/3	245	15	6,000	612	1 225
110 2010	126	126	125	] =====================================	10	0,000	612	1,225
	137	137	136	]				
	164.07	2133/13	2120/13					
	41	41	40	]				
	81	81	80	1				
RV-42N	105	105	104	412	15	6,000	1,029	2,058
	126	126	125	-				
	141	141	140	-				
	164.07	2133/13	2120/13					
	41 81	41 81	40 80	-				
	102.17	1737/17	1720/17	-				
RV-60N	102.17	121	120	600	15	6,000	1,500	3,000
	145.61	1893/13	1880/13	1				
	161	161	160	1				
	41	41	40					
	81	81	80	†				
D1 / 001 /	101	101	100					
RV-80N	129	129	128	784	15	6,000	1,960	3,920
	141	141	140	1				
	171	171	170	1				
	41	41	40					
	81	81	80	1,000	15	6,000	2,500	5,000
RV-100N	102.17	1737/17	1720/17					
110 10014	121	121	120					
	141	141	140					
	161	161	160					
	41	41	40	1				
	81	81	80	1	1,225 15	6,000	3,062	6,125
RV-125N	102.17	1737/17	1720/17	1,225				
	121	121	120					
	145.61 161	1893/13 161	1880/13 160	-				
	41	41	40	-				
	81	81	80	-				
	102.81	1131/11	1120/11	-	15	6,000	4,000	8,000
RV-160N	125.21	2379/19	2360/19	1,600				
	156	156	155	1				
	201	201	200	1				
	75	75	74					
	93	93	92	1				
RV-380N	117	117	116	3,724	15	6,000	9,310	18 600
nv-30UN	139	139	138	3,724	15	0,000	9,310	18,620
	162	162	161	]				
	185	185	184					
	81	81	80					
	105	105	104	]				
RV-500N	123	123	122	4,900	15	6,000	12,250	24,500
	144	144	143	1				
	159	159	158	1				
	192.75	192.75	191.75	-				
	105	105	104	-				
	118	118	117	-				
RV-700N	142.44	142.44	141.44	7,000	15	6,000	17,500	35,000
	159	159	158	-				
	183	183	182	-				
	203.52	3867/19	3848/19		<u> </u>	1		

Note: 1. The allowable output speed will differ depending upon the duty ratio, load, and ambient temperature. Contact us regarding use above the allowable output speed Ns1 with a 40% duty ratio.

<sup>2.</sup> The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (P. 29).

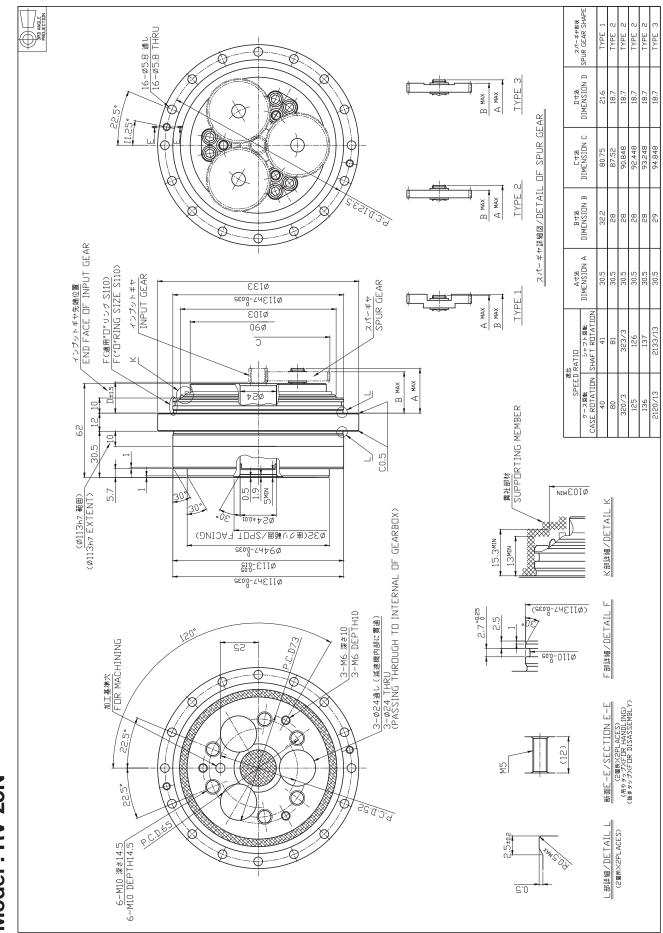
<sup>3.</sup> The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.

<sup>4.</sup> For the moment rigidity and torsional rigidity, refer to the calculation of tilt angle and the torsion angle (p. 32).

N <sub>so</sub> Allowable Output Speed (Note 1) Duty ratio: 100%	N <sub>S1</sub> Allowable Output Speed (Note 1) Duty ratio: 40%	Backlash	Lost motion	Angular transmission error (Max.)	Startup efficiency (Typical value)	M <sub>O1</sub> Allowable moment (Note 2)	M <sub>o2</sub> Momentary allowable moment (Max.)	Reduced value of the inertia moment for the input shaft	Weight
(rpm.)	(rpm.)	(arc.min.)	(arc.min.)	(arc.sec.)	(%)	(Nm)	(Nm)	(Note 3) (kgm²)	(kg)
57	110	1.0	1.0	70	80	784	1,568	1.71x10 <sup>-5</sup> 6.79x10 <sup>-6</sup> 4.91x10 <sup>-6</sup> 4.03x10 <sup>-6</sup> 3.62x10 <sup>-6</sup> 3.26x10 <sup>-6</sup>	3.8
52	100	1.0	1.0	60	80	1,660	3,320	4.43x10 <sup>-5</sup> 1.87x10 <sup>-5</sup> 1.42x10 <sup>-5</sup> 1.07x10 <sup>-5</sup> 1.01x10 <sup>-5</sup> 7.66x10 <sup>-6</sup>	6.3
44	94	1.0	1.0	50	80	2,000	4,000	8.51x10 <sup>-5</sup> 3.93x10 <sup>-5</sup> 2.86x10 <sup>-5</sup> 2.33x10 <sup>-5</sup> 1.84x10 <sup>-5</sup> 1.61x10 <sup>-5</sup>	8.9
40	88	1.0	1.0	50	80	2,150	4,300	1.16x10 <sup>-4</sup> 5.17x10 <sup>-5</sup> 3.57x10 <sup>-5</sup> 2.68x10 <sup>-5</sup> 2.40x10 <sup>-5</sup> 1.86x10 <sup>-5</sup>	9.3
35	83	1.0	1.0	50	80	2,700	5,400	1.58×10 <sup>-4</sup> 7.30×10 <sup>-5</sup> 5.82×10 <sup>-5</sup> 4.85×10 <sup>-5</sup> 4.05×10 <sup>-5</sup> 3.43×10 <sup>-5</sup>	13.0
35	79	1.0	1.0	50	80	3,430	6,860	2.59×10 <sup>-4</sup> 9.61×10 <sup>-5</sup> 7.27×10 <sup>-5</sup> 5.88×10 <sup>-5</sup> 4.60×10 <sup>-5</sup> 4.01×10 <sup>-5</sup>	13.9
19	48	1.0	1.0	50	80	4,000	8,000	3.32x10 <sup>-4</sup> 1.54x10 <sup>-4</sup> 1.13x10 <sup>-4</sup> 8.95x10 <sup>-5</sup> 6.75x10 <sup>-5</sup> 4.75x10 <sup>-5</sup>	22.1
11.5	27	1.0	1.0	50	80	7,050	14,000	7.30×10 <sup>-4</sup> 5.61×10 <sup>-4</sup> 4.93×10 <sup>-4</sup> 3.84×10 <sup>-4</sup> 3.28×10 <sup>-4</sup> 2.64×10 <sup>-4</sup>	44
11	25	1.0	1.0	50	80	11,000	22,000	1.35x10 <sup>-3</sup> 9.50x10 <sup>-4</sup> 7.44x10 <sup>-4</sup> 6.16x10 <sup>-4</sup> 5.62x10 <sup>-4</sup> 4.16x10 <sup>-4</sup>	61.1
7.5	19	1.0	1.0	50	80	15,000	30,000	1.61x10 <sup>-3</sup> 1.28x10 <sup>-3</sup> 1.18x10 <sup>-3</sup> 9.11x10 <sup>-4</sup> 8.42x10 <sup>-4</sup> 7.46x10 <sup>-4</sup>	106.0

Note: 5. The rated torque is the value that produces the rated service life based on operation at the rated output speed; it does not indicate the maximum load. Refer to the "Glossary" (p.22) and the "Product selection flowchart" (p.23).
6. Contact us regarding speed ratios other than those listed above.
7. The specifications above 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.

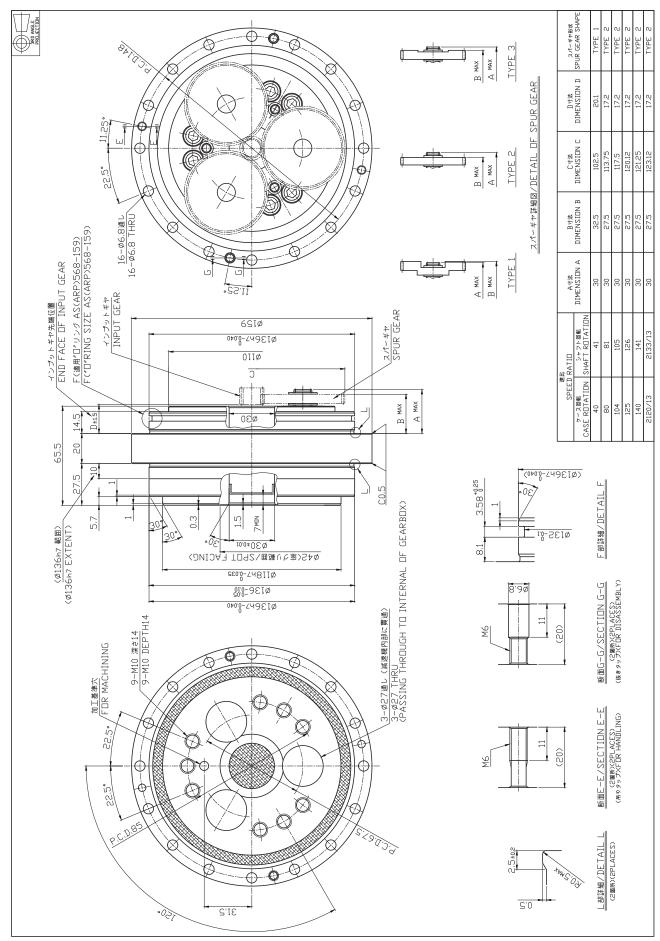
# **External dimensions**



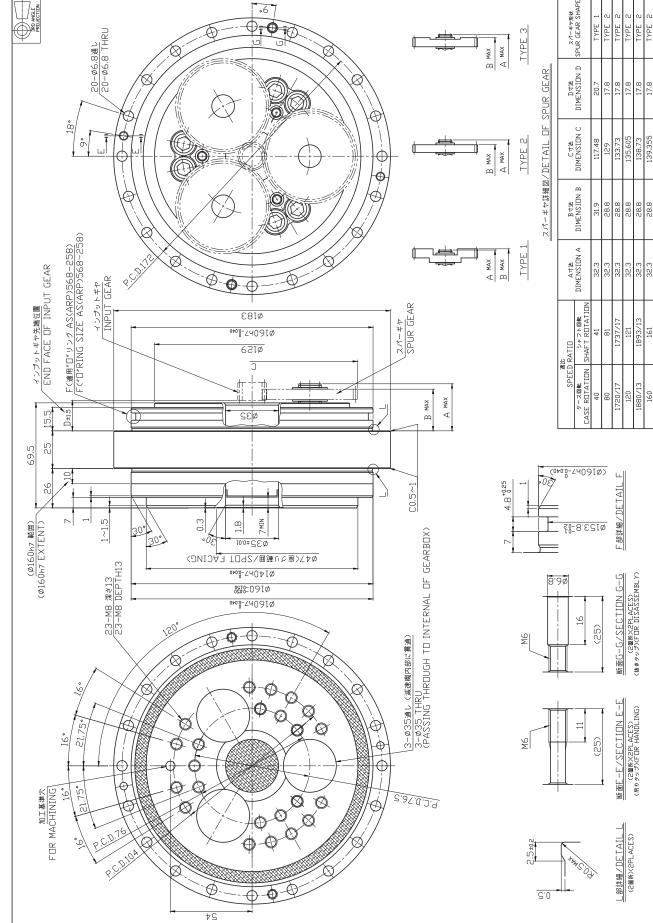
Specifications and dimensions are subject to change without notice.

Model: RV-25N

Model: RV-42N



Specifications and dimensions are subject to change without notice.

