Fenghua Technology Servo Precision Reducer Products

Planetary Gearbox | Harmonic Reducer | 90 Degree Right Angle Gearbox

Fenghua Transmission is committed to offering you quality products
Specializing in R & D and production of various precision planetary gear transmission products
Free service hotline: 400-8040-668
Click www.3fgearbox.com for CAD, 3D, 2D files of products

FAMED®

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Fenghua Transmission Technology (Shanghai) Co.,Ltd.

Fenghua Transmission Technology (Jiangsu) Co.,Ltd.

Stepper/servo motor driving (for robot industry)

Cycloidal pin-Wheel RV Reducer

High cost-effective/perfectly match and replace the sizes of Japanes harmonic reducers

FAMED®

Jiangsu Fenghua Transmission Technology Co.,Ltd.

FAMED® Company Introduction

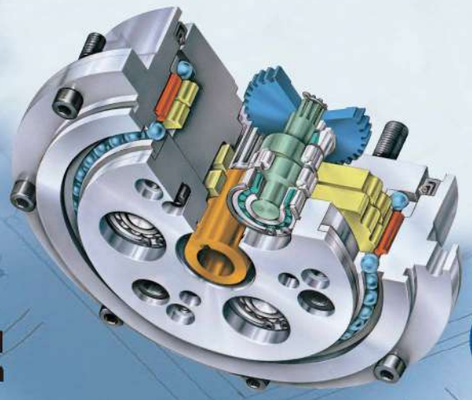
Fenghua Transmission Technology Co., Ltd. is developed from a factory which professionally manufactures the gears. All staffs of factory and R & D team have more than 20 years' gear manufacturing and designing experience. The factory cooperated with professional planetary gearbox technology team in the early period, and then established business department of the planetary gearbox , and developed the design and manufacturing process of product line of planetary gearbox series. Later, we developed and produced multi-joint robot industry reducers (RV high-precision pin-wheel reducers) with the Japanese NDK company, and the wave gear device (harmonic reducers) invented by American genius inventor C. W. Musser.

Harmonic reducer is composed of three components of wave generator, flexspline and circular spline. The product utilizes the transmission mode of metal winding deformation, and through the breakthrough of tooth meshing and material and processing accuracy, the company successfully developed CSG, CSF, SHG, SHF, SHD series harmonic reducer products, which are widely applied in horizontal reciprocating joint motion occasions like SCARA horizontal multi-joint robots.

RV high-precision cycloidal pinwheel reducer is composed of a cycloid pin wheel and a planet carrier. It features of small volume, strong impact resistance, large torque and high positioning accuracy, small vibration, large reduction ratio, etc. RV-E and RV-C series reducers are widely used in six-axis industrial robots, palletizing robots, and other robot fields like welding robots and positioners in the welding fields, and stamping robots in the punching field. Combined with the application of peripheral automation, Fenghua company developed the RV-EM, RV-CM, FHA & FHD series reducers models for direct-connected motor, which is more convenient for customers to choose and implement.

Fenghua high-precision reducers can directly replace the products manufactured by Germany and Japanese company. Fenghua product series range are full, and sizes and precision can be perfectly matched with the gearbox produced by Japanese & German manufacturers. The products are widely used in six-axis industrial robots, SCARA horizontal multi-joint robots, parallel robots, and palletizing robots, as well as welding robots in the welding field, positioners, stamping robots in the punching field, and rotating application of the fourth & fifth axis in the machine tool industry, and rotary positioning control in the fields of 3C, semiconductor and high-end medical devices. And Fenghua harmonic reducers can be found having been long-term applied in the fields of photovoltaic equipment, lithium battery and other new energy equipment.

The factory set up a service department in mainland of China in the early period, mainly promoting domestic market, and later established Fenghua Transmission Equipment (Shanghai) Co., Ltd. The company matches a large stocks of products to coordinate with servo motor manufacturers and system integration traders, rooting in the domestic market, and determined to serve the domestic automatic industry and robotic field by excellent products and serve for the Chinese robot cause and Industrial 4.0 direction.



Low noise internal helical gear design

High Precision Customized Service

Innovative R & D Quality Assurance

Professional Processing 20 Years of Experience

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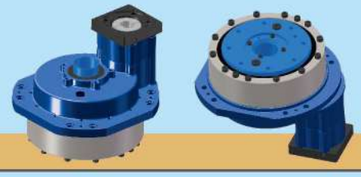
RV-CM CK、CW Series  44-66

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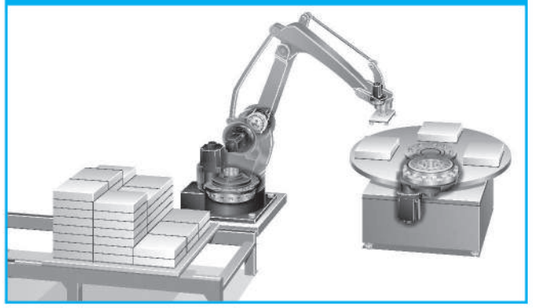
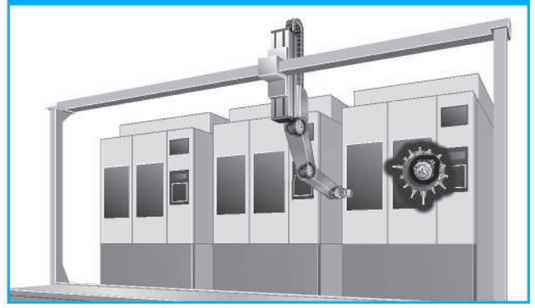
Product Application Industry

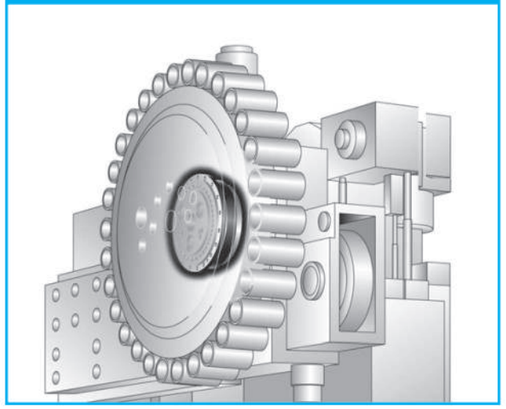
Palletizing robot / Rotary workenh



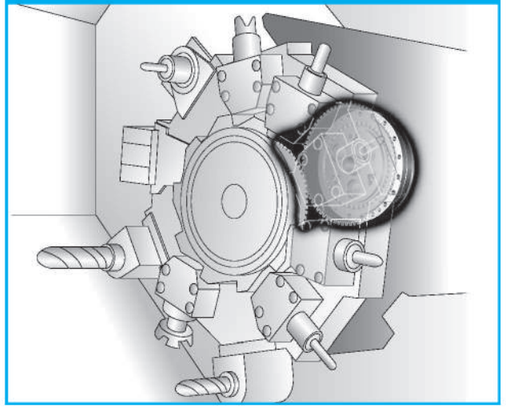
Gantry loader / ATC device



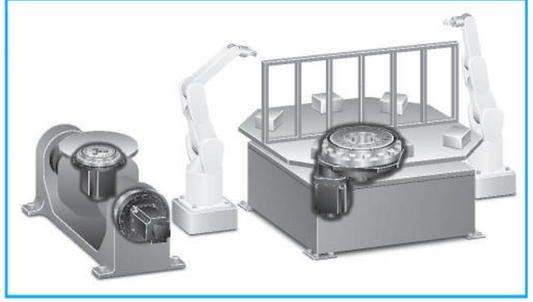
Machine tool ATC tool magazine



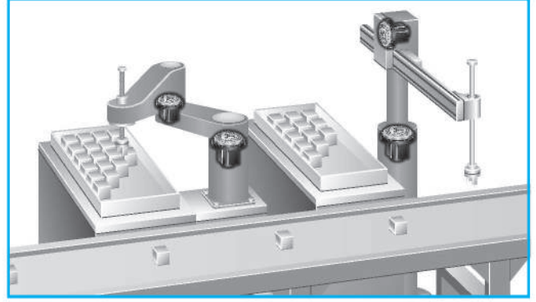
Machine tool (turret)



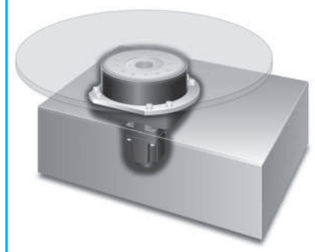
Various positioners



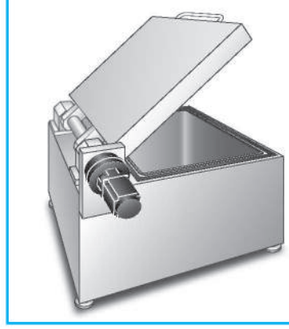
Horizontal multi-joint robot / Cylindrical coordinate robot



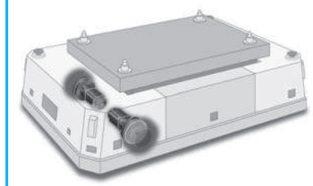
Positioning turntable (rotary axis)



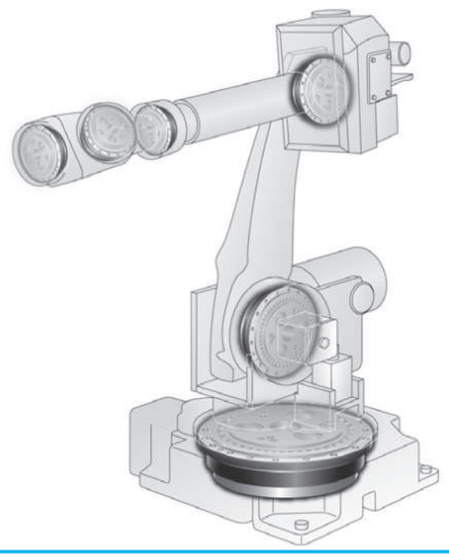
Cover switch device



ABV drive

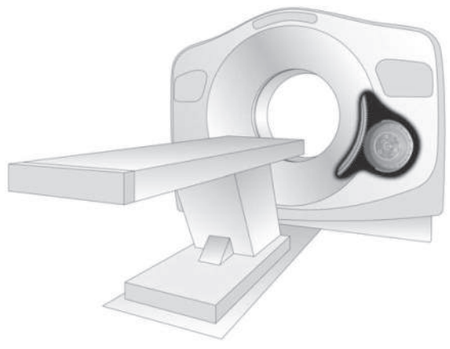


Vertical multi-joint robot (joint axis)

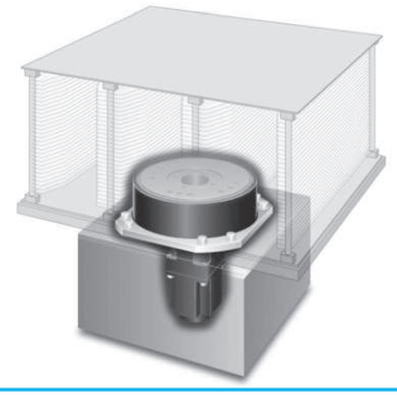


SCARA robot

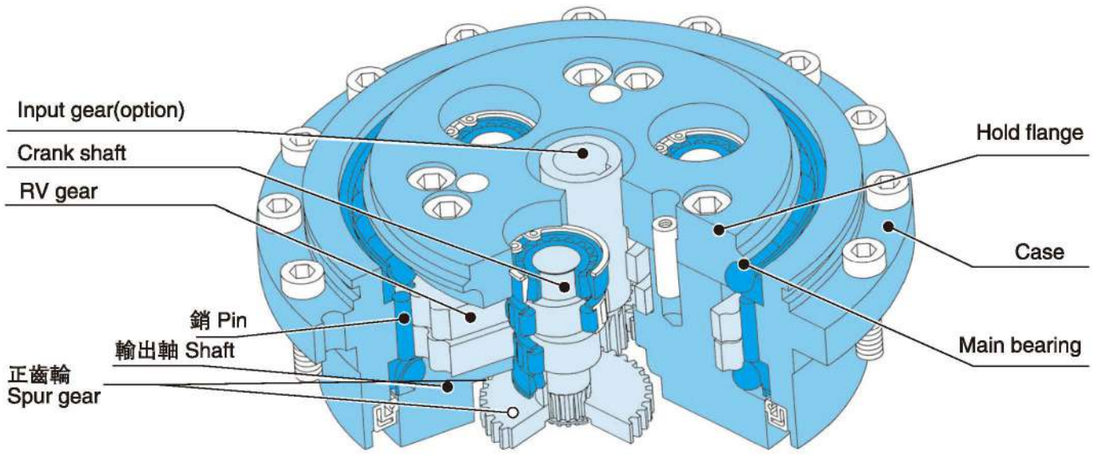
Medical instruments



Glass substrate and wafer rotation axis



RV-E series Features and construction



Integrated angular ball bearings

Benefits:
- Increases reliabilty
- Reduces overall cost

Attributed to:
- Built-in angular ball bearing construction improves the ability to support external loads, increases moment rigidity and maximum allowable moment.
- Reduces the number of components required.
- Simplifies installation.

2-stage reduction

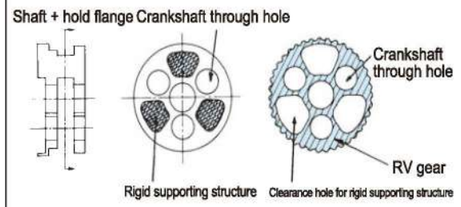
Benefits:
- Reduces vibration
- Reduces inertia (GD²)

Attributed to:
- Low speed rotation of the RV gear reduces vibration.
- Reduced size of the motor coupling part (input gear) lowers intertia.

All main elements are supported on both sides

Benefits:
- Higher torsional stiffness
- Less vibration
- High shock load capability (5 times rated torque)

Detail:
- Crankshafts are supported on both sides of the reduction gear as shown below.



Pin & gear structure

Benefits:
- Very low backlash (1 arc. min.)
- Higher shock load capability(5 times rated torque)

Attributed to:
- Synchromeshing of many RV gear teeth and pins.

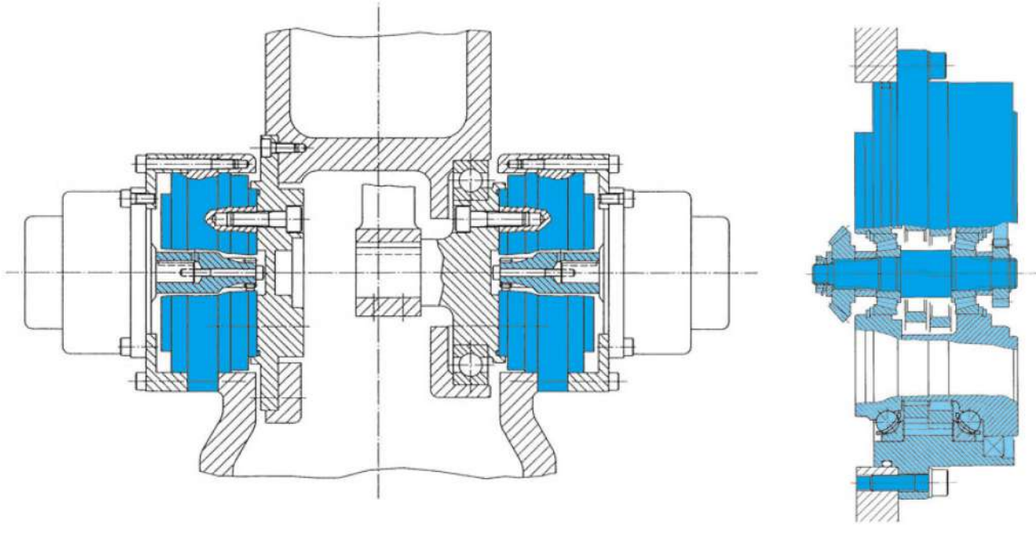
Rolling contact elements

Benefits:
- Excellent starting efficiency
- Low wear and longer life
- Low backlash (1 arc. min.)

Attributed to:
- Use of roller bearings throughout.

RV-E Series

Robot arm



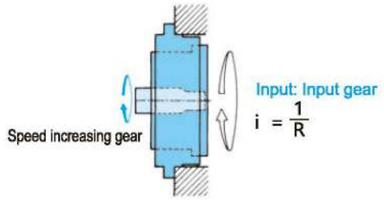
Robot wrist axis

As shown in the figure(right), the input gear can also be supported within the reduction gear mechanism.
Please contact FH for more details.

RV-E series rotary direction and speed ratio

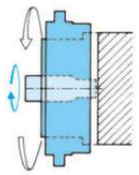
The rotary direction and speed ratio of the E series are shown below.
Use the following figure to select a mechanism most suitable for your application.

1. Case fixed, shaft output



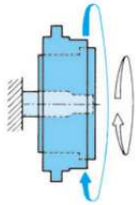
Input: Input gear
$i = \frac{1}{R}$

2. Shaft fixed, case output



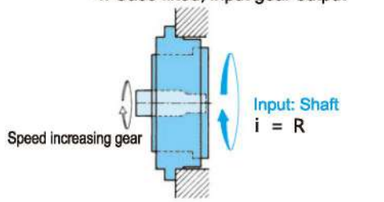
Input: Input gear
$i = -\frac{1}{R-1}$

3. Input gear fixed, shaft output



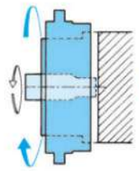
Input: Case
$i = \frac{R-1}{R}$

4. Case fixed, input gear output



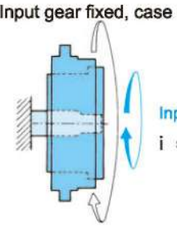
Input: Shaft
$i = R$

5. Shaft fixed, input gear output



Input: Case
$i = -(R-1)$

6. Input gear fixed, case output



Input: Shaft
$i = \frac{R}{R-1}$

- The "i" in the above equations signifies the speed ratio of the output for the input in each case. The "+" signifies the output in the same direction as the input and the "-" signifies the output in the opposite direction to the input.
- The above figures show the situation when the motor is installed on the fixed side.

RV-E ratio

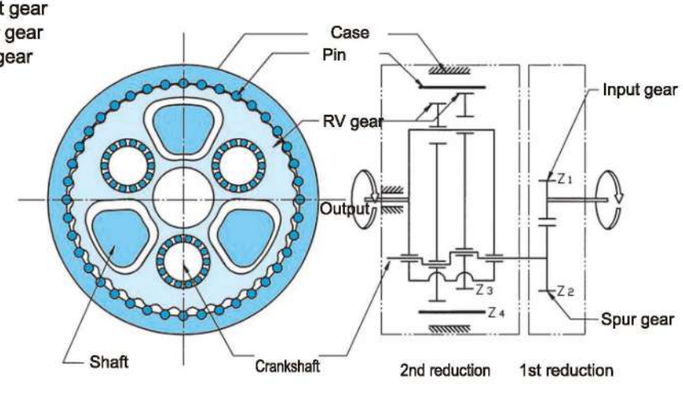
The overall reduction ratio i (of the First and Second reduction stages) will differ depending on the use, and can be calculated using the speed ratio values displayed in the table below.

With the shaft as output;

$$R = 1 + \frac{Z_2}{Z_1} \cdot Z_4$$

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

R : Speed ratio
Z_1: Number of teeth on input gear
Z_2: Number of teeth on spur gear
Z_3: Number of teeth on RV gear
Z_4: Number of pins
i : Reduction ratio



RV–E Series Precision Robot Joints

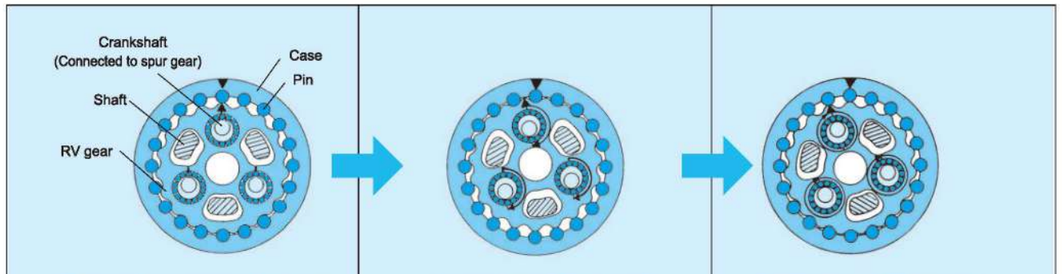
Principle of Speed Reduction

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.



RV–E series instruction

- When placing an order or making an inquiry, please use the following codes to specify the appropriate model.

RV – 80 E – 121 – A – B – Motor

Model code	Frame number	Series code	Ratio code	Input gear code Input spline code	Output shaft clamp code	Motor
RV	6	E: Main bearing built-in type	31, 43, 53.5, 59, 79, 103	A: Standard gear A B: Standard gear B Z: No gear	B: Bolt-clamping output shaft type P: Pin/bolt clamping output shaft type	Motor Model
	20		57, 81, 105, 121, 141, 161			
	40		57, 81, 105, 121, 153			
	80		57, 81, 101, 121, 153			
	110		81, 111, 161, 175			
	160		81, 101, 129, 145, 171			
	320		81, 101, 118.5, 129, 141, 171, 185			
	450		81, 101, 118.5, 129, 154.8, 171, 192.4			

RV-E series Rating Table

Output speed (rpm)				5	10	15	20	25	30	40	50	60
Type	Ratio code	R Speed ratio		Output torque (Nm) / Input capacity (kW)								
		Shaft rotation	Case rotation									
RV-6E	31	31	30	101 / 0.07	81 / 0.11	72 / 0.15	66 / 0.19	62 / 0.22	58 / 0.25	54 / 0.30	50 / 0.35	47 / 0.40
	43	43	42									
	53.5	53.5	52.5									
	59	59	58									
	79	79	78									
	103	103	102									
RV-20E	57	57	56	231 / 0.16	188 / 0.26	167 / 0.35	153 / 0.43	143 / 0.50	135 / 0.57	124 / 0.70	115 / 0.81	110 / 0.92
	81	81	80									
	105	105	104									
	121	121	120									
	141	141	140									
	161	161	160									
RV-40E	57	57	56	572 / 0.40	465 / 0.65	412 / 0.86	377 / 1.05	353 / 1.23	334 / 1.40	307 / 1.71	287 / 2.00	271 / 2.27
	81	81	80									
	105	105	104									
	121	121	120									
	153	153	152									
RV-80E	57	57	56	1,088 / 0.76	885 / 1.24	784 / 1.64	719 / 2.01	672 / 2.35	637 / 2.67	584 / 3.26	546 / 3.81	517 / 4.33
	81	81	80									
	101	101	100									
	121	121	120									
	153	*1 (153)	*1 (152)									
RV-110E	81	81	80	1,499 / 1.05	1,215 / 1.70	1,078 / 2.26	990 / 2.76	925 / 3.23	875 / 3.67	804 / 4.49		
	111	111	110									
	161	161	160									
	175	1227/7	1220/7									
RV-160E	81	81	80	2,176 / 1.52	1,774 / 2.48	1,568 / 3.28	1,441 / 4.02	1,343 / 4.69	1,274 / 5.34			
	101	101	100									
	129	129	128									
	145	145	144									
	171	171	170									
RV-320E	81	81	80	4,361 / 3.04	3,538 / 4.94	3,136 / 6.57	2,881 / 8.05	2,695 / 9.41	2,548 / 10.7			
	101	101	100									
	118.5	118.5	117.5									
	129	129	128									
	141	141	140									
	171	171	170									
	185	185	184									
RV-450E	81	81	80	6,135 / 4.28	4,978 / 6.95	4,410 / 9.24	4,047 / 11.3	3,783 / 13.2				
	101	101	100									
	118.5	118.5	117.5									
	129	129	128									
	154.8	2013/13	2000/13									
	171	171	170									
	192	1347/7	1340/7									

Note: 1. The allowable output speed will differ depending upon the duty ratio, load, and ambient temperature. Contact us regar ding use above the allowable output speed Ns1.

2. The input capacity (kW) is calculated according to the following calculation formula:

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

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

Note: The input capacity is a reference value.

3. When the reduction gear is used at low temperatures, there will be a larger no-load running torque. Note this characteristi c when selecting a motor. (Refer to "Low temperature characteristic" on page 93)

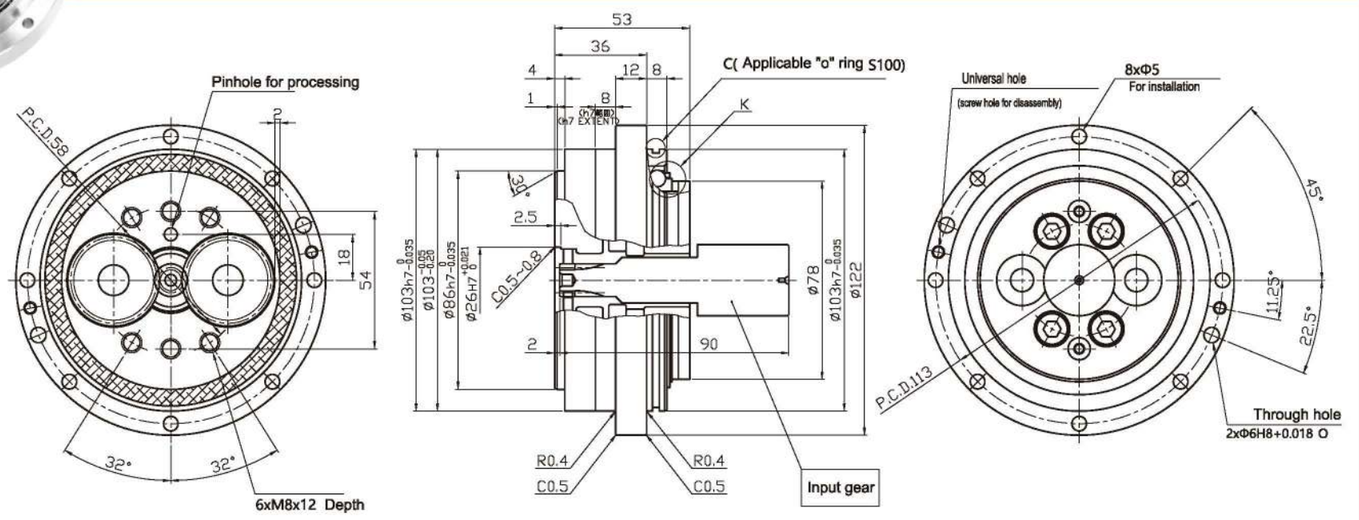
T_0 Rated torque (Note 7)	N_0 Rated output Speed	K Rated service life	T_{S1} Allowable acceleration deceleration torque	T_{S2} Momentary maximum allowable torque	N_{S0} Maximum allowable output speed (Note 1)	Backlash	MAX. Lost motion MAX.	MAX. Angular transmission error MAX.	Startup effi ciency (Typical value)	M_{O1} Allowable moment (Note 4)	M_{O2} Momentary allowable moment (Max.)	Wr Allowable radial load (Note 10)	I Reduced value of the inertia moment for the input shaft (Note 5)	Weight
(Nm)	(rpm)	(h)	(Nm)	(Nm)	(r/min)	(arc.sec)	(arc.min.)	(arc.sec.)	(%)	(Nm)	(Nm)	(N)	(kgm^2)	(kg)
58	30	6,000	117	294	100	1.5	1.5	80	70	196	392	2,140	2.63×10^{-6}	2.5
													2.00×10^{-6}	
													1.53×10^{-6}	
													1.39×10^{-6}	
													1.09×10^{-6}	
													0.74×10^{-6}	
167	15	6,000	412	833	75	1.0	1.0	70	75	882	1,764	7,785	9.66×10^{-6}	4.7
													6.07×10^{-6}	
													4.32×10^{-6}	
													3.56×10^{-6}	
													2.88×10^{-6}	
													2.39×10^{-6}	
412	15	6,000	1,029	2,058	70	1.0	1.0	60	85	1,666	3,332	11,594	3.25×10^{-5}	9.3
													2.20×10^{-5}	
													1.63×10^{-5}	
													1.37×10^{-5}	
													1.01×10^{-5}	
784	15	6,000	1,960	Bolt joint 3,920	70	1.0	1.0	50	85	Bolt joint 2,156	Bolt joint 4,312	Bolt joint 12,988	8.16×10^{-5}	Bolt joint 13.1
													6.00×10^{-5}	
				Pin/bolt joint 3,185						Pin/bolt joint 1,735	Pin/bolt joint 2,156	Pin/bolt joint 10,452	4.82×10^{-5}	Pin/bolt joint 12.7
													3.96×10^{-5}	
													2.98×10^{-5}	
1,078	15	6,000	2,695	5,390	50	1.0	1.0	50	85	2,940	5,880	16,648	9.88×10^{-5}	17.4
													6.96×10^{-5}	
													4.36×10^{-5}	
													3.89×10^{-5}	
1,568	15	6,000	3,920	Bolt joint 7,840	45	1.0	1.0	50	85	3,920	Bolt joint 7,840	18,587	1.77×10^{-4}	26.4
													1.40×10^{-4}	
				Pin/bolt joint 6,615							Pin/bolt joint 6,762		1.06×10^{-4}	
													0.87×10^{-4}	
													0.74×10^{-4}	
3,136	15	6,000	7,840	Bolt joint 15,680	35	1.0	1.0	50	80	Bolt joint 7,056	Bolt joint 14,112	Bolt joint 28,067	4.83×10^{-4}	44.3
													3.79×10^{-4}	
				Pin/bolt joint 12,250						Pin/bolt joint 6,174	Pin/bolt joint 10,976	Pin/bolt joint 24,558	3.15×10^{-4}	
													2.84×10^{-4}	
													2.54×10^{-4}	
													1.97×10^{-4}	
													1.77×10^{-4}	
4,410	15	6,000	11,025	Bolt joint 22,050	25	1.0	1.0	50	85	8,820	Bolt joint 17,640	30,133	8.75×10^{-4}	66.4
													6.91×10^{-4}	
				Pin/bolt joint 18,620							Pin/bolt joint 13,524		5.75×10^{-4}	
													5.20×10^{-4}	
													4.12×10^{-4}	
													3.61×10^{-4}	
													3.07×10^{-4}	

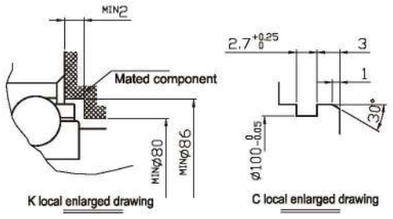
Note:
4. The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (p. 91).
5. The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.
6. For the moment rigidity and torsional rigidity, refer to the calculation of tilt angle and the torsion angle (p. 99).
7. 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.81) and the "Product selection flowchart" (p.82).
8. Contact us regarding speed ratios other than those listed above.
9. The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operatingconditions of your system.
10. When radial load b is applied within dimension b, use the reduction gear within the allowable radial load.
11. *1 The R=153 for the RV-80E is only for the bolt-clamping output shaft type (page 20, 21).