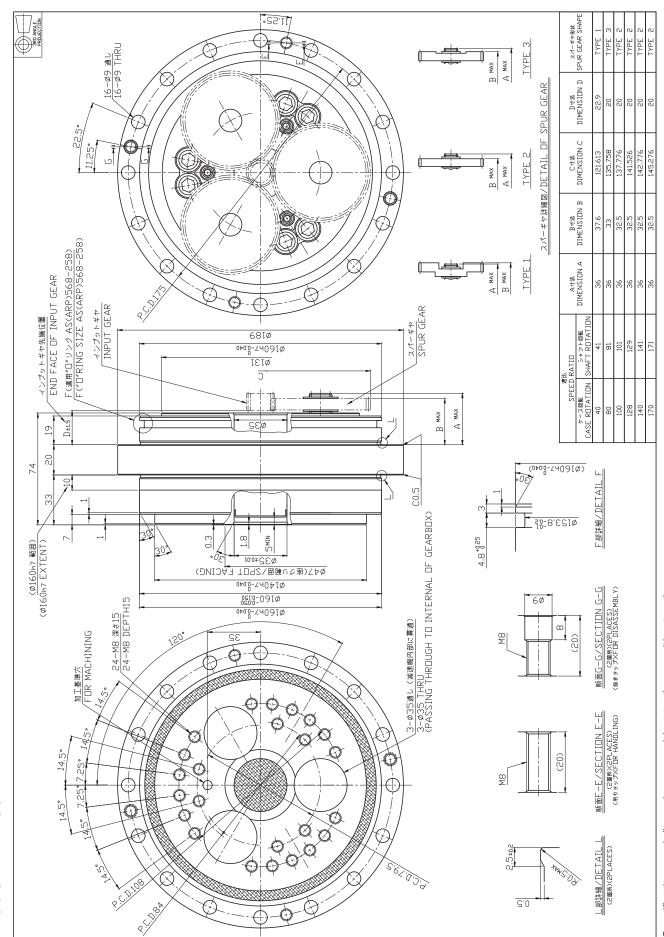


•6 0 0 TO

Model: RV-60N

Specifications and dimensions are subject to change without notice.





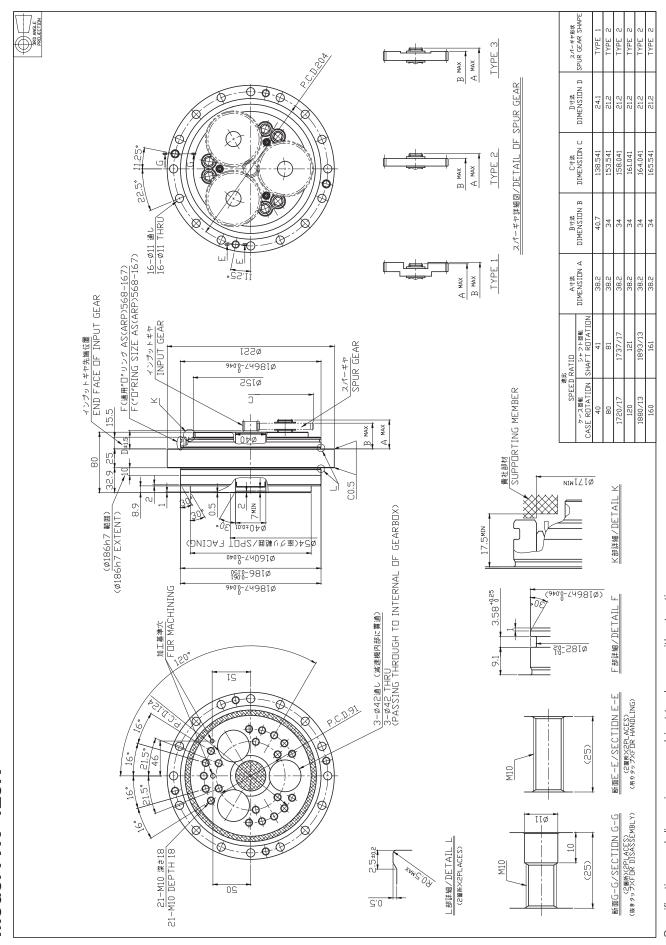
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スパーギヤ形状 SPUR GEAR SHAPE TYPE TYPE 3 A MAX В мах D寸算 DIMENSION D スパーギヤ詳細図/DETAIL OF SPUR GEAR 18.3 18.3 18.3 18.3 C寸M DIMENSION C 153 156 160.05 161.25 163.5 TYPE 2 A MAX В мах B寸M DIMENSION B 18-ø9 通じ 18-ø9 THRU F(適用"ロ"リング AS(ARP)568-166) F("ロ"RING SIZE AS(ARP)568-166) A寸法 DIMENSION A TYPE 1 A MAX В мах 34.6 34.6 34.6 34.6 34.6 インブットギヤ先端位置 // END FACE OF INPUT GEAR 18.2 インプットギヤ INPUT GEAR スパーギャ SPUR GEAR シャフト回転 SHAFT RDTATION 80Zø 121 141 161 0+0.0-7A87IQ 9+Iø С ケース回転 CASE ROTATION 80 720/17 120 140 160 MAX MAX 80 (0179h0.0-74871Q) F部詳細/DETAIL (Ø179h7 範囲) (Ø179h7 EXTENT) 3-635軍人(強張橋内部に賃値) 3-635 THRU (PASSING THRDGH TO INTERNAL OF GEARBOX) 11.9 3.8 6.11 1.0-2,471Q PO(庫ごり範囲/SPOT FACING 0+0:0-74021à 051.0-671\psi 0+0:0-7A87IQ 加工基準穴 FOR MACHINING 6ø (2箇所)(2PLACES) (抜きタップ)(FDR DISASSEMBLY) 断面G-G/SECTION G-G 18 150° (30) C.D.86  $\frac{\infty}{\Sigma}$ 000 断面E-E/SECTION E-E (2箇所)(2PLACES) (吊りタップ)(FDR HANDLING) 13 000 P.C.D.118 L部詳細/DETAIL L St S'0

Model: RV-100N

Specifications and dimensions are subject to change without notice.



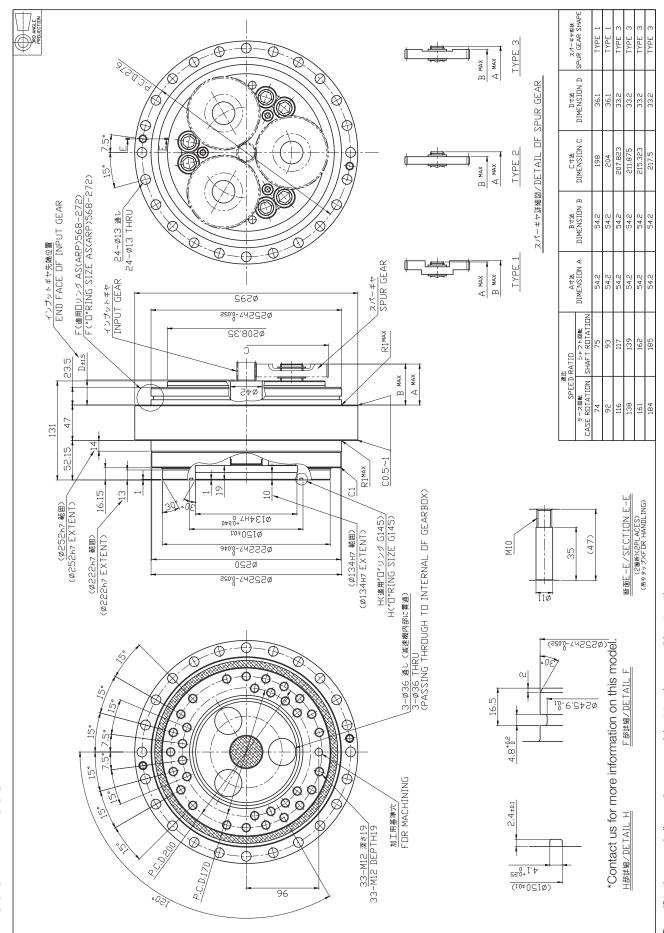


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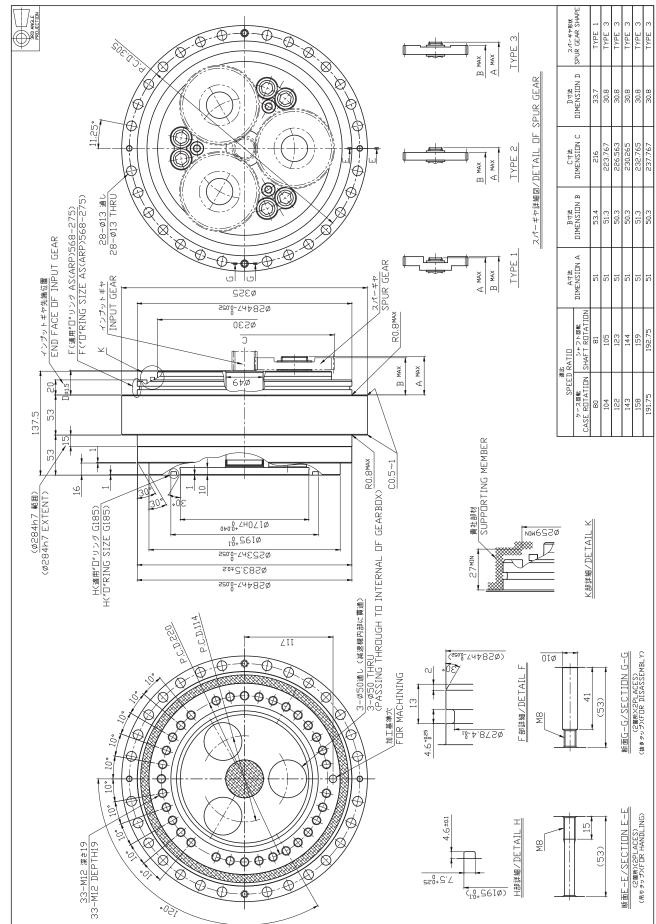
3RD ANGLE PROJECTION スパーギヤ形状 SPUR GEAR SHAPE TYPE 3 A MAX В мах D寸所 DIMENSION D スパーギや詳細図/DETAIL OF SPUR GEAR 25.9 22.9 22.9 22.9 22.9 C寸M DIMENSION C 167.317 171.833 175.583 179.333 183.083 TYPE 2 22.5 В мах A MAX B寸法 DIMENSION B F(適用"ロ"リンダ AS(ARP) 568-170) /F("ロ"RING SIZE AS(ARP) 568-170) A寸法 DIMENSION A インプットギヤ先端位置 END FACE OF INPUT GEAR TYPE 1 11.25 A MAX В мах 39.9 39.9 39.9 39.9 スパーギヤ SPUR GEAR インプットギヤ INPUT GEAR **\$538** シャフト回転 SHAFT ROTATION 9+0.8-7AS0S& 99Iø R1MAX ケース回転 CASE RDTATION ₩ ₩ × В мах 20.6 D±1.5 80 1120/11 2360/19 155 200 2tø 37 104 43.5 9 cu H(適用"ロ"リング G130) H("ロ"RING SIZE G130) (め202h7 範囲) (め202h7 EXTENT) 3-ø30 THRU (PASSING THRUGH TO INTERNAL OF GEARBOX) L部詳細/DETAIL L Φ150H7<sup>+0.035</sup> ¥132+0:1 0+0:0-7A87IQ \$505-0:12 9+0.8-7AS0S& 2,0 ΙΙØ 3-ダ30 通し(減速機内部に貫通) (と箇所)(2PLACES) (抜きタップ)(FDR DISASSEMBLY) 2.4±0.1 断面G-G/SECTION G-G H部詳細/DETAIL H 22 85 0 **\***  $\phi$ 4'I+0'.25 0 (\$132<sub>+0.1</sub>) (a+0.6-74S0SQ) 加工基準次/ FOR MACHINING 断面E-E/SECTION E-E (2箇所)(2PLACES) (吊りタップ)(FDR HANDLING) **Model: RV-160N** 10/ F部詳細/DETAIL F 8 M10 0 0 (37) -STAN 1.0-7,7e1à 18-M12 深ぎ19 18-M12 DEPTH 19

Specifications and dimensions are subject to change without notice.