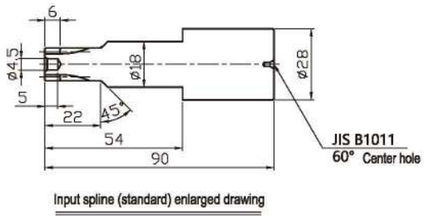
RV-6E Bolt clamping output shaft type

Type RV-6E-□-A-B

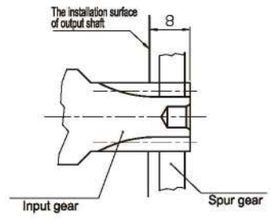
Ratio







Input spline (standard) enlarged drawing



Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	627.2Nm		627.2Nm
Shaft side	607.6Nm		607.6Nm

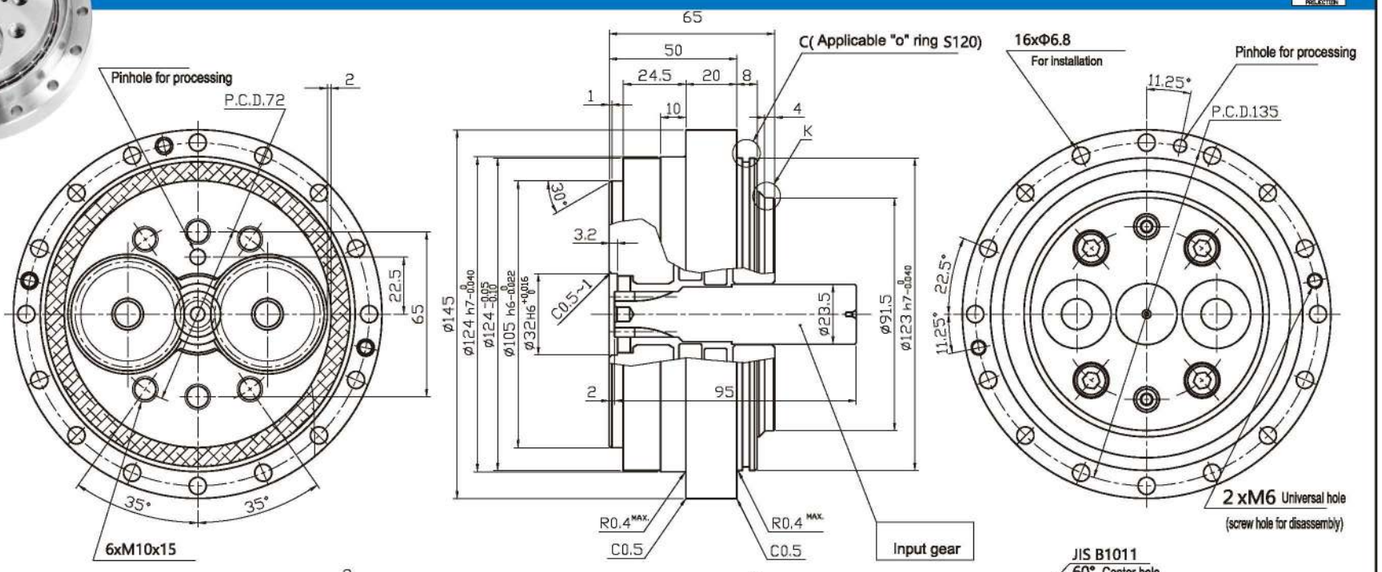
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

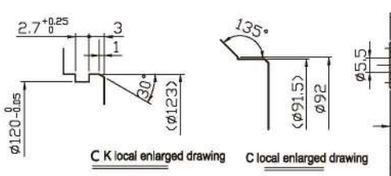
Specifications and sizes might be changed without any advanced announcement

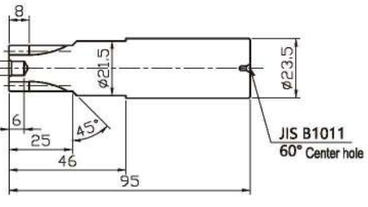
RV-20E Bolt clamping output shaft type

Type RV-20E-□-A/B-B

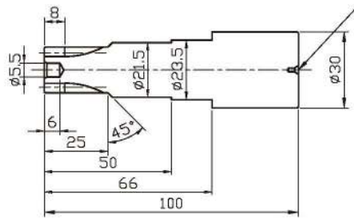
Ratio



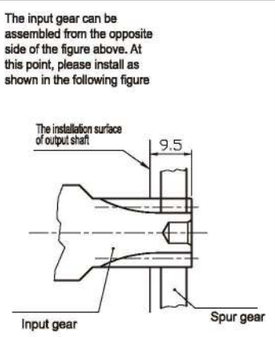




Input spline (standard A) enlarged drawing



Input spline (standard B) enlarged drawing



Allowable transmission torque

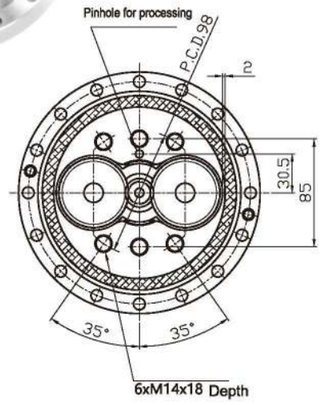
	Screw bolt	Taper pin	总计 Amount
Shell side	2136.4Nm		2136.4Nm
Shaft side	1195.6Nm		1195.6Nm

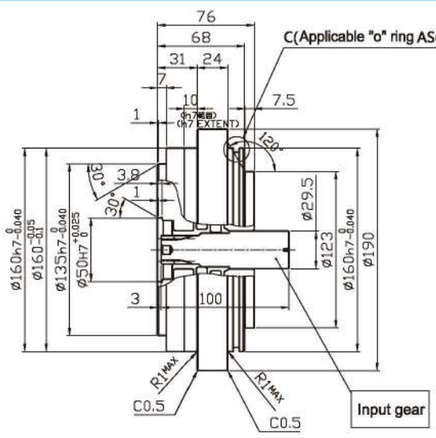
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

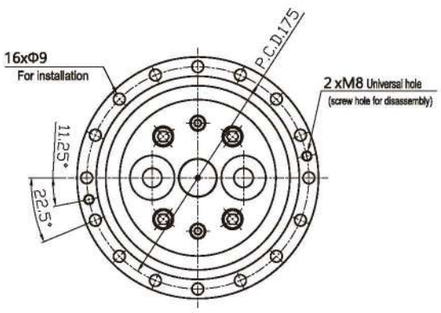
Specifications and sizes might be changed without any advanced announcement

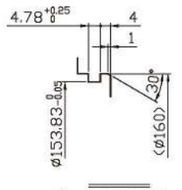
Bolt clamping output shaft type

Type RV-40E-□-Ratio(A/B)-B

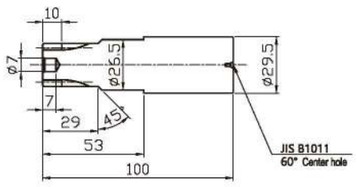






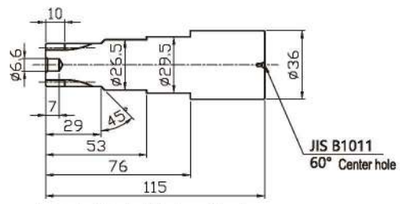


C local enlarged drawing



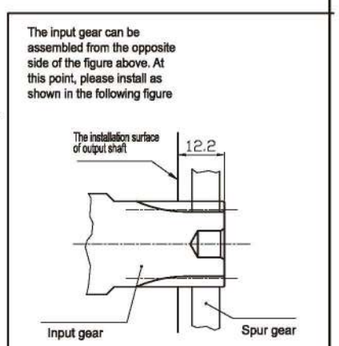
Input spline (standard A) enlarged drawing

(S=1.5/1)



Input spline (standard B) enlarged drawing

(S=1.5/1)



Allowable transmission torque

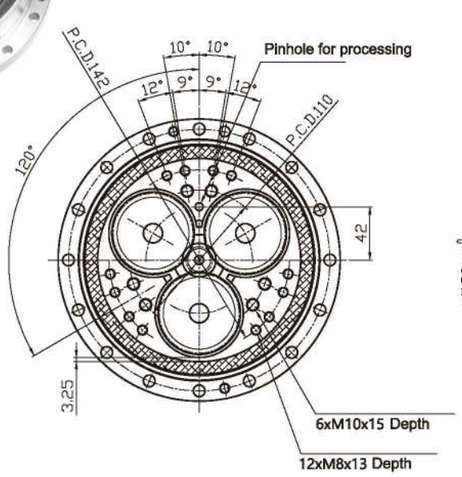
	Screw bolt	Taper pin	Amount
Shell side	5027.4Nm		5027.4Nm
Shaft side	3204.6Nm		3204.6Nm

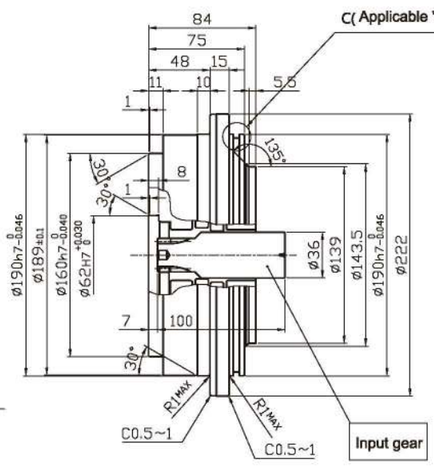
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

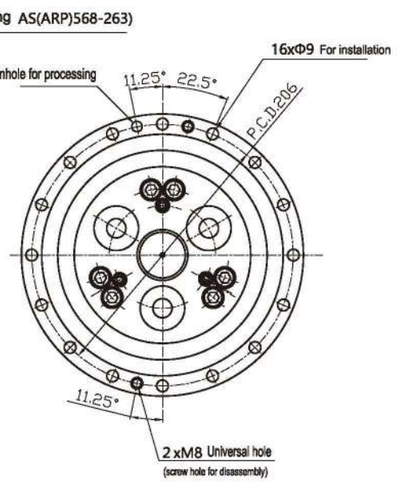
Specifications and sizes might be changed without any advanced announcement

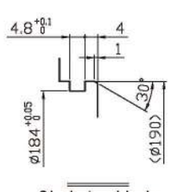
RV-80E Bolt clamping output shaft type

Type RV-80E-□-Ratio(A/B)-B

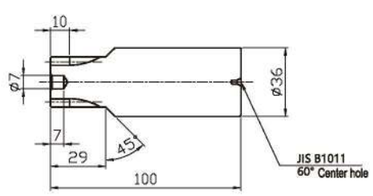






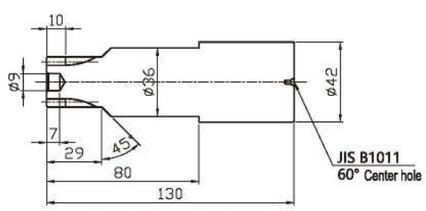


C local enlarged drawing



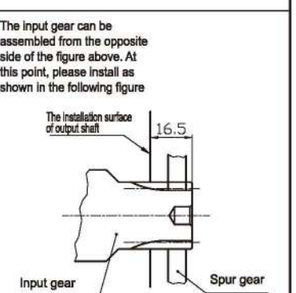
Input spline (standard A) enlarged drawing

(S=1.5/1)



Input spline (standard B) enlarged drawing

(S=1.5/1)



Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	5919.2Nm		5919.2Nm
Shaft side	4939.2Nm		4939.2Nm

Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

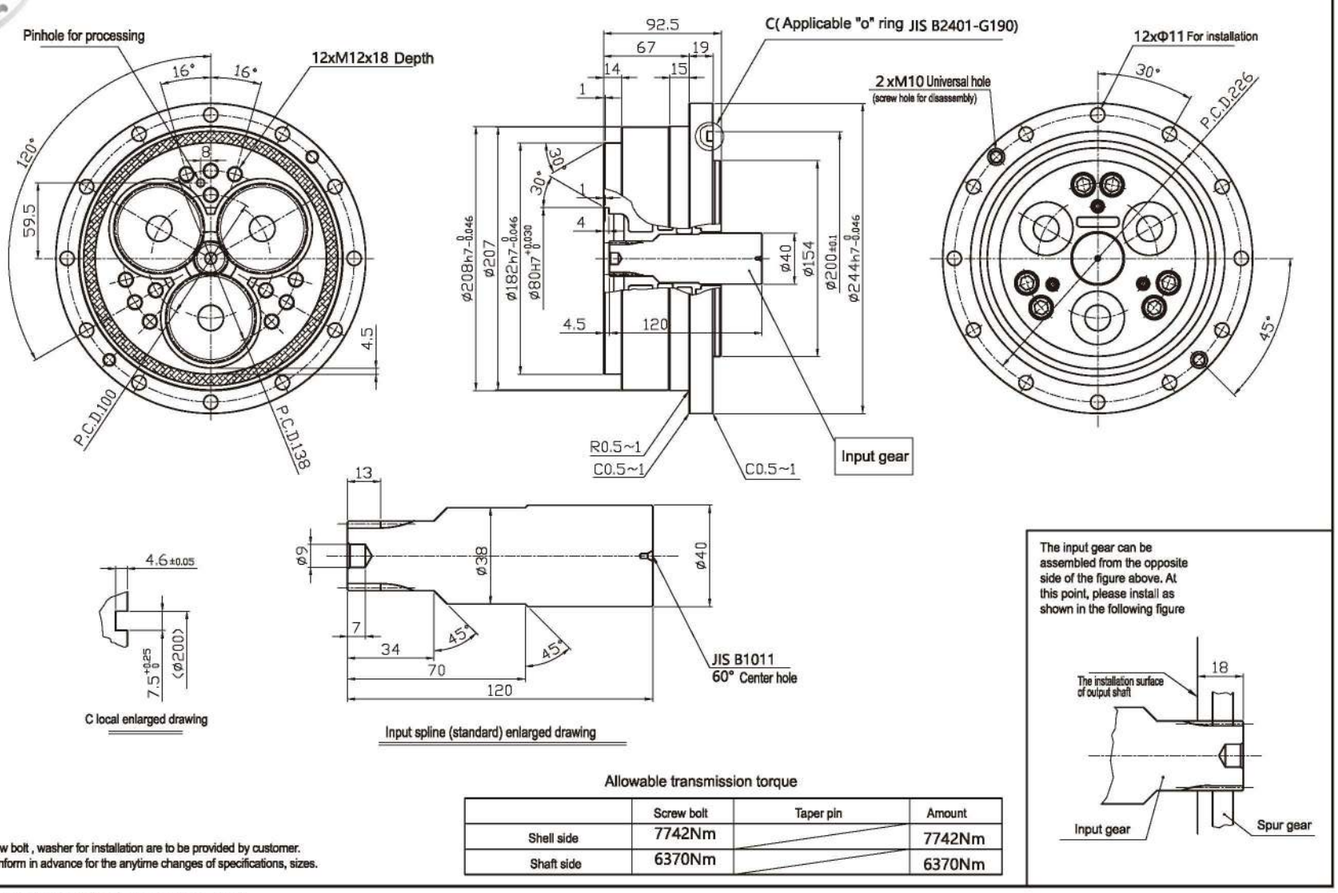
Specifications and sizes might be changed without any advanced announcement

RV-110E Bolt clamping output shaft type

Type RV-110E-□-A-B

Ratio

3RD ANGLE PROJECTION



The input gear can be assembled from the opposite side of the figure above. At this point, please install as shown in the following figure

Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	7742Nm		7742Nm
Shaft side	6370Nm		6370Nm

Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

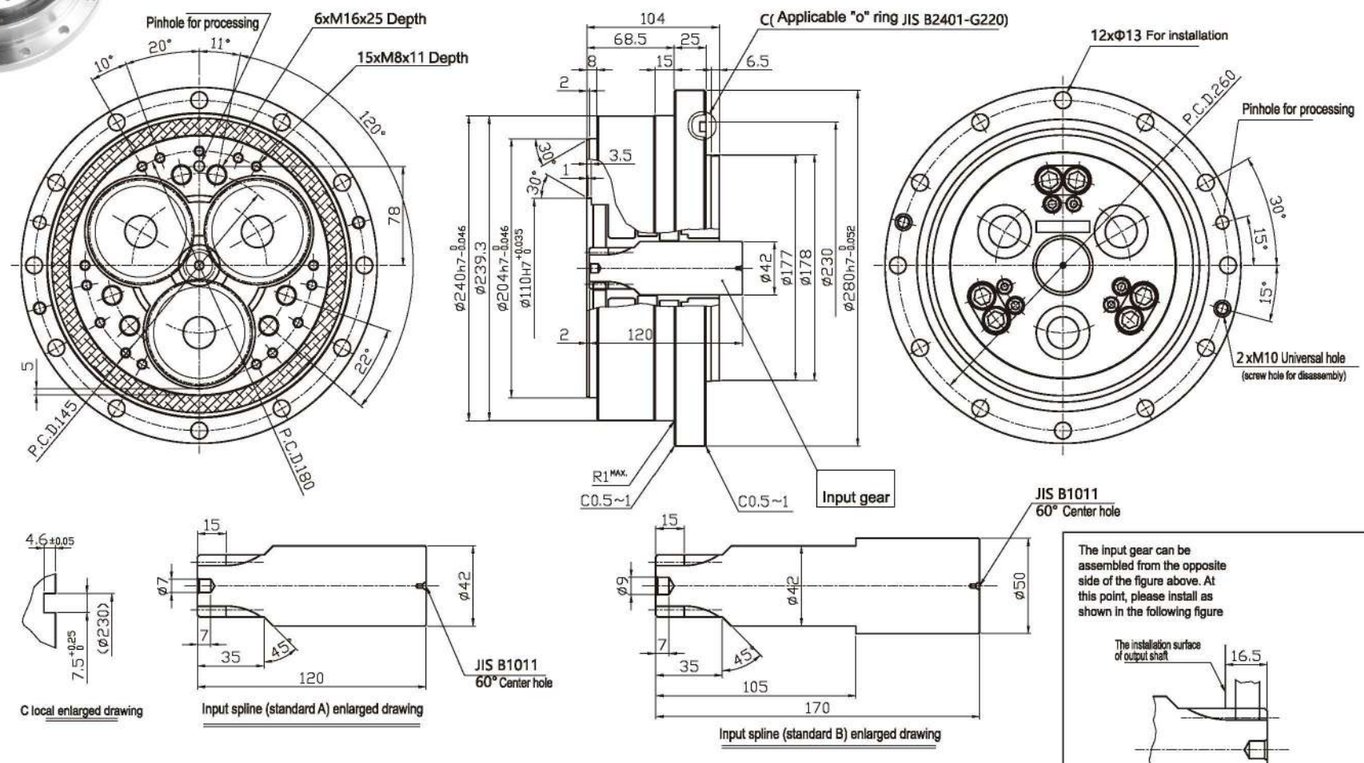
Specifications and sizes might be changed without any advanced announcement

RV-160E Bolt clamping output shaft type

Type RV-160E-□-A/B-B

Ratio

3RD ANGLE PROJECTION



The input gear can be assembled from the opposite side of the figure above. At this point, please install as shown in the following figure

Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	12887Nm		12887Nm
Shaft side	11593.4Nm		11593.4Nm

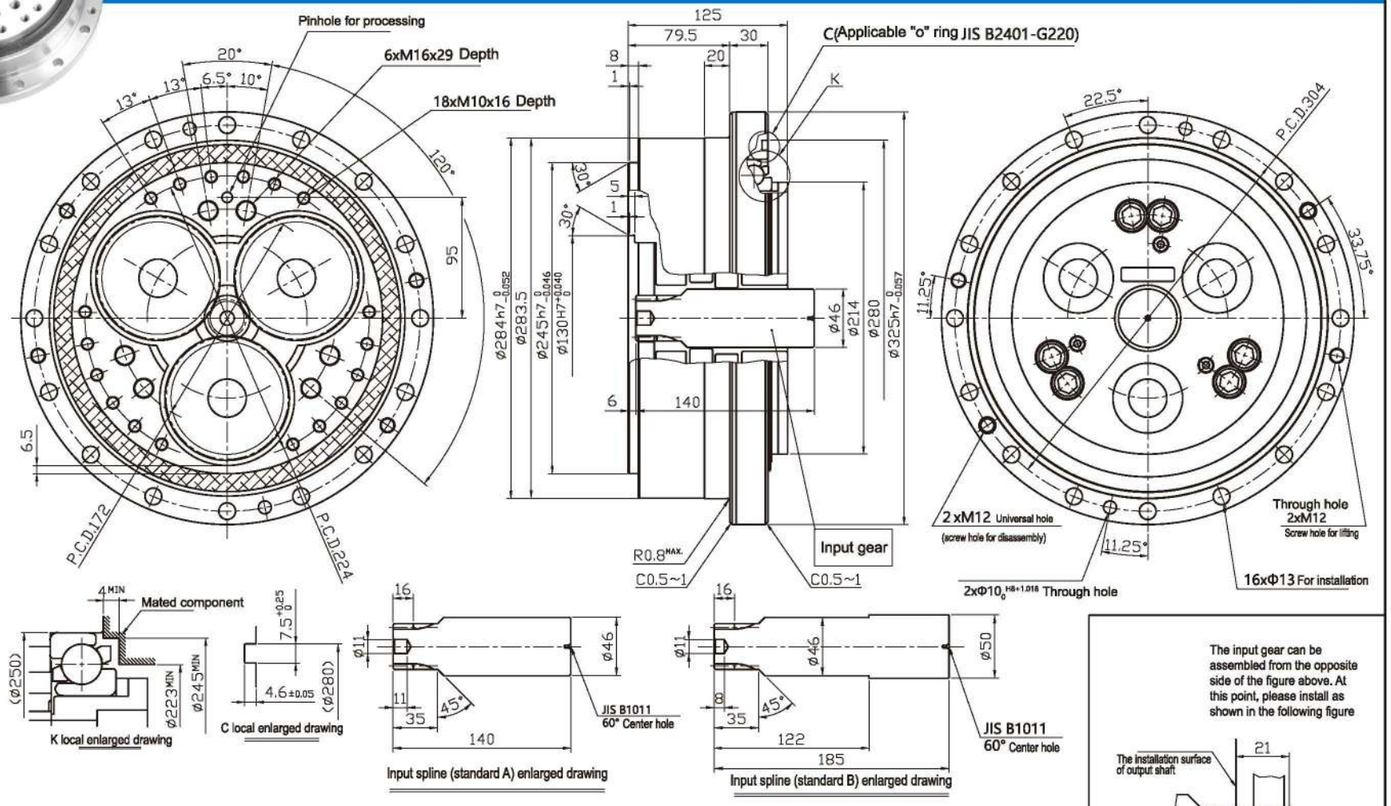
Note: 1) The shape of input gear will be different on the low speed condition (i=1/66)
3) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement

RV-320E Bolt clamping output shaft type

Type RV-320E-□-A/B-B

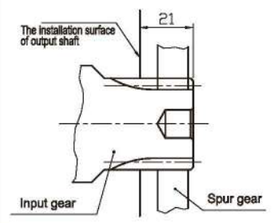
Ratio



Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	20099.8Nm		20099.8Nm
Shaft side	19521.6Nm		19521.6Nm

The input gear can be assembled from the opposite side of the figure above. At this point, please install as shown in the following figure



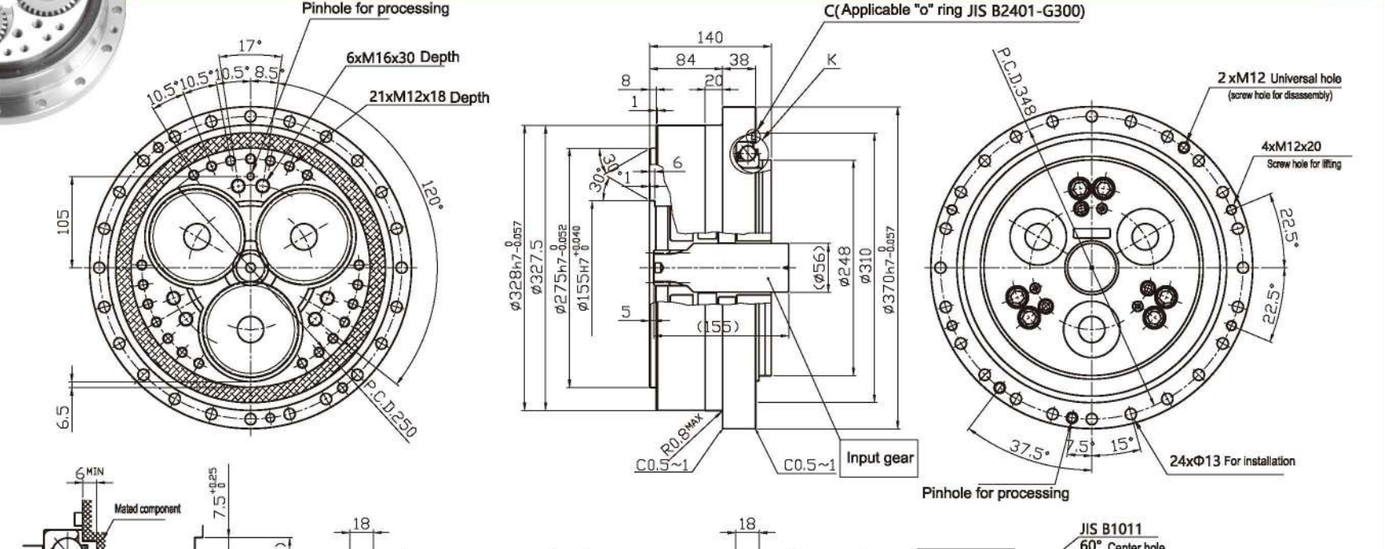
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement

RV-450E Bolt clamping output shaft type

Type RV-450E-□-A/B-B

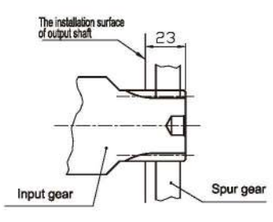
Ratio



Allowable transmission torque

	Screw bolt	Taper pin	Amount
Shell side	34515Nm		34515Nm
Shaft side	30536Nm		30536Nm

The input gear can be assembled from the opposite side of the figure above. At this point, please install as shown in the following figure



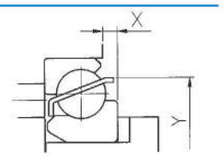
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement

RV-E Series Design Points Installation Components

Design of the motor mounting flange

In order to avoid contact with gearbox components, refer to the sizes indicated in the "External 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 gearbox's case mounting holes.
After installing the gearbox, we recommend installing an adding and draining grease fitting to enable grease replacement. An installation example is shown below.
Use the specified tightening torque to uniformly tighten the hexagon socket head cap screws (with corresponding conical spring washers)
To obtain maximum performance from the E series, it is important to optimally design the assembly, installation, lubrication, and sealing.
Be sure to read the following precautions before designing. As angular ball bearings are used as the main bearings, designing the mating component dimensions according to the table on the right to make sure that the bearing retainer does not come in contact with the motor mounting flange.



	X	Y
RV-6E	MAX1.9	MAXφ 85
RV-320E	MAX3.2	MAXφ222.2
RV-450E	MAX5.5	MAXφ285

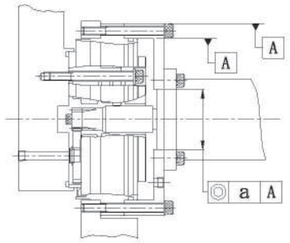
With other models, the retainer does not stick out from the casing, so no special attention is needed.

RV-E Series Assembly accuracy

Design the motor mounting flange according to the following accuracy.
Poor assembly accuracy easily causes vibration and noise.

(Unit : mm)

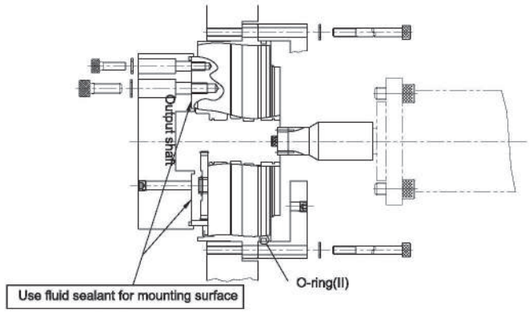
Model	Concentricity tolerance a	Model	Concentricity tolerance a
RV-6E	MAX0.03	RV-110E	MAX0.03
RV-20E	MAX0.03	RV-160E	MAX0.05
RV-40E	MAX0.03	RV-320E	MAX0.05
RV-80E	MAX0.03	RV-450E	MAX0.05



RV-E Series Installation procedure

- Typical installation examples for gearboxes to be mounted on the mating components are shown below. Be sure to apply the specified amount of the specified grease during assembly.
  Refer to the O-ring seals shown to make a seal design for the mounting side.
  If O-ring (II) cannot be used due to the structure, apply the appropriate liquid sealant from the table on the right.
  If a seal cannot be formed by applying liquid sealants due to the structure, use O-ring (I) and (III) on page 22.

- Bolt clamping output shaft type
  Note: The sizes of bolts for tightening the output shaft are not all the same. Make sure that each bolt is tightened with the specified torque after assembling.



Recommended liquid sealant

Manufacturer	Characteristics and applications
Three Bond 1211 (Three Bond)	• Silicone–based, solventless type • Semi–dry gasket
HERME SERL SS-60F (Nihon-Hermetics)	• One-part, non-solvent elastic sealant • Metal contact side (flange surface) seal • Three Bond1211 Any product basically equivalent to ThreeBond 1211
Locktite515 (Henkel)	• Anaerobic flange sealant • Metal contact side (flange surface) seal

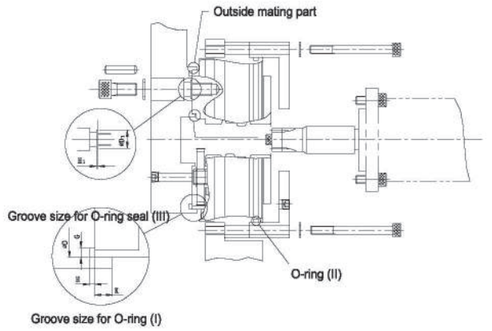
Notes 1. Do not use these sealants for copper material or copper alloy material.
2. If these sealants need to be used under special conditions such as concentrated alkali, pressurized steam, etc., please contact us.

O-ring(II)

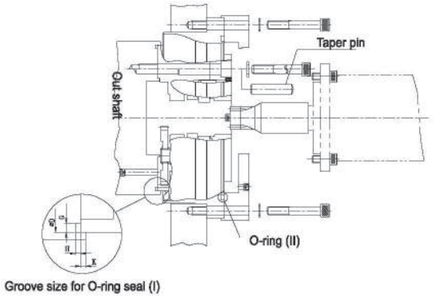
	Applicable O-ring
RV-6E	S100
RV-20E	S120
RV-40E	AS568-258
RV-80E	AS568-263
RV-110E	G190
RV-160E	G220
RV-320E	G270
RV-450E	G300

- Pin/bolt clamping output shaft type
  Note: The prepared pinhole and the output shaft need to be reamed jointly with a reamer before knocking in the taper pin.
  The gearbox needs to be appropriately masked during reaming to prevent chips from entering inside.

RV-20E、40E Installation example

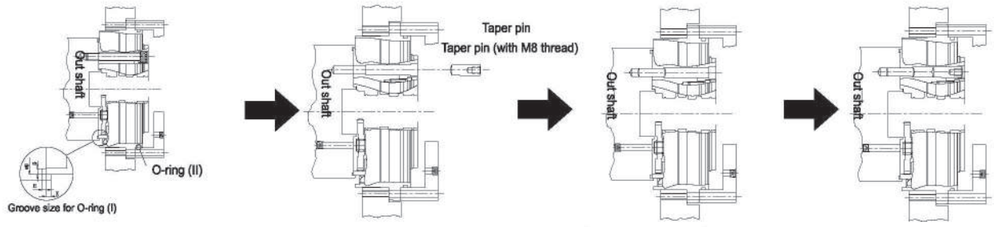


RV-160E、320E、450E Installation example



RV-80E Installation example

A different method is used on RV-80E to knock in the taper pin, so follow the next procedure for assembling.



1. Loosely tighten the hexagon socket head cap screw to temporarily secure the gearbox shaft to the output shaft.
2. Remove the taper pin (with M8 screw) installed in the gearbox.
3. From the hole of the removed taper pin, drill a hole for the taper pin (10 mm. dia.) in the output shaft. (At this time, masking is needed to prevent chips from entering the gearbox.)
4. After reaming, remove the bolt to remove the gearbox, then remove any chips and burrs.
5. Install the gearbox and knock in the taper pin for fixing the output shaft.
6. Tighten the hexagon socket head cap screw securely to fix the gearbox to the output shaft.
7. Be sure to knock in the taper pin (with M8 screw) embedded in the gearbox. Use a taper pin with screw.

Dimensions for O-ring (I) seal (Unit : mm)

		RV-20E (A)	RV-20E (B)	RV-40E	RV-80E	RV-110E	RV-160E	RV-320E	RV-450E
Dimensions	O-ring ID No.	AS568-045	S100	S132	AS568-163	AS568-167	AS568-265	AS568-271	AS568-275
	O-ring Wire dia.	φ1.78 ±0.07	φ2.0 ±0.1	φ2.0 ±0.1	φ2.62 ±0.07	φ2.62 ±0.07	φ3.53 ±0.1	φ3.53 ±0.1	φ3.53 ±0.1
	O-ring I. D.	φ101.32 ±0.38	φ 99.5 ±0 . 4	φ131.5 ±0.6	φ152.07 ±0.58	φ177.47 ±0.58	φ196.44 ±076	φ234.54 ±0.76	φ266.29 ±0.76
	Groove dimensions Outside dia. D	φ 105	φ105	φ135	φ160	φ182	φ204	φ243	φ273
	Groove dimensions Depth H	1.27 ±0.05	1.5 $^{-0}_{-0.1}$	1.5 $^{-0}_{-0.1}$	2.06 ±0.05	2.06 ±0.05	2.82 ±0.05	2.82 ±0.0 5	2.82 ±0.05
	Groove dimensions Width G	2.39 $^{+0.25}_{0}$	2.7 $^{+0.25}_{0}$	2.7 $^{+0.25}_{0}$	3.58 $^{+0.25}_{0}$	3.58 $^{+0.25}_{0}$	4.78 $^{+0.25}_{0}$	4.78 $^{+0.25}_{0}$	4.78 $^{+0.25}_{0}$
	Groove dimensions Height(for reference) K	3	3	3	3	3	4	4	4

Dimensions for O-ring (II) seal (単位 Unit : mm)

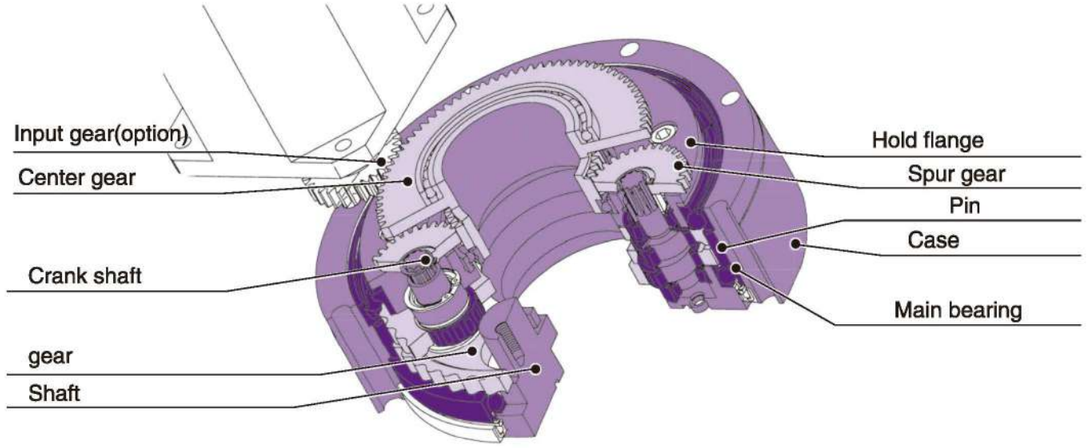
	RV-20E	RV-40E	RV-80E	RV-160E	RV-320E	RV-450E
ID No.	S120	AS568-258	AS568-263	G220	G270	G300

Dimensions for O-ring (III) seal (Unit : mm)

		RV-20E	RV-40E
Dimensions	O-ring ID No.	S12.5	S14
	O-ring Wire dia.	φ1.5±0.1	φ 1.5±0.1
	O-ring I. D.	φ 12	φ 13.5
	Groove dimensions Outside dia. D_1	φ14.8±0.1	φ 16.3±0.1
	Groove dimensions Depth H_1	1 $^{-0}_{-0.1}$	1 $^{-0}_{-0.1}$

Notes 1. Use O-ring seal of either type (A) or type (B).
2. The S type ID number is the manufacturer's own standard.

RV-C series Features and construction



Hollow shaft structure

- Cables and other lines can pass through the reduction gear
- Allows space saving design

Integrated angular ball bearings

Benefits:
- Increases reliabilty
- Reduces overall cost

Attributed to:
- Built-in angular ball bearing construction improves the ability to support external loads and increases moment rigidity and maximum allowable moment. As a result, this model can be used for the rotary axis.
- Reduces the number of components required.
- Simplifies installation.

2-stage reduction

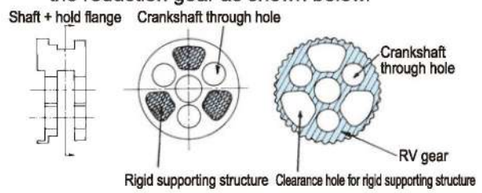
Benefits:
- Reduces vibration
- Reduces inertia (GD^2)

Attributed to:
- Low speed rotation of the RV gear reduces vibration.
- Reduced size of the motor coupling part (input gear) lowers intertia.

All main elements are supported from both sides

Benefits:
- Higher torsional stiffness
- Less vibration
- High shock load capability (5 times rated torque)

Detail:
- Crankshafts are supported on both sides of the reduction gear as shown below.



Rolling contact elements

Benefits:
- Excellent starting efficiency
- Low wear and longer life
- Low backlash (1 arc. min.)

Attributed to:
- Use of roller bearings throughout.

Pin & gear structure

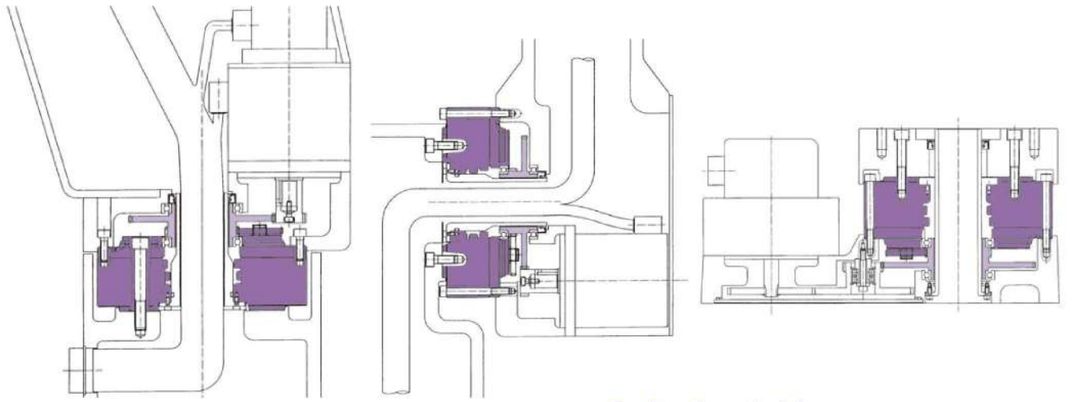
Benefits:
- Very low backlash (1 arc. min.)
- Higher shock loadcapability (5 times rated torque)

Attributed to:
- Synchromeshing of many RV gear teeth and pins.

RV–C Series

Robot wrist axis

- Allows space-saving design
- Main bearing is not required on robot side.



Indexing table

- The table can be made into a hollow shaft structure.

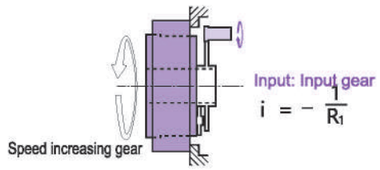
Robot arm

- As cables can be passed through the arm, environmental resistance increases.
- Wider operating angle.

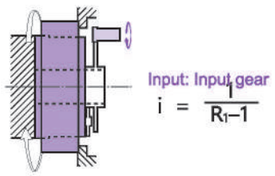
RV-C series rotary direction and speed ratio

Both the E series and Original series may be used in various ways. The following figures show six combinations of the rotary direction and speed ratio. Use the following figure to select a mechanism most suitable for your application.

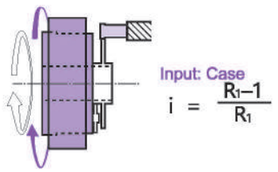
1. Case fixed, shaft output

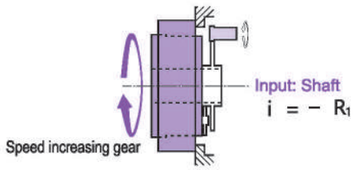


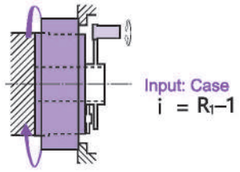
2. Shaft fixed, case output

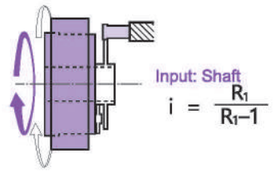


3. Input gear fixed, shaft output



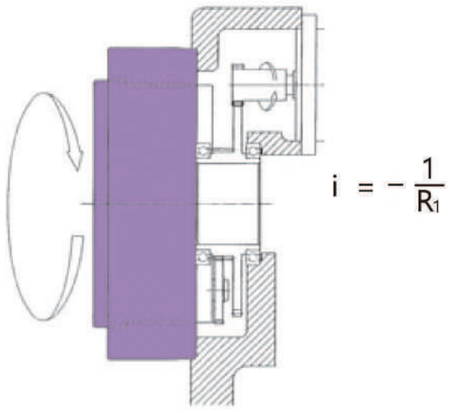




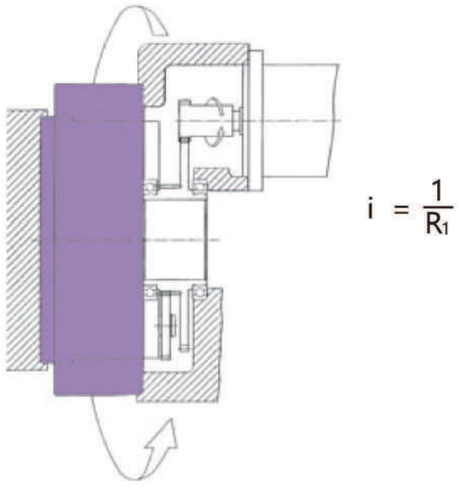


Installation example (motor installed on case side of reduction gear)

1. Case is fixed, shaft output



2. Shaft fixed, case output

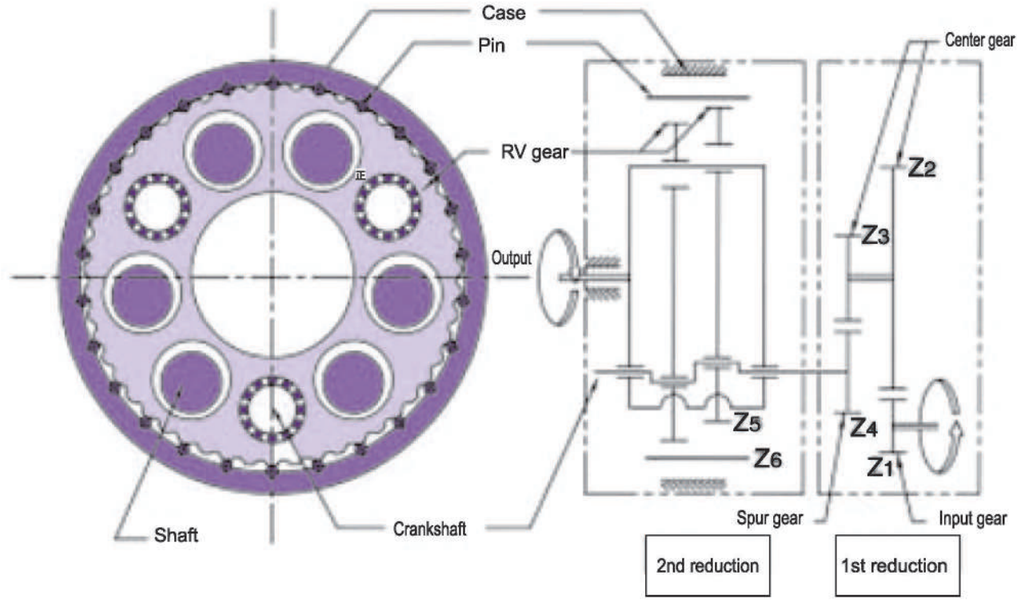


• The "i" in the above equations signifies the speed ratio of the output for the input in each case.The "+" signifi es the output in the same direction as the input and the "-" signifies the output in the opposite direction to the input.

• The above figures show the situation when the motor is installed on the fi xed side.

RV–C Ratio

Mechanism block drawing



The overall reduction ratio i (of the First and Second reduction stages) will differ depending on the use, and can be calculated using the speed ratio values displayed in the table below.

With the shaft as output;

$R = R_1 \times \frac{Z_2}{Z_1}$

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

$(R_1 = 1 + \frac{Z_4}{Z_3} \cdot Z_6)$

R : Overall speed ratio
R_1 : Speed ratio of a discrete reduction gear
Z_1 : Number of teeth on input gear
Z_2 : Number of teeth on large center gear
Z_3 : Number of teeth on small center gear
Z_4 : Number of teeth on spur gear
Z_5 : Number of teeth on RV gear
Z_6 : Number of pins
i : Reduction ratio

Note: The speed ratio values and rotation directions shown above indicate when the motor (motor fixing component) is installed on the case side of the reduction gear.

RV–C Series Precision Robot Joints

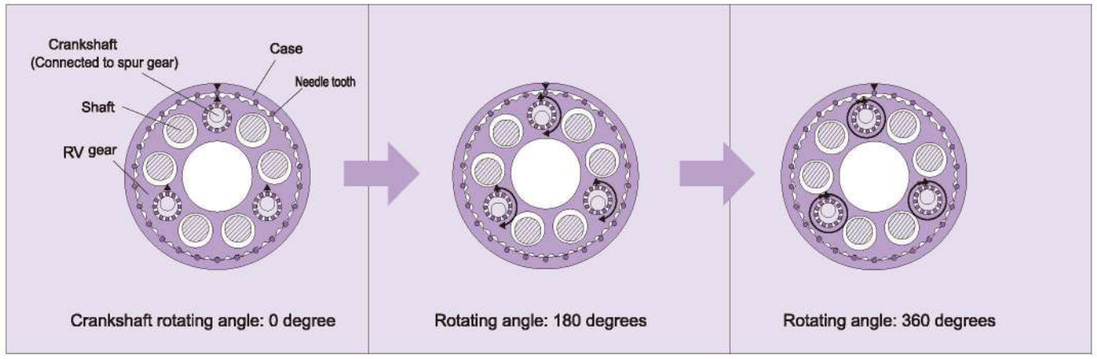
Principle of Speed Reduction

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.



RV–C Series Model Indication

- When placing an order or making an inquiry, please use the following codes to specify the appropriate model.

RV – 80 C – 36.75 – A – B – Motor

Model code	Frame number	Series code	Ratio code	Center gear code	Output shaft clamp code	Motor
RV	10	C: Hollow shaft type	27	A: Standard gear A Z: No gear	B : Bolt-clamping output shaft type T : Through-bolt clamping output shaft type	Motor
	27		36.57			
	50		32.54			
	100		36.75			
	200		34.86			
	320		35.61			
	500		37.34			

Technical note

Rated service life

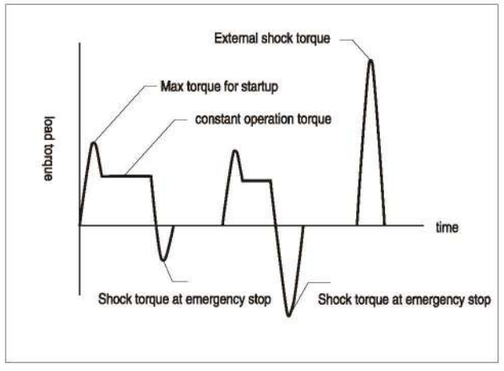
The lifetime resulting from the operation with the rated torque and the rated output speed is referred to as the "rated service life"

Allowable acceleration/deceleration torque

When the machine starts or stops, the load torque to be applied to the gearbox 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

When the machine results from emergency stop or external impact, the larger torque to be applied to gearbox. In such a situation, the allowable torque is referred to as momentary maximum allowable torque.
A large torque may be applied to the gearbox 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 gearbox' 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 gearbox 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 gearbox at a speed that keeps the surface temperature at 60° C or lower.

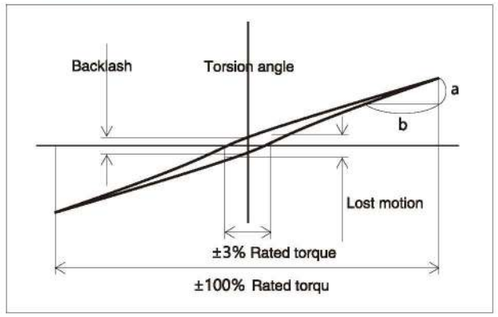
Duty ratio

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

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 gearbox starts up is referred to as "startup efficiency".

No–load running torque (input shaft)

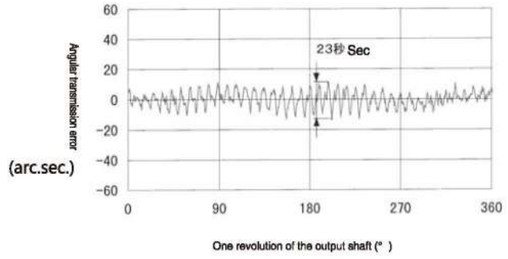
The torque for the input shaft that is required to run the gearbox without load is referred to as "no–load running torque".

Allowable moment and maximum thrust load

The external load moment may be applied to the gearbox 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.



RV–C series Rating Table

Output speed (rpm)				5	10	15	20	25	30	40	50	60
Type	Ratio code	R Speed ratio		Output torque (Nm) / Input capacity (kW)								
		Shaft rotation	Case rotation									
RV-10C	27	27	26	136 / 0.09	111 / 0.16	98 / 0.21	90 / 0.25	84 / 0.29	80 / 0.34	73 / 0.41	68 / 0.47	65 / 0.54
RV-27C	36.57	1,390/38	1352/38	368 / 0.26	299 / 0.42	265 / 0.55	243 / 0.68	227 / 0.79	215 / 0.90	197 / 1.10	184 / 1.29	174 / 1.46
RV-50C	32.54	1,985/61	1924/61	681 / 0.48	554 / 0.77	490 / 1.03	450 / 1.26	420 / 1.47	398 / 1.67	366 / 2.04	341 / 2.38	
RV-100C	36.75	36.75	35.75	1,362 / 0.95	1,107 / 1.55	980 / 2.05	899 / 2.51	841 / 2.94	796 / 3.33	730 / 4.08		
RV-200C	34.86	1,499/43	1456/43	2,724 / 1.90	2,215 / 3.09	1,960 / 4.11	1,803 / 5.04	1,686 / 5.88	1,597 / 6.69			
RV-320C	35.61	2,778/78	2700/78	4,361 / 3.04	3,538 / 4.94	3,136 / 6.57	2,881 / 8.05	2,690 / 9.41				
RV-500C	37.34	3,099/83	3016/83	6,811 / 4.75	5,537 / 7.73	4,900 / 10.26	4,498 / 12.56					

Note: 1. The allowable output speed will differ depending upon the duty ratio, load, and ambient temperature. Contact us regar ding use above the allowable output speed Ns1.

2. The input capacity (kW) is calculated according to the following calculation formula:

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

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

Note: The input capacity is a reference value.

3. When the reduction gear is used at low temperatures, there will be a larger no-load running torque. Note this characteristi c when selecting a motor.
(Refer to “Low temperature characteristic” on page 93)

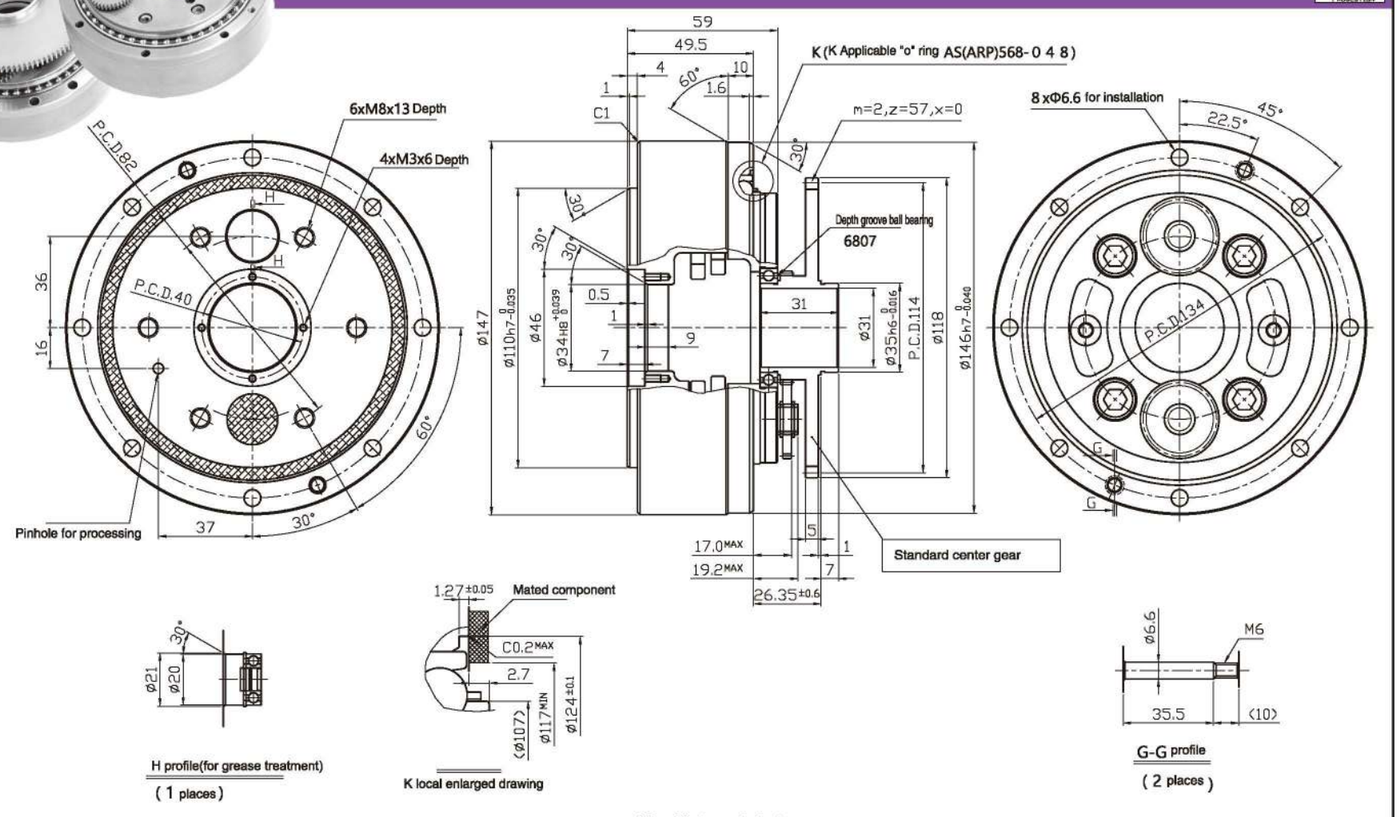
T_R Rated torque (Note 7)	N_R Rated output Speed	K Rated service life	T_{S1} Allowable acceleration deceleration torque	T_{S2} Momentary maximum allowable torque	N_{S0} Maximum allowable output speed (Note 1)	Backlash	Lost motion MAX.	Angular transmission error MAX.	Startup efficiency (Typical value)	M_{O1} Allowable moment (Note 4)	M_{O2} Momentary allowable moment (Max.)	Wr Allowable radial load (Note 9)	I Reduced value of the inertia moment for the input shaft (Note 5)	I (=$\frac{GD^2}{4}$) Inertia of center gear	Weight
(Nm)	(rpm)	(h)	(Nm)	(Nm)	(r/min)	(arc.sec.)	(arc.min.)	(arc.sec.)	(%)	(Nm)	(Nm)	(N)	(kgm^2)	(kgm^2)	(kg)
98	15	6,000	245	490	80	1.0	1.0	70	75	686	1,372	5,755	1.38×10^{-5}	0.678×10^{-3}	4.6
264.6	15	6,000	662	1,323	60	1.0	1.0	70	80	980	1,960	6,520	0.550×10^{-4}	0.563×10^{-3}	8.5
490	15	6,000	1,225	Bolt joint 2,450 / Through-bolt clamping 1,960	50	1.0	1.0	60	75	1,764	3,528	9,428	1.82×10^{-4}	0.363×10^{-2}	14.6
980	15	6,000	2,450	Bolt joint 4,900 / Through-bolt clamping 3,430	40	1.0	1.0	50	80	2,450	4,900	11,802	0.475×10^{-3}	0.953×10^{-2}	19.5
1,960	15	6,000	4,900	Bolt joint 9,800 / Through-bolt clamping 7,350	30	1.0	1.0	50	80	8,820	17,640	31,455	1.39×10^{-3}	1.94×10^{-2}	55.6
3,136	15	6,000	7,840	15,680	25	1.0	1.0	50	85	20,580	39,200	57,087	0.518×10^{-2}	0.405×10^{-1}	79.5
4,900	15	6,000	12,250	24,500	20	1.0	1.0	50	80	34,300	78,400	82,970	0.996×10^{-2}	1.014×10^{-1}	154

Note:
4. The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (p. 91).
5. The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.
6. For the moment rigidity and torsional rigidity, refer to the calculation of tilt angle and the torsion angle (p. 99).
7. 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.81) and the “Product selection flowchart” (p.82).
8. Contact us regarding speed ratios other than those listed above.
9. The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operatingconditions of your system.
10. When radial load b is applied within dimension b, use the reduction gear within the allowable radial load.
11. *1 The R=153 for the RV-80E is only for the bolt-clamping output shaft type (page 20, 21).

RV-10C Bolt clamping output shaft type

Type RV-10C-27-A-B

Ratio



Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	8-M6	1058.4Nm
Shaft side	6-M8	882Nm

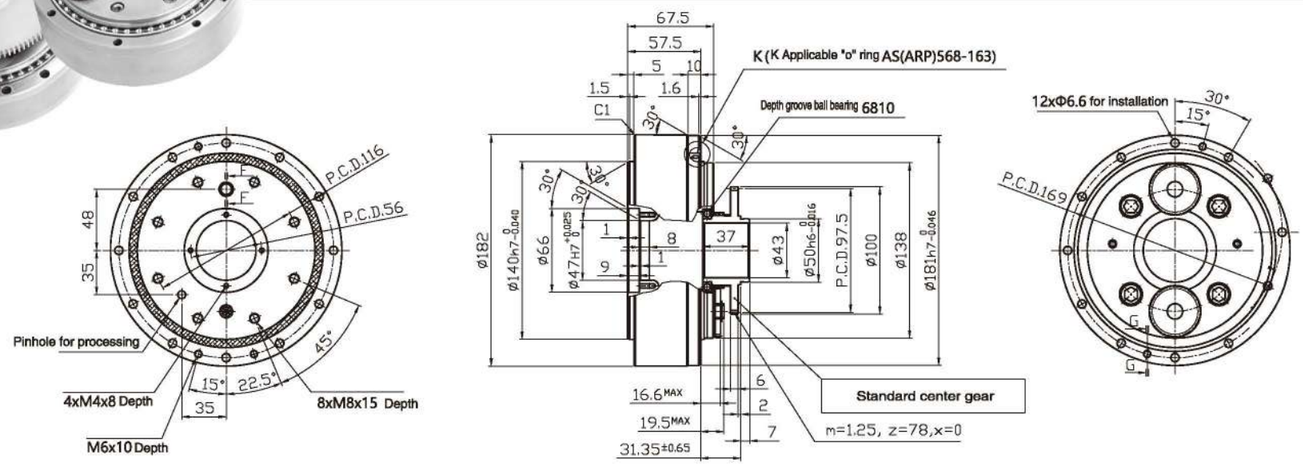
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement

RV-27C Bolt clamping output shaft type

Type RV-27C- 36.57-A-B

Ratio



Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	12-M6	1999.2Nm
Shaft side	6-M8	1666Nm

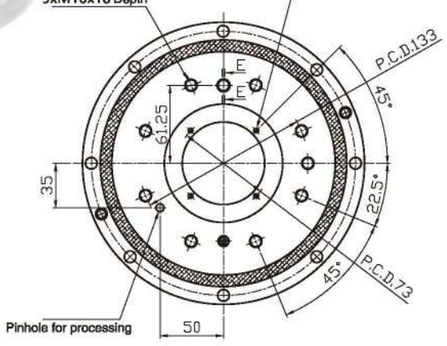
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

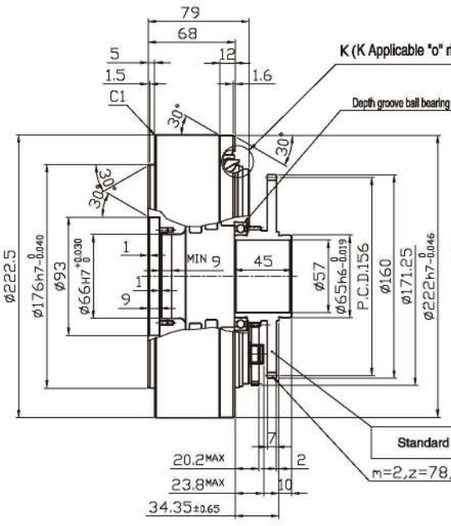
Specifications and sizes might be changed without any advanced announcement

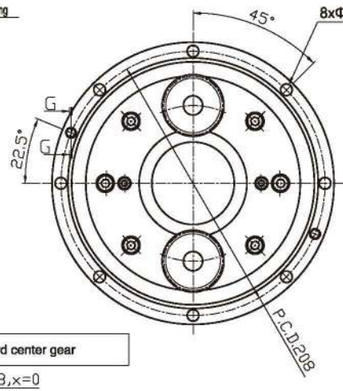
RV-50C Bolt clamping output shaft type

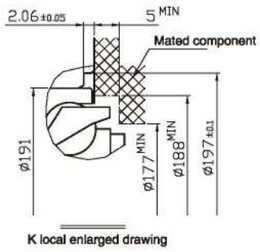
Type RV-50C- 32.54- A -B

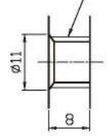
Ratio

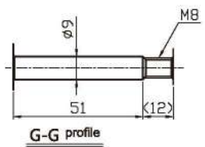












Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	8-M8	2989Nm
Shaft side	9-M10	3410.4Nm

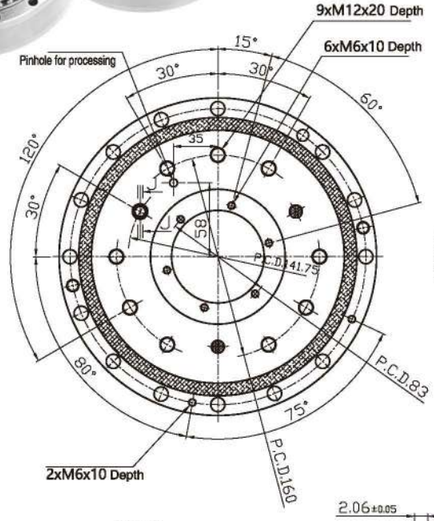
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

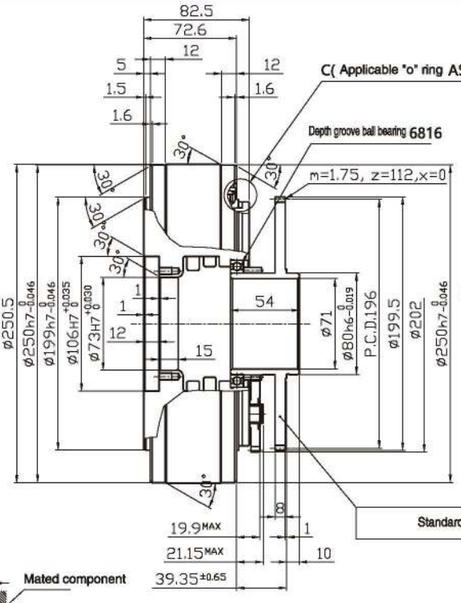
Specifications and sizes might be changed without any advanced announcement

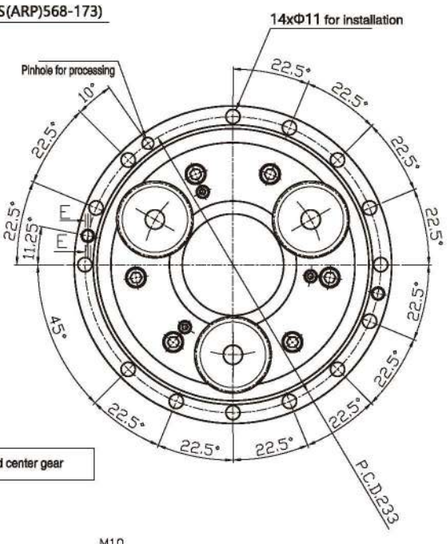
RV-100C Bolt clamping output shaft type

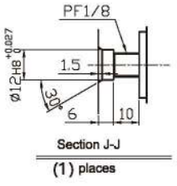
Type RV-100C- 36.75- A -B

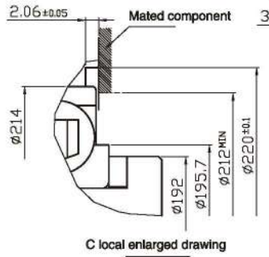
Ratio

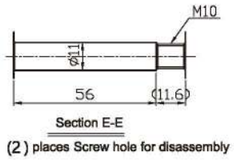












Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	14-M10	9310Nm
Shaft side	9-M12	5948.6Nm

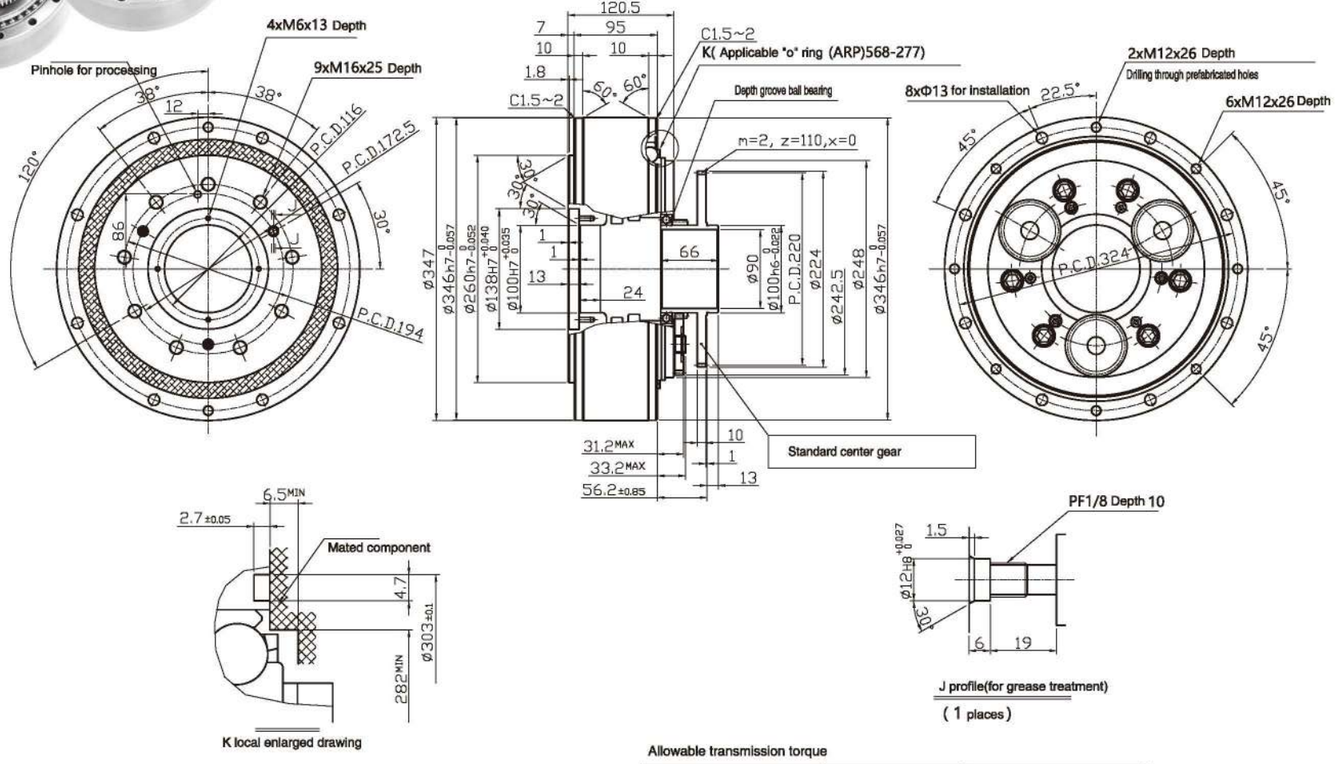
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement

RV-200C Bolt clamping output shaft type

Type RV-200C- 34.86- A -B

Ratio



Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	8-M12	10701.6Nm
Shaft side	9-M16	13543Nm

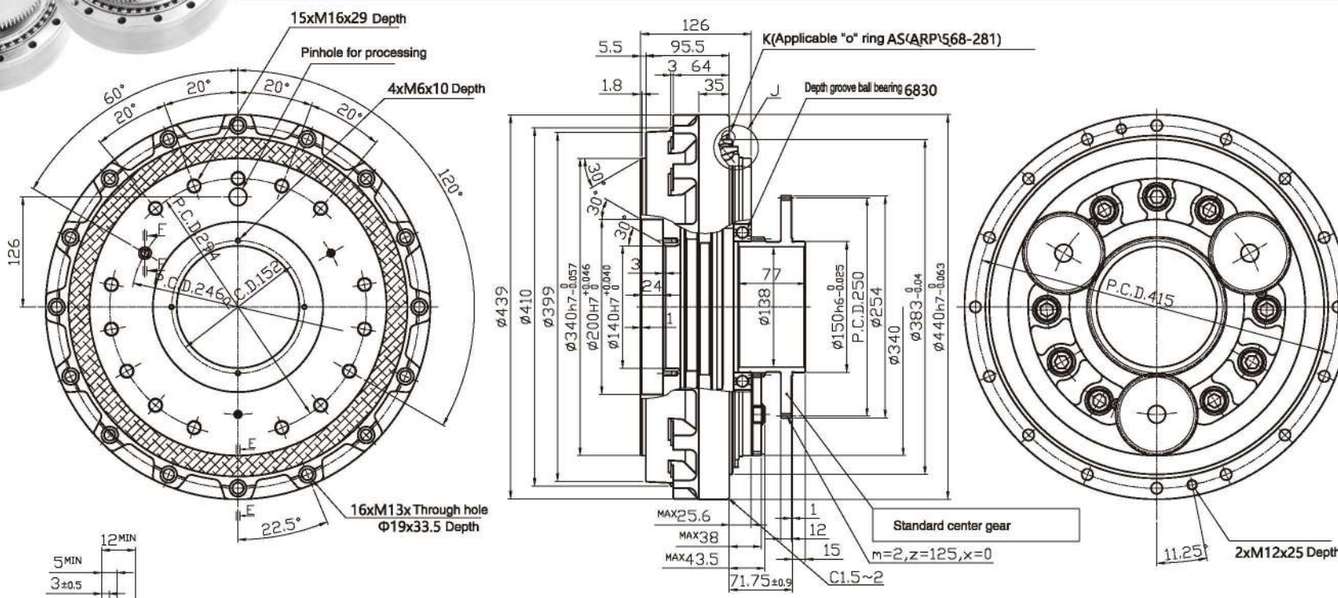
Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

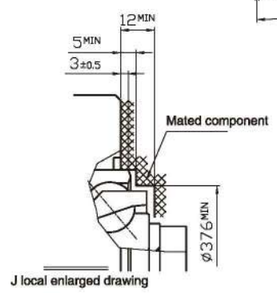
Specifications and sizes might be changed without any advanced announcement

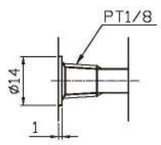
RV-320C Bolt clamping output shaft type

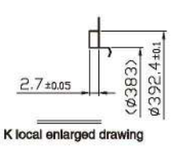
Type RV-320C- 35.61- A -B

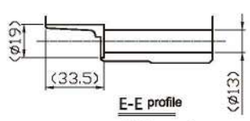
Ratio









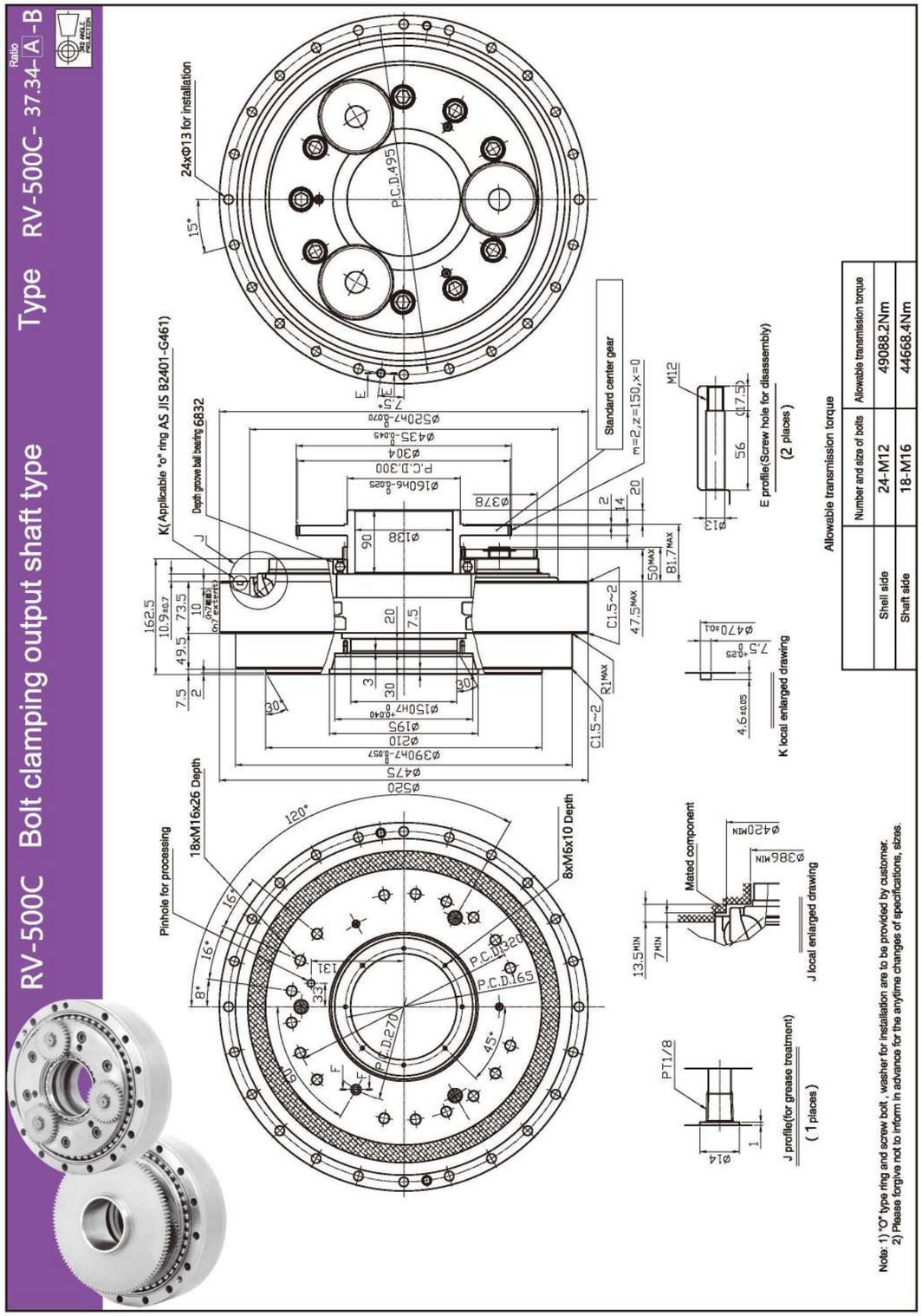


Allowable transmission torque

	Number and size of bolts	Allowable transmission torque
Shell side	16-M12	27440Nm
Shaft side	15-M16	34202Nm

Note: 1) "O" type ring and screw bolt , washer for installation are to be provided by customer.
2) Please forgive not to inform in advance for the anytime changes of specifications, sizes.