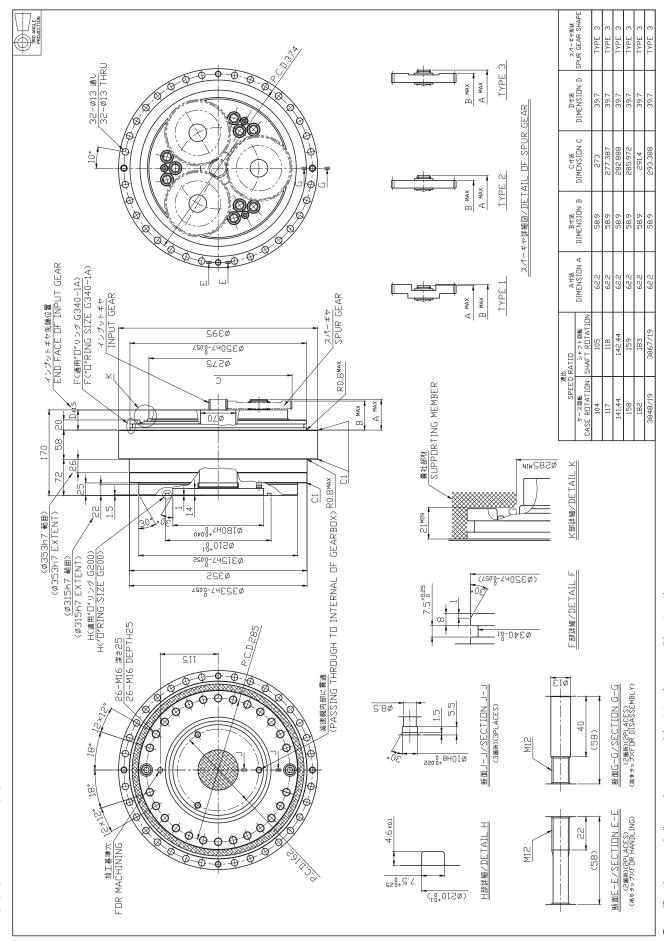
Specifications and dimensions are subject to change without notice.



Model: RV-500N

Specifications and dimensions are subject to change without notice.

Model: RV-700N



Specifications and dimensions are subject to change without notice.



# Considering the use of the RV<sup>™</sup> N SERIES

This product features high precision and high rigidity, however, it is necessary to strictly comply with various restrictions and make appropriate 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 facilities, space 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:

- $\cdot$  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 the reduction gear at the following locations.

- · Location where a lot of dust is collected.
- $\cdot$  Outdoors that can be directly affected by wind and rain
- · Location near the environment that contains combustible, explosive, or corrosive gases and flammable materials.
- $\cdot$  Location that is heated due to heat transfer and radiation from peripherals and direct sun.
- · Location where the performance of the servo 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 reduction gear 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 grease 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 grease 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 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. The operation manual can be downloaded from the following web address.

### http://precision.nabtesco.com/

# **Glossary**

### Rating 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.

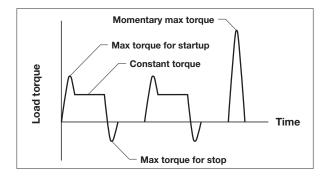
In such a situation, the allowable torque during acceleration/deceleration is referred to as "allowable acceleration/deceleration torque".

**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".

Notes: 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, and deceleration to the cycle time of the reduction gear.

### Torsional rigidity, lost motion, backlash

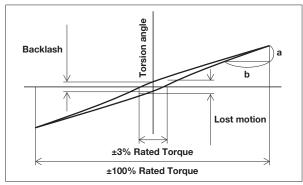
When a torque is applied to the output shaft while the input shaft is fixed, torsion is generated according to the torque value. The torsion can be shown in the hysteresis curves.

The value of b/a is referred to as "torsional rigidity".

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



### Startup Efficiency

The efficiency of the moment when the reduction gear starts up is referred to as "startup efficiency".

### No-load running torque (input shaft)

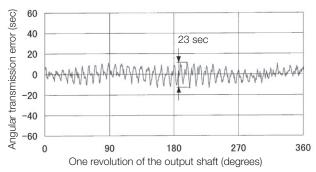
The torque for the input shaft that is required to run the reduction gear without load is referred to as "no-load running torque".

### **Allowable Moment and Maximum Thrust Load**

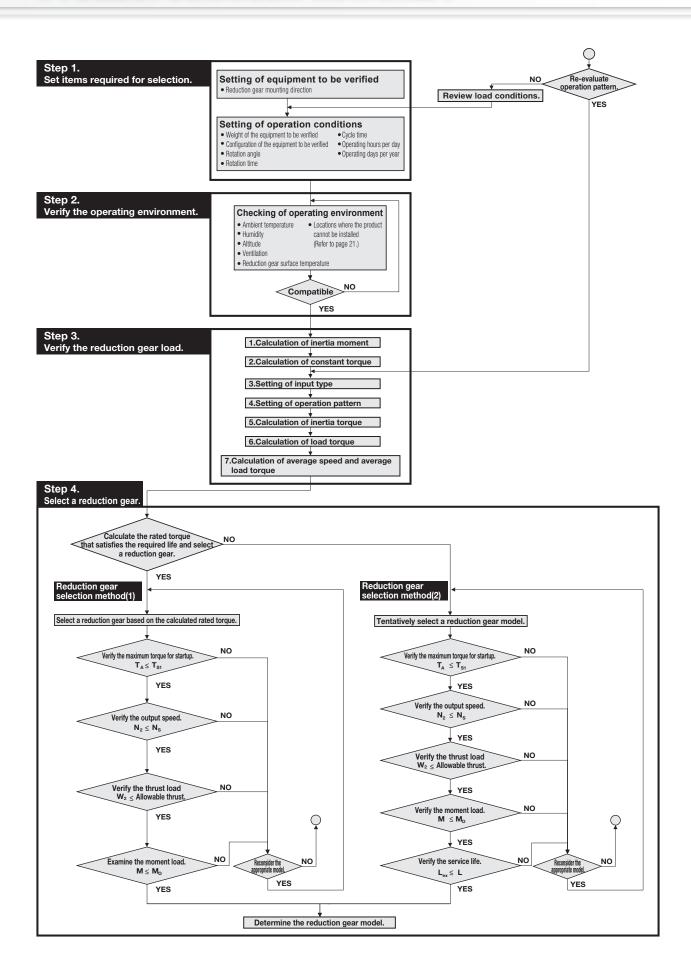
The external load moment may be applied to the reduction gear during normal operation. The allowable values of the external moment and the external axial load at this time are each referred to as "allowable moment" and "maximum thrust load".

### Angular transmission error

The angular transmission error is defined as the difference between the theoretical output angle of rotation (when there are input instructions for an arbitrary rotation angle) and the actual output angle of rotation.



# **Product selection flowchart**



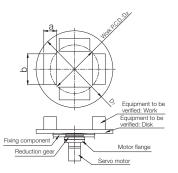
# Model code selection examples

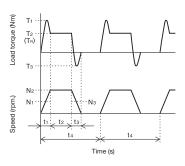
### With horizontal rotational transfer

### Step 1. Set the items required for selection.

Setting item	Setting
Reduction gear mounting direction	Vertical shaft installation
Equipment weight to be considered	
W <sub>A</sub> ———— Disk weight (kg)	180
W <sub>B</sub> — Work weight (kg)	20×4 pieces
Equipment configuration to be considered	
D <sub>1</sub> Disk: D dimension (mm)	1,200
a — Work piece: a dimension (mm)	100
b Work piece: b dimension (mm)	300
D <sub>2</sub> — Work piece: P.C.D. (mm)	1,000
Operation conditions	
θ———Rotation angle (°)*1	180
$[t_1+t_2+t_3]$ —— Rotation time (sec)	2.5
[t <sub>4</sub> ]———Cycle time (sec)	20
Q <sub>1</sub> ——— Equipment operation hours per day (hours/day)	12
Q <sub>2</sub> ——— Equipment operation days per year (days/year)	365

<sup>\*1.</sup> When the range of the rotation angle is small (10 degrees or less), the rating life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

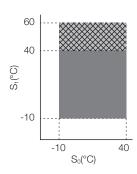




### Step 2. Verify the operating environment.

Checkpoint	Standard value
S <sub>0</sub> ———— Ambient temperature (°C)	-10 to +40
S <sub>1</sub> ———— Reduction gear surface temperature (°C)	60 or less

Note: Refer to "Operating environment" on p. 21 for values other than those listed above.



### Step 3-1. Examine the reduction gear load

	e calculation formula on page 42. $I_{R1} = \frac{W_{A} \times \left(\frac{D_{1}}{2 \times 1,000}\right)^{2}}{2}$ $I_{R2} = \left[\frac{W_{B}}{12} \left  \left(\frac{a}{1,000}\right)^{2} + \left(\frac{b}{1,000}\right)^{2} \right  + W_{B} \times \left(\frac{D_{2}}{2 \times 1,000}\right)^{2} \right] \times n$	$I_{R1} = \frac{180 \times \left(\frac{1,200}{2 \times 1,000}\right)^2}{2}$ = 32.4 (kgm²)
Load inertia moment	2	= 32.4 (kgm²)
Examine the constant torque.	$I_{R1}$ = Disk inertia moment $I_{R2}$ = Work inertia $I_{R} = I_{R1} + I_{R2}$ n = Number of work pieces	$I_{R2} = \left[\frac{20}{12} \left\{ \left(\frac{100}{1,000}\right)^2 + \left(\frac{300}{1,000}\right)^2 \right\} + 20 \times \left(\frac{1,000}{2 \times 1,000}\right)^2 \right] \times 4$ $= 20.7$ $I_{R} = 32.4 + 20.7$ $= 53.1 \text{ (kgm²)}$

Z.Examme un	e constant torque.		
T <sub>R</sub>	Constant torque (Nm)	$\begin{split} T_R = & (W_A + W_B \text{ )} \times 9.8 \times \frac{D_{in}}{2 \times 1,000} \times \mu \\ \mu = & \text{Friction factor} \\ \text{Note: Use 0.015 for this example as the load} \\ & \text{ is applied to the bearing of the RD2} \\ & \text{ reduction gear.} \\ D_{in} = & \text{Rolling diameter: Use the pilot diameter} \\ & \text{ which is almost equivalent} \\ & \text{ to the rolling diameter in} \\ & \text{ this selection calculation.} \end{split}$	$T_R = (180 + 20 \times 4) \times 9.8 \times \frac{353}{2 \times 1,000} \times 0.018$ = 6.7(Nm)

Note: If the reduction gear model is not determined, select the following pilot diameter: Maximum pilot diameter: 353 (mm)

Step 3-2: Proceed to p. 26.

### With vertical rotational transfer

### Step 1. Set the items required for selection.

Setting item	Setting
Reduction gear mounting direction	Horizontal shaft installation
Equipment weight to be considered	
W <sub>C</sub> ——— Mounted work weight (kg)	490
Equipment configuration to be considered	
a ——— a dimension (mm)	500
b ——— b dimension (mm)	500
R ———— R dimension (mm)	320
Operation conditions	
$\theta$ ———— Rotation angle (°)*1	90
$[t_1+t_2+t_3]$ —— Rotation time (sec)	1.5
[t <sub>4</sub> ] ———— Cycle time (sec)	20
Q <sub>1</sub> ——— Equipment operation hours per day (hours/day)	24
Q <sub>2</sub> ——— Equipment operation days per year (days/year)	365

<sup>\*1.</sup> When the range of the rotation angle is small (10 degrees or less), the rating life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

### Step 2. Verify the operating environment.

Checkpoint	Standard value
S <sub>0</sub> ———— Ambient temperature (°C)	-10 to +40
$S_1$ ———— Reduction gear surface temperature (°C)	60 or less

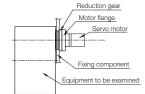
Note: Refer to "Operating environment" on p. 21 for values other than those listed above.

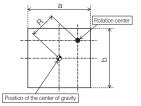
### Step 3-1. Examine the reduction gear load

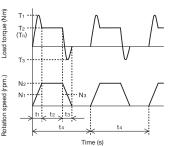
Otop o II =		godi iodd	O <sub>0</sub> ( O)					
	Setting item	Calculation formula	Selection examples					
1.Calculate the inertia moment based the calculation formula on page 42.								
I <sub>R</sub>	Load inertia moment (kgm²)	$I_{R} = \frac{W_{C}}{12} \times \left[ \left( \frac{a}{1,000} \right)^{2} + \left( \frac{b}{1,000} \right)^{2} \right] + W_{C} \times \left( \frac{R}{1,000} \right)^{2}$	$I_{R} = \frac{490}{12} \times \left[ \left( \frac{500}{1,000} \right)^{2} + \left( \frac{500}{1,000} \right)^{2} \right] + 490 \times \left( \frac{320}{1,000} \right)^{2}$ $= 70.6 (kgm^{2})$					
2.Examine the constant torque.								
T <sub>R</sub>	Constant torque (Nm)	$T_{R} = W_{C} \times 9.8 \times \frac{R}{1,000}$	$T_{R} = 490 \times 9.8 \times \frac{320}{1,000}$ $= 1,537 \text{ (Nm)}$					

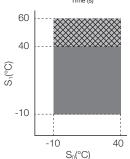
### Step 3-2: Proceed to p. 26.

(Refer to "With horizontal rotational transfer" for selection examples.)