Specifications and sizes might be changed without any advanced announcement



Specifications and sizes might be changed without any advanced announcement

RV-C Series Design Points Installation Components

Design of the motor mounting flange

In order to avoid contact with reduction gear components, refer to the sizes indicated in the "External 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 hexagon socket head cap screws (with corresponding conical spring washers).

To obtain maximum performance from the C series, it is important to optimally design the assembly, installation,lubrication, and sealing. Be sure to read the following precautions before designing the above.
As angular ball bearings are used as the main bearings, design the mating component dimensions according to the dimensions shown in the "External Dimensions" drawings to make sure that the bearing retainer does not come in contact with the motor mounting flange.

Note: Two types of C series are available: bolt clamping output shaft type (refer to pages 40 to 46 for "External Dimensions" drawings, and through bolt clamping output shaft type (refer to pages 47 to 52 for "External Dimensions" drawings excluding RV-500C). Please be sure to specify when ordering.

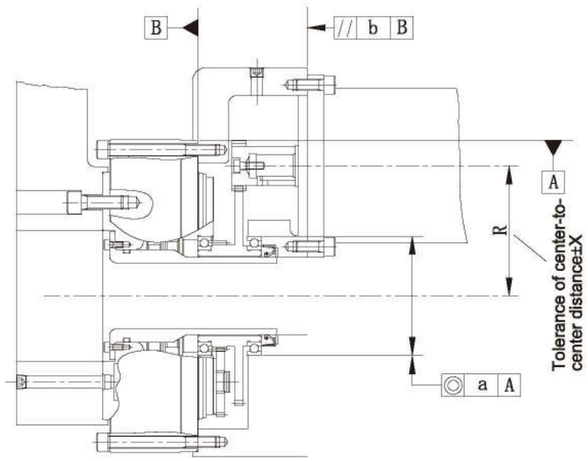
RV-C Series Assembly accuracy

Design the mounting side components of the C series according to the following.
Poor assembly accuracy causes vibration and particularly noise or backlash.

•Assembly accuracy of RV-10C, 27C, 50C, 100C, 200C, 320C, and 500C

(Unit : mm)

Type	Tolerance of center to-center distance X	Concentricity tolerance a	Tolerance of parallelism b
RV-10C	±0.03	MAX0.03	MAX0.03
RV-27C			
RV-50C			
RV-100C			
RV-200C			
RV-320C			
RV-500C			



R indicates distance from center of reduction gear to center of motor.

Installation procedure

- Typical installation examples for gearboxes to be mounted on the mating components are shown below. Be sure to apply the specified amount of the specified grease during assembly. Seals are required for the mounting surfaces of the center tube and gearbox.
- Refer to the O-ring seals shown to make a seal design of the mounting side.
- If O-ring (II) cannot be used due to the structure, apply the appropriate liquid sealant from the table on the right.
- If a seal cannot be formed by applying liquid sealants due to the structure, use O-ring (III) and (IV) .

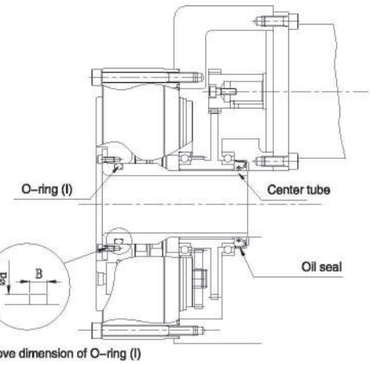
Recommended liquid sealant

Manufacturer	Characteristics and applications
Three Bond 1211 (Three Bond)	• Silicone–based, solventless type • Semi–dry gasket
HERME SERL SS-60F (Nihon-Hermetics)	• One-part, non-solvent elastic sealant • Metal contact side (flange surface) seal • Three Bond1211 Any product basically equivalent to ThreeBond 1211
Locktite515 (Henkel)	• Anaerobic flange sealant • Metal contact side (flange surface) seal

Notes 1. Do not use these sealants for copper material or copper alloy material.
2. If these sealants need to be used under special conditions such as concentrated alkali, pressurized steam, etc., please contact us.

Assembly example of center tube

Centre tube is used to protect the grease passing through the hollow part and sealing the inside of the reducer. The following figure shows an example of an assembly reference for a centre tube.



Dimensions for O-ring (I) seal(for reference) (单位 Unit : mm)

			RV-10C	RV-27C	RV-50C
Dimensions	O-ring	ID No.	CO 0625	CO 0634	CO 0643
		Wire dia.	φ 2.4 ±0.07	←	φ 3.5 ±0.1
		I. D.	φ 29.7	φ 42.2	φ 59.6
	Groove dimensions	I. D.: d	φ 30.2 $^{0}_{-0.08}$	φ 43.2 $^{0}_{-0.08}$	φ 60.3 $^{0}_{-0.10}$
		Width B	3.2 $^{+0.25}_{0}$	←	4.7 $^{+0.25}_{0}$

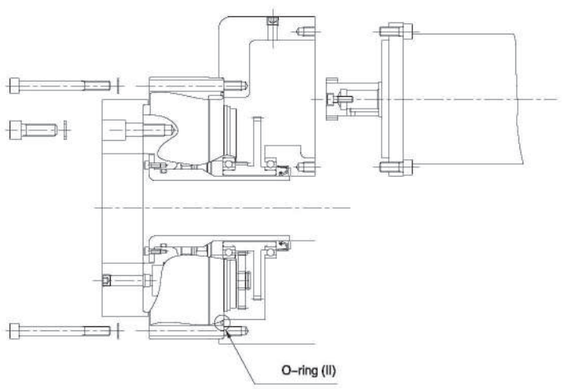
(单位 Unit : mm)

			RV-100C	RV-200C	RV-320C	RV-500C
Dimensions	O-ring	ID No.	S70	G95	G135	G145
		Wire dia.	φ 2.0 ±0.1	φ 3.1 ±0.1	←	←
		I. D.	φ 69.5	φ 94.4	φ 134.4	φ 144.4
	Groove dimensions	I. D.: d	φ 70.0 $^{0}_{-0.05}$	φ 95.0 $^{0}_{-0.10}$	φ 135.0 $^{0}_{-0.08}$	φ 145.0 $^{0}_{-0.10}$
		Width B	2.7 $^{+0.25}_{0}$	4.1 $^{+0.25}_{0}$	←	←

Assembly example with the output shaft bolt clamping type

(RV-10C、27C、50C、100C、200C、320C、500C)

If center tube, oil seal and O-ring (I) are used together, the seal on the mounting surface of output shaft side is not required.



O–ring (II)

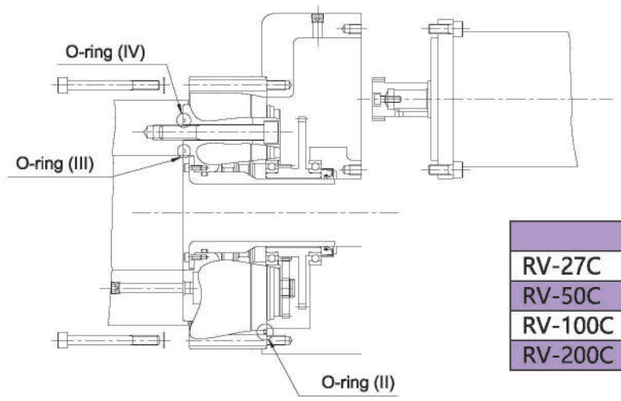
	Applicable to O–ring
RV-10C	AS568-048
RV-27C	AS568-163
RV-50C	AS568-169
RV-100C	AS568-173
RV-200C	AS568-277
RV-320C	AS568-281
RV-500C	G460

The O-ring (II) can be applied to both bolt clamping and through-bolt clamping output shaft types.

Assembly example of through-bolt clamping output shaft type

(RV-27C、RV-50C、100C、200C)

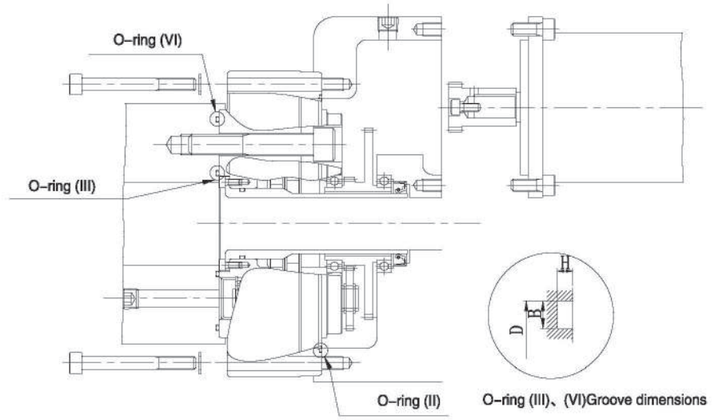
The O-ring groove is provided at the end face of output shaft of the reduction gear. Use O-rings as shown below.



	Applicable to O–ring (III)	Applicable to O–ring (VI)
RV-27C	S75	S120
RV-50C	S100	S150
RV-100C	G115	AS568-165
RV-200C	S150	AS568-271

● Assembly example of through-bolt clamping output shaft type (RV-10C、320C)

Provide the O-ring groove on the counterpart component. Dimensions of O-rings are shown below for reference.



Dimensions for O-ring (I) seal(for reference) (Unit : mm)

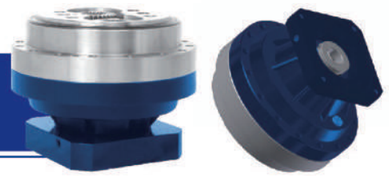
			RV-10C	RV-320C
Dimensions	O-ring	ID No.	AS568-032	G210
		Wire dia.	φ 1.78 ±0.07	φ 5.7 ±0.13
		I. D.	φ 47.35 ±0.38	φ 209.3
	Groove dimensions	Outside dia.D	φ 51.0 $^{+0.05}_{0}$	φ 220.0 $^{+0.1}_{0}$
		Depth H	1.27 ±0.05	5.5 ±0.05
		Width B	2.39 $^{+0.25}_{0}$	7.5 $^{+0.25}_{0}$

Note: The S type ID number is the manufacturer's own standard.

Dimensions for O-ring (VI) seal(for reference) (Unit : mm)

			RV-10C	RV-320C
Dimensions	O-ring	ID No.	S100	G290
		Wire dia.	φ 2.0 ±0.1	φ 5.7 ±0.13
		I. D.	φ 99.5 ±0.4	φ 289.3
		Outside dia.D	φ 103.0 $^{+0.05}_{0}$	φ 300.0 $^{+0.1}_{0}$
		Depth H	1.5 $^{0}_{-0.1}$	5.5 ±0.05
		Width B	2.7 $^{+0.25}_{0}$	7.5 $^{+0.25}_{0}$

RV–EM Series model Indication



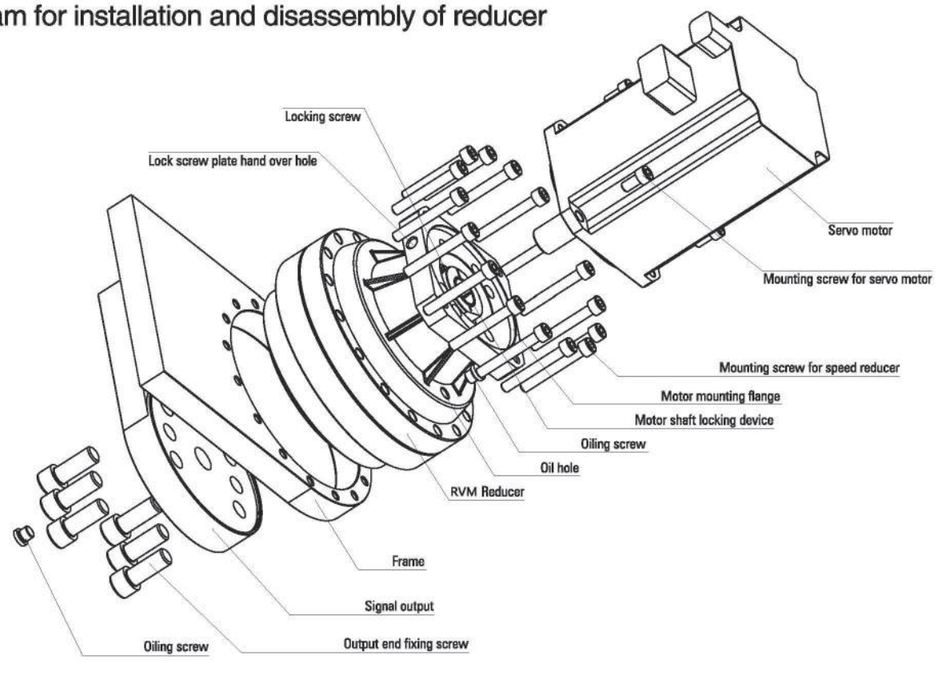
•When placing an order or making an inquiry, please use the following codes to specify the appropriate model.

RV – 80 EM – 121 – A – B – Motor

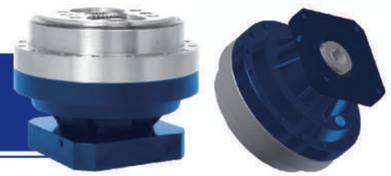
Model code	Frame number	Series code	Ratio code	Input gear code Input spline code	Output shaft clamp code	Motor
RV	6	E: Main bearing built-in type	31, 43, 53.5, 59, 79, 103	A: Standard gear A B: Standard gear B Z: No gear	B: Bolt-clamping output shaft type P: Pin/bolt clamping output shaft type	Motor Model
	20		57, 81, 105, 121, 141, 161			
	40		57, 81, 105, 121, 153			
	80		57, 81, 101, 121, 153			
	110		81, 111, 161, 175			
	160		81, 101, 129, 145, 171			
	320		81, 101, 118.5, 129, 141, 171, 185			
	450		81, 101, 118.5, 129, 154.8, 171, 192.4			

RV–EM Series

Diagram for installation and disassembly of reducer

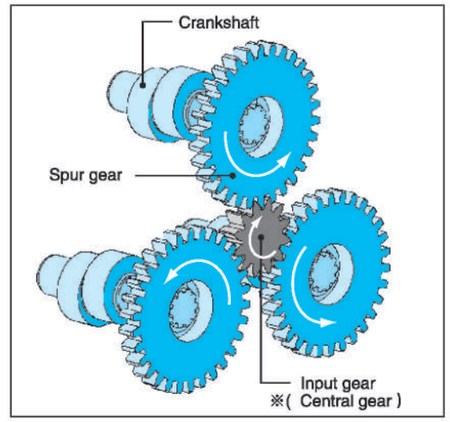


RV–EM Series working principle

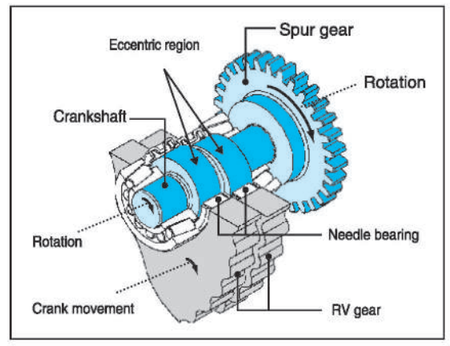


1. Rotation of the servomotor is transmitted through the input gear to the spur gears, and the speed is reduced
   accordingly with the gear ratio between the input gear and the spur gears <Fig. 1>.
※The hollow series is transmitted from the input gear to the spur gear through the central gear.
2. Since they are directly connected, the crankshafts have the same rotational speed as the spur gears <Fig. 1>.
3. Two RV gears are mounted around the needle bearings on the eccentric region of the crankshaft. (In order to
   balance the equal amount of force, two RV gears are mounted) <Fig. 2>.
4. When the crankshafts rotate, the RV gears mounted on the eccentric sections also revolve eccentrically
   around the input axis (crank movement) <Fig. 2>.
5. Pins are arrayed in a constant pitch in the grooves inside the case. The number of pins is just one larger than
   the number of RV teeth <Fig. 3>.
6. As the crankshafts revolve one complete rotation, the RV gears revolve eccentrically one pitch of a pin (crank
   movement). As a result of this, the RV gears rotate one tooth in the direction opposite to the rotation of the
   crankshafts <Fig. 3>.
7. The rotation is then transmitted to the shaft (output shaft) via the crankshaft. At this time, the shaft rotation
   speed can be reduced in proportion to the number of pins against the crankshaft. This is the second reduction
   section <Fig. 3>.
8. The total reduction ratio is the product of the first reduction ratio multiplied by the second reduction ratio.
※ Hollow series include reduction ratio of the centre gear section.

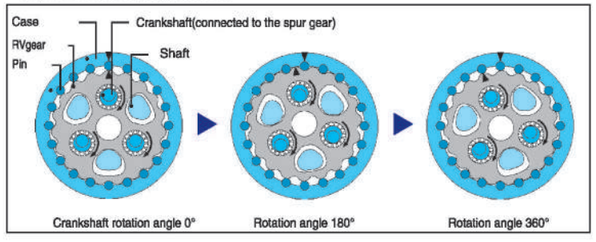
■ Fig. 1 First reduction section

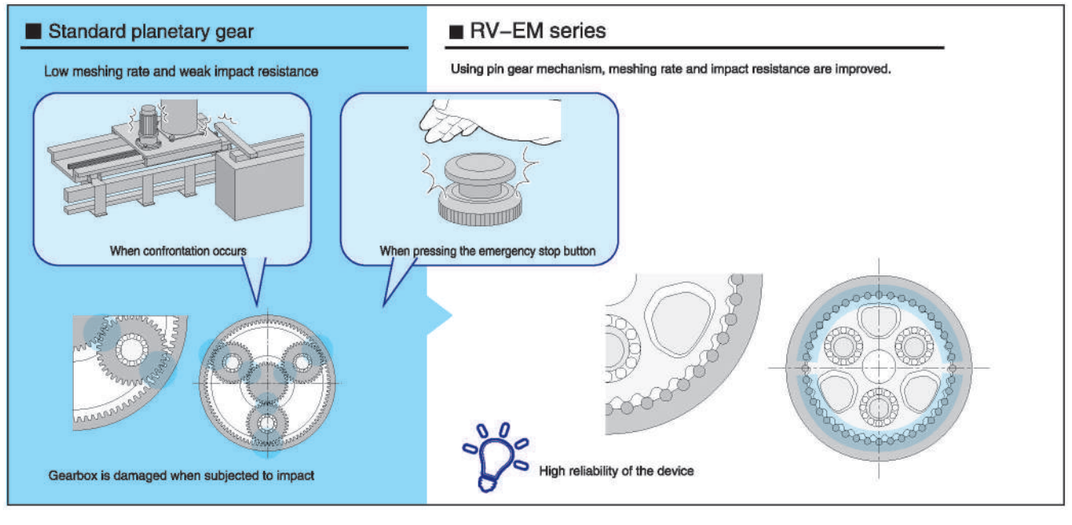


■ Fig.2 Crankshaft section



■ Fig. 3 Second reduction section





RV-EM Series Rating Table

Output speed (rpm)			5	10	15	20	25	30	40	50	60
Type	Ratio code	R Speed ratio									
		Shaft rotation / Case rotation	Output torque (Nm) / Input capacity (kW)								
RV-6EM	31	31 / 30	101 / 0.07	81 / 0.11	72 / 0.15	66 / 0.19	62 / 0.22	58 / 0.25	54 / 0.30	50 / 0.35	47 / 0.40
	43	43 / 42									
	53.5	53.5 / 52.5									
	59	59 / 58									
	79	79 / 78									
	103	103 / 102									
RV-20EM	57	57 / 56	231 / 0.16	188 / 0.26	167 / 0.35	153 / 0.43	143 / 0.50	135 / 0.57	124 / 0.70	115 / 0.81	110 / 0.92
	81	81 / 80									
	105	105 / 104									
	121	121 / 120									
	141	141 / 140									
	161	161 / 160									
RV-40EM	57	57 / 56	572 / 0.40	465 / 0.65	412 / 0.86	377 / 1.05	353 / 1.23	334 / 1.40	307 / 1.71	287 / 2.00	271 / 2.27
	81	81 / 80									
	105	105 / 104									
	121	121 / 120									
	153	153 / 152									
RV-80EM	57	57 / 56	1,088 / 0.76	885 / 1.24	784 / 1.64	719 / 2.01	672 / 2.35	637 / 2.67	584 / 3.26	546 / 3.81	517 / 4.33
	81	81 / 80									
	101	101 / 100									
	121	121 / 120									
	153	*1 (153) / *1 (152)									
RV-110EM	81	81 / 80	1,499 / 1.05	1,215 / 1.70	1,078 / 2.26	990 / 2.76	925 / 3.23	875 / 3.67	804 / 4.49		
	111	111 / 110									
	161	161 / 160									
	175	1227/7 / 1220/7									
RV-160EM	81	81 / 80	2,176 / 1.52	1,774 / 2.48	1,568 / 3.28	1,441 / 4.02	1,343 / 4.69	1,274 / 5.34			
	101	101 / 100									
	129	129 / 128									
	145	145 / 144									
	171	171 / 170									
RV-320EM	81	81 / 80	4,361 / 3.04	3,538 / 4.94	3,136 / 6.57	2,881 / 8.05	2,695 / 9.41	2,548 / 10.7			
	101	101 / 100									
	118.5	118.5 / 117.5									
	129	129 / 128									
	141	141 / 140									
	171	171 / 170									
	185	185 / 184									
RV-450EM	81	81 / 80	6,135 / 4.28	4,978 / 6.95	4,410 / 9.24	4,047 / 11.3	3,783 / 13.2				
	101	101 / 100									
	118.5	118.5 / 117.5									
	129	129 / 128									
	154.8	2013/13 / 2000/13									
	171	171 / 170									
	192	1347/7 / 1340/7									

Note: 1. The allowable output speed will differ depending upon the duty ratio, load, and ambient temperature.
Contact us regar ding use above the allowable output speed Ns1.

2. The input capacity (kW) is calculated according to the following calculation formula:

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

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

Note: The input capacity is a reference value.

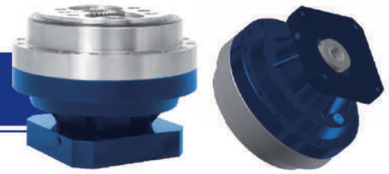
3. When the reduction gear is used at low temperatures, there will be a larger no-load running torque. Note this characteristi c when selecting a motor. (Refer to "Low temperature characteristic" on page 93)

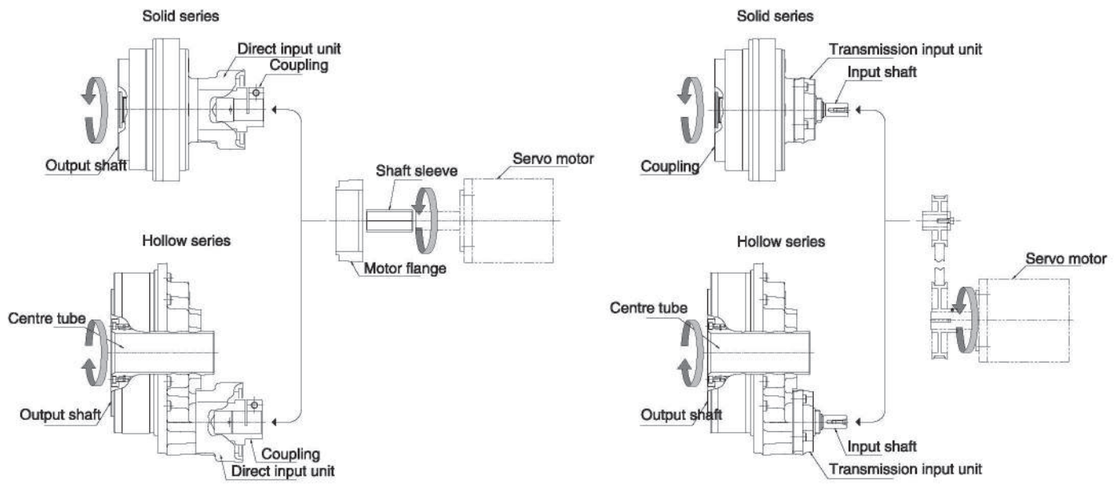
T_0 Rated torque (Note 7)	N_0 Rated output Speed	K Rated service life	T_{S1} Allowable acceleration deceleration torque	T_{S2} Momentary maximum allowable torque	N_{S0} Maximum allowable output speed (Note 1)	Backlash	Lost motion MAX.	Angular transmission error MAX.	Startup effi ciency (Typical value)	M_{O1} Allowable moment (Note 4)	M_{O2} Momentary allowable moment (Max.)	Wr Allowable radial load (Note 10)	I Reduced value of the inertia moment for the input shaft (Note 5)	Weight
(Nm)	(rpm)	(h)	(Nm)	(Nm)	(r/min)	(arc.sec.)	(arc.min.)	(arc.sec.)	(%)	(Nm)	(Nm)	(N)	(kgm^2)	(kg)
58	30	6,000	117	294	100	1.5	1.5	80	70	196	392	2,140	2.63×10^{-6}	2.5
													2.00×10^{-6}	
													1.53×10^{-6}	
													1.39×10^{-6}	
													1.09×10^{-6}	
													0.74×10^{-6}	
167	15	6,000	412	833	75	1.0	1.0	70	75	882	1,764	7,785	9.66×10^{-6}	4.7
													6.07×10^{-6}	
													4.32×10^{-6}	
													3.56×10^{-6}	
													2.88×10^{-6}	
													2.39×10^{-6}	
412	15	6,000	1,029	2,058	70	1.0	1.0	60	85	1,666	3,332	11,594	3.25×10^{-5}	9.3
													2.20×10^{-5}	
													1.63×10^{-5}	
													1.37×10^{-5}	
													1.01×10^{-5}	
784	15	6,000	1,960	Bolt joint 3,920 / Pin/bolt joint 3,185	70	1.0	1.0	50	85	Bolt joint 2,156 / Pin/bolt joint 1,735	Bolt joint 4,312 / Pin/bolt joint 2,156	Bolt joint 12,988 / Pin/bolt joint 10,452	8.16×10^{-5}	Bolt joint 13.1 / Pin/bolt joint 12.7
													6.00×10^{-5}	
													4.82×10^{-5}	
													3.96×10^{-5}	
													2.98×10^{-5}	
1,078	15	6,000	2,695	5,390	50	1.0	1.0	50	85	2,940	5,880	16,648	9.88×10^{-5}	17.4
													6.96×10^{-5}	
													4.36×10^{-5}	
													3.89×10^{-5}	
1,568	15	6,000	3,920	Bolt joint 7,840 / Pin/bolt joint 6,615	45	1.0	1.0	50	85	3,920	Bolt joint 7,840 / Pin/bolt joint 6,762	18,587	1.77×10^{-4}	26.4
													1.40×10^{-4}	
													1.06×10^{-4}	
													0.87×10^{-4}	
													0.74×10^{-4}	
3,136	15	6,000	7,840	Bolt joint 15,680 / Pin/bolt joint 12,250	35	1.0	1.0	50	80	Bolt joint 7,056 / Pin/bolt joint 6,174	Bolt joint 14,112 / Pin/bolt joint 10,976	Bolt joint 28,067 / Pin/bolt joint 24,558	4.83×10^{-4}	44.3
													3.79×10^{-4}	
													3.15×10^{-4}	
													2.84×10^{-4}	
													2.54×10^{-4}	
													1.97×10^{-4}	
													1.77×10^{-4}	
4,410	15	6,000	11,025	Bolt joint 22,050 / Pin/bolt joint 18,620	25	1.0	1.0	50	85	8,820	Bolt joint 17,640 / Pin/bolt joint 13,524	30,133	8.75×10^{-4}	66.4
													6.91×10^{-4}	
													5.75×10^{-4}	
													5.20×10^{-4}	
													4.12×10^{-4}	
													3.61×10^{-4}	
													3.07×10^{-4}	

Note:
4. The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (p. 91).
5. The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.
6. For the moment rigidity and torsional rigidity, refer to the calculation of tilt angle and the torsion angle (p. 99).
7. 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.81) and the "Product selection flowchart" (p.82).
8. Contact us regarding speed ratios other than those listed above.
9. The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operatingconditions of your system.
10. When radial load b is applied within dimension b, use the reduction gear within the allowable radial load.
11. *1 The R=153 for the RV-80E is only for the bolt-clamping output shaft type (page 20, 21).

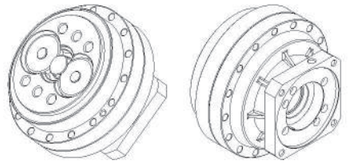
RV–EM Series

Reducer Installation Drawing



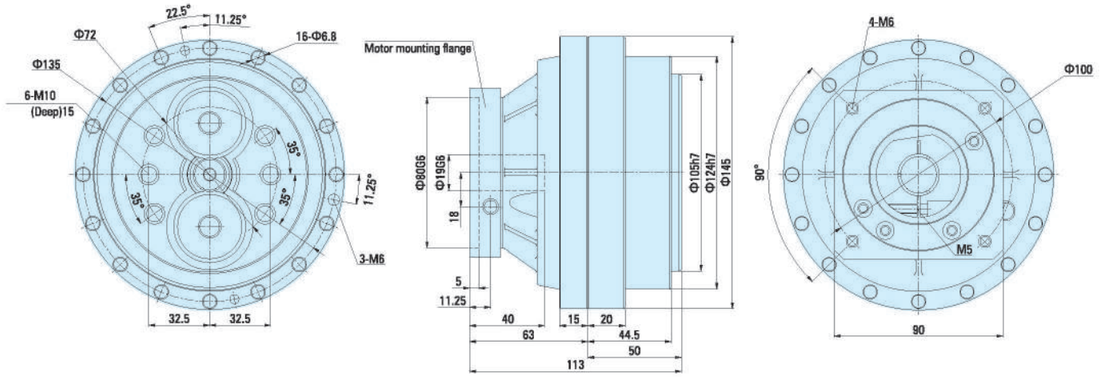


RV–20EM–(19 Shaft)



Overall Dimension Drawing

Output

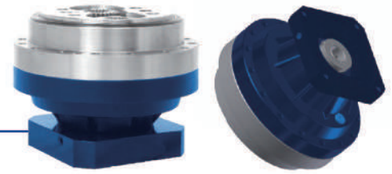


Input

● Note:

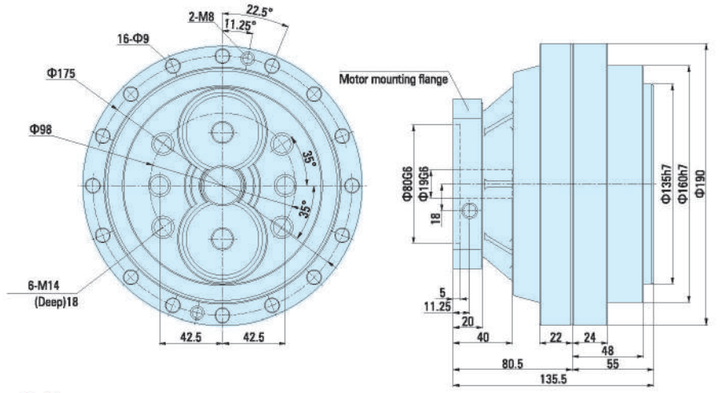
1. This figure applies to the motor shaft: <=19x40L; motor shaft lock use locker.
2. Motor mounting flange according to motor model.

RV–40EM–(19 Shaft)

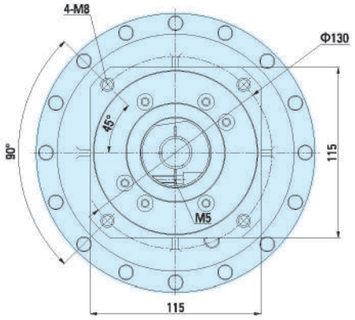


Overall Dimension Drawing

Output



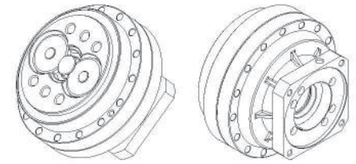
Input



● Note:

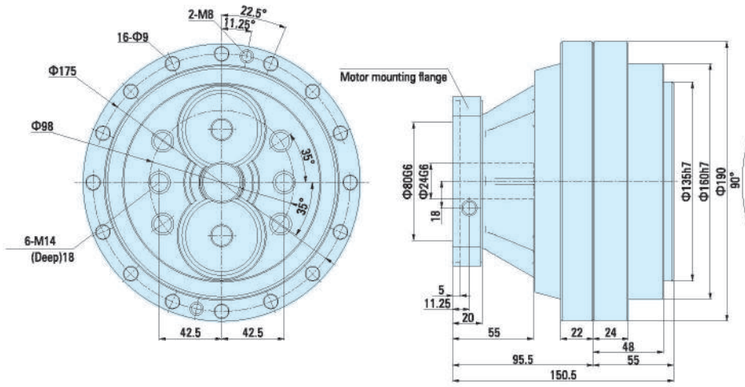
1. This figure applies to the motor shaft: <=19x40L; motor shaft lock use locker.
2. Motor mounting flange according to motor model.

RV–40EM–(24 Shaft)

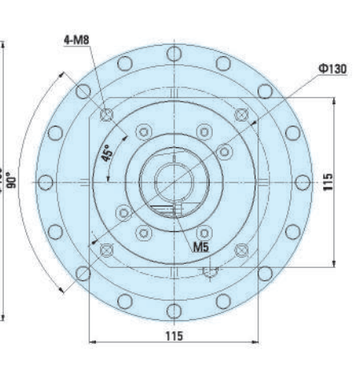


Overall Dimension Drawing

Output



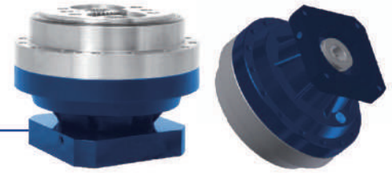
Input



● Note:

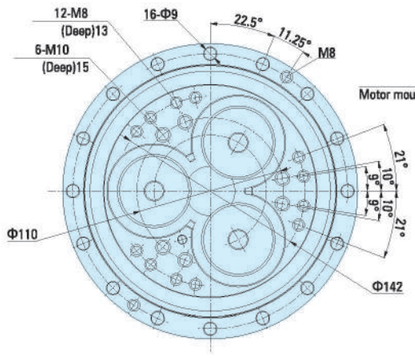
1. This figure applies to the motor shaft: <=24x55L; motor shaft lock use locker.
2. Motor mounting flange according to motor model.

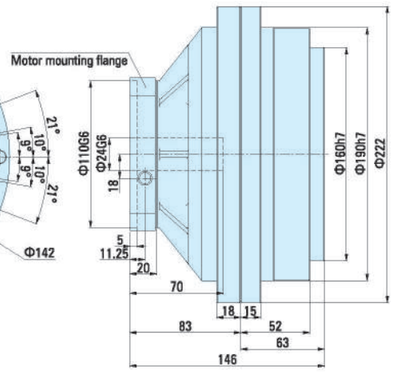
RV–80EM–(24 Shaft)



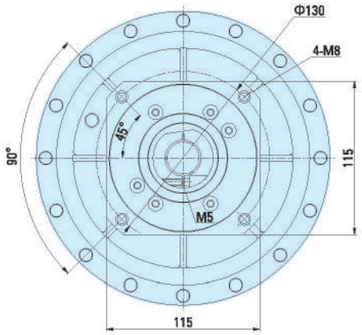
Overall Dimension Drawing

Output





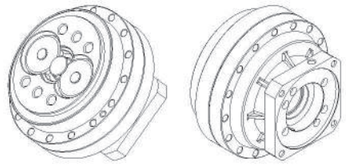
Input



● Note:

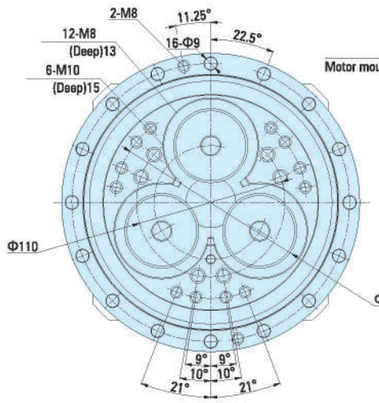
1. This figure applies to the motor shaft: <=24x70L; motor shaft lock use locker.
2. Motor mounting flange according to motor model.

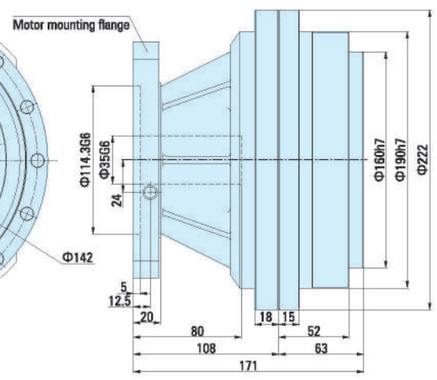
RV–80EM–(35 Shaft)



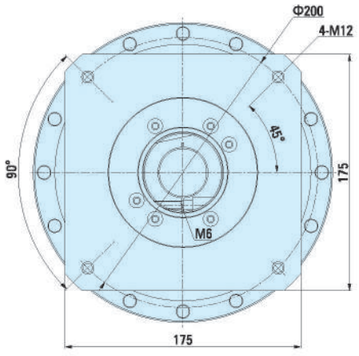
Overall Dimension Drawing

Output





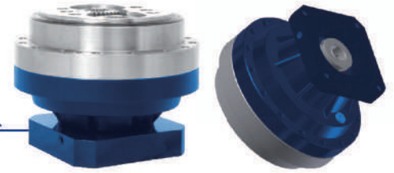
Input



● Note:

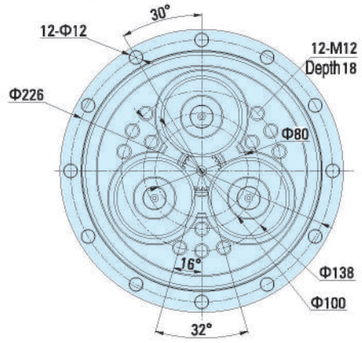
1. This figure applies to the motor shaft: <=35x80L; motor shaft lock use locker.
2. Motor mounting flange according to motor model.

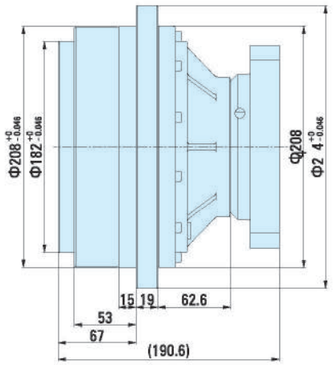
RV–110EM–(35 Shaft)



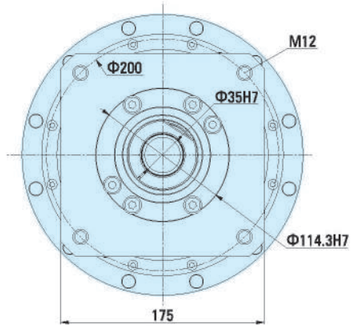
Overall Dimension Drawing

Output





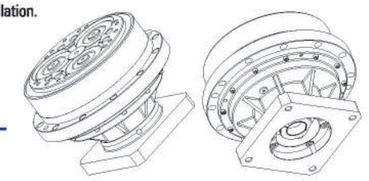
Input



● Note:

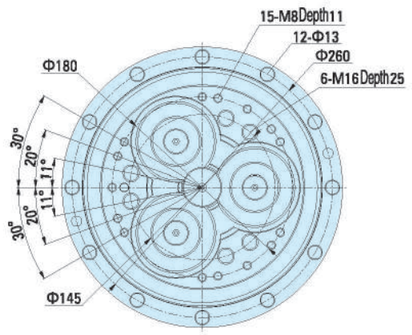
1. This figure applies to the motor shaft: <=35x70L; Motor shaft is locked by locker.
2. Speed reduction ratio: (81, 111, 161): 1 (shaft output).
3. Lubricants: VIGO GREASE RE0 or RE-00 (MOLYWHITE).
4. Rated output torque: 1100N.m (output speed: 15R/Min).
5. The motor mounting flange is supplied according to the motor type.
6. The output terminal must be sealed, please pay attention to the seal and concentricity position during the installation.

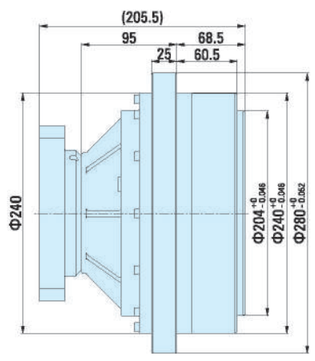
RV–160EM–(35 Shaft)



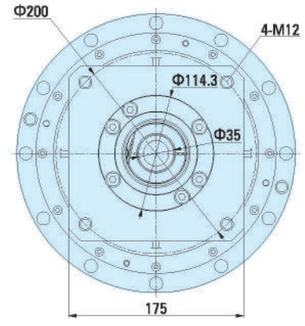
Overall Dimension Drawing

Output





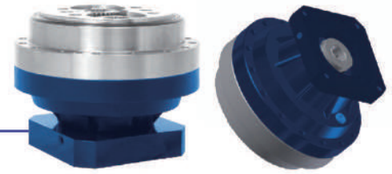
Input



● 说明 Note:

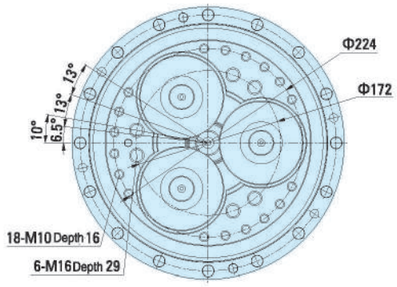
1. This figure applies to the motor shaft: <=35x70L; Motor shaft is locked by locker.
2. Speed reduction ratio: (81, 129, 171): 1 (shaft output).
3. Lubricants: VIGO GREASE RE0 or RE-00 (MOLYWHITE).
4. Rated output torque: 1570N.m (output speed: 15R/Min).
5. The motor mounting flange is supplied according to the motor type.
6. The output terminal must be sealed, please pay attention to the seal and concentricity position during the installation.

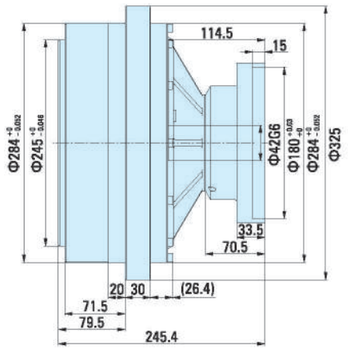
RV–320EM–(35 Shaft)



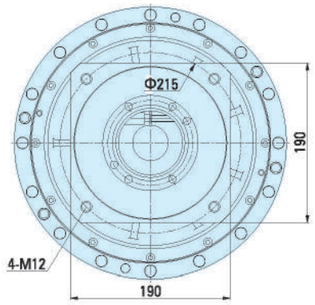
Overall Dimension Drawing

Output



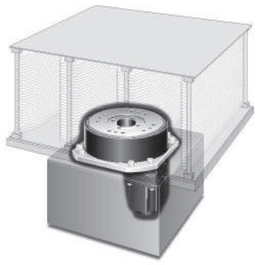


Input

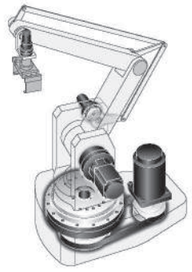


RV–EM Application example

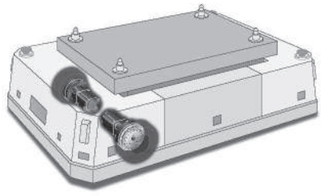
■ Glass substrate, wafer rotary shaft



■ Connecting axis of the palletizing robot



■ AGV drive and control axis



Maintenance

- The standard replacement time for lubricant is 20,000 hours. However, when operation involves a gearbox 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.

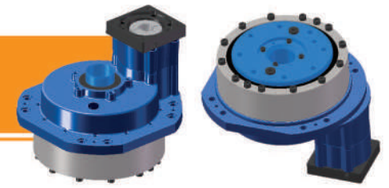
Temperature of gearbox

- When using the gearbox under heavy 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 gearbox 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.

Output rotary angle of gearbox

- When the range of the rotary angle is small (10 degrees or less), the service life of the gearbox may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.
  Note: Contact us in case the rotary angle is 10 degrees or less.

RV–CM Series model Indication



- When placing an order or making an inquiry, please use the following codes to specify the appropriate model.

RV – 80 CM – 36.75 – A – B – Motor

Model code	Frame number	Series code	Ratio code	Center gear code	Output shaft clamp code	Motor
RV	10	CM Input matching Motor flange	27	A: Standard gear A Z: No gear 76.3、100.2 124.7、151.6 214.3、264.6	B : Bolt-clamping output shaft type T : Through-bolt clamping output shaft type	Motor
	27		36.57			
	50		32.54			
	100	CK	36.75			
	200		34.86			
	320	CW	35.61			
	500		37.34			

■ General equipment

Need bearings + supplying platform

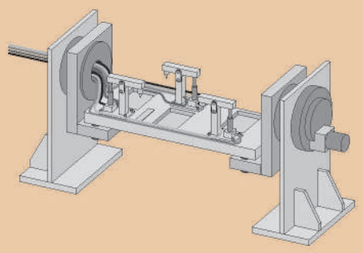
Large number of components, assembly and adjustment takes lots of time and efforts

■ RV–CM series

Bearings with large capacity inside

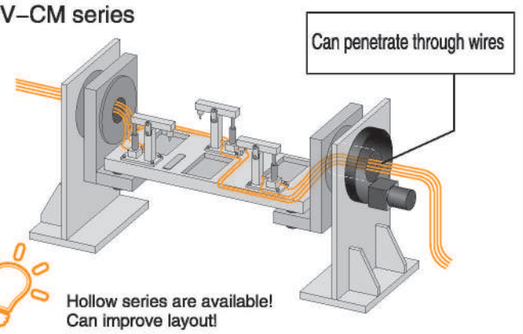
Less components, and less time of assembly and designing take

■ General equipment



Cable handling is troublesome

■ RV–CM series



Hollow series are available!
Can improve layout!

RV-C series Rating Table

Output speed (rpm)				5	10	15	20	25	30	40	50	60
Type	Ratio code	R Speed ratio		Output torque (Nm) / Input capacity (kW)								
		Shaft rotation	Case rotation									
RV-10CM	81、108 153、189 243	27	26	136 / 0.09	111 / 0.16	98 / 0.21	90 / 0.25	84 / 0.29	80 / 0.34	73 / 0.41	68 / 0.47	65 / 0.54
RV-27CM	79、103 157、177 231.5	1,390/38	1352/38	368 / 0.26	299 / 0.42	265 / 0.55	243 / 0.68	227 / 0.79	215 / 0.90	197 / 1.10	184 / 1.29	174 / 1.46
RV-50CM	80、107 151、177 234	1,985/61	1924/61	681 / 0.48	554 / 0.77	490 / 1.03	450 / 1.26	420 / 1.47	398 / 1.67	366 / 2.04	341 / 2.38	
RV-100CM	76.3、100.2 124.7、151.6 214.3、264.6	36.75	35.75	1,362 / 0.95	1,107 / 1.55	980 / 2.05	899 / 2.51	841 / 2.94	796 / 3.33	730 / 4.08		
RV-200CM	34.86	1,499/43	1456/43	2,724 / 1.90	2,215 / 3.09	1,960 / 4.11	1,803 / 5.04	1,686 / 5.88	1,597 / 6.69			
RV-320CM	35.61	2,778/78	2700/78	4,361 / 3.04	3,538 / 4.94	3,136 / 6.57	2,881 / 8.05	2,690 / 9.41				
RV-500CM	37.34	3,099/83	3016/83	6,811 / 4.75	5,537 / 7.73	4,900 / 10.26	4,498 / 12.56					

Note: 1. The allowable output speed will differ depending upon the duty ratio, load, and ambient temperature.
Contact us regar ding use above the allowable output speed Ns1.

2. The input capacity (kW) is calculated according to the following calculation formula:

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

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

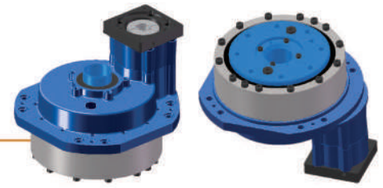
Note: The input capacity is a reference value.

3. When the reduction gear is used at low temperatures, there will be a larger no-load running torque. Note this characteristi c when selecting a motor.
(Refer to "Low temperature characteristic" on page 93)

T_0 Rated torque (Note 7)	N_0 Rated output Speed	K Rated service life	T_{S1} Allowable acceleration deceleration torque	T_{S2} Momentary maximum allowable torque	N_{S0} Maximum allowable output speed (Note 1)	Backlash	Lost motion MAX.	transmission error MAX.	Startup effi ciency (Typical value)	M_{O1} Allowable moment (Note 4)	M_{O2} Momentary allowable moment (Max.)	Wr Allowable radial load (Note 9)	I Reduced value of the inertia moment for the input shaft (Note 5)	I (=$\frac{GD^2}{4}$) Inertia of center gear	Weight
(Nm)	(rpm)	(h)	(Nm)	(Nm)	(r/min)	(arc.sec.)	(arc.min.)	(arc.sec.)	(%)	(Nm)	(Nm)	(N)	(kgm^2)	(kgm^2)	(kg)
98	15	6,000	245	490	80	1.0	1.0	70	75	686	1,372	5,755	1.38×10^{-5}	0.678×10^{-3}	4.6
264.6	15	6,000	662	1,323	60	1.0	1.0	70	80	980	1,960	6,520	0.550×10^{-4}	0.563×10^{-3}	8.5
490	15	6,000	1,225	Bolt clamping 2,450 Through-bolt clamping 1,960	50	1.0	1.0	60	75	1,764	3,528	9,428	1.82×10^{-4}	0.363×10^{-2}	14.6
980	15	6,000	2,450	Bolt clamping 4,900 Through-bolt clamping 3,430	40	1.0	1.0	50	80	2,450	4,900	11,802	0.475×10^{-3}	0.953×10^{-2}	19.5
1,960	15	6,000	4,900	Bolt clamping 9,800 Through-bolt clamping 7,350	30	1.0	1.0	50	80	8,820	17,640	31,455	1.39×10^{-3}	1.94×10^{-2}	55.6
3,136	15	6,000	7,840	15,680	25	1.0	1.0	50	85	20,580	39,200	57,087	0.518×10^{-2}	0.405×10^{-1}	79.5
4,900	15	6,000	12,250	24,500	20	1.0	1.0	50	80	34,300	78,400	82,970	0.996×10^{-2}	1.014×10^{-1}	154

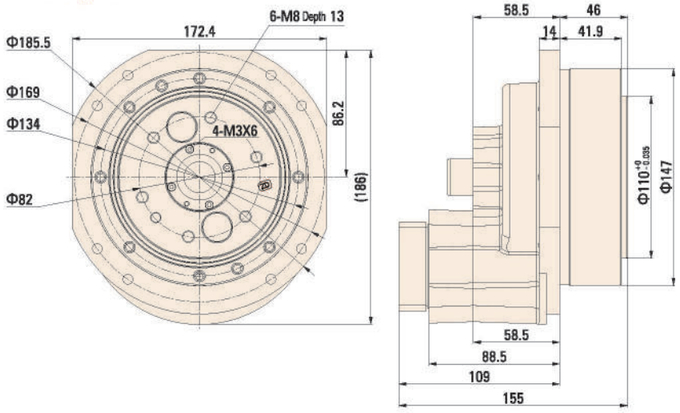
Note:
4. The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (p. 91).
5. The inertia moment value is for the reduction gear. It does not include the inertia moment for the input gear.
6. For the moment rigidity and torsional rigidity, refer to the calculation of tilt angle and the torsion angle (p. 99).
7. 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.81) and the "Product selection flowchart" (p.82).
8. Contact us regarding speed ratios other than those listed above.
9. The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operatingconditions of your system.
10. When radial load b is applied within dimension b, use the reduction gear within the allowable radial load.
11. *1 The R=153 for the RV-80E is only for the bolt-clamping output shaft type (page 20, 21).

RV–10CM–(14 Shaft)

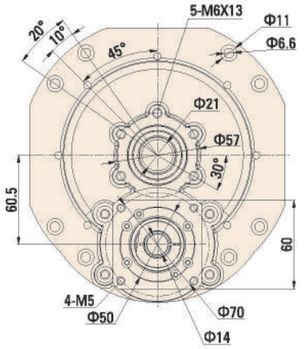


Overall Dimension Drawing

Output



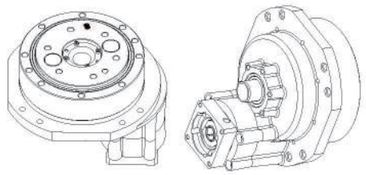
Input



Note:

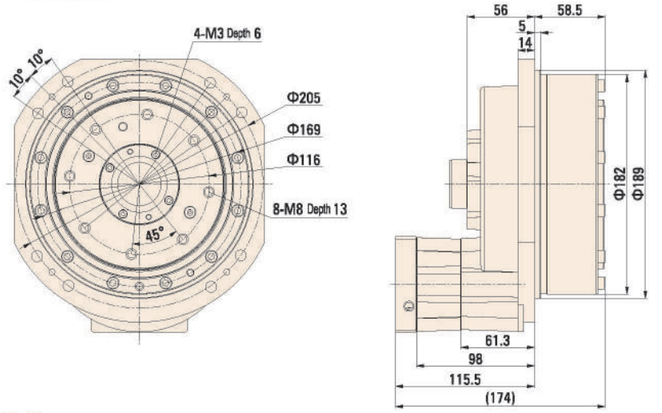
1. **This figure applies to the motor shaft: <=14x30L; Motor shaft is locked by locker.**
2. Speed reduction ratio: (81, 108, 153, 189, 243): 1 (shaft output).
3. Lubricants: VIGO GREASE RE0 or RE-00 (MOLYWHITE).
4. Rated output torque: 98N.m (output speed: 15R/Min).
5. The motor mounting flange is supplied according to the motor type.

RV–27CM–(19 Shaft)

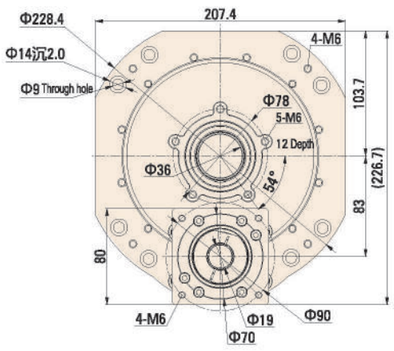


Overall Dimension Drawing

Output



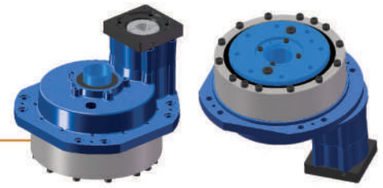
Input



Note:

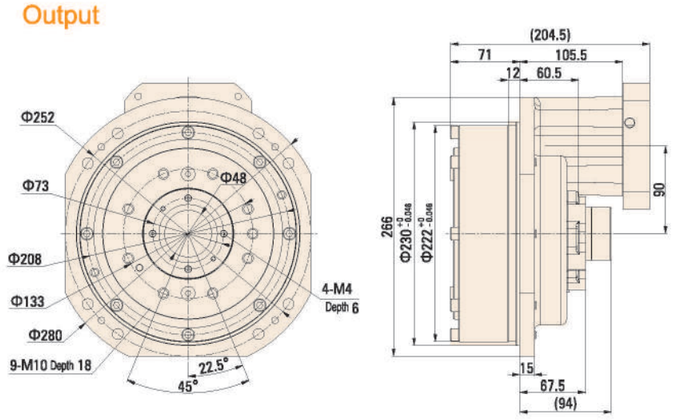
1. **This figure applies to the motor shaft: <=19x35L; Motor shaft is locked by locker**
2. Speed reduction ratio: (79, 99, 140, 189, 231.6): 1 (shaft output).
3. Lubricants: VIGO GREASE RE0 or RE-00 (MOLYWHITE).
4. Rated output torque: 270N.m (output speed: 15R/Min).
5. he motor mounting flange is supplied according to the motor type.

RV–50CM–(24 Shaft)

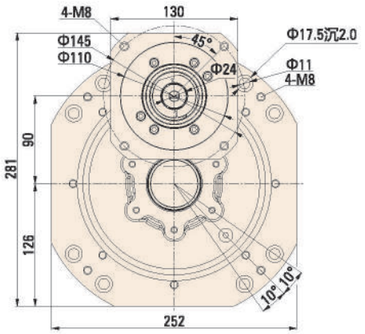


Overall Dimension Drawing

Output



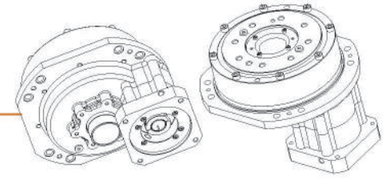
Input



Note:

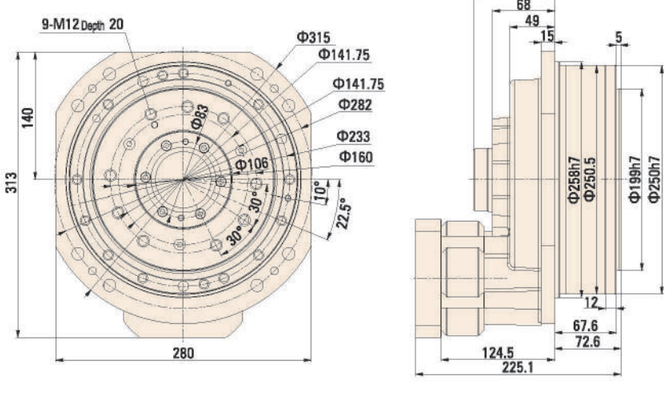
1. **This figure applies to the motor shaft: <=24x55L; Motor shaft is locked by locker.**
2. Speed reduction ratio: (49, 107, 125, 150, 193, 234): 1 (shaft output).
3. Lubricants: VIGO GREASE RE0 or RE-00 (MOLYWHITE).
4. Rated output torque: 498N.m (output speed: 15R/Min).
5. The motor mounting flange is supplied according to the motor type.

RV–100CM–(24 Shaft)

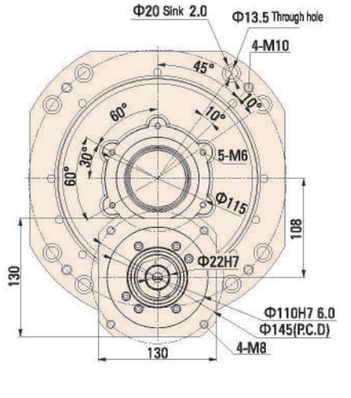


Overall Dimension Drawing

Output



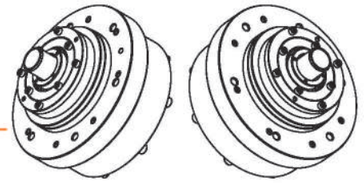
Input



Note:

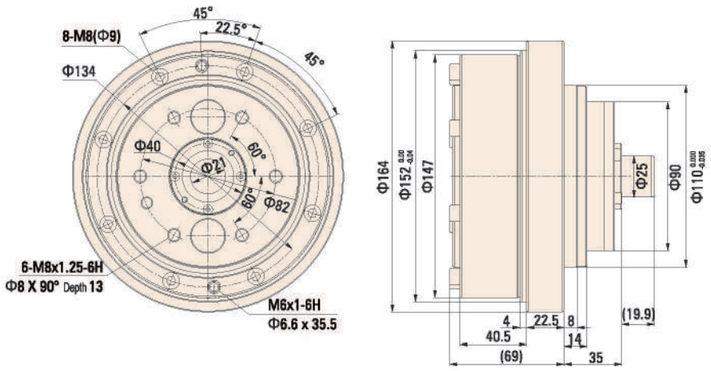
1. This figure applies to motor shaft: = 22x55L; motor shaft is locked with lock;
2. Reducer speed ratio: (76.3,100.2,124.7,151.6,214.3,264.6): 1 (shaft output);
3. Grease: VIGO GREASE RE0 or RE-00 (MOLYWHITE);
4. Rated output torque: 980N.m (output speed: 15R / Min);
5. Motor mounting flange according to the motor model;

RV–10CK

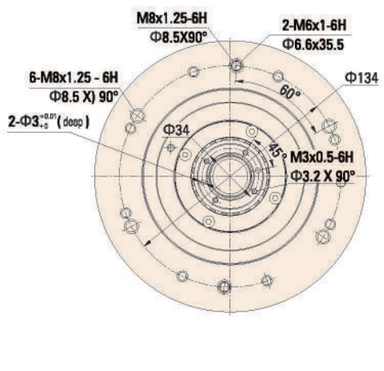


Overall Dimension Drawing

Output



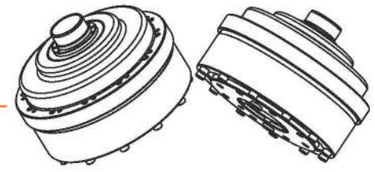
Input



Note:

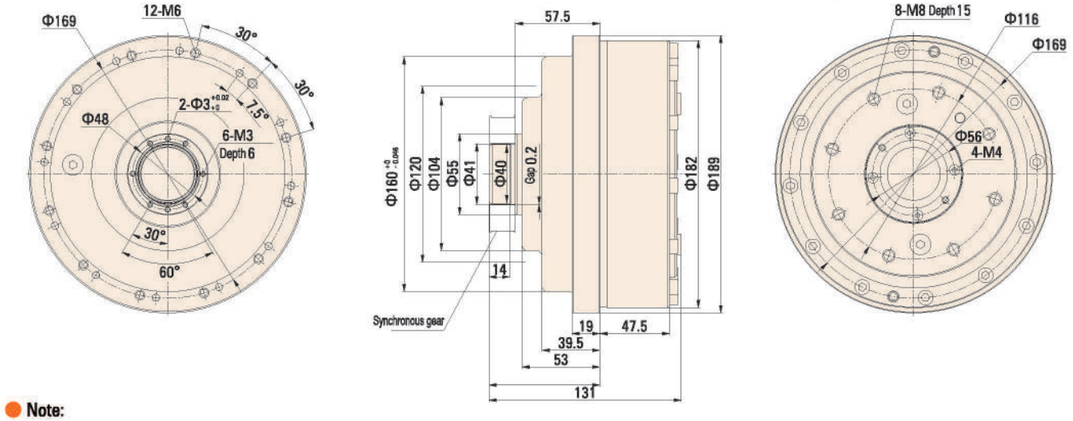
1. This picture shows the hollow 10CBX reducer, the input end with timing pulley;
2. Reducer speed ratio: 27:1;
3. Grease: VIGO GREASE RE0 or RE-00 (MOLYWHITE);
4. Rated output torque: 98N.m (output speed: 15R / Min);
5. The installation flanges shall be specially designed and manufactured to ensure the center distance and the relevant requirements of the PRCs;
6. Seal to be installed, pay attention to concentricity positioning.

RV–27CK



Overall Dimension Drawing

Output

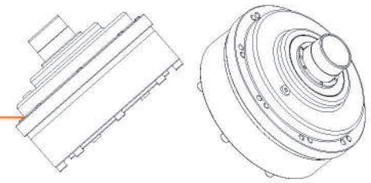


Input

Note:

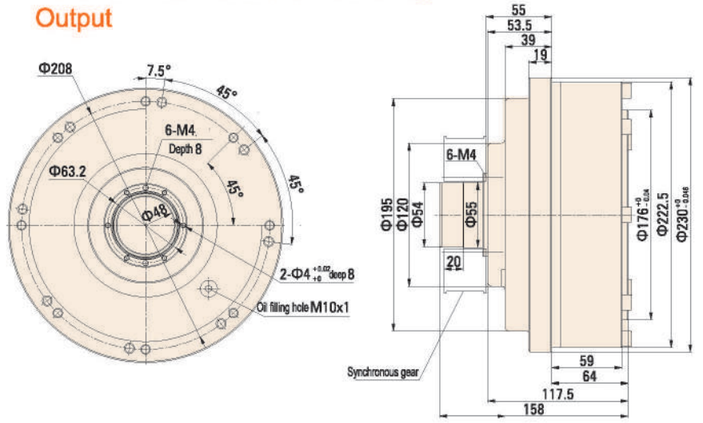
1. This picture shows the hollow 10CBX reducer, the input end with timing pulley;
2. Reducer speed ratio: 27:1;
3. Grease: VIGO GREASE RE0 or RE-00 (MOLYWHITE);
4. Rated output torque: 98N.m (output speed: 15R / Min);
5. The installation flanges shall be specially designed and manufactured to ensure the center distance and the relevant requirements of the PRCs;
6. Seal to be installed, pay attention to concentricity positioning.