Step 3-2. Set items required for selection

	Setting item	Calculation formula	Selection examples (With horizontal rotational transfer)
(3) Set the ac	cceleration/deceleration time, cons	stant-speed operation time, and output speed.	
t <sub>1</sub>	Acceleration time (sec)	The operation pattern does not need to be verified if it is already set. If the operation pattern has not been determined, use the following formula to calculate the reference operation pattern.	Examine the operation pattern using $N_2 = 15$ rpm. as the reduction gear output speed is unknown. $t_1 = t_2 = 2.5 - \frac{180}{1000} = 0.5(sec)$
t <sub>2</sub>	Constant-speed operation time (sec)	$t_1 = t_3 = \text{Rotation } [t_1 + t_2 + t_3] - \frac{\theta}{\left(\frac{N_2}{60} \times 360\right)}$	$t_1 = t_3 = 2.5 - \frac{180}{\left(\frac{15}{60} \times 360\right)} = 0.5 \text{ (sec)}$ $t_2 = 2.5 - (0.5 + 0.5) = 1.5 \text{ (sec)}$
t <sub>3</sub>	Deceleration time (sec)	$t_2$ = Rotation $[t_1 + t_2 + t_3] - (t_1 + t_3)$ Note: 1. Assume that $t_1$ and $t_3$ are the same.	$\therefore t_1 = t_3 = 0.5 \text{ (sec)}$ $t_2 = 1.5 \text{ (sec)}$
N <sub>2</sub>	Constant speed (rpm.)	Note: 2. N <sub>2</sub> = 15 rpm. if the reduction gear output speed (N <sub>2</sub> ) is not known.  Note: 3. If t <sub>1</sub> and t <sub>2</sub> is less than 0, increase the output speed or extend the rotation time.	N <sub>2</sub> = 15 (rpm.)
N <sub>1</sub>	Average speed for startup (rpm.)	$N_1 = \frac{N_2}{2}$	$N_1 = \frac{15}{2} = 7.5 \text{ (rpm.)}$
N <sub>3</sub>	Average speed for stop (rpm.)	$N_3 = \frac{N_2}{2}$	$N_3 = \frac{15}{2} = 7.5$ (rpm.)
(4) Calculate	the inertia torque for acceleration/	deceleration.	
T <sub>A</sub>	_ Inertia torque for acceleration (Nm)	$T_{A} = \left\{ \frac{I_{R} \times (N_{2} - 0)}{t_{1}} \right\} \times \frac{2\pi}{60}$	$T_{A} = \left\{ \frac{53.1 \times (15 - 0)}{0.5} \right\} \times \frac{2\pi}{60}$ $= 166.8(Nm)$
T <sub>D</sub>	_ Inertia torque for deceleration (Nm)	$T_{D} = \left\{ \frac{I_{R} \times (0 - N_{2})}{t_{3}} \right\} \times \frac{2\pi}{60}$	$T_{o} = \left\{ \frac{53.1 \times (0 - 15)}{0.5} \right\} \times \frac{2\pi}{60}$ $= -166.8(Nm)$
(5) Calculate	the load torque for acceleration/d	eceleration.	
T <sub>1</sub>	Maximum torque for startup (Nm)	$T_1 =  T_A + T_R $ $T_R$ : Constant torque See page 24.	$T_1 =  166.8 + 6.7 $ = 173.5 (Nm)
T <sub>2</sub> ————————————————————————————————————	Constant maximum torque (Nm)	$T_2 =  T_R $	T <sub>2</sub> =6.7 (Nm)
Т3 ———	Maximum torque for stop (Nm)	$T_1 =  T_A + T_R $ $T_R$ : Constant torque See page 24.	T <sub>3</sub> = -166.8+6.7  =160.1(Nm)
(6)-1 Calcula	te the average speed.		
N <sub>m</sub> —	— Average speed (rpm.)	$N_{m} = \frac{t_{1} \times N_{1} + t_{2} \times N_{2} + t_{3} \times N_{3}}{t_{1} + t_{2} + t_{3}}$	$N_{m} = \frac{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}{0.5 + 1.5 + 0.5}$ $= 12 (rpm.)$
(6)-2 Calcula	te the average load torque.		
T <sub>m</sub>	— Average load torque (Nm)	$T_{m} = \sqrt[10]{\frac{10}{3}} \underbrace{t_{1} \times N_{1} \times \overline{t_{1}}^{\frac{10}{3}} + t_{2} \times N_{2} \times \overline{t_{2}}^{\frac{10}{3}} + t_{3} \times N_{3} \times \overline{t_{3}}^{\frac{10}{3}}}_{t_{1} \times N_{1} + t_{2} \times N_{2} + t_{3} \times N_{3}}$	$T_{m} = \sqrt[3]{\frac{0.5 \times 7.5 \times 173.5^{\frac{10}{3}} + 1.5 \times 15 \times 6.7^{\frac{10}{3}} + 0.5 \times 7.5 \times 160.1^{\frac{10}{3}}}{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}}$ =110.3 (Nm)

Go to Page 27 if the reduction gear model is verified based on the required life. Go to Page 28 if the service life is verified based on the reduction gear model.

### Step 4. Select a reduction gear

Reduction gear selection method (1) Calculate the required torque based on the load conditions and required life and select a reduction gear.

	Setting item	Calculation formula	Selection examples (With horizontal rotational transfer)
1) Calculat	te the rated torque for the reduction	gear that satisfies the required life.	
L <sub>ex</sub> ——	Required life (year)	Based on the operation conditions	5 years
Q <sub>1cy</sub> ——	Number of cycles per day (times)	$Q_{tcy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$Q_{toy} = \frac{12 \times 60 \times 60}{20}$ = 2,160 (times)
Q <sub>3</sub> ———	Operating hours of reduction gear per day (h)	$Q_3 = \frac{Q_{loy} \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_3 = \frac{2,160 \times (0.5 + 1.5 + 0.5)}{60 \times 60}$ = 1.5(h)
Q <sub>4</sub>	Operating hours of reduction gear per year (h)	$Q_4 = Q_3 \times Q_2$	Q <sub>4</sub> =1.5×365 =548 (h)
L <sub>hour</sub> ——	— Reduction gear service life (h)	$L_{hour} = Q_4 \times L_{ex}$	Lhour = 548 × 5 = 2,740 (h)
T <sub>O</sub> '	Reduction gear rated torque that satisfies the required life (Nm)	$To' = T_m \times \left(\frac{10}{3}\right) \sqrt{\frac{Lhour}{K} \times \frac{N_m}{N_0}}$ K: Reduction gear rated life (h) $N_0: \text{Reduction gear rated output speed (rpm.)}$	$To' = 110.3 \times \frac{\binom{10}{3}}{\binom{2,740}{6,000}} \times \frac{12}{15}$ $= 81.5 \text{ (Nm)}$
(2) Select a	a reduction gear model based on the	e calculated rated torque.	
	election of the reduction gear actual reduction ratio	Tentatively select a reduction gear model that $T_0$ is equal to or greater than $T_0$ . Then check that $T_{S1}$ of the tentatively selected model is equal to or greater than the maximum torque for startup $T_1$ and $N_S$ of the tentatively selected model is equal to or greater than the output speed $N_S$ . If the tentatively selected reduction gear is outside of the specifications, increase the reduction gear model. $T_{S1}$ , $N_S$ : Refer to the rating table on page 8. $N_S$ : The allowable output speed varies depending on the actual reduction ratio. Tentatively select the actual reduction ratio alongside the allowable output	Tentatively select RV-25N ( $T_0$ = 245 Nm) based on the calculated rated torque. Rated torque: 245 (Nm) $\geq$ 81.5 (Nm) Allowable acceleration/deceleration torque: 613 (Nm) $\geq$ 173.5 (Nm) Allowable output speed: 57 (rpm.) (when the actual reduction ratio is 233.45) is equal to or greater than 15 (rpm.), tentatively selecting RV-25N should be no problem.
W <sub>1</sub>		speed.	O(N)
	Distance to the point of radial		
L1	load application (mm)	W	O(mm)
W <sub>2</sub>	— Thrust load (N)	WZ WZ	$W_2 = (180 + 20 \times 4) \times 9.8$ = 2,548 ( N)
L <sub>2</sub>	Distance to the point of thrust load application (mm)	<u>a</u> b	O(mm)
М	Calculation of the moment load (Nm)	$M = \frac{W_1 \times (L_1 + b - a) + W_2 \times L_2}{1,000}$ a,b: Refer to the calculation of the tilt angle on page 32.	As dimension a = 22.1 (mm) and dimension b = 112.4 (mm): $M = \frac{0 \times (0 + 112.4 - 22.1) + 2,548 \times 0}{1,000} = 0 \text{ (Nm)}$
Determinat	iion of the reduction gear model	From the allowable moment diagram on Page 29 • Thrust load • Moment load Select a reduction gear for which the above fall within the allowable moment diagram. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.	For this example, Thrust load $W_2=2,548$ (N) Moment load $M=0$ (N) As the above values are within the RV-25N allowable moment diagram, RV-25N is selected.
Selection o	of the motor flange and bushing.  Motor momentary maximum torque (Nm)	Determine based on the motor specifications.	For example, T <sub>M1</sub> = 25 (Nm)
Тм100т —	Maximum torque generated at the output shaft for the reduc- tion gear (Nm)	$\begin{split} T_{M1out} = T_{M1} \times R \times \eta \\ R : Actual reduction ratio \\ \eta : Startup efficiency(%) \end{split}$ Note: If the maximum torque generated at the output shaft for the reduction gear exceeds the momentary maximum allowable torque, impose a limitation on the motor torque value. Also, ensure that the shock torque, due to an emergency stop, is the same as or lower than the momentary maximum	For example, calculate the maximum torque generated at the output shaft for the reduction gear based on the specifications when RV-25N-164.07 was selected. $ T_{M1out} = T_{M1} \times R \times \eta                               $

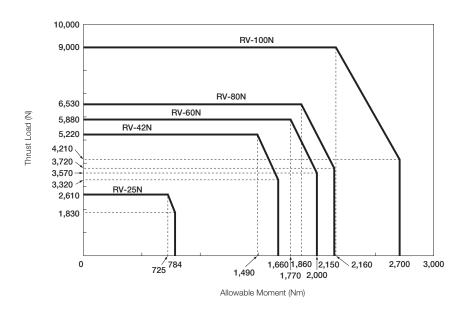
### Reduction gear selection method (2): Tentatively select a reduction gear model and evaluate the service life.