RV–50CK

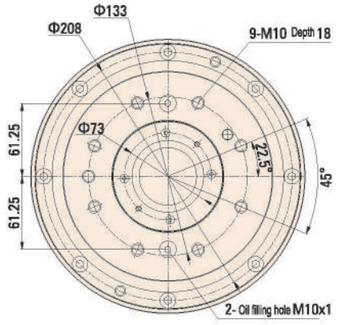


Overall Dimension Drawing

Output



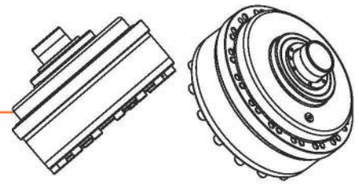
Input



Note:

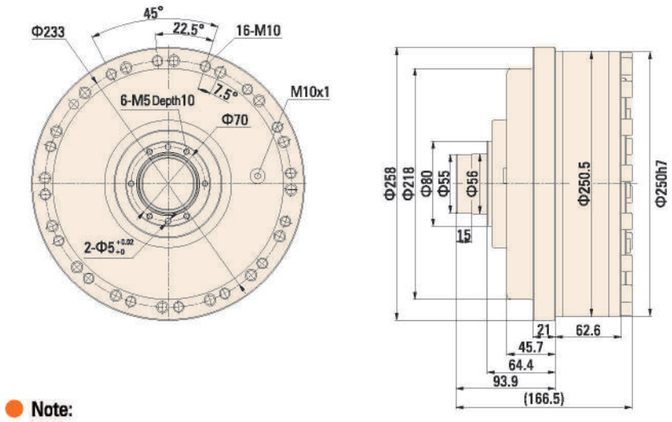
1. The figure applies with timing pulley;
2. Reducer soeed ratio: 32.54:1 ;
3. Grease: VIGO GREASE RE0 or RE-00 (MOLYWHITE);
4. Rated output torque: 498N.m (output speed: 15R / Min);
5. System reduction ratio: 32.54 multiplied by the speed ratio belt;

RV–100CK

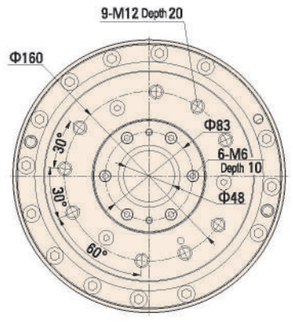


Overall Dimension Drawing

Output



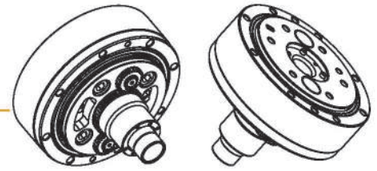
Input



Note:

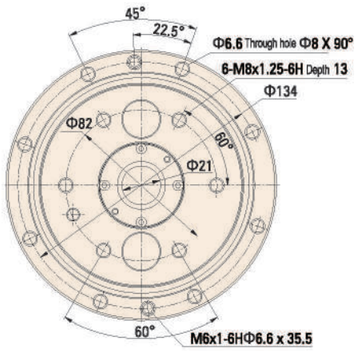
1. The figure applies with timing pulley;
2. Reducer speed ratio: 36.75:1 ;
3. Grease: VIGO GREASE RE0 or RE-00 (MOLYWHITE);
4. Rated output torque: 980N.m (output speed: 15R / Min);
5. System reduction ratio: 36.75 multiplied by the speed ratio belt;

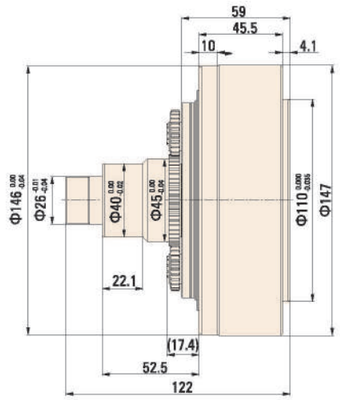
RV–10CW



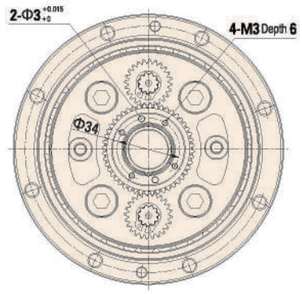
Overall Dimension Drawing

Output





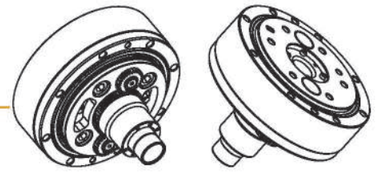
Input



Note:

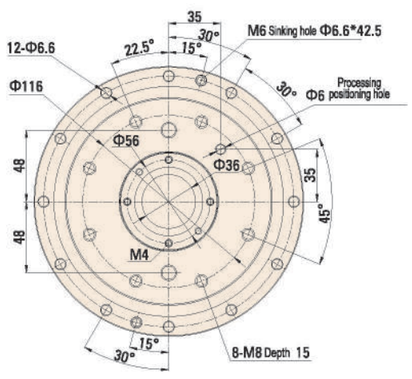
1. Reducer single reduction ratio: i = 27 (shaft output), reducer overall weight: 8.2kg;
2. Graphic center input type for synchronous belt drive, the customer design assembly interface;
3. Reducer rated output torque of 98Nm (output speed 15RPM, input motor power 200W);
4. When using gear reducer add grease, grease recommendations: RE0, RE00. And make the appropriate sealing measures and oil drain device;

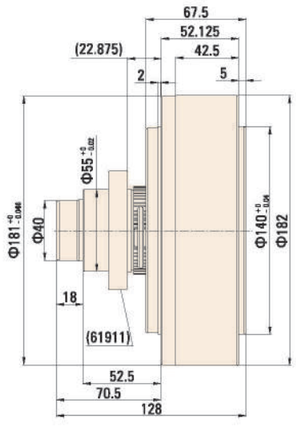
RV–27CW



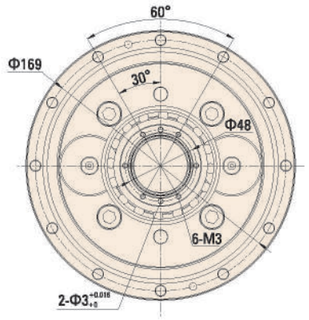
Overall Dimension Drawing

Output





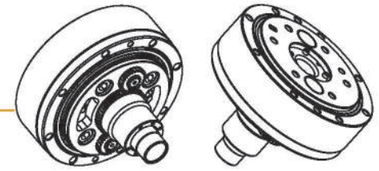
Input



Note:

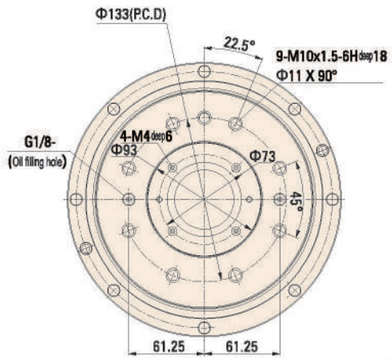
1. Reducer single reduction ratio: i = 36.57 (shaft output), reducer overall weight: 9.5kg;
2. Reducer rated output torque of 270Nm (output speed 15RPM, input motor power 550W);
3. Reducer is not injected lubricating grease, grease recommended RE0;
4. Reducer to be used when necessary to make the appropriate sealing measures, plus drain device;

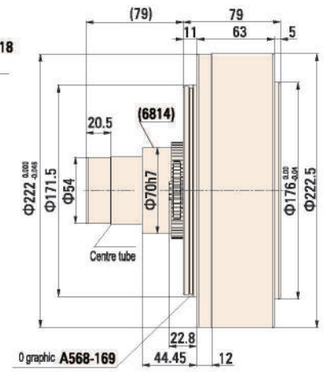
RV–50CW



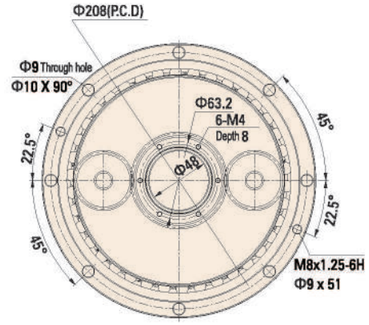
Overall Dimension Drawing

Output

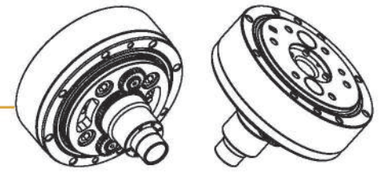




Input

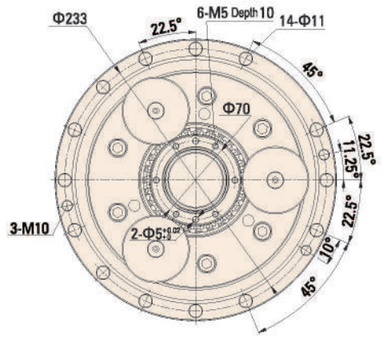


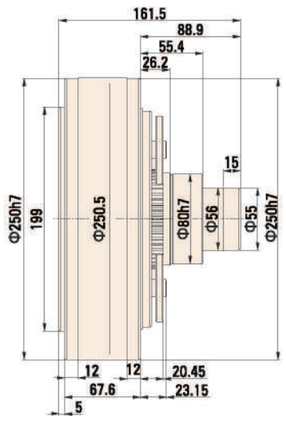
RV–100CW



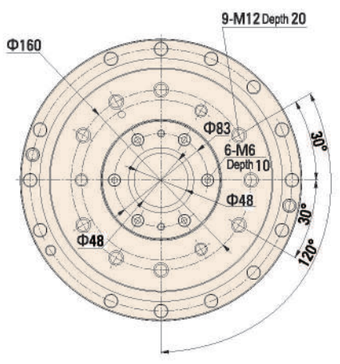
Overall Dimension Drawing

Output





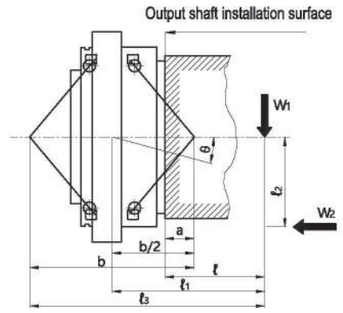
Input



Technical data Calculation tilt angle and torsion angle

Calculation tilt angle

When a load moment occurs with an external load applied, the output shaft will tilt in proportion to the load moment (If ℓ3 is larger than b.)
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.



$$\theta = \frac{W_1\ell_1 + W_2\ell_2}{M_f \times 10^3}$$

θ : :Tilt angle of the output shaft (arc.min.)
Mf : :Moment rigidity (Nm/arc.min.)
W1、W2 : :Load (N)
ℓ1、ℓ2 : :Distance to the point of load application (mm)
ℓ1 : $\ell + \frac{b}{2} - a$
ℓ : :Distance from the output shaft installation surface to the point of load application (mm)

E Series

Model	Moment rigidity (Nm/arc.min.)※3	Size (mm) a	b
RV-6E	117	17.6	91.6
RV-20E	372	20.1	113.3
RV-40E	931	29.6	143.7
RV-80E※1	1,176	33.4	166.0
RV-80E※2	1,176	37.4	166.0
RV-110E	1,470	32.2	176.6
RV-160E	2,940	47.8	210.9
RV-320E	4,900	56.4	251.4
RV-450E	7,448	69.0	292.7

C Series

Model	Moment rigidity (Nm/arc.min.)※3	Size (mm) a	b
RV-10C	421	28.0	119.2
RV-27C	1,068	38.2	150.3
RV-50C	1,960	50.4	187.1
RV-100C	2,813	58.7	207.6
RV-200C	9,800	76.0	280.4
RV-320C	12,740	114.5	360.5
RV-500C	24,500	125	413.4

* 1 Bolt mounting output shaft type　　* 2 Pin/bolt clamping output shaft type
* 3 The moment rigidity values are typical values.

Calculation of torsion angle

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

1) When the load torque is 30 Nm.....Torsion angle (ST1)
• When the load torque is 3% or less of the rated torque

$$ST_1 = \frac{30}{47.0} \times \frac{1\ (arc.min.)}{2} = 0.32(arc.min.)$$

2) When the load torque is 1,300 Nm.....Torsion angle (ST2)
• When the load torque is more than 3% of the rated torque and less than the rated torque

$$ST_2 = \frac{1}{2} + \frac{1{,}300 - 47.0}{392} = 3.70\ (arc.min.)$$

Note: The torsion angles that are calculated above are for a single gearbox.

E Series

Model	Torsion rigidity (Nm/arc.min.)	Lost motion (arc.min.)	Lost motion (Nm) Measured torque	Backlash (arc.min.)
RV-6E	20	MAX1.5	± 1.76	MAX1.5
RV-20E	49	MAX1	± 5.00	MAX1
RV-40E	108		± 12.3	
RV-80E	196		± 23.5	
RV-110E	294		± 32.3	
RV-160E	392		± 47.0	
RV-320E	980		± 94.0	
RV-450E	1,176		± 132.0	

C Series

Model	Torsion rigidity (Nm/arc.min.)	Lost motion (arc.min.)	Lost motion (Nm) Measured torque	Backlash (arc.min.)
RV-10C	47	MAX1	± 2.94	MAX1
RV-27C	147		± 7.94	
RV-50C	255		± 14.7	
RV-100C	510		± 29.4	
RV-200C	980		± 58.8	
RV-320C	1,960		± 94.1	
RV-500C	3,430		± 147.0	

Design points Mounting bolt of gearbox

Installation of the gearbox and mounting it to the output shaft

When installing the gearbox and mounting it to the output shaft, use hexagon 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.

● Hexagon socket head cap screw

<Bolt tightening torque and tightening force>

Hexagon socket head cap screw Nominal size x pitch(mm)	(Nm) Tightening torque	F (N) Tightening force	Bolt specification
M5 × 0.8	9.01 ± 0.49	9,310	◆ Hexagon socket head cap screw JIS B 1176: 2006
M6 × 1.0	15.6 ± 0.78	13,180	◆ Strength class JIS B 1051: 2000 12.9
M8 × 1.25	37.2 ± 1.86	23,960	◆ Thread JIS B 0209: 2001 6g
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	

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 consideration.

<Calculation of allowable transmission torque of bolts>

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

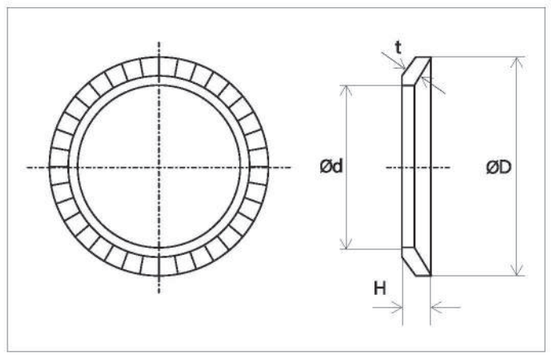
T	Allowable transmission torque by tightening bolt (Nm)
F	Bolt tightening force (N)
D	Bolt mounting P.C.D. (mm)
μ	Friction factor μ=0.15... When lubricant remains on the mating face. μ=0.20... When lubricant is removed from the mating face.
n	Number of bolts (pcs.)

• 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 φd	φD	t	H
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.



Design points Input gears

Pass-through and capacity of input gear

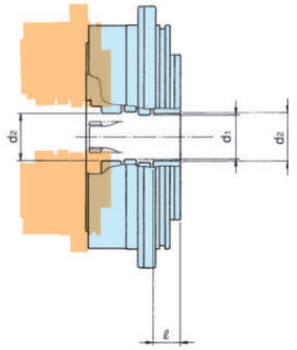
The following table shows which ratios can and can not allow the input gear to pass through.

E Series

(Unit mm)

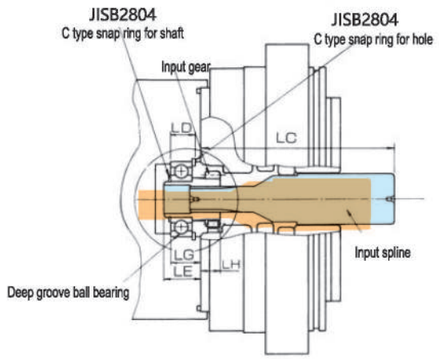
Model	Hole dia		Depth	Speed ratio adequate for shaft passage		Speed ratio inadequate for shaft passage	
	d1	d2	ℓ	Shaft revolution	Case revolution	Shaft revolution	Case revolution
RV-6E	19	21	18	53.5、59、79、103	52.5、58、78、102	31、43	30、42
RV-20E	22	24	18.5	81、105、121、141	80、104、120、140	57	56
RV-40E	27	30	23.5	81、105、121、153	80、104、120、152	57	56
RV-80E	37	40	23	81、101、121、153	80、100、120、152	57	56
RV-110E	39	42	20	81、111、127.7 161、175.2	80、110、126.7 160、174.2	——	——
RV-160E	43	47	30	81、101、129、145、171	80、100、128、144、170	* 66	* 65
RV-320E	47	52	34	81、101、118.5 129、141、171、185	80、100、117.5 128、140、170、184	* 66	* 65
RV-450E	57	62	40	81、101、118.5 129、155、171、192	80、100、117.5 128、154、170、191	* 66	* 65

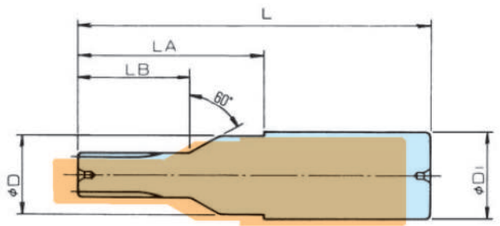
* Not described on the rating table. Please consult us if needed.



Speed ratio inadequate for shaft passage

The lower the speed ratio, the larger the outside diameter of the input gear. Therefore, the installation of the input gear through the gearbox is not possible with all ratios. (Refer to "External Dimensions")





E Series

(Unit mm)

Series	L	LA	LB	D	D1	LC	LD +0.1 0	LE	LG ±0.1	LH	Deep groove ball bearing
RV-6E Model	96	60	23	18	28	92	10.3	16	13	7.5	6002
RV-20E,RV-15	95	53	30	21.5	23.5	90	11.7	17	14	9	6003
RV-40E,RV-30	105	58	30	26.5	29.5	103	13.9	19	16	11.5	6004
RV-80E※1,RV-60	110	—	35	36	←	109	13.9	15.5	12	16	6005
RV-80E※2,RV-60	110	—	35	36	←	105	13.9	19.5	16	12	6005
RV-160E,RV-160	130	—	38	42	←	128	15.1	21	17	16	6006
RV-320E,RV-320	155	—	48	46	←	148	16.1	22	18	20	6007
RV-450E,RV-450	200	—	48	56	←	195	17.6	26	22.5	21	6008

Note: Deep groove ball bearing and C-shaped snap rings are to be provided by the customer.
*1: Bolt clamping output shaft type *2: Pin/bolt clamping output shaft type

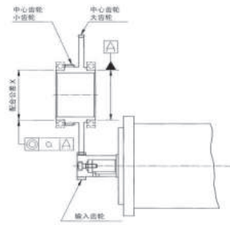
Accuracy of center gear and input gear for RV-C series

Poor installation accuracy of center gear and input gear may cause noise and backlash, so design center gear and input gear according to the following accuracy.

* Attach a bearing to the input gear to accommodate the reaction torque from the center gear.

(Unit mm)

Tolerance of fitting X	Tolerance of concentricity a	Tooth grade of small center gear	Tooth grade of large center gear	Tooth grade of input gear
h6	MAX0.03	JIS 5 class or lower	JIS 4 class or lower	JIS 5 class or lower



(Unit/mm)

	Backlash between input gear and large center gear
RV-10C	0.035 ~ 0.090
RV-27C	0.040 ~ 0.110
RV-50C	0.050 ~ 0.130
RV-100C	0.060 ~ 0.140
RV-200C	0.075 ~ 0.180
RV-320C	
RV-500C	

Specifications of small center gear tooth

	Module	Number of teeth	Addendum modification coefficient
RV-10C	1.0	48	− 0.04
RV-27C	1.0	57	+0.2
RV-50C	1.25	61	0
RV-100C	1.75	48	+0.3
RV-200C	2.5	43	0
RV-320C	2	78	0
RV-500C	2	83	0

Standard center gear

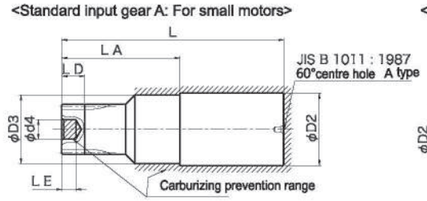
The standard center gears for C series are available from 3F. If the standard center gear is needed, please specify when ordering. Refer to the external dimension for installation Specifications of standard large center gears are shown below.

	Module	Number of teeth	Addendum modification coefficient	Base tangent length(mm)	Addendum modification coefficient
RV-10C	2	57	0	39.974 -0.017 -0.042	7
RV-27C	1.25	78	0	32.732 -0.023 -0.061	9
RV-50C	2	78	0	52.371 -0.023 -0.061	9
RV-100C	1.75	112	0	67.323 -0.028 -0.066	13
RV-200C	2	110	0	76.885 -0.035 -0.085	13
RV-320C	2	125	0	89.113 -0.035 -0.085	15
RV-500C	2	150	0	101.622 -0.035 -0.085	17

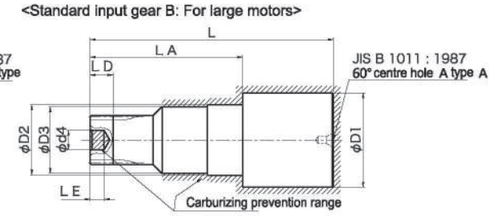
Standard input gear specifications

Material	
Heat treatment	Carburizing, quenching and tempering
Surface hardness	HRC58 ~ 62 (excluding the carburizing prevention range)
Material	SCM415 Normalizing, or equivalent material

<Standard input gear A: For small motors>

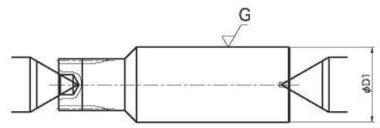


<Standard input gear B: For large motors>



Note: The above drawing shows the shape before the additional machining is performed. Check the dimensions of each section.

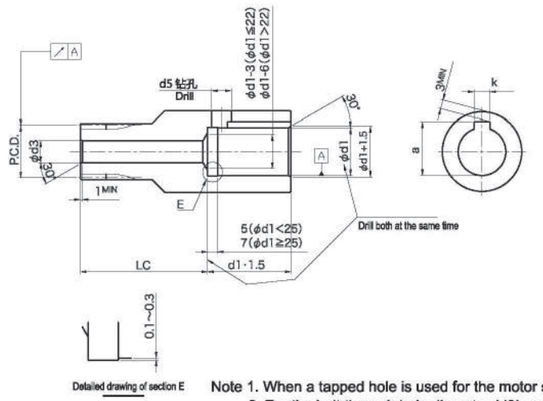
*Reference for additional machining
Standard input gears come equipped with center holes and ground boss outer diameter (D1).
When modifying them, use the center hole or boss outer diameter (D1) as the reference surface.



Design points Input gears

•Selection of the input gear type
There are the following two types of standard input gear:
Standard input gear A: For small motors
Standard input gear B: For large motors
Select the type of input gear to be used by referring to the tables below.

•Design of the motor mounting area
<Design example 1: For straight shafts (attached to motor shaft tip)>



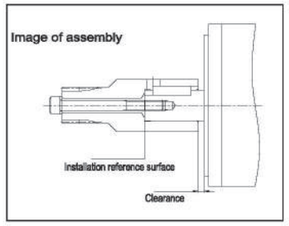
Applicable motor shaft diameters for standard input gear (mm)

Model	Standard input gear A	Standard input gear B
RV-6E	φ16 Following	
RV-20E、RV-15	Lower than φ14	φ14 Above
RV-40E、RV-30	Lower than φ19	φ19 Above
RV-80E、RV-60	Lower than φ24	φ24 Above
RV-110E	φ24 Following	

(Unit mm)

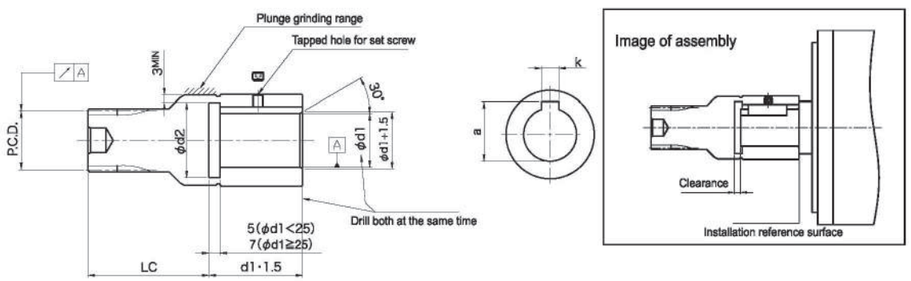
Model	Standard input gear A	Standard input gear B
RV-160E、RV-160	Lower than φ28	φ28 Above
RV-320E、RV-320	Lower than φ32	φ32 Above
RV-450E、RV-450	Lower than φ42	φ42 Above
RV-550	φ40 Following	

Note: Some models have only standard input gear A.



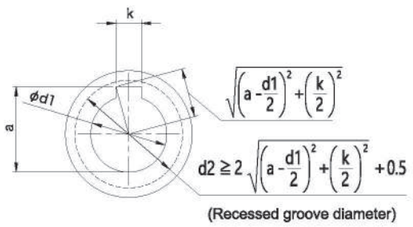
Note 1. When a tapped hole is used for the motor shaft, fix the input gear to the motor shaft with a bolt.
2. For the bolt through hole diameter (d3), radial runout, and the shaft hole position (LC), refer to "Dimensions after modification" in the "Dimensions" table.
3. If the bolt through hole diameter (d3) is larger than the center hole diameter on the tooth surface side (d4), it is necessary to process the carburized surface. In such a case, confirm the applicable tools and processing conditions, etc.
4. The clearance hole diameter for the keyway (d5) is "keyway width (k) + 2 mm", approximately. (The clearance hole diameter must be larger than the keyway width (k).)
5. Design the motor shaft hole diameter (d1) according to the motor shaft diameter to be used.
6. For the keyway width (k) and keyway height (a), refer to the specifications of the key to be used.

<Design example 2: For straight shafts (attached to motor shaft base)>



Note 1. When a tapped hole is not used for the motor shaft, fix the input gear to the motor shaft with a set screw.
2. If a clearance hole for the keyway cannot be drilled due to some reason, such as the plunge grinding area being located on the outer periphery, create a recessed groove instead.
3. For the radial runout and the shaft hole position (LC), refer to "Dimensions after modification" in the "Dimensions" table.
4. Design the motor shaft hole diameter (d1) according to the motor shaft diameter to be used.
5. For the keyway width (k) and keyway height (a), refer to the specifications of the key to be used.
6. Design the diameter of the recessed groove for the keyway (d2) according to the following instructions.

● Recessed groove diameter for keyway



(Recessed groove diameter)

Set the diameter of the recessed groove (d2) so that it is larger than the corner of the keyway

$$d2 \geqq 2\sqrt{\left(a-\frac{d1}{2}\right)^2+\left(\frac{k}{2}\right)^2}+0.5$$

Although the above calculation formula is used in this example, design the diameter using appropriate values, based on the keyway tolerance, processing tolerance, etc. The following is an example of when the diameter of the recessed groove is selected based on the above calculation formula. Use it as a reference when designing.

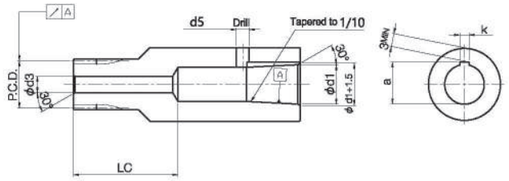
(Unit mm)

φd1 Motor shaft hole diameter	k Keyway width	a Keyway height	φd2 Recessed groove diameter
8	3	9.4	12
9	3	10.4	13
10	4	11.8	15
11	4	12.8	16
14	5	16.3	20
15	5	17.3	21
16	5	18.3	22
17	6	19.8	24
19	6	21.8	26

(Unit mm)

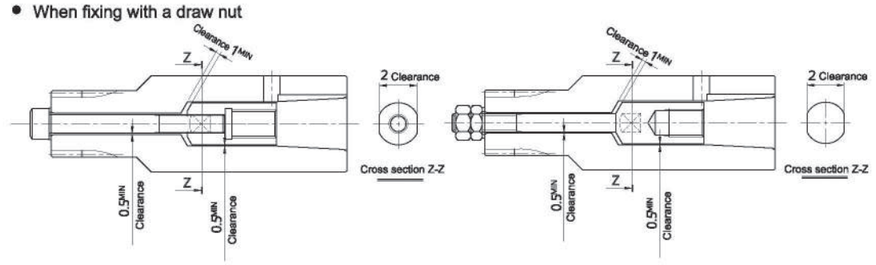
φd1 Motor shaft hole diameter	k Keyway width	a Keyway height	φd2 Recessed groove diameter
22	8	25.3	31
24	8	27.3	33
25	8	28.3	34
28	8	31.3	37
32	10	35.3	41
35	10	38.3	44
38	10	41.3	47
38	12	41.3	47
42	12	45.3	51

<Design example3: For tapered shafts>

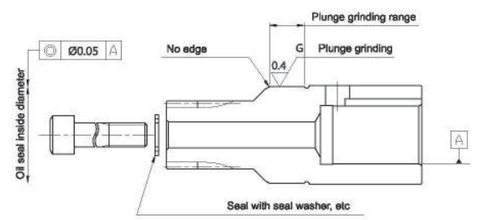


Note 1. For the bolt through hole diameter (d3), radial runout, and the shaft hole position (LC), refer to "Dimensions after modification" in the "Dimensions" table.
2. Design the motor shaft hole diameter (d1) according to the motor shaft diameter to be used.
3. For the keyway width (k) and keyway height (a), refer to the specifications of the key to be used.
4. There are two ways to fix the tapered shaft to the motor shaft: draw nut and draw bolt. Fix the shaft using either of them, referring to the drawings below.
5. You can manufacture the draw nut and draw bolt on your own, or contact us.

● When fixing with a draw nut



● Design of the oil seal <Design example 4>
If a lip surface is required for the oil seal, manufacture a new input gear and quench the D2 section, and then perform plunge grinding.



Note 1. The design specifications vary depending on the oil seal manufacturer. When designing, be sure to confirm with the manufacturer of the oil seal to be used.
2. The standard input gear is not compatible with the oil seal surface. If the lip surface is required for the oil seal, manufacture a new input gear.
3. Rubber containing fluorine is recommended for the material of the oil seal.
4. When assembling the oil seal, be careful to avoid any contact between the lip section and the gear, as it causes scratches.
5. Design the oil seal assembly position so that the lip section of the oil seal does not fall off from the plunge grinding range.

Design points Input gears

Dimensions of standard input gear

< Model RV-6E > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
※ 31	18	5	12	96	60	4.5	28					5.2	-	63	
※ 43		5	12	96	60	4.5						5.2	-	63	
53.5		5	6	90	54	4.5						8.5	0.047	57	
59		5	6	90	54	4.5						7.5	0.047	57	
79		5	6	90	54	4.5						5.5	0.050	57	
103		5	6	90	54	4.5						4.4	0.043	57	

< Model RV-20E、RV-15 > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
※ 57	21.5	6	16	95	53	5.5	23.5	110	73	5.5	30	5.6	-	56	76
81		6	8	95	46	5.5		100	66	5.5		9.2	0.050	49	69
105		6	8	95	46	5.5		100	66	5.5		6.7	0.050	49	69
121		6	8	95	46	5.5		100	66	5.5		5.2	0.050	49	69
141		6	8	95	46	5.5		100	66	5.5		6.5	0.043	49	69
161		6	8	95	46	5.5		100	66	5.5		5.8	0.043	49	69

(Unit/mm)

< Model RV-40E、RV-30 > (Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
※ 57	26.5	7	15	105	58	6.8	29.5	120	81	6.8	36	7	-	61	84
81		7	10	100	53	7		115	76	6.6		14.5	0.050	56	79
105		7	10	100	53	7		115	76	6.6		9	0.053	56	79
121		7	10	100	53	7		115	76	6.6		9.7	0.050	56	79
153		7	10	100	53	7		115	76	6.6		6.7	0.050	56	79

(单位Unit/mm)

< Model RV-80E、RV-60 > (Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
※ 57	-	7	17	110	35	6.8	36	140	88	6.8	42	7	-	61.4	91
81		7	10	100	29	7		130	80	9		18.3	0.059	38.3	83
101		7	10	100	29	7		130	80	9		13	0.053	40	83
121		7	10	100	29	7		130	80	9		11.4	0.053	41.8	83
153		7	10	100	29	7		130	80	9		7.9	0.053	43.6	83

The speed ratio code with * is the input spline standard size

< Model RV-110E > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
81	38	7	13	120	70	9	40					28.7	0.055	73	
111		7	13	120	70	9						22.5	0.050	73	
161		7	13	120	70	9						17	0.050	73	
175.28		7	13	120	70	9						15.7	0.050	73	

< Model RV-160E、RV-160 > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
81	-	8	15	120	35	7	42	170	105	9	50	20.2	0.059	44.5	108
101		8	15	120	35	7		170	105	9		16.2	0.059	46.5	108
129		8	15	120	35	7		170	105	9		11.2	0.053	49	108
145		8	15	120	35	7		170	105	9		14.2	0.050	51.8	108
171		8	15	120	35	7		170	105	9		13.1	0.050	53.4	108

< Model RV-320E、RV-320 > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
81	-	11	16	140	35	11	46	185	122	11	50	29	0.059	45.6	125
101		11	16	140	35	11		185	122	11		25	0.059	47.6	125
118.5		11	16	140	35	11		185	122	11		21	0.059	49.6	125
129		11	16	140	35	11		185	122	11		19	0.059	50.6	125
141		11	16	140	35	11		185	122	11		17	0.059	51.6	125
171		11	16	140	35	11		185	122	11		13	0.053	53.6	125
185		11	16	140	35	11		185	122	11		14.2	0.050	55.1	125

< Model RV-450E、RV-450 > (Unit/mm)

(Unit/mm)

Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
81	-	8	18	155	38	11	56	215	139	11	58	32.6	0.059	54.1	142
101		8	18	155	38	11		215	139	11		28.3	0.059	56.3	142
118.5		8	18	155	38	11		215	139	11		23.8	0.059	58.5	142
129		8	18	155	38	11		215	139	11		21.5	0.059	59.7	142
154.8		8	18	155	38	11		215	139	11		17.1	0.059	61.9	142
171		8	18	155	38	11		215	139	11		14.8	0.059	63	142
192.4		8	18	155	38	11		215	139	11		15.1	0.053	65	142

< Model RV-550 > (Unit/mm)

(Unit/mm)

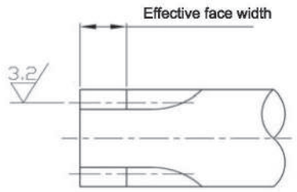
Ratio code	Dimensions before modifi cation (when shipped)											Dimensions after modification			
	φD3	LE	$LD^{+2.0}_{0}$	Standard input gear A				Standard input gear B				$\varphi d3^{MAX}$	Radial runout	Standard input gear A LC^{MIN}	Standard input gear B LC^{MIN}
				L	LA	φd4	φD2	L	LA	φd5	φD1				
123	-	7	22	180	45	9	56					27.0	0.059	64.3	
141		7	22	180	45	9						24.2	0.059	65.7	
163.5		7	22	180	45	9						20.2	0.059	67.7	
192.4		7	22	180	45	9						16.2	0.059	69.7	

Gear tooth specifications

Refer to the specifications and materials shown in the following tables when designing a system with a processed or non-standard input gear.
For a model or speed ratio other than those listed below, contact us.