(1) Select a r		Calculation formula	Selection examples (With horizontal rotational transfer)
	eduction gear model based on the	e maximum torque for startup $T_1$ , output speed $N_2$ , thru	ist load, and moment load.
	selection of the reduction gear actual reduction ratio	If $T_{S1}$ of the tentatively selected model is equal to or greater than the maximum torque for startup $T_1$ and the tentatively selected model is outside of the reduction gear specifications, upgrade the reduction gear model. $T_{S1}$ , Ns: Refer to the rating table on page 8. NS: The allowable output speed varies depending on the actual reduction ratio. Tentatively select the actual reduction ratio alongside the allowable output speed.	From the rating table on page 8: Allowable acceleration/deceleration torque: 613 (Nm) ≥ 173.5 (Nm) Allowable output speed: 57 (rpm.) is equal to or greater than 15 (rpm.), tentatively select RV-25N.
W <sub>1</sub>	R adial load (N)		O(N)
L <sub>1</sub> —	Distance to the point of radial load application (mm)		O(mm)
W <sub>2</sub>	— Thrust load (N)	WI WIZ	$W_2 = (180 + 20 \times 4) \times 9.8$ = 2,548 (N)
L <sub>2</sub>	Distance to the point of thrust load application (mm)	1 L1	O(mm)
М ———	— Calculation of the moment load (Nm)	$M = \frac{W_1 \times (L_1 + b - a) + W_2 \times L_2}{1,000}$ a,b: Refer to the calculation of the tilt angle on page 32.	RV-25N As dimension a = 22.1 (mm) and dimension b = 112.4 (mm): $M = \frac{0 \times (0 + 112.4 - 22.1) + 2,548 \times 0}{1,000} = 0 \text{ (Nm)}$
Determinat	ion of the reduction gear model	From the allowable moment diagram on Page 29 • Thrust load • Moment load Select a reduction gear for which the above fall within the allowable moment diagram. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.	For this example, $Thrust\ load\ W_2=2,548\ (N)$ $Moment\ load\ M=0\ (N)$ As the above values are within the RV-25N allowable moment diagram, RV-25N is selected.
2) Calculate	the reduction gear service life and	compare to the required life.	
L <sub>h</sub>		$L_{h} = 6,000 \times \frac{N_{0}}{N_{m}} \times \left(\frac{T_{0}}{T_{m}}\right)^{\frac{10}{3}}$	$L_{h} = 6,000 \times \frac{15}{12} \times \left(\frac{245}{110.3}\right)^{\frac{10}{3}}$
		. ,	= 107,242
Q <sub>1cy</sub> ———	Number of cycles per day (times)	$Q_{tcy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$= 107,242$ $Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$
	Number of cycles per day (times)      Operating hours per day (h)	$Q_{1cy} = \frac{Q_1 \times 60 \times 60}{t_4}$ $Q_3 = \frac{Q_1 \times (t_1 + t_2 + t_3)}{60 \times 60}$	
Q <sub>3</sub>		-4	$Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$
Q <sub>3</sub>	Operating hours per day (h)	$Q_3 = \frac{Q_1 \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$ $Q_3 = \frac{2,160 \times (0.5+1.5+0.5)}{60 \times 60} = 1.5 \text{ (h)}$
Q <sub>3</sub>	Operating hours per day (h)      Operating hours per year (h)	$Q_{3} = \frac{Q_{1} \times (t_{1} + t_{2} + t_{3})}{60 \times 60}$ $Q_{4} = Q_{3} \times Q_{2}$	$Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$ $Q_3 = \frac{2,160 \times (0.5+1.5+0.5)}{60 \times 60} = 1.5 \text{ (h)}$ $Q_4 = 1.5 \times 365 = 548 \text{(h)}$
Q <sub>3</sub> ————————————————————————————————————	Operating hours per day (h)      Operating hours per year (h)      Reduction gear service life (year)	$Q_3 = \frac{Q_1 \times (t_1 + t_2 + t_3)}{60 \times 60}$ $Q_4 = Q_3 \times Q_2$ $L_{year} = \frac{L_h}{Q_4}$ Based on the required specifications. If the required life is longer than the service life, upgrade the	$Q_{1\text{cy}} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$ $Q_3 = \frac{2,160 \times (0.5 + 1.5 + 0.5)}{60 \times 60} = 1.5 \text{ (h)}$ $Q_4 = 1.5 \times 365 = 548 \text{(h)}$ $L_{year} = \frac{107,242}{548} = 195.7 \text{ (year)}$ As Lex 5 (year) is equal to or less than 195.7 (year), the re-
Q <sub>3</sub> ————————————————————————————————————	— Operating hours per day (h)  — Operating hours per year (h)  — Reduction gear service life (year)  — Required life (year)	$Q_3 = \frac{Q_1 \times (t_1 + t_2 + t_3)}{60 \times 60}$ $Q_4 = Q_3 \times Q_2$ $L_{year} = \frac{L_h}{Q_4}$ Based on the required specifications. If the required life is longer than the service life, upgrade the	$Q_{1\text{cy}} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$ $Q_3 = \frac{2,160 \times (0.5 + 1.5 + 0.5)}{60 \times 60} = 1.5 \text{ (h)}$ $Q_4 = 1.5 \times 365 = 548 \text{ (h)}$ $L_{year} = \frac{107,242}{548} = 195.7 \text{ (year)}$ As Lex 5 (year) is equal to or less than 195.7 (year), the re-

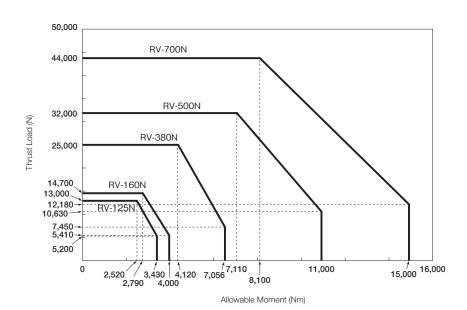
### **Product selection**

# Allowable moment diagram

### RV-25N, 42N, 60N, 80N, 100N



### RV-125N, 160N, 380N, 500N, 700N



### **Technical data**

# No-load running torque

Use the following formula to calculate the no-load running torque converted to the motor shaft.

No-load running torque converted to the motor shaft (Nm) =

Torque converted into the output shaft (Nm)

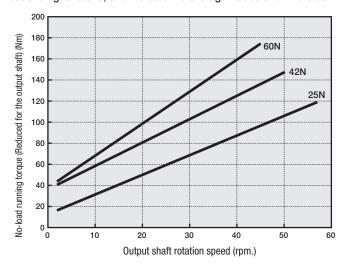
- (R: speed ratio value)

R

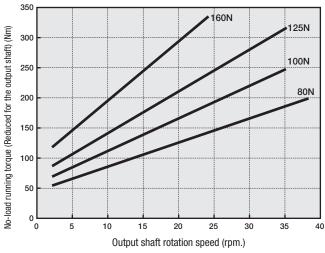
[Measurement conditions] Lubricant: Grease (VIGOGREASE RE0)

Note: The values in the following graphs are for the reduction gear alone, and indicate the average values after the break-in period.

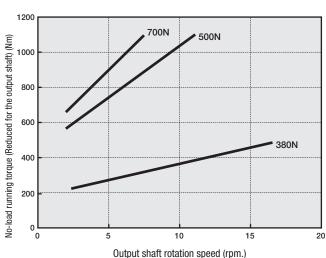
RV-25N, 42N, 60N



RV-80N, 100N, 125N, 160N



RV-380N, 500N, 700N



### **Technical data**

# Low temperature characteristic

When the RV-N reduction gear is used at a low temperature, viscosity of lubricant increases and causes a larger no-load running torque. The no-load running torque at low temperature is shown below.

[Measurement conditions]

Use the following formula to calculate the no-load running torque converted to the motor shaft.

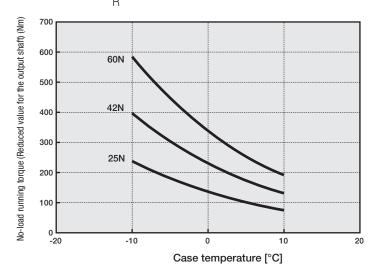
[Measurement conditions] Input speed: 2,000 rpm. Lubricant: Grease (VIGOGREASE RE0)

No-load running torque converted to the motor shaft (Nm) =

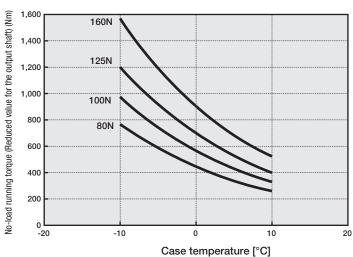
Torque converted into the output shaft (Nm)

(R: speed ratio value)

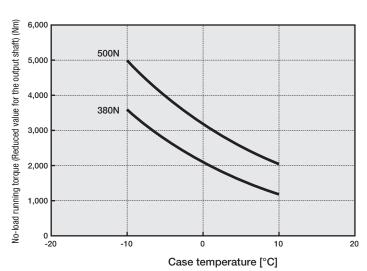
RV-25N, 42N, 60N



RV-80N, 100N, 125N, 160N



RV-380N, 500N, 700N



Note: Contact us regarding use of the RV-700N at a low-temperature environment.

### **Technical data**

# Calculation of tilt angle and torsion angle

### Calculation of tilt angle

When a load moment occurs with an external load applied, the output shaft will tilt in proportion to the load moment (If  $\ell_3$  is larger than b, and  $\ell_2$  is larger than c/2) The moment rigidity indicates the rigidity of the main bearing, and it is represented by the load moment value required for tilting the main

bearing by 1 arc.min.

 $\theta = \frac{W_1 \, \varrho_1 + W_2 \, \varrho_2}{M_1 \times 10^3} \, \frac{W_1}{\varrho_1, \, \varrho_2 : \text{Distance}}$ 

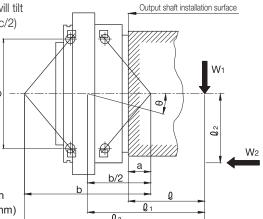
: Tilt angle of the output shaft (arc.min.)

: Moment rigidity (Nm/arc.min.)

 $Q_1, Q_2$ : Distance to the point of load application

 $\varrho_1$  :  $\varrho + \frac{b}{2} - a$ 

: Distance from the output shaft installation surface to the point of load application (mm)



Moment rigidity		Dimensions (mm)		
Model	(central value) Nm/arc.min.	а	b	С
RV-25N	530	22.1	112.4	91
RV-42N	840	29	131.1	111
RV-60N	1,140	35	147.0	130
RV-80N	1,190	33.8	151.8	133
RV-100N	1,400	38.1	168.2	148

	Moment rigidity	Dimensions (mm)		
Model	(central value) Nm/arc.min.	а	b	С
RV-125N	1,600	41.6	173.2	154
RV-160N	2,050	35.0	194.0	168
RV-380N	5,200	48.7	248.9	210
RV-500N	6,850	56.3	271.7	232
RV-700N	9,000	66.3	323.5	283

### Calculation of torsion angle

Calculate the torsion angle when the torque is applied in a single direction, using an example of RV-160N.

- 1) When the load torque is 30 Nm·····Torsion angle (ST<sub>1</sub>)
  - When the load torque is 3% or less of the rated torque

$$ST_1 = \frac{30}{48.0} \times \frac{1 \text{ (arc.min.)}}{2} = 0.31 \text{(arc.min.)} \text{ or less}$$

- 2) When the load torque is 1,300 Nm·····Torsion angle (ST<sub>2</sub>)
  - When the load torque is more than 3% of the rated torque

$$ST_2 = \frac{1}{2} + \frac{1,300 - 48.0}{490} = 1.28(arc.min.)$$

Note: 1. The torsion angles that are calculated above are for a single reduction gear.

	Torsional rigidity	Lost motion		Backlash
Model	(central value) Nm/arc.min.	Lost motion arc.min.	Measured torque Nm	arc.min.
RV-25N	61		±7.35	
RV-42N	113		±12.4	
RV-60N	200	1.0	±18.0	1.0
RV-80N	212		±23.5	
RV-100N	312		±30.0	

	Torsional rigidity	Lost r	notion	Backlash
Model	(central value) Nm/arc.min.	Lost motion arc.min.	Measured torque Nm	arc.min.
RV-125N	334		±36.8	
RV-160N	490		±48.0	
RV-380N	948	1.0	±112	1.0
RV-500N	1,620		±147	
RV-700N	2,600		±210	

### **Design points**

# Reduction gear installation components

### Installation of the reduction gear and mounting it to the output shaft

When installing the reduction gear and mounting it to the output shaft, use hexagonal socket head cap screws and tighten to the torque, as specified below, in order to satisfy the momentary maximum allowable torque, which is noted in the rating table.

The use of the Belleville spring washers are recommended to prevent the bolt from loosening and protect the bolt seat surface from flaws.

### <Bolt tightening torque and tightening force>

Hexagon socket head cap screw nominal size x pitch	Tightening torque	Tightening force F	Bolt specification
(mm)	(Nm)	(N)	
M5 × 0.8	9.01 ± 0.49	9,310	Hexagon socket head cap screw
M6 × 1.0	15.6 ± 0.78	13,180	JIS B 1176 or equivalent (ISO 4762)
M8 × 1.25	37.2 ± 1.86	23,960	Strength class
M10 × 1.5	73.5 ± 3.43	38,080	JIS B 1051 12.9 or equivalent (ISO 898-1)
M12 × 1.75	129 ± 6.37	55,360	Thread
M16 × 2.0	319 ± 15.9	103,410	JIS B 0205 6 g or class 2 or Equivalent

Note: 1. The tightening torque values listed are for steel or cast iron material.

2. If softer material, such as aluminum or stainless, is used, limit the tightening torque. Also take the transmission torque and load moment into due consideration.

### <Calculation of allowable transmission torque of bolts>

	Т	Allowable transmission torque by tightening bolt (Nm)
	F	Bolt tightening force (N)
D	D	Bolt mounting P.C.D (mm)
$T = F \times \mu \times \frac{D}{2 \times 1,000} \times n$	μ	Friction factor
2×1,000		μ=0.15: When grease remains on the mating face.
		μ=0.20: When grease is removed from the mating face.
	n	Number of bolts (pcs.)

### <Serrated lock washer external teeth for hexagonal socket head cap screw>

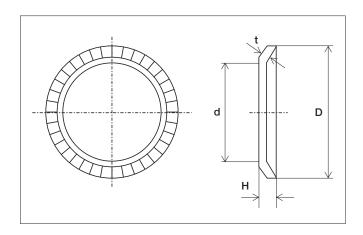
Name: Belleville spring washer (made by Heiwa Hatsujyo Industry Co., Ltd.)

Corporation symbol: CDW-2H-Nominal size

CDW-2L-5 (Only for M5)

Material: S50C to S70C Hardness: HRC 40 to 48

Nominal	opinig tracitor			
size			t	Н
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



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

(Unit: mm)

### Design of the motor mounting flange

In order to avoid contact with reduction gear components, refer to the sizes indicated in the "Outer dimensions" drawings when designing the motor mounting flange.

Note: The size and number of bolts for the motor mounting flange should be determined with the torque and moment taken into consideration, and should be positioned in line with the reduction gear's case mounting holes. After installing the reduction gear, we recommend installing an add/drain grease fitting to enable grease replacement. An installation example is shown below.

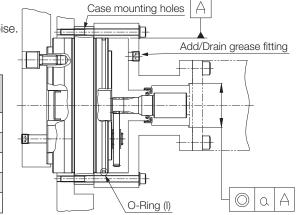
Use the specified tightening torque to uniformly tighten the hexagonal socket head cap screws (with corresponding conical spring washers).

Design the motor mounting flange to the following accuracy. If the installation accuracy is poor, it will result in vibration and noise.

### < Installation accuracy>

Model	Concentricity tolerance a mm
RV-25N	MAX φ 0.03
RV-42N	MAX φ 0.03
RV-60N	MAX φ 0.03
RV-80N	MAX φ 0.03
RV-100N	MAX φ 0.03

Concentricity tolerance a mm
MAX φ 0.03
MAX φ 0.03
MAX φ 0.05
MAX φ 0.05
MAX φ 0.05



Suited O-rings for O-Ring (I) in the diagram above are indicated in the following tables. Refer to these tables when designing seals for the installation components.

### <0-Ring (I)>

Model	O-ring number
RV-25N	S110
RV-42N	AS568-159
RV-60N	AS568-258
RV-80N	AS568-258
RV-100N	AS568-166

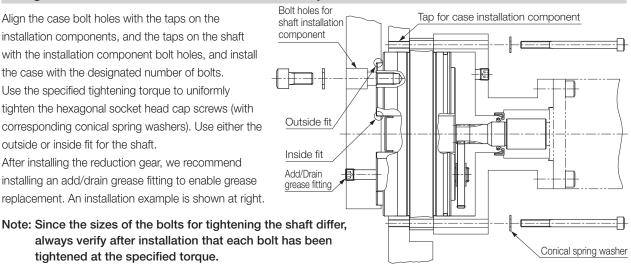
Model	O-ring number
RV-125N	AS568-167
RV-160N	AS568-170
RV-380N	AS568-272
RV-500N	AS568-275
RV-700N	G340-1A

### Design of the case and shaft installation components

Align the case bolt holes with the taps on the installation components, and the taps on the shaft with the installation component bolt holes, and install the case with the designated number of bolts. Use the specified tightening torque to uniformly tighten the hexagonal socket head cap screws (with corresponding conical spring washers). Use either the outside or inside fit for the shaft.

After installing the reduction gear, we recommend installing an add/drain grease fitting to enable grease replacement. An installation example is shown at right.

tightened at the specified torque.



Suited O-rings for O-Ring (I) in the diagram above are indicated in the following tables. Refer to these tables when designing seals for the installation components.

# Seal with Diestat or other comparable product. Shaft installation component grease fitting Shaft installation component grease fitting

Note: The output shaft on these models does not have an O-ring groove.

Prepare a groove for an O-ring in the shaft installation component.

Use Daistat or other comparable product to seal the tightening side of the shaft installation component bolt.

Note: Use an O-ring groove on the reduction gear output surface for these models.

### <O-Ring (II)>

NA - dal	Dooring	O-rir	ng groove din	nensions
Model	Bearing number	O.D. (D)	Depth (H)	Width (G)
RV-25N	G85	φ90±0.1	2.4±0.05	4.1 +0.25/0
RV-42N	G110	φ115±0.1	2.4±0.05	4.1 +0.25/0
RV-60N	G130	φ 135±0.1	2.4±0.05	4.1 +0.25/0
RV-80N	G130	φ 135±0.1	2.4±0.05	4.1 +0.25/0
RV-100N	G145	φ 150±0.1	2.4±0.05	4.1 +0.25/0

NAI - I	Dooring	O-rin	ng groove dim	nensions							
Model	Bearing number	O.D. (D)	Depth (H)	Width (G)							
RV-125N	G145	φ 150±0.1	2.4±0.05	4.1 +0.25/0							
RV-160N	G130	Use the reduction gear O-ring groove.									
RV-380N	G145	Use the redu	iction gear O	-ring groove.							
RV-500N	G185	Use the reduction gear O-ring groove.									
RV-700N	G200	Use the reduction gear O-ring groove.									

When an O-ring cannot be used for structural reasons, use one of the liquid gaskets or other sealant indicated in the following table.

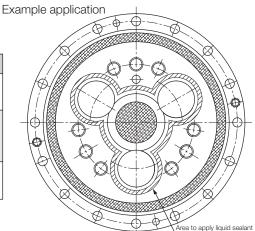
Refer to the diagram at right and apply the sealant so that it does not get inside the reduction gear and does not leak out of the shaft installation bolt hole.

### <Recommended liquid sealant>

Name (Manufacturer)	Characteristics and applications
ThreeBond 1211 (ThreeBond Co.)	<ul><li>Silicone-based, solventless type</li><li>Semi-dry gasket</li></ul>
HermeSeal SS-60F (Nihon Hermetics Co.)	<ul> <li>One-part, non-solvent elastic sealant</li> <li>Metal contact side (flange surface) seal</li> <li>Any product basically equivalent to ThreeBond 1211</li> </ul>
Loctite 515 (Henkel)	Anaerobic flange sealant     Metal contact side (flange surface) seal

Note: 1. Do not use for copper or a copper alloy.

2. Contact us regarding use under special conditions (concentrated alkali, high-pressure steam, etc.).



# Input gears

### Installation of the input gear

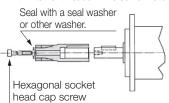
The following shows examples of the shape of the servo motor shaft and installation of the input gear.

Refer to the following diagram when designing the input gear. (The setscrew, drawbolt, and hex nut must be supplied by your company.)

Note: Locate the setscrew to the motor side of the oil seal contact.

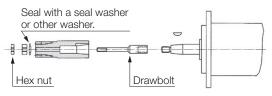
### <For straight shafts>

Without internal threads in the servo motor With internal threads in the servo motor



### <For tapered shafts>

With male screw on the servo motor



### Design of the input gear

Use a standard input gear and drill holes to anchor the motor shaft and prepare the oil seal surface.

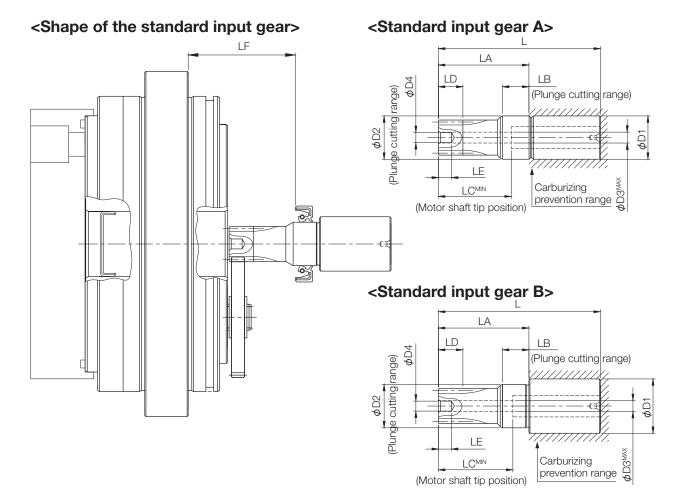
The oil seal surface should be the value indicated by D2 in the "Dimensions" table, and the LB section should be finished by plunge grinding.

Standard input gears come equipped with center holes on both-sides.

Polish the outside diameter of area D1 to achieve the reference level and then perform processing of the inside diameter of the anchor holes for the motor shaft.

Parts not indicated in the "Dimensions" table should have a minimum thickness of 3 mm.

Note: When incorporating an input gear, be careful not to obstruct the spur gear and thus damage the gear. Damage to the gear will result in abnormal noise.



<model: rv-25n=""></model:>
(unit:mm)

1			D	12							ard input					ard input		
)	Ratio	LF	Before	After	D3	D4	LE	LD+2.0	Motor	shaft dia	meter: le	ss than 2	28 mm	Motor	shaft dia	ameter: 2	28 mm or	more
	code		plunge cutting	plunge cutting				0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
Γ	41				17.6	11	8	13	126.1	57.1		51.4		139.6	57.1		60.1	
Γ	81				10.8	9	7	12	129	60		54.3		142.5	60	1	63	
	107.66	05.7	40.4	401.0	9.6	9	7	12	129	60	١	54.3		142.5	60	١	63	
	126	65.7	40.4	40h8	8.0	7	7	12	129	60	14	54.3	41	142.5	60	14	63	54
	137				7.2	7	7	12	129	60		54.3		142.5	60	1	63	
	164.07				5.6	5.5	6	13	129	60		54.3		142.5	60		63	

# <Model: RV-42N> (unit:mm)

		D	)2						Standa	ard input	gear A				rd input		
Ratio	LF	Before	After	D3	D4	LE	LD+2.0	Motor	shaft dia	ımeter: le	ss than 3	32 mm	Moto	r shaft dia	ameter: 3	32 mm or	more
code		plunge	plunge	20	D4		0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
41				26.8	11	8	15	135.6	61.6		57.7		146.6	64.1		58.7	
81				15.6	11	8	12.5	138.5	64.5	]	60.6		149.5	67		61.6	
105	67.2	50.4	501.0	11.8	11	8	12.5	138.5	64.5	1	60.6		149.5	67	4.0	61.6	
126	67.2	50.4	50h8	10.5	9	7	12.5	138.5	64.5	15.5	60.6	50.4	149.5	67	18	61.6	57
141				8.1	7	7	12.5	138.5	64.5	1	60.6	1	149.5	67		61.6	
164.07				7.5	7	7	12.5	138.5	64.5	1	60.6	]	149.5	67		61.6	

### <Model: RV-60N>

(unit:mm)

			D	)2						Standa	ard input	gear A			Standa	ard input	gear B	
	Ratio	LE	Before	After	D3	D4	LE	LD <sup>+2.0</sup>	Motor	shaft dia	ımeter: le	ss than 3	32 mm	Moto	r shaft di	ameter: 3	32 mm or	more
	code		plunge	plunge	30	5,		0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
	41				30.0	11	8	14	136.1	62.1		58.2		147.1	64.6		59.2	
	81				17.2	11	8	13.5	139	65		61.1	]	150	67.5		62.1	
	102.17		50.4	501.0	13.7	11	8	13.5	139	65	455	61.1		150	67.5		62.1	
Γ	121	68.3	50.4	50h8	11.8	11	8	13.5	139	65	15.5	61.1	50.4	150	67.5	18	62.1	57
Γ	145.61				8.7	7	7	13.5	139	65	]	61.1	]	150	67.5	]	62.1	
	161				8.1	7	7	13.5	139	65		61.1		150	67.5		62.1	

### <Model: RV-80N>

(unit:mm)

			)2						Standa	ard input	gear A			Standa	rd input	gear B	
Ratio	LF	Before	After	D3	D4	LE	LD+2.0	Motor	shaft dia	ımeter: le	ss than 3	88 mm	Moto	r shaft dia	ameter: 3	88 mm or	more
code		plunge	plunge				0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
41				30.7	11	8	17.5	146	65.5		61.6		185	68		64.0	
81	]			17.6	11	8	16	148.9	68.4	1	64.5		187.9	70.9		66.9	1
101	700	4	551.0	15.6	11	8	14.5	148.9	68.4	1	64.5		187.9	70.9	18	66.9	
129	73.9	55.4	55h8	11.8	11	8	14.5	148.9	68.4	15.5	64.5	55.4	187.9	70.9	18	66.9	60
141				10.6	9	7	14.5	148.9	68.4		64.5		187.9	70.9		66.9	
171				8.1	7	7	14.5	148.9	68.4		64.5		187.9	70.9		66.9	

# <Model: RV-100N> (unit:mm)

		D	12						Standa	ard input	gear A	
Ratio	LE	Before	After	D3	D4	LE	LD <sup>+2.0</sup>	Moto	r shaft di	iameter:	42 mm o	r less
code		plunge	plunge	50	٥,		0	L	LA	LB	LC	D1
41				36.7	11	8	19	182.2	67.2		65.7	
81				20.2	11	8	15	185.1	70.1	]	68.6	
102.17	70.0	60.4	001.0	17.2	11	8	15	185.1	70.1		68.6	
121	73.9	60.4	60h8	13.2	11	8	15	185.1	70.1	15.5	68.6	60.4
141				13.1	11	8	15	185.1	70.1	1	68.6	
161				9.7	9	7	15	185.1	70.1	]	68.6	