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 tempering
Surface hardness	HRC 58 ~ 62
Effective case depth <HV 513>(mm)	0.3 ~ 0.7 ※1
Material	SCM415 Normalizing
Alternate material	SCM420 Normalizing



The value will differ depending on the module.

Module	1 or lower	More than 1
Effective case depth <HV 513>(mm)	0.2 ~ 0.6	0.3 ~ 0.7

Input gear tooth specifications for each model

Model	RV-6E					
Ratio code	31	43	53.5	59	79	103
Module	1	1.25	1	1	1.25	1
No. of teeth	22	15	16	15	10	10
Shift coefficient	+0.04	+0.25	+0.5	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$7.716^{-0.017}_{-0.042}$ (3个)	$9.702^{-0.017}_{-0.042}$ (3个)	$4.994^{-0.017}_{-0.042}$ (2个)	$4.980^{-0.017}_{-0.042}$ (2个)	$6.138^{-0.017}_{-0.042}$ (2个)	$4.910^{-0.017}_{-0.042}$ (2个)
Min. effective face width (mm)	6	6	6	6	6	6

Model	RV-20E、RV-15					
Ratio code	57	81	105	121	141	161
Module	1.5	1.5	1.5	1.5	1.0	0.9
No. of teeth	15	12	10	9	12	12
Shift coefficient	+0.2	+0.4	+0.5	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$7.163^{-0.017}_{-0.042}$ (2个)	$7.305^{-0.017}_{-0.042}$ (2个)	$7.365^{-0.017}_{-0.042}$ (2个)	$7.344^{-0.017}_{-0.042}$ (2个)	$7.890^{-0.017}_{-0.042}$ (3个)	$7.101^{-0.017}_{-0.042}$ (3个)
Min. effective face width (mm)	8	8	8	8	8	8

Model	RV-40E、RV-30				
Ratio code	57	81	105	121	153
Module	1.5	1.5	2.0	1.5	1.5
No. of teeth	20	16	10	12	10
Shift coefficient	0	+0.1	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$11.491^{-0.023}_{-0.061}$ (3个)	$7.081^{-0.023}_{-0.061}$ (2个)	$9.821^{-0.023}_{-0.061}$ (2个)	$11.835^{-0.023}_{-0.061}$ (3个)	$7.365^{-0.023}_{-0.061}$ (2个)
Min. effective face width (mm)	10	10	10	10	10

Model	RV-80E、RV-60					
Ratio code	57	81(RV-60用)	81(RV-80E用)	101	121	153
Module	1.75	2.0	1.75	2.0	1.75	1.75
No. of teeth	20	14	16	12	12	10
Shift coefficient	0	+0.5	+0.5	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$13.406^{-0.028}_{-0.066}$ (3个)	$15.837^{-0.028}_{-0.066}$ (3个)	$13.906^{-0.028}_{-0.066}$ (3个)	$15.781^{-0.028}_{-0.066}$ (3个)	$13.808^{-0.028}_{-0.066}$ (3个)	$8.593^{-0.028}_{-0.066}$ (2个)
Min. effective face width (mm)	10	10	10	10	10	10

Model	RV-110E			
Ratio code	81	111	161	175.28
Module	1.25	1.25	1.25	1.25
No. of teeth	25	20	15	14
Shift coefficient	0	0	+0.3	+0.3
Base tangent length (mm) No. of teeth	$9.663^{-0.028}_{-0.066}$ (3个)	$9.576^{-0.028}_{-0.066}$ (3个)	$9.746^{-0.028}_{-0.066}$ (3个)	$9.727^{-0.028}_{-0.066}$ (3个)
Min. effective face width (mm)	13	13	13	13

Model	RV-160E、RV-160				
Ratio code	81	101	129	145	171
Module	2.5	2.5	2.5	1.5	1.25
No. of teeth	14	12	10	15	16
Shift coefficient	+0.3	+0.5	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$19.453^{-0.035}_{-0.085}$ (3个)	$19.726^{-0.035}_{-0.085}$ (3个)	$12.276^{-0.035}_{-0.085}$ (2个)	$11.899^{-0.035}_{-0.085}$ (3个)	$9.933^{-0.035}_{-0.085}$ (3个)
Min. effective face width (mm)	15	15	15	15	15

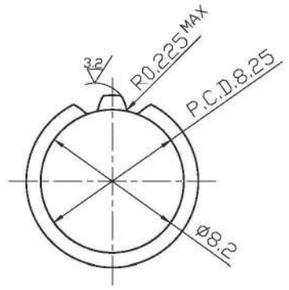
Model	RV-320E、RV-320						
Ratio code	81	101	118.5	129	141	171	185
Module	2.0	2.0	2.0	2.0	2.0	2.0	1.5
No. of teeth	21	18	16	15	14	12	15
Shift coefficient	0	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5
Base tangent length (mm) No. of teeth	$15.349^{-0.035}_{-0.085}$ (3个)	$15.949^{-0.035}_{-0.085}$ (3个)	$15.893^{-0.035}_{-0.085}$ (3个)	$15.865^{-0.035}_{-0.085}$ (3个)	$9.933^{-0.035}_{-0.085}$ (2个)	$15.781^{-0.035}_{-0.085}$ (3个)	$11.899^{-0.035}_{-0.085}$ (3个)
Min. effective face width (mm)	16	16	16	16	16	16	16

Model	RV-450E、RV-450						
Ratio code	81	101	118.5	129	154.8	171	192.4
Module	2.25	2.25	2.25	2.25	2.25	2.25	1.75
No. of teeth	21	18	16	15	13	12	14
Shift coefficient	0	+0.556	+0.556	+0.556	+0.556	+0.556	+0.572
Base tangent length (mm) No. of teeth	$17.267^{-0.035}_{-0.085}$ (3个)	$18.029^{-0.035}_{-0.085}$ (3个)	$17.966^{-0.035}_{-0.085}$ (3个)	$17.934^{-0.035}_{-0.085}$ (3个)	$17.871^{-0.035}_{-0.085}$ (3个)	$17.840^{-0.035}_{-0.085}$ (3个)	$13.944^{-0.035}_{-0.085}$ (3个)
Min. effective face width (mm)	18	18	18	18	18	18	18

Model	RV-550			
Ratio code	123	141	163.5	192.4
Module	2.0	2.0	2.0	2.0
No. of teeth	20	18	16	14
Shift coefficient	0	+0.3	+0.3	+0.3
Base tangent length (mm) No. of teeth	$15.321^{0.035}_{0.085}$ (3个)	$15.675^{0.035}_{-0.085}$ (3个)	$15.619^{0.035}_{-0.085}$ (3个)	$15.563^{0.035}_{-0.085}$ (3个)
Min. effective face width (mm)	22	22	22	22

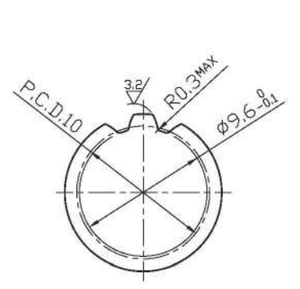
Input spline gear tooth specifications for each model

Refer to the specifications shown in the following tables when designing with a processed or non-standard input spline.
The specifications of the hardness and material are the same as those of the input gear.



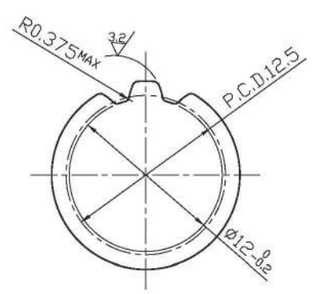
Detailed drawing of spline section

RV-6E		
Automotive involute spline (shaft) 10x11x0.75 (JIS D2001)		
Shift coefficient		+0.9667
Tool	Tool profile	Stub tooth
	Module	0.75
	Pressure angle	20°
No. of teeth		11
Reference pitch diameter		8.25
Face width	Over-pin diameter Pin diameter φ1.4 (Pin diameter φ1.5)	$11.120^{-0.011}_{-0.076}$ ($11.380^{-0.011}_{-0.076}$)
	Grade	b
Remarks		Side fit



Detailed drawing of spline section

RV-20E		
Automotive involute spline (shaft) 12x10x1.0 (JIS D2001)		
Shift coefficient		+0.8
Tool	Tool profile	Stub tooth
	Module	1.0
	Pressure angle	20°
No. of teeth		10
Reference pitch diameter		10
Face width	Over-pin diameter Pin diameter φ1.8 (Pin diameter φ2.0)	$13.564^{-0.012}_{-0.078}$ ($13.564^{-0.012}_{-0.078}$)
	Grade	b
Remarks		Side fit



Detailed drawing of spline section

RV-40E、RV-80E		
Automotive involute spline (shaft) 15x10x1.25 (JIS D2001)		
Shift coefficient		+0.8
Tool	Tool profile	Stub tooth
	Module	1.25
	Pressure angle	20°
No. of teeth		10
Reference pitch diameter		12.5
Face width	Over-pin diameter Pin diameter φ2.25 (Pin diameter φ2.381)	$16.954^{-0.012}_{-0.078}$ ($17.301^{-0.012}_{-0.078}$)
	Grade	b
Remarks		Side fit

Design point Lubricant

Amount of lubricant

RV precision gearbox are not applied with lubricant when shipped. Be sure to design your equipment so that the necessary amount of lubricant can be applied. (When pneumatic pressure is used for applying the lubricant, set the pressure below 0.03 MPa.)

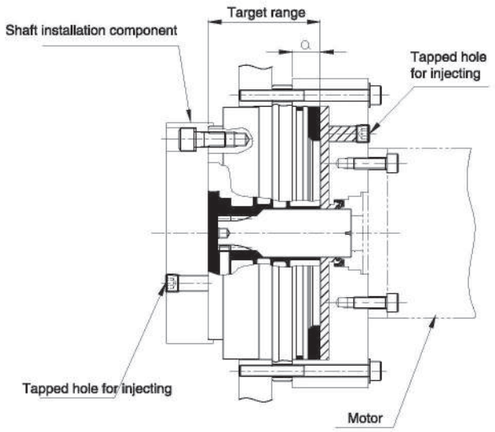
E Series

The amount of lubricant required for the gearbox and the target range (the ■ areas in the diagram) when the gearbox is installed in the horizontal shaft are indicated in Fig. 1 and when the gearbox is installed in the vertical shaft are indicated in Fig. 2. Each amount does not include the space (the ▨ areas in the diagram) on the motor mounting side. Therefore, if there is a blank space, also fill the space. Leave a space about 10% of the total volume of the internal capacity of the gearbox (the ■ areas in the diagram) and the space on the motor mounting side (the ▨ areas in the diagram).

E Series

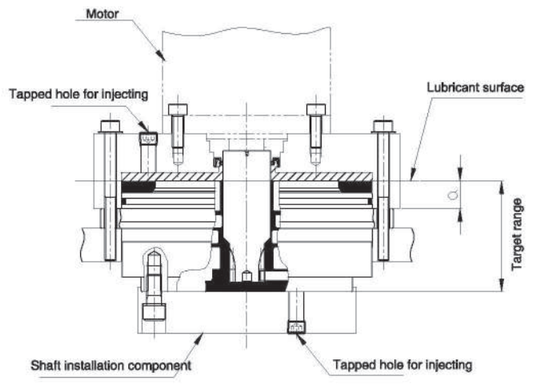
Model	Required amount		a (mm) Dimensions
	(cc)	(g)※1	
RV-6E	42	(38)	17
RV-20E	87	(78)	15
RV-40E	195	(176)	21
RV-80E(1)※2	383	(345)	21
RV-80E(2)※2	345	(311)	21
RV-110E	432	(389)	6.5
RV-160E	630	(567)	10.5
RV-320E	1,040	(936)	15.5
RV-450E	1,596	(1,436)	18

Horizontal shaft installation

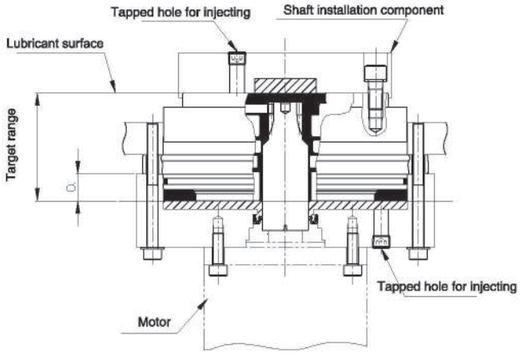


E Series

Vertical shaft installation (with shaft facing downward)



Vertical shaft installation (with shaft facing upward)



E Series

Model	Required amount		a (mm) Dimensions
	(cc)	(g)※1	
RV-6E	48	(43)	17
RV-20E	100	(90)	15
RV-40E	224	(202)	21
RV-80E(1)※2	439	(395)	21
RV-80E(2)※2	396	(356)	21
RV-110E	495	(446)	6.5
RV-160E	694	(625)	10.5
RV-320E	1,193	(1,074)	15.5
RV-450E	1,831	(1,648)	18

C Series

For the C series

The amount of lubricant required for the gearbox and the target range (the ■ areas in the diagram) when the gearbox is installed in the horizontal shaft are indicated in Fig. 3 and when the gearbox is installed in the vertical shaft are indicated in Fig. 4. If there is a blank space inside (e.g., when a center tube is used), exclude the volume of the blank space. Each amount does not include the space (the ▨ areas in the diagram) on the motor mounting side. Therefore, if there is a blank space, also fill the space. Leave a space about 10% of the total volume of the internal capacity of the gearbox (the ■ areas in the diagram) and the space on the motor mounting side (the ▨ areas in the diagram). The space on the motor mounting side (the ▨ areas in the diagram) includes the center gear external capacity (the ▩ areas in the diagram) and the external capacity of the reduction gear (the ▨ areas in the diagram). Therefore, when calculating the volume of the space on the motor mounting side, exclude the relevant external capacity.

Model	Required amount		a Dimensions (mm)	b Dimensions (mm)	Gearbox external capacity (cc)	Center gear external capacity (cc)
	(cc)	(g)※1				
RV-10C	147	(132)	9.5	16.85	4	70
RV-27C	266	(239)	10	21.35	10	83
RV-50C	498	(448)	11	23.35	21	208
RV-100C	756	(680)	9.9	29.45	57	369
RV-200C	1,831	(1,648)	18.5	37.7	93	642
RV-320C	3,536	(3,182)	25	46.75	197	1,275
RV-500C	5,934	(5,341)	32	49.7	310	1,803

Horizontal shaft installation

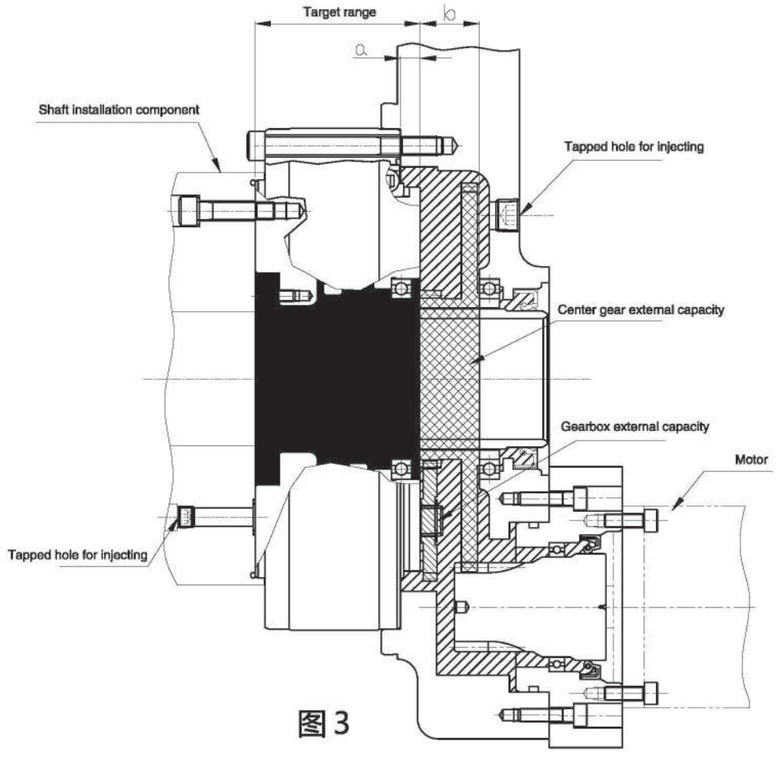
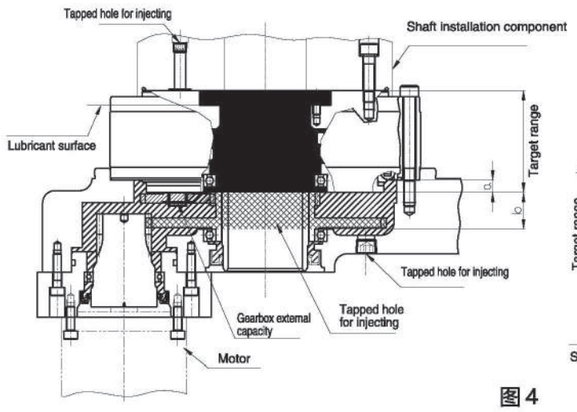


図 3

Design point Lubricant

Vertical shaft installation (with shaft facing upward)



Vertical shaft installation (with shaft facing downward)

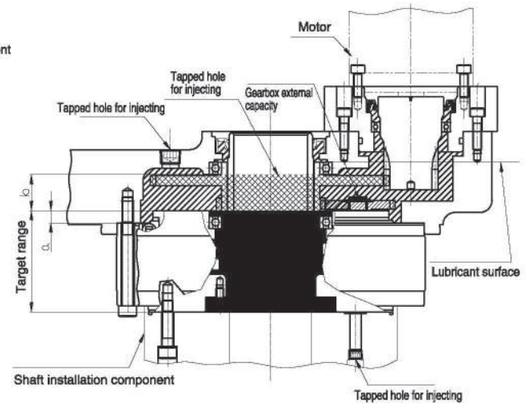


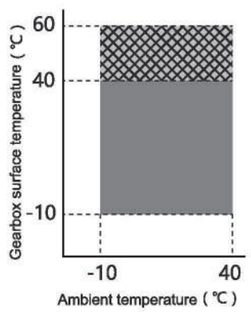
図 4

Model	Required amount (cc)	Required amount (g) ※1	a (mm) Dimensions	b (mm) Dimensions	(cc) Gearbox external capacity	(cc) Center gear external capacity
RV-10C	167	(150)	9.5	16.85	4	70
RV-27C	305	(275)	10	21.35	10	83
RV-50C	571	(514)	11	23.35	21	208
RV-100C	857	(771)	9.9	29.45	57	369
RV-200C	2,076	(1,868)	18.5	37.7	93	642
RV-320C	4,047	(3,642)	25	46.75	197	1,275
RV-500C	6,900	(6,210)	32	49.7	310	1,803

*1. Density of VIGOGREASE RE0: 0.9 g/cc

Grease replacement time

During proper operation of the gearbox, the standard grease replacement time due to lubricant degradation is 20,000 hours.
However, when operation involves a gearbox 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.



Running-in operation

It is recommended that the running-in operation is performed after the our specified lubricant is added. Abnormal noise or torque irregularity may occur during operation, depending on the characteristics of the lubricant. There is no problem with the quality when the symptom disappears after the running-in operation is performed for 30 minutes or more (until the surface temperature of the gearbox body reaches around 50°C).

Please supply us the following items when ordering gearbox

1. Site of use

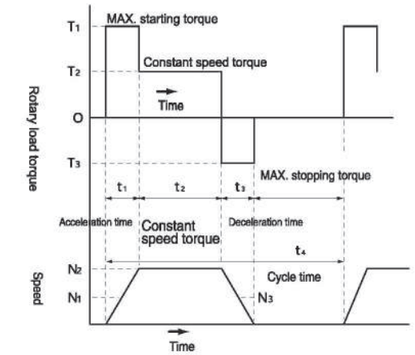
Name of Machine:

Applied to:

2. Model

RV-

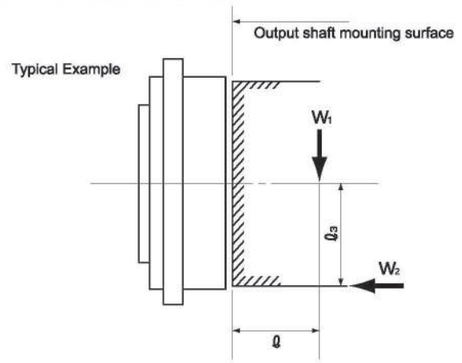
3. Conditions of load



	For starting (MAX)	For stopping	(MAX)	Cycle time
Load torque (Nm)	T1	T2	T3	——
Speed (rpm)	N1	N2	N3	——
Time (s)	t1	t2	t3	t4

Working hours Cycle/Day Day/Year Year

4. External load conditions



(W1): (N) (ℓ): (mm)

(W2): (N) (ℓ2): (mm)

5. Operating environment

Operating environment temperature ——℃

6. Installation

□ Horizontal Vertical (□ Upper motor □ Lower Motor)

Illustration for installation

7. Input gear specification

Reduction speed ratio i=

□ Standard size □ Other

Input gear Prepared by □ User □ Our company

Required dimension of input gear

8. Driving section specification

□ Servo motor □ Other ( )

Power: (kW)

Rated torque: (Nm)

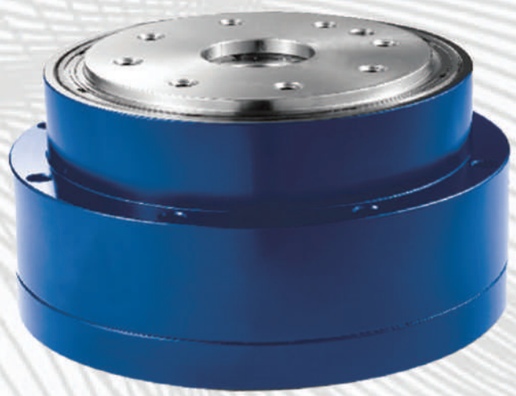
Speed: (rpm)

Shaft size: (mm)

9. Other

FHA-E SERIES

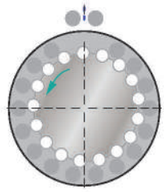
DIRECT OUTPUT, TIGHT ENGAGEMENT
AND HIGH PRECISION



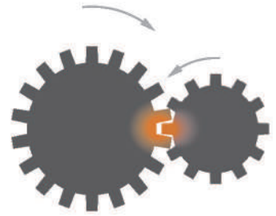
Overview

- Type : FHA-5E~ FHA-450E
- Backlash: ≦1-5 Arc.min
- Ratio : 1/35 ~ 1/140
- Capacity: 0.1KW ~ 15KW
- Rotation : Shaft Run or Case Run
- Rated output torque: 60NM ~ 5100NM

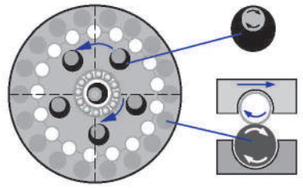
FEATURE OF ROLLER REDUCER



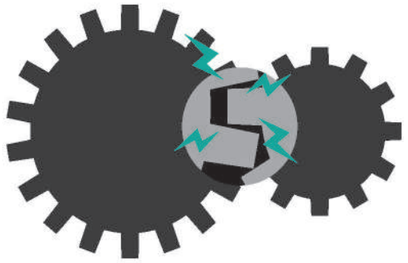
▲ Load-decentralized technology via multi-gear engagement, enhance raise impact capability rapidly.



▲ Conventional spur or helical gear must bear over-load impact due to merely one-tooth engagement in each mesh.



▲ Drive of external & internal rollers involved sliding and rotation-self , obtain extremely high efficiency.



▲ The unsmooth torque transmission caused by the abrasion or interference of gear in conventional mechanism.

Innovative transmission , si gnificant advantage

The features and benefits: With advantages of Harmonic gear drive without the weaknessof flexspline. With high ratio of planetary gear drive without the length concern.With benefit of high loading capacity of cycloid drive without obvious vibration.

Low sliding loss · high efficiency

All sliding parts composed of rollers , whose operation involve sliding and rolling at thesame time , therefore the mechanism loss is almost neglected and obtained extremehigh efficiency. The efficiency up to 95% under one stage reduction.

Smooth operation · low noise

Multi-teeth mesh simultaneous, high overlap-coefficient, counterbalanced twin-disc structure offset vibration , roller contact with proper gap could avoid the interference like gear, above characteristics could minimize the noise and vibration effectively .

High precision , low backlash

The backlashcould be eliminated due to multi-teeth engagement,therefore the transmission deviation is merely 25% of the conventional gear reducer.

Long diameter of wave exciter , high torque output

Due to regular characteristic of rolling wave , the diameter of rolling wave of roller transmission is bigger than other conventional disc or carrier , so the torque is higher accordingly .

High ratio , compact structure

The number of rollers on the roller disc is equal to ratio , single stage can obtain high ratio.Output and input shaft are on co-axis and mechanisms are robust and space-saving, so the dimension is more compact compared to the worm reducer and gear reducer especially on the high ratio ones.

Multi-teeth engagement , high loading capability

Half rollers mesh simultaneously of twin-disc roller mechanism , compared to only one tooth mesh of conventional reducer , whose loads capacity is higher than worm reducer and gear reducer .

Roller tooth , long service life

Innovative roller drive design , excellent handcraft , high manufacturing technique and unique roller outline , no broken-teeth phenomenon , make overall robust mechanism , free to maintenance and durable service life.

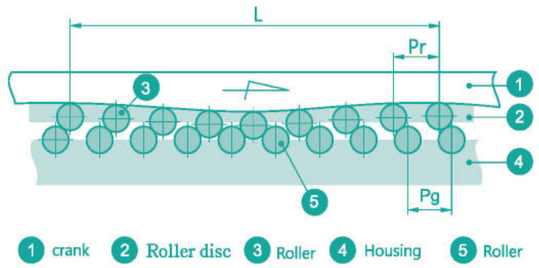
Low energy consumption , better economic benefit

High torque output and high efficiency, low energy consumption, low operation load, better economical benefit.

Hollow design , direct output

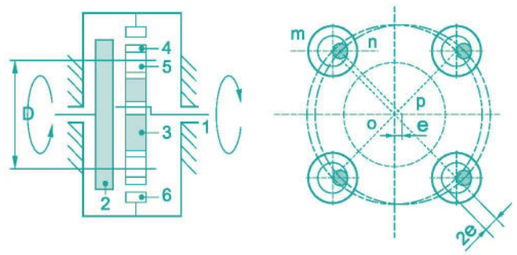
C TYPE-hollow shaft type , design-friendly , allows to array the routing hydraulic tubes and electrical cables through the reducer. Coupling and motor flange provide easy motor mounting.

FEATURE OF ROLLER REDUCER



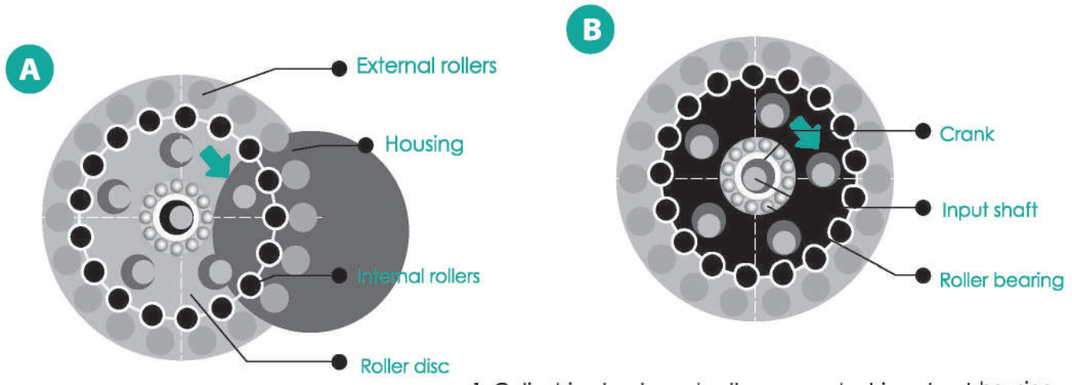
▲ Stretch

First · stretch the basic roller wave transmission as the figure 1 · when crank(1) moved to certain direction , propel roller (3) of roller disc (2) to mesh with roller (5) of housing (4) , then rollers (3) of roller disc (2) are moved adversely , rollers (3) also are limited in the pitch (Pr) of roller disc (2) · the rollers are propelled continuously , one by one , no dead point and meet below formula : L=Tg x Pg = Tr x Pr
Tr and Tg represent the number of roller(3) and roller(5) separately.

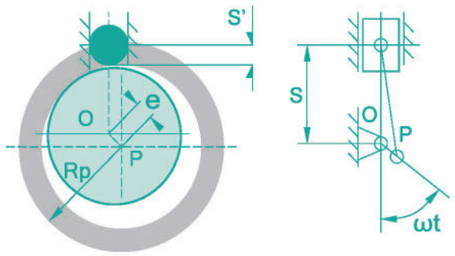


▲ Output

The roller disc (3) are propelled by thecrank(1) · make the high speed revolution and the low speed rotation itself at the same time.Retarding rotation could propel shaft pin (5) viaroller (4) , (PS.:shaft pin (5) mounted on output shaft (2) directly or indirectly) , we can easily prove : the 4 points of m , n , o , p form aparallelogram , therefore output speed is equal to low speed of roller disc (3). Shown as the above figure.



1. Cylindrical external rollers mounted in robust housing.
2.Cylindrical internal rollers mounted in precision roller disc.
3.Input shaft rotate clockwise to synchronously drive crank rotation clockwise.
4.Roller disc turns counter-clockwiseeccentrically propelled by the crank.
5.Internal rollers turn counter-clockwise accompanied with roller disc.



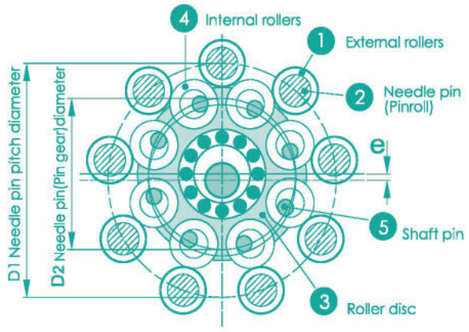
▲ Rolling wave

The housing(4) adopting the profile of roller(5) , and the rolling wave adopted standard crank , both interaction frequency issimilar to motion of the crank-slide mechanism shown as the above figure.

$$S = Rp \cos\beta - e\cos\omega$$

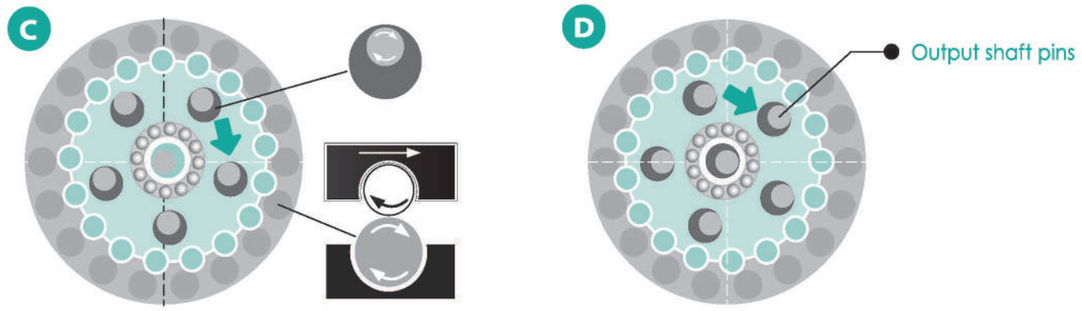
$$S' = \sqrt{Rp^2 - e^2\sin^2\omega t} - e\cos\omega t - RO$$

Rp = Eccentric circle theoretical contour radius
Ro = Radius of Shock Base Circle
β = Angle between connecting rod and rail center line
e= Eccentricity
ω= Eccentric fillet speed
t= Time parameter



▲ Assembly

The detail shown as the above figure, when internal rollers(4) of roller disc (3) are small so that shaft pin(5) can't be inserted into internal rollers , especially high ratio status , shaft pin(5) is used to being put in roller disc (3)directly , also maintain the same output speed. Basically , this system is rolling contact completely with very low mechanical loss and obtain very high efficiency.



6.While internal rollers turning counter-clockwise accompanied with roller disc,this make rotationof internal rollers and external rollers separatelyfollow individual center axis due to mesh transmission.

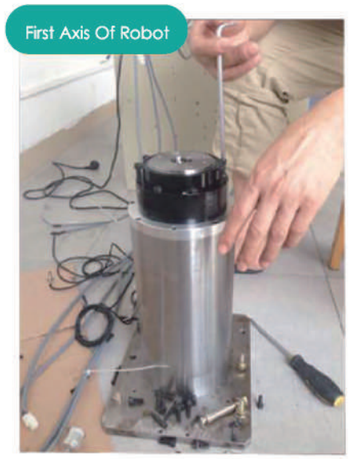
7.Because the internal/external rollers can rotatefreely around individual center,we called this transmission type"innovative revolution-rotation roller drive mechanism"

8.Output shaft pins propelled with roller disc turn revolution counter-clockwise; output shaft connected with output shaft pins also turns counter -clockwise.

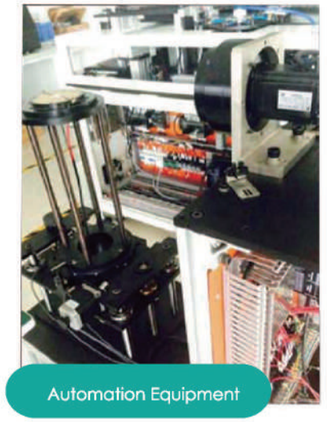
9.As figure A to D, input shaft turns for one cycle, internal rollers turn for one tooth in adverse direction.As a result, the number of teeth of internal rollers is equal to the reduction ratio.