# <Model: RV-125N> (unit:mm)

С			D	12						Standa	ard input	gear A		
)	Ratio	LF	Before	After	D3	D4	LE	LD+2.0	Moto	r shaft d	ameter:	42 mm o	r less	
	code		plunge	plunge	50			0	L	LA	LB	LC	D1	
	41				36.7	11	8	19	182.2	67.2		65.7		
	81				21.7	11	8	15	185.1	70.1		68.6	m or less  D D1  7  6  6  6  6  6  6  6  6  6  6  6  6	ı
	102.17	76.8	60.4	60h8	17.2	11	8	15	185.1	70.1	15.5	68.6	00.4	ı
	121	76.6	60.4	60116	14.2	11	8	15	185.1	70.1	15.5	68.6	6 60.4	ı
	145.61				11.2	11	8	15	185.1	70.1		68.6	į	ı
	161				9.7	9	7	15	185.1	70.1		68.6	1	ı

# <Model: RV-160N> (unit:mm)

			D	12						Standa	ard input	gear A	
)	Ratio	LF	Before	After	D3	D4	LE	LD <sup>+2.0</sup>	Moto	r shaft di	ameter:	48 mm o	r less
	code		plunge cutting	plunge cutting				0	L	LA	LB	LC	D1
	41				37.0	11	8	17	187.1	72.1		72.6	
	81				23.9	11	8	16.5	190	75		75.5	
	102.81		05.4	051.0	20.6	11	8	16.5	190	75	45.5	75.5	05.4
	125.21	83.4	65.4	65h8	16.8	11	8	16.5	190	75	15.5	75.5	65.4
	156				13.1	11	8	16.5	190	75		75.5	
	201				9.3	9	7	16.5	190	75		75.5	

# <Model: RV-380N> (unit:mm)

ſ			D	)2						Standa	ard input	gear A			Standa	rd input	gear B	
)	Ratio	LF	Before	After	D3	D4	LE	LD+2.0	Motor	shaft dia	meter: le	ss than 5	55 mm	Motor	shaft dia	ameter: 5	55 mm or	more
	code		plunge	plunge	20			0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
ſ	75				33.0	11	8	21	190.1	75.1		75.6		196.6	77.6		80.6	
ſ	93				27.0	11	8	21	190.1	75.1		75.6		196.6	77.6		80.6	1
ſ	117	00.7	05.4	051.0	25.5	11	8	23.5	193	78	45.5	78.5	05.4	199.5	80.5	1	83.5	7.0
	139	96.7	65.4	65h8	21.5	11	8	23.5	193	78	15.5	78.5	65.4	199.5	80.5	18	83.5	72
1	162				18.0	11	8	23.5	193	78		78.5		199.5	80.5		83.5	1
Ī	185				16.0	11	8	23.5	193	78		78.5		199.5	80.5		83.5	1

### <Model: RV-500N> (unit:mm)

		D2							Standa	ard input	gear A			Standa	ard input	gear B	
Ratio	1 F	F Before	After	D3	D4	D4 LE	LD+2.0	Motor shaft diameter: less than 55 mm					Moto	r shaft di	ameter: 5	55 mm or	more
code		plunge	plunge	20	D4	LL	0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
81				39.0	11	8	22.5	189.6	74.6		74.1		222.1	77.1		80.1	
105				32.3	11	8	23	192.5	77.5	]	77		225	80		83	
123		05.4	65h8	30.7	11	8	22	192.5	77.5	105	77	05.4	225	80	19	83	78
144	92.8	65.4	6508	28.1	11	8	22	192.5	77.5	16.5	77	65.4	225	80	19	83	/8
159				25.6	11	8	23	192.5	77.5	1	77		225	80	1	83	1
192.75				18.3	11	8	22	192.5	77.5	1	77		225	80	1	83	1

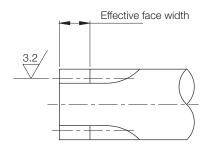
# <Model: RV-700N> (unit:mm)

.			D2						Standard input gear A				Standard input gear B					
)	Ratio	LF	Before	After	D3	D4	LE	LD <sup>+2.0</sup>	p+2.0 Motor shaft diameter: less than 55 mm				Moto	r shaft di	ameter: 5	55 mm or	more	
,	code		plunge	plunge	Do	D4		0	L	LA	LB	LC	D1	L	LA	LB	LC	D1
	105				42.0	11	8	22	192.5	77.5		78		225	80		83	
	118				38.3	11	8	22	192.5	77.5		78		225	80		83	
	142.44	100 7	05.4	051.0	33.2	11	8	22	192.5	77.5	45.5	78		225	80		83	1
	159	102.7	65.4	65h8	31.7	11	8	22	192.5	77.5	15.5	78	65.4	225	80	18	83	78
	183				23.6	11	8	22	192.5	77.5		78		225	80	1	83	
	203.52				22.7	11	8	22	192.5	77.5		78		225	80	1	83	

Refer to the specifications and materials shown in the following tables when designing with a processed or non-standard input gear.

Common specifications								
Tooth profile	Full depth							
Pressure angle (°)	20							
Precision	JIS B 1702:1976, grade 5							

Spur gear tooth surface	hardness and material						
Heat treatment Carburizing, quenching and temperin							
Surface hardness	HRC 58 to 62						
Effective case depth	0.3 to 0.7*1						
Material	SCM415 Normalizing						
Alternate material	SCM420 Normalizing						



<sup>\*1.</sup> The values for some RV-25N and RV-42N units will differ depending on the module.

Model	RV-	25N	RV-42N		
Module	0.8	1.25	1.0	1.25	
Effective case depth <hv 513="">(mm)</hv>	0.2 to 0.6	0.3 to 0.7	0.2 to 0.6	0.3 to 0.7	

### <Specifications by model>

Model		RV-25N					
Ratio code	41	81	107.66	126	137	164.07	
Module	1.25	1.25	0.8	0.8	0.8	0.8	
No. of teeth	21	14	18	16	15	13	
Shift coefficient	-0.193	+0.6	+0.25	+0.25	+0.25	+0.25	
Base tangent length(mm)	-0.017 5.738-0.042	-0.017 9.984 -0.042	-0.017 <b>6.243</b> -0.042	-0.017 <b>6.220</b> -0.042	-0.017 <b>6.210</b> -0.042	-0.017 3.825 -0.042	
No. of teeth	(2)	(3)	(3)	(3)	(3)	(2)	
Min. effective face width (mm)	13	12	12	12	12	13	

Model		RV-42N							
Ratio code	41	81	105	126	141	164.07			
Module	1.25	1.25	1.25	1.0	1.25	1.0			
No. of teeth	27	18	15	16	12	13			
Shift coefficient	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5			
Base tangent length(mm)	-0.017 13.816-0.042	-0.017 <b>9.968</b> -0.042	9.916-0.042	-0.017 <b>7.946</b> -0.042	-0.017 <b>9.863</b> -0.042	-0.017 7.904 -0.042			
No. of teeth	(4)	(3)	(3)	(3)	(3)	(3)			
Min. effective face width (mm)	15	12.5	12.5	12.5	12.5	12.5			

Model		RV-60N							
Ratio code	41	81	102.17	121	145.61	161			
Module	1.25	1.5	1.25	1.25	1.25	1.25			
No. of teeth	30	17	17	15	13	12			
Shift coefficient	+0.25	+0.5	+0.25	+0.5	+0.25	+0.5			
Base tangent length(mm)	-0.023 13.655-0.061	-0.023 11.941-0.061	-0.023 9.737 -0.061	-0.023 9.916-0.061	-0.023 5.977 -0.061	-0.023 9.863 -0.061			
No. of teeth	(4)	(3)	(3)	(3)	(2)	(3)			
Min. effective face width (mm)	14	13.5	13.5	13.5	13.5	13.5			

Model		RV-80N								
Ratio code	41	81	101	129	141	171				
Module	1.5	1.25	1.25	1.25	1.25	1.25				
No. of teeth	27	21	18	15	14	12				
Shift coefficient	0	-0.193	+0.5	+0.5	+0.5	+0.5				
Base tangent length(mm)	-0.023 16.065 -0.061	-0.023 5.738-0.061	-0.023 <b>9.968</b> -0.061	-0.023 9.916-0.061	-0.023 9.898-0.061	-0.023 9.863 -0.061				
No. of teeth	(4)	(2)	(3)	(3)	(3)	(3)				
Min. effective face width (mm)	17.5	16	14.5	14.5	14.5	14.5				

Model						
Ratio code	41	81	102.17	121	141	161
Module	1.5	1.5	1.5	1.5	1.25	1.5
No. of teeth	30	20	17	15	16	12
Shift coefficient	+0.5	0	+0.5	+0.15	+0.5	+0.5
Base tangent length(mm)	-0.023 21.070-0.061	-0.023 11.491-0.061	-0.023 11.941-0.061	-0.023 <b>7.111</b> -0.061	-0.023 9.933 -0.061	-0.023 11.836-0.061
No. of teeth	(5)	(3)	(3)	(2)	(3)	(3)
Min. effective face width (mm)	19	15	15	15	15	15

Model		RV-125N								
Ratio code	41	81	102.17	121	145.61	161				
Module	1.5	1.5	1.5	1.5	1.5	1.5				
No. of teeth	30	20	17	15	13	12				
Shift coefficient	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5				
Base tangent length(mm)	-0.023 21.070-0.061	-0.023 12.004 -0.061	-0.023 11.941-0.061	-0.023 11.900-0.061	-0.023 11.857 -0.061	-0.023 11.836 -0.061				
No. of teeth	(5)	(3)	(3)	(3)	(3)	(3)				
Min. effective face width (mm)	19	15	15	15	15	15				

Model		RV-160N							
Ratio code	41	81	102.81	125.21	156	201			
Module	2.0	1.5	1.25	1.25	1.25	1.25			
No. of teeth	24	22	22	19	16	13			
Shift coefficient	+0.5	+0.228	+0.5	+0.5	+0.5	+0.5			
Base tangent length(mm)	-0.035 22.021-0.085	-0.035 11.766 -0.085	-0.035 13.728-0.085	-0.035 <b>9.986</b> -0.085	-0.035 9.933 -0.085	-0.035 9.881-0.085			
No. of teeth	(4)	(3)	(4)	(3)	(3)	(3)			
Min. effective face width (mm)	17	16.5	16.5	16.5	16.5	16.5			

Model		RV-380N					
Ratio code	75	93	117	139	162	185	
Module	2.0	2.0	1.5	1.25	1.5	1.0	
No. of teeth	23	20	23	24	18	24	
Shift coefficient	0	0	+0.25	+0.25	+0.25	+0.25	
Base tangent length(mm)	-0.035 15.405-0.085	-0.035 15.321-0.085	-0.035 11.810-0.085	-0.035 13.550-0.085	-0.035 11.705-0.085	-0.035 10.840-0.085	
No. of teeth	(3)	(3)	(3)	(4)	(3)	(4)	
Min. effective face width (mm)	21	21	23.5	23.5	23.5	23.5	

Model	RV-500N					
Ratio code	81	105	123	144	159	192.75
Module	2.0	1.75	1.5	1.25	1.25	1.75
No. of teeth	26	25	26	28	26	16
Shift coefficient	0	0	+0.5	+0.5	+0.5	+0.5
Base tangent length(mm)	-0.035 15.489-0.085	-0.035 13.528 -0.085	-0.035 16.558-0.085	-0.035 13.833-0.085	-0.035 13.798-0.085	-0.035 13.906-0.085
No. of teeth	(3)	(3)	(4)	(4)	(4)	(3)
Min. effective face width (mm)	22.5	23	22	22	23	22

Model		RV-700N					
Ratio code	105	118	142.44	159	183	203.52	
Module	2.0	2.0	1.75	1.5	2.0	1.75	
No. of teeth	27	24	25	26	18	19	
Shift coefficient	+0.25	+0.847	+0.25	+0.824	+0.15	+0.25	
Base tangent length(mm)	-0.035 21.763 -0.085	-0.035 22.496 -0.085	-0.035 18.994 -0.085	-0.035 21.318-0.085	-0.035 15.470-0.085	-0.035 13.681-0.085	
No. of teeth	(4)	(4)	(4)	(5)	(3)	(3)	
Min. effective face width (mm)	22	22	22	22	22	22	

# **Lubricant VIGOGREASE®**

### Lubricant

The standard lubricant for RV reduction gears is grease.

In order to take advantage of the performance of RV reduction gears, we recommend using Nabtesco VIGOGREASE RE0 grease.

VIGOGREASE was specifically developed for use with Nabtesco products and does not take into account the use with products from other companies.

It is therefore recommended that you refrain from using VIGOGREASE with products from any other company. Should for any reason it be necessary to use VIGOGREASE with another company's product, Nabtesco assumes no responsibility whatsoever for any breakdown, malfunction, or other trouble such as with the corresponding reduction gear, the equipment or system it is used in.

In such cases, it should also be understood that Nabtesco cannot comply with any request to inspect the quality of the corresponding grease, etc.

### <Approved lubricant brand>

Grease		
Nabtesco	VIGOGREASE RE0	

Note: Do not mix with other lubricants.