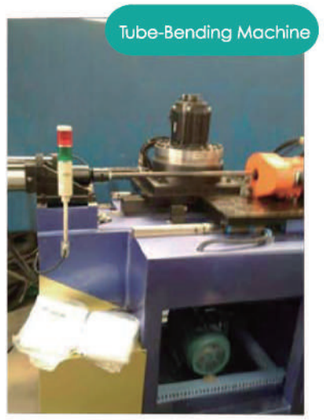
FEATURE OF ROLLER REDUCER


Rotary Table/Position Device/ 7th/8th Axis application


First Axis Of Robot


Palletizing Robot


Automation Equipment


Tube-Bending Machine


Auto Labeling Machine


Electroheads


SCARA

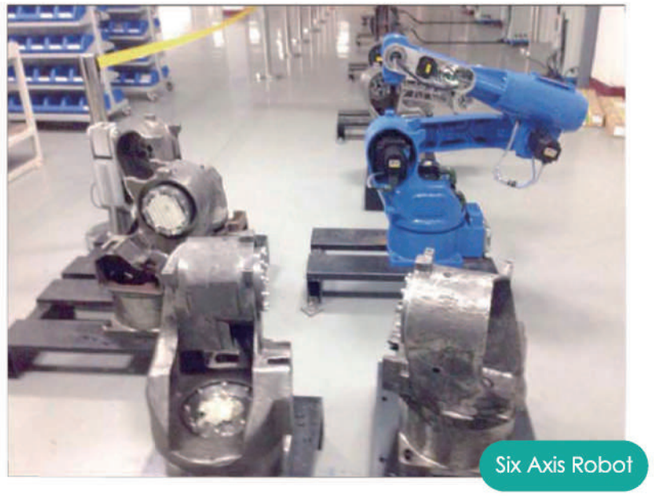
Transportation Robot

Welding Robot and Auxiliary

Four Axis Robot

4th/5th Axis application of tooling machine

Six Axis Robot



Six Axis Robot

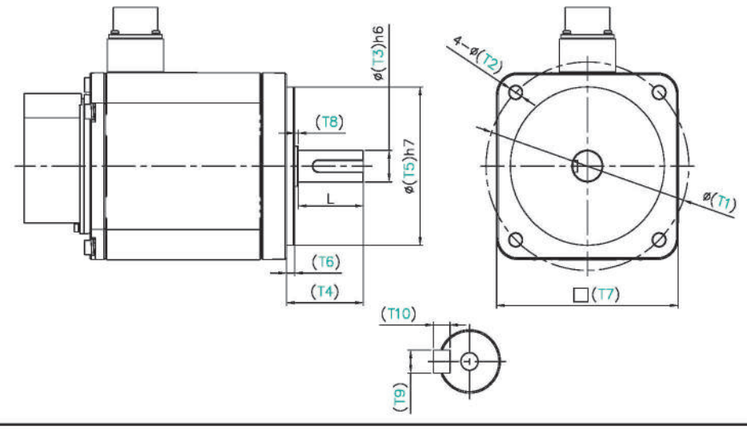
FHA-E ORDERING INSTRUCTIONS

- ORDERING CODE EXAMPLE :

(For the type and ratio, please refer to technical specifications table.)

FHA	25E	40	C	P2	D		S5
Model	Type: 5E 7E 25E 45E 135E 165E 325E 450E 700E	Ratio: 35 40 50 59 79 99 119 139 (Shell rotation ratio + 1)	Motor mounting selections: Rotation; C- Shaft Run; A- Case Run	P2 Standard Backlash; P1 Precision Backlash; P0 High Precision Backlash	D-Direct fixed type; S-Set screw fixed type; L-Clamp fixed type	output type: - Standard; S Shaft	Servo motor

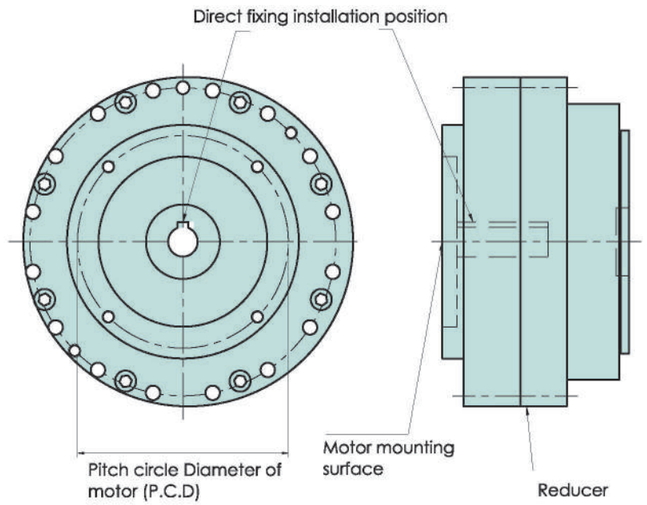
- Please provide the motor dimension below when ordering



Motor Brand :					
Motor Model :					
T1	T2	T3	T4	T5	T6
P.C.D	Bolt Hole Diameter	Motor Shaft Diameter	Motor shaft length	Motor Pilot Diameter	Motor Pilot Height
T7	L	T8		T9	T10
Motor Outline Dimension	Motor Shaht Lenght	Diameter required when using YASKAWA made motor		Key Width	Key Thickness

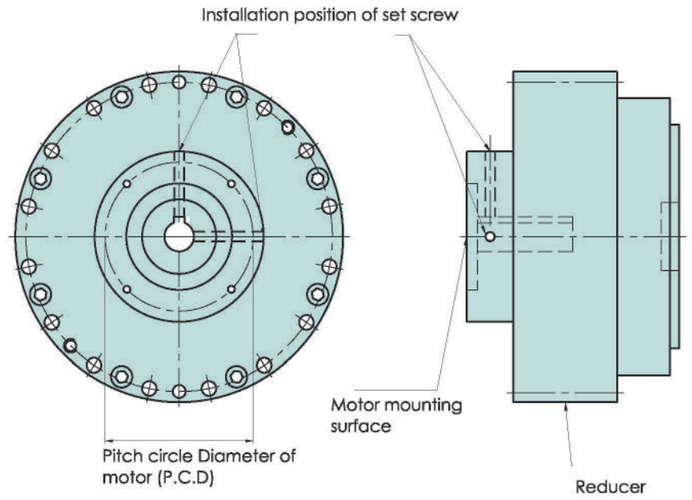
MOTOR MOUNTING SELECTIONS:

● D-直結式
D-Direct fixed type



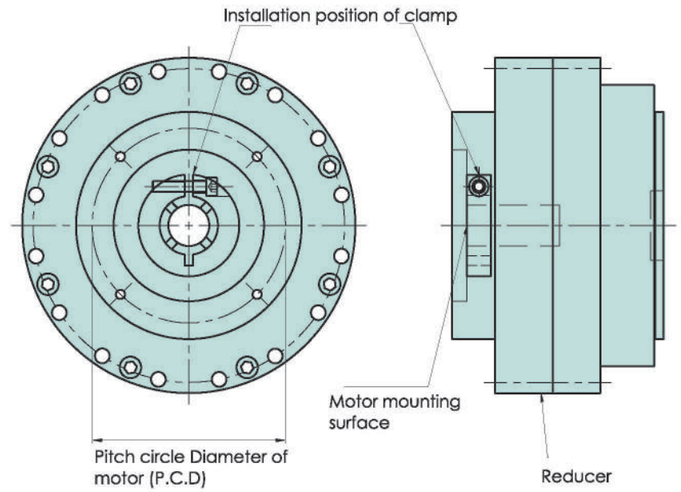
1. Place motor shaft key and reducer input shaft key way in a straight line, and insert motor shaft into reducer input shaft.
2. After connection of motor and reducer, tighten four screws into hex-socket cap screw holes.

● S-Set screw fixed type



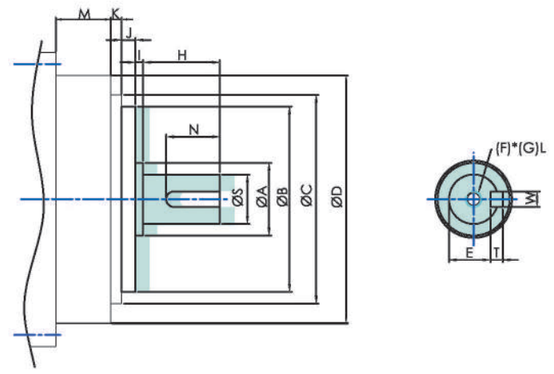
1.Place motor shaft key andreducerinput shaft key way in a straight line,and insert motor shaft into reducerinput shaft.
2.After connection of motor andreducer tighten four screws into hex-socket cap screw holes.
3.Fix the set screw onreducerinput shaft by T-type spanner.

● L-Clamp fixed type



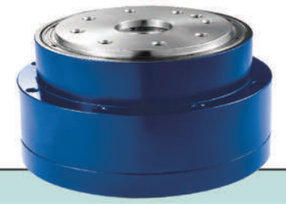
1.Place motor shaft key and reducer input shaft key way in a straight line, and insert motor shaft into reducer input shaft.
2.After connection of motor andreducer tighten four screws into hex-socket cap screw holes.
3.Tighten the clamp ofreducerinput shaft by T-type spanner.

Output type :S-Shaft



Model THA	M	K	J	I	H	N	A	B	C	D	S	W	T	E	F	G
5E	22	3	10	3	30	20	42	47	49	66	19	6	6	15.5	M6	12
7E	21	3	12	3	35	30	40	80	86	106	28	8	7	24	M8	15
25E	25	4.5	12	3	55	49	54	85	105	130	38	10	8	33	M8	15
45E	36	7	15	5	90	80	80	120	135	160	60	18	11	53	M10	18
135E	47.5	7.1	15	5	90	80	80	140	145	228	60	18	11	53	M10	18
165E	51	8	20	5	105	95	90	204	204	240	70	20	12	62.5	M12	24
325E	63.5	8	20	5	130	120	110	230	245	284	90	25	14	81	M16	30
450E	64	8	25	5	165	155	120	275	275	328	100	28	16	90	M20	40

FHA-E TECHNICAL SPECIFICATION TABLE

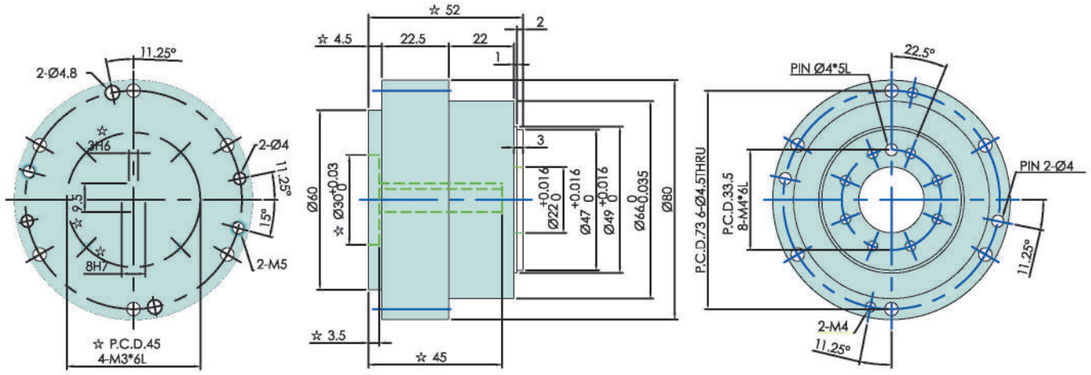


FHA-E Technical Specification Table																			
Specification		FHA-5E		FHA-7E		FHA-25E		FHA-45E		FHA-135E		FHA-165E		FHA-325E		FHA-450E		FHA -700E
Rotation		Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	Shaft Run	Case Run	–
Ratio		40	41	40	41	40	41	35	36	50	51	50	51	59	60	59	60	
		50	51	50	51	50	51	40	41	60	61	60	61	79	80	79	80	
		–	–	59	60	60	61	50	51	79	80	79	80	99	100	99	100	–
		–	–	–	–	–	–	59	60	99	100	99	100	119	120	119	120	
		–	–	–	–	–	–	79	80	–	–	–	–	–	–	139	140	
Rated Output Torque	Nm kgf-m	60 (6.1)		83 (8.46)		245 (25)		460 (46.8)		1400 (136)		1615 (165)		3595 (366)		5100 (520)		–
Acceleration & Braking Torque	Nm kgf-m	97.5 (9.9)		136 (14)		515 (52)		1158 (118)		2083 (212)		4043 (412)		7963 (812)		11025 (1125)		–
Instantaneous Max. Allowable Torque	Nm kgf-m	245 (25)		415 (42)		1000 (102)		2300 (234.4)		4155 (423.5)		8075 (823)		17975 (1830)		25500 (2600)		–
Rated Input Speed	Nr (rpm)	2000		2000		2000		2000		2000		1500		1500		1500		–
Rated Lifetime	Hr	6000		6000		6000		6000		6000		6000		6000		6000		–
Allowable Max. Input Speed	Nmax (rpm)	3000		3000		3000		3000		2500		2500		2000		2000		–
Tilting Stiffness	Nm/arc.min kgf-m/arc.min	82 (8.3)		117 (12)		372 (38)		931 (95)		1176 (120)		2940 (300)		4900 (500)		7448 (760)		–
Torsional Stiffness	Nm/arc.min kgf-m/arc.min	18 (1.83)		20 (2)		49 (5)		108 (11)		196 (20)		392 (40)		980 (100)		1176 (120)		–
Max.Lost Motion	(arc.min)	<3.0		<3.0		<2.0		<2.0		<1.5		<1.5		<1.5		<1.5		–
Angular Transmission Error	ATE (arc.sec)	40		80		40		40		40		40		40		40		–
Backlash – Standard Backlash	(arc.min)	<5.0		<5.0		<5.0		<5.0		<4.0		<4.0		<4.0		<4.0		
Backlash – Precision Backlash		<3.0		<3.0		<3.0		<3.0		<2.0		<2.0		<2.0		<2.0		–
Backlash – High Precision Backlash		-		-		-		<1.0		<1.0		<1.0		<1.0		<1.0		
Maximum Tilting Moment	Nm kgf-m	282 (28.8)		392 (40)		1764 (180)		3332 (340)		4312 (440)		7840 (800)		14112 (1440)		17640 (1800)		–
Rated Radial Force	Nm	118		196		882		1666		2156		3920		7056		8820		–
Max. AxialForce	N	885		1470		3920		5194		7840		14700		19600		24500		–
($I=GD^2/4$)	Input Inertia $Kg-m^2$	1.65×10^{-6}		2.60×10^{-6}		1.08×10^{-5}		4.50×10^{-5}		5.65×10^{-5}		1.9×10^{-4}		6×10^{-4}		9×10^{-4}	
		1.46×10^{-6}		1.85×10^{-6}		0.65×10^{-5}		3.75×10^{-5}		4.40×10^{-5}		1.8×10^{-4}		5.4×10^{-4}		7.3×10^{-4}	
		–		1.66×10^{-6}		0.45×10^{-5}		2.4×10^{-5}		3.53×10^{-5}		1.78×10^{-4}		4×10^{-4}		6×10^{-4}	–
		–		–		–		1.75×10^{-5}		2.63×10^{-5}		1.51×10^{-4}		2.8×10^{-4}		4.8×10^{-4}	
		–		–		–		2.4×10^{-5}		–		–		–		4.2×10^{-4}	
Weight	KG	1.5		4.5		8.5		12		32.5		37		65		81		–

Please contact us for other ratio selections.Please be noted that the noise will be increased when the input speed (RPM:revolution per minute)of motor is higher than rated input speed; the operating temperature and motor service temperature should be under 70°C.

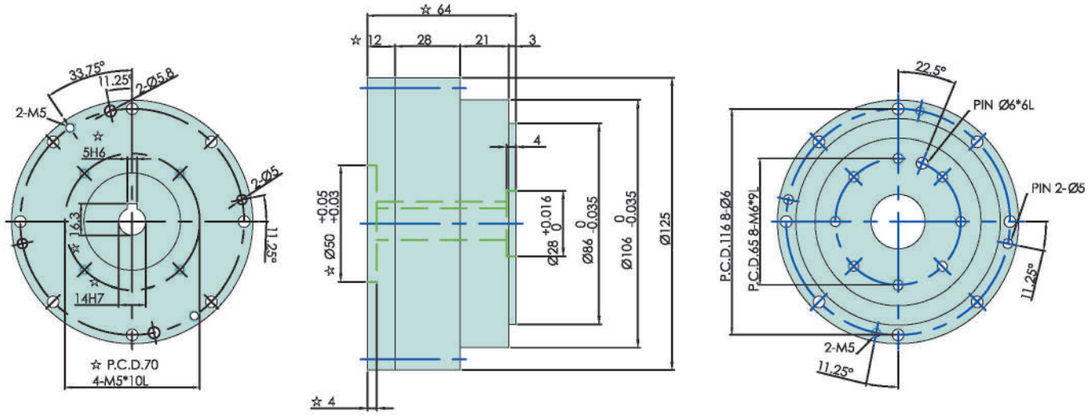
DRAWING&DIMENSION

FHA-5E-□-C-□-D



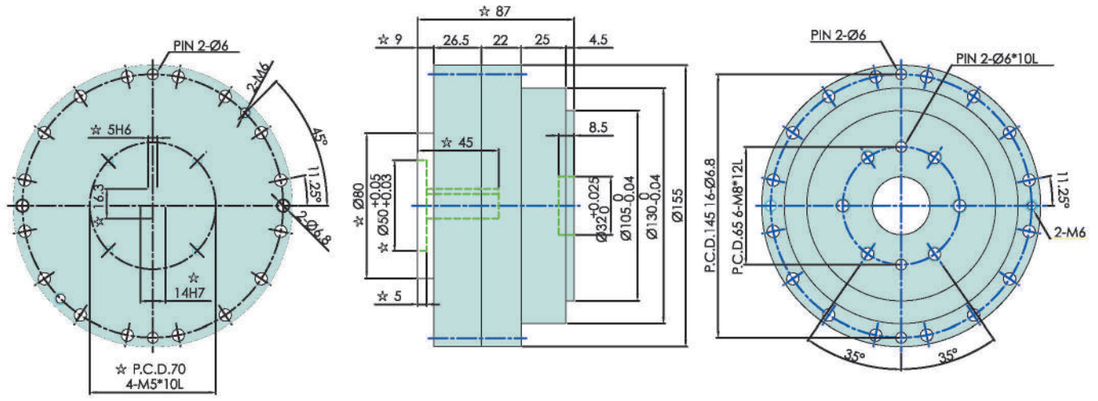
1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ8~Φ11 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

FHA-7E-□-C-□-D



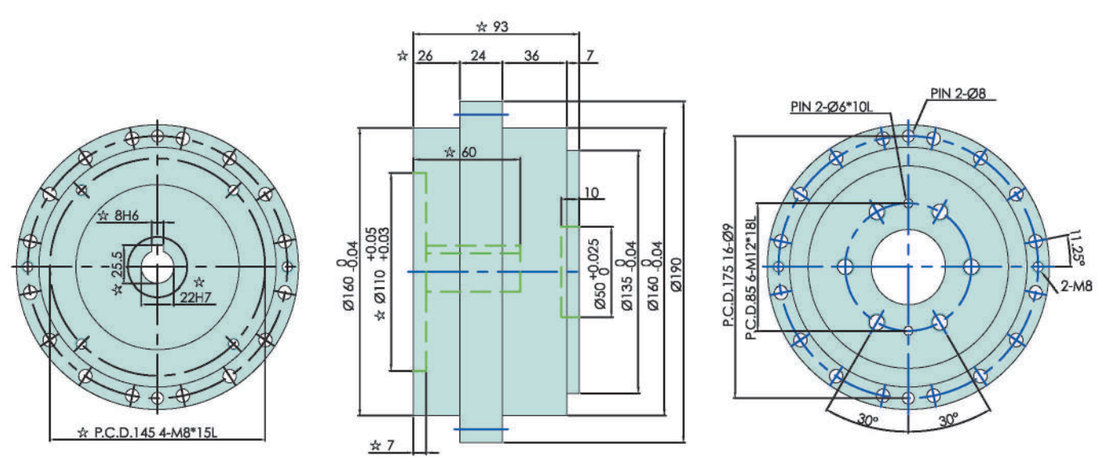
1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ11~Φ19 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

FHA-25E-□-C-□-D



1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ11~Φ24 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

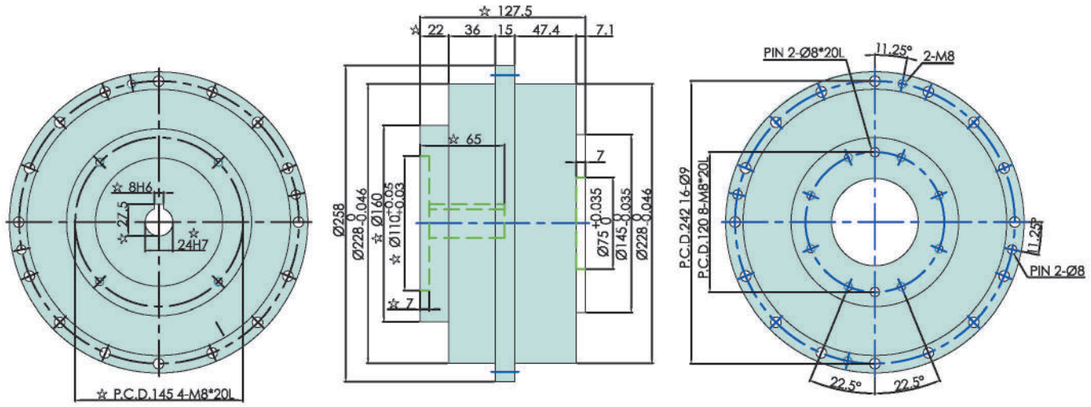
FHA-45E-□-C-□-D



1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ14~Φ28 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

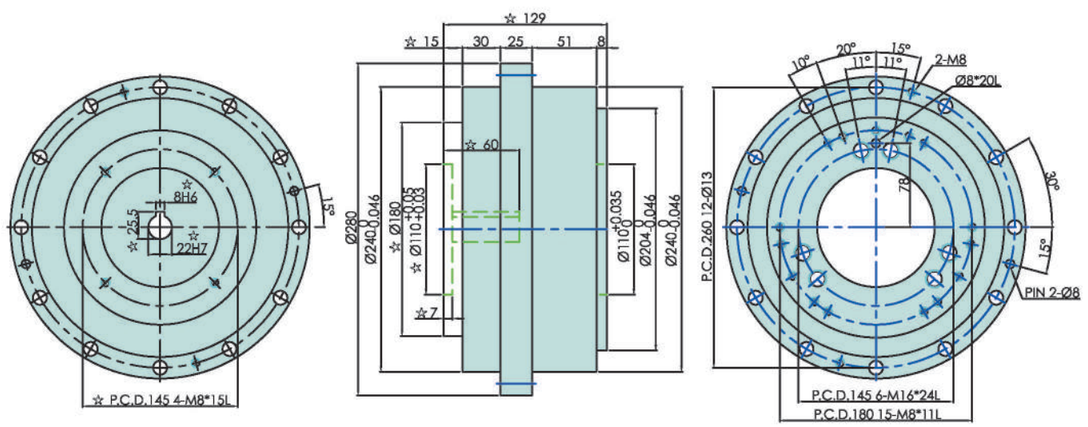
DRAWING&DIMENSION

FHA-135E-□-C-□-D



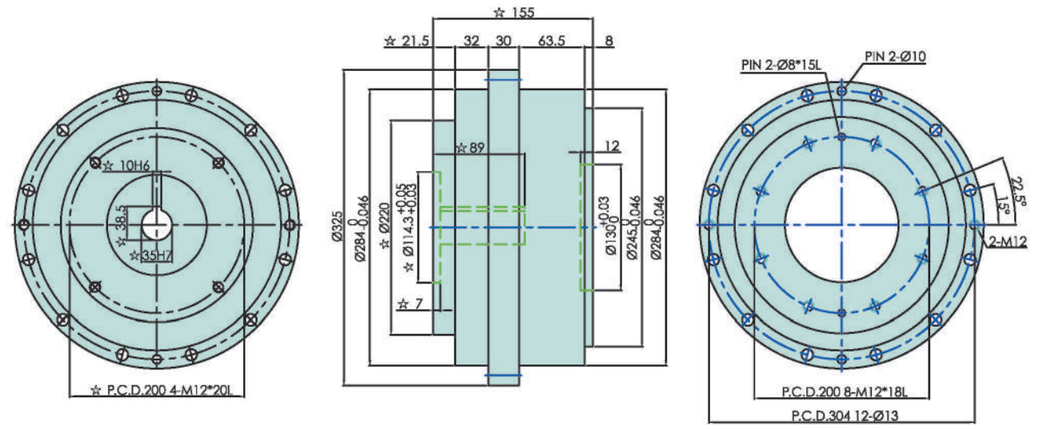
1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ19~Φ35 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

FHA-165E-□-C-□-D



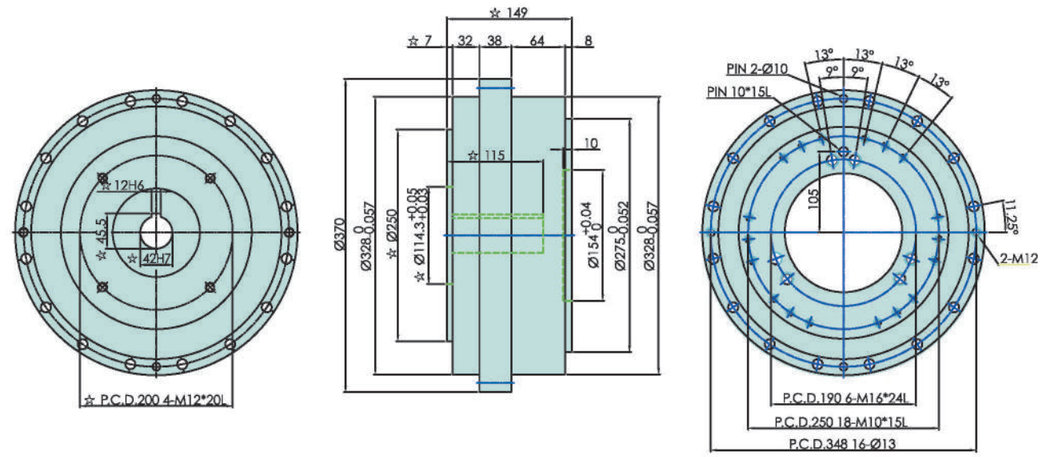
1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ22~Φ42 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

FHA-325E-□-C-□-D



1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ24~Φ42 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

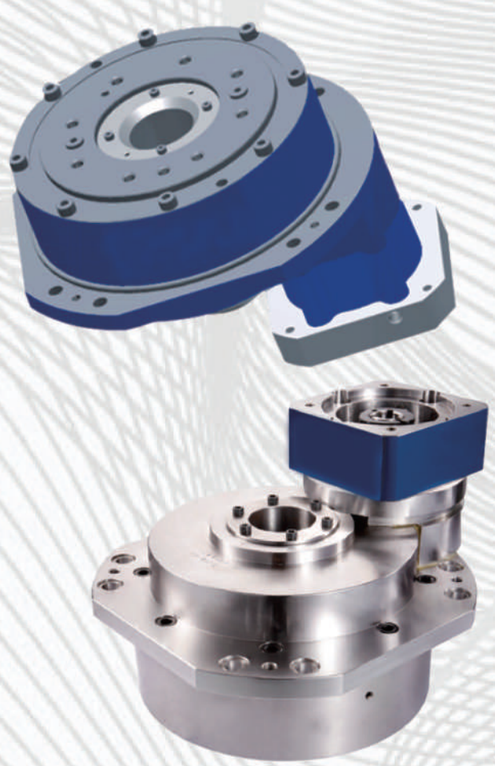
FHA-450E-□-C-□-D



1. "☆"The dimensions modify with motor specification.
2. Output shaft diameterΦ35~Φ60 mm.
3. This drawing is model of shaft rotation, for case run drawing, please contact us.

FHD-C SERIES

HOLLOW BODY DESING,DIRECT OUTPUT
DESIGNED FOR BASE OF ROBOT



Overview

- Type : FHD-10C~ FHD-500C
- Backlash : ≦1-5 Arc.min
- Ratio : 1/64.38 ~ 1/219
- Capacity: 0.2KW ~ 15KW
- Rotation : Shaft Run
- Rated output torque: 98NM ~ 4900NM

FHD-CORDERING INSTRUCTIONS

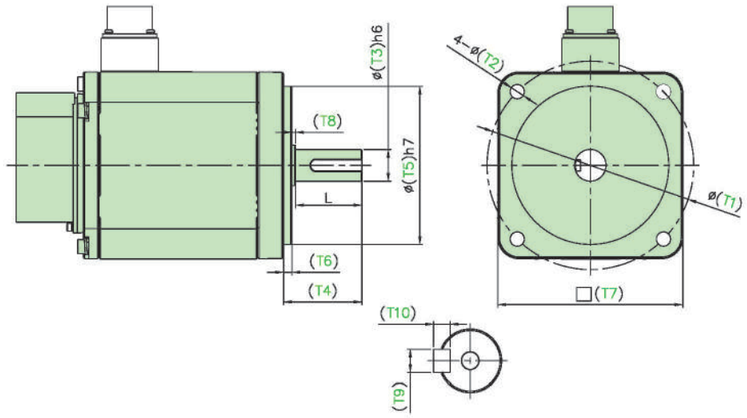
- ORDERING CODE EXAMPLE :

(For the type and ratio, please refer to technical specifications table.)

FHD — 10C — 106.5 — P2 — S3

- FHD: Model
- 10C: Type — 10C, 30C, 50C, 105C, 200C, 320C, 500C
- 106.5: Ratio
- P2: P2 Standard Backlash; P1 Precision Backlash
- S3: Servo motor

- Please provide the motor dimension below when ordering



Motor Brand :					
Motor Model :					
T1	T2	T3	T4	T5	T6
P.C.D	Bolt Hole Diameter	Motor Shaft Diameter	Motor shaft length	Motor Pilot Diameter	Motor Pilot Height
T7	L	T8		T9	T10
Motor Outline Dimension	Motor Shaht Lenght	Diameter required when using YASKAWA made motor		Key Width	Key Thickness

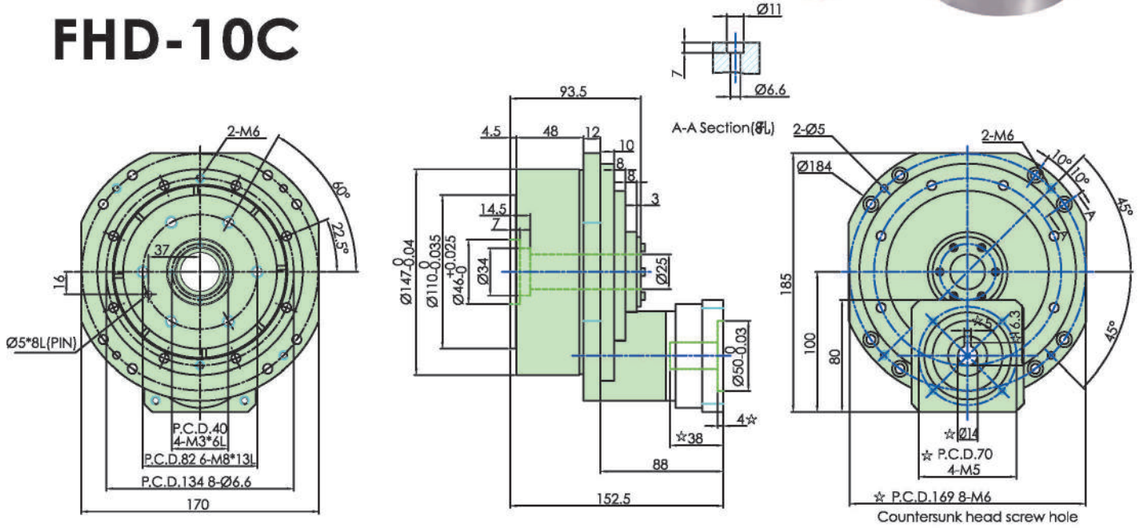
FHD-C TECHNICAL SPECIFICATION TABLE

FHD-C Technical Specification Table										
Specification		FHD-10C	FHD-30C	FHD-50C	FHD-105C	FHD-200C	FHD-320C	FHD-500C	FHD-700C	
Rotation		Shaft Run	Shaft Run	Shaft Run	Shaft Run	Shaft Run	Shaft Run	Shaft Run	–	
Ratio		106.5	64.38	78.4	97.6777	71.9924	94.5	111	–	
		154	84.18	102.4	110.5677	92.2932	109.5	147		
		–	103.98	126.4	136.3478	105.827	123	183		
		–	–	–	187.9079	137.9699	153	219		
		–	–	–	–	–	–	–		
Rated Output Torque	Nm kgf-m	98 (10)	295 (30)	490 (50)	1030 (105)	1960 (200)	3136 (325)	4900 (500)	–	
Acceleration & Braking Torque	Nm kgf-m	245 (25)	737 (75)	1225 (125)	2575 (262)	4900 (500)	7840 (800)	12250 (1250)	–	
Instantaneous Max. Allowable Torque	Nm kgf-m	490 (50)	1475 (150)	2450 (250)	5150 (525)	9800 (1000)	15680 (1600)	24500 (2500)	–	
Rated Input Speed	Nr (rpm)	2000	2000	1500	1500	1500	1500	1500	–	
Rated Output Speed	Nr (rpm)	15	15	15	15	15	15	15	–	
Rated Lifetime	Hr	6000	6000	6000	6000	6000	6000	6000	–	
Maximum Allowable Output Speed(Intermittent)	Nmax (rpm)	28	47	38	26	28	21	18	–	
		19	36	29	23	22	18	14		
		–	29	24	18	19	16	11		
		–	–	–	13	14	13	9		
Allowable Output Speed (Continuous)	Min (rpm)	19	31	26	15	21	16	14	–	
		13	24	20	14	16	14	10		
		–	19	16	11	14	12	8		
		–	–	–	8	11	10	7		
Tilting Stiffness	Nm/arc.min kgf-m/arc.min	421 (43)	1068 (109)	1960 (200)	2813 (287)	9800 (1000)	12740 (1300)	24500 (2500)	–	
Torsional Stiffness	Nm/arc.min kgf-m/arc.min	47 (4.8)	147 (15)	255 (26)	510 (52)	980 (100)	1960 (200)	3430 (350)	–	
Max.Lost Motion	(arc.min)	<2.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	–	
Angular