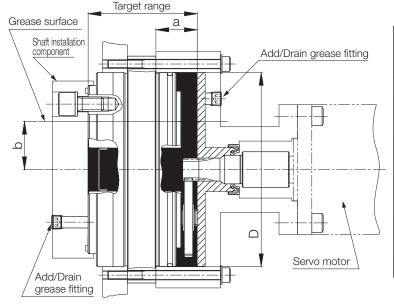
### Amount of grease to use in reduction gears

RV reduction gears are not filled with grease when shipped. Be sure to design your equipment so that a grease gun or other tool can be used to fill it with the necessary quantity of our authorized lubricant. (When using a grease gun, be sure to set it to 0.03 MPa or less.)

The amount of grease the reduction gear requires will differ according to the orientation in which the gear is installed. The amount of grease required and the target range (the areas in the diagram) are indicated below for each direction of installation.

Note: The spaces (indicated by the //// and example are not included in that target range but should also be filled. However, since there is the possibility of high internal pressure and that an oil seal may fail or grease may leak if overfilled, be sure to leave about 10% of that area and the area inside the reduction gear empty. (Reference: Allowable internal pressure 0.03 MPa (during normal operation), Specific gravity: 0.9 g/cc)

### <Horizontal shaft installation>



Model	Internal capacity of reduction gear Required amount		Dimensions (mm)			
	(cc)	(cc)	(g)	а	D	b
RV-25N	223	185	(167)	32.2	113	27
RV-42N	377	313	(282)	32.5	136	34
RV-60N	459	381	(343)	32.3	160	39
RV-80N	607	504	(454)	37.6	160	40
RV-100N	849	705	(635)	36.9	179	45
RV-125N	887	736	(662)	40.7	186	46
RV-160N	1036	860	(774)	40.1	202	50
RV-380N	2174	1805	(1625)	54.2	252	60
RV-500N	2704	2245	(2021)	53.4	284	67
RV-700N	3993	3299	(2969)	62.2	350	81

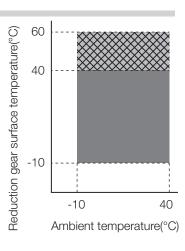
### <Vertical shaft installation (1)> <Vertical shaft installation (2)> Space for a 90% or less fill ratio (Note 2) Add/Drain grease fitting Shaft installation component Servo motor Grease surface Farget range Add/Drain grease fitting D Grease surface \*ო Target range D (Note 1) Add/Drain grease fitting Servo motor Shaft installation component Add/Drain grease fitting Internal capacity Internal capacity Required amount Dimensions (mm) Required amount Dimensions (mm) of reduction gea Model of reduction gea Model D D a\* b a\* b (cc) (cc) (g) С (cc) (cc) (g) С 32.2 27 887 35 35 RV-25N 223 211 (190)113 30 RV-125N 843 (759)40.7 186 RV-42N 377 358 (322)32.5 136 29 31 RV-160N 1036 984 40.1 202 36 46 (886)RV-60N 459 436 (392)32.3 160 29 32 RV-380N 2174 2066 (1859)54.2 252 48 60 RV-80N 607 577 (519)37.6 160 33 31 RV-500N 2704 2569 (2312)53.4 284 46 65 849 807 (726)36.9 179 32 37 3993 3776 (3398)62.2 350 78 RV-100N **RV-700N**

- Notes: 1. Set the amount of grease so that there is no space below the grease surface, or in the motor installation side of "Vertical shaft installation (2)" (the area in the diagram above).
  - 2. When inserting the required amount of lubricant, allow space above the grease surface so that the fill rate does not exceed 90%. (Ex.: The ZZZZZ area in the "Vertical shaft installation (2)" diagram.)

### Grease replacement time

During proper operation of the reduction gear, the standard grease replacement time due to lubricant degradation is 20,000 hours.

However, when operation involves a reduction gear surface temperature above 40°C (the area in the right diagram), the state of the lubricant should be checked in advance and the grease replaced earlier as necessary.



<sup>\* &</sup>quot;a" does not conform to the crank height.

# Inertia moment calculation formula

Shape	l(kgm²)	Shape	I(kgm²)
Cylinder solid	i(kgiii )	6. Horizontal movement by conveyor	i(i\giii )
$\begin{array}{c c} \underline{M(kg)} & Z & \\ \hline X & & \overline{\mathbb{Q}} \\ \hline & \underline{A(m)} & \end{array}$	$I_x = \frac{1}{2} M R^2$ $I_y = \frac{1}{4} M \left( R^2 + \frac{R^2}{3} \right)$ $I_z = I_y$	$\underbrace{\begin{array}{c} M_1(kg) \\ M_2(kg) \\ R(m) \end{array}}_{N(rpm.)} \underbrace{\begin{array}{c} M_2(kg) \\ R(m) \\ N(rpm.) \end{array}}_{N(rpm.)}$	$I = \left(\frac{M_1 + M_2}{2} + M_3 + M_4\right) \times R^2$
2. Cylinder hollow  M(kg) Z R1(m)  A (m)  R2(m)	$I_{x} = \frac{1}{2}M \left(R_{1}^{2} + R_{2}^{2}\right)$ $I_{y} = \frac{1}{4}M \left\{ \left(R_{1}^{2} + R_{2}^{2}\right) + \frac{a^{2}}{3}\right\}$ $I_{z} = I_{y}$	7. Horizontal movement by lead screw  V(m/min)  N(rpm.)  Lead: P(m/rev)	$I = \frac{M}{4} \left( \frac{V}{\pi \times N} \right)^2 = \frac{M}{4} \left( \frac{P}{\pi} \right)^2$
3. Oval cross section  M(kg)  Y  a(m)  Z  D  D  D  D  D  D  D  D  D  D  D  D	$I_{x} = \frac{1}{16} M \left( b^{2} + c^{2} \right)$ $I_{y} = \frac{1}{4} M \left( \frac{c^{2}}{4} + \frac{a^{2}}{3} \right)$ $I_{z} = \frac{1}{4} M \left( \frac{b^{2}}{4} + \frac{a^{2}}{3} \right)$	8. Up/down movement by hoist  Mz(kg)  N(rpm.)  V(m/min)  M1(kg)	$I = M_1 R^2 + \frac{1}{2} M_2 R^2$
4. Rectangle $ \frac{M(kg)}{X} $ $ \frac{Z}{A(m)} $ $ \frac{Z}{A(m)} $ $ \frac{Z}{A(m)} $	$I_{x} = \frac{1}{12} M (b^{2} + c^{2})$ $I_{y} = \frac{1}{12} M (a^{2} + c^{2})$ $I_{z} = \frac{1}{12} M (a^{2} + b^{2})$	9. Parallel axis theorem  M(kg)  Center axis  n(m)  Rotation axis	I = I <sub>0</sub> + Mη <sup>2</sup> I <sub>0</sub> : Moment of inertia of any object about an axis through its center of mass I: Moment of inertia about any axis parallel to the axis through its center of mass η: Perpendicular distance between the above two axes
5. General application  M(kg)  V(m/min)  R(m)  N(rpm.)	$I = \frac{M}{4} \left( \frac{V}{\pi \times N} \right)^2 = MR^2$		

# **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 Service Center.

### [URL]: http://precision.nabtesco.com/documents/request.html

### 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 gear is appropriately installed on the motor.
	Make sure there is no damage to the surface of the input gear teeth.
	Make sure the input gear specifications (precision, number of teeth, module, shift coefficient, dimensions of each part) are correct.
	Make sure the flange and other components are designed and manufactured with the correct tolerances.

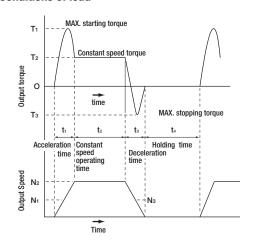
### The trouble started during operation

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.

# APPLICATION WORKSHEET

- ☐ Please supply us the following items when ordering RV series Reduction Gears.
- 1. How used
  Name of Machine:
  Applied to:
- 2. Model RV-

### 3. Conditions of load



	For starting (MAX)	For constant speed	For stopping (MAX)	Holding time
Load torque Nm	T <sub>1</sub>	<b>T</b> 2	Тз	
Speed rpm.	N <sub>1</sub>	N <sub>2</sub>	<b>N</b> 3	
Time sec.	tı	t <sub>2</sub>	t <sub>3</sub>	t <sub>4</sub>

Working hours Cycle/Day: Day/Year: Year

4. External load conditions (Typical Example)  $\begin{array}{c} W_1 \\ W_2 \\ W_2 \\ W_3 \\ W_4 \\ W_5 \\ W_6 \\ W_8 \\ W_8 \\ W_9 \\$ 

	g environment	
Operating	ng environment tempe	erature°C
6. Installation		
☐ Horizont	tal Vertical $\left( egin{array}{c} \Box$ Uppe $\Box$ Lowe	er motor er Motor )
Illustration for	r installation	
	speed ratio: i=	
	size, Other	oor TE Cornoratio
input gea	nr Prepared by 🗌 U	ser TS Corporation
Required dime	nsion of input gear (Illus	stration)
8. Driving por	rtion (Servo motor)	,
8. Driving por	/	,
	/	,
☐ Manufac	turer 🗆 Model (	,
☐ Manufact	turer 🗆 Model (	,
☐ Manufact Capacity: Rated torqu	turer	
☐ Manufact Capacity: Rated torqu Speed: Shape of the	turer	
☐ Manufact Capacity:  Rated torqu Speed:	turer	

# **Nabtesco**

# **Grease VIGOGREASE RE0 Ordering Information**

**Application and features –** 

This product is a lubricant specially made for Nabtesco precision reduction gears and can achieve high efficiency and extended service life for our reduction gears.

### Package —

Select from among the following container sizes.

Package	Part number	Style of packing
2kg	VIGOG-RE0-2KG	Can (in cardboard box)
16kg	VIGOG-RE0-16KG	Pail
170kg	VIGOG-RE0-170KG	Drum

### Caution

Be sure to use this product only after fully and carefully reading the cautions, etc., on the container.

### Contact Information —

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North & South Ameria (Nabtesco Motion Control, Inc.)

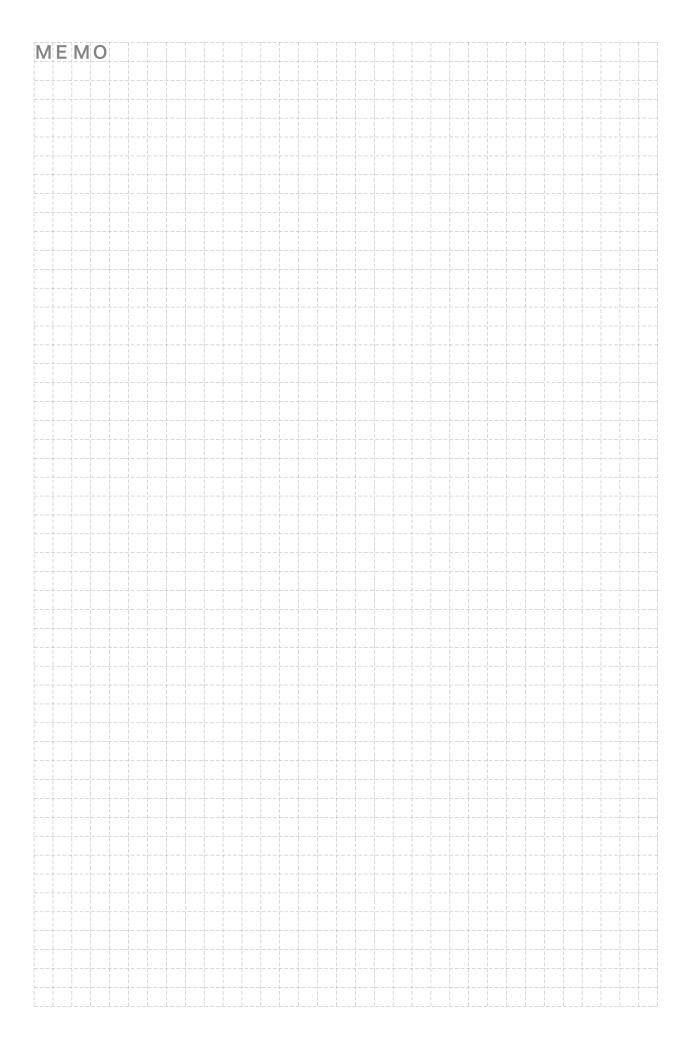
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### Warranty

- 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 running of the Product installed into Customer's equipment, whichever comes earlier.
- 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 WARRATIES 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 the 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 part 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) the Product was disassembled, re-assembled, repaired or modified by anyone other than Nabtesco;
  - 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.
- 4. The warranty period for the repaired/replaced Product/part under the Section 1 above shall be the rest of the initial Warranty Period of the defective Product subjected to such repair/replace.

# Nabtesco Corporation

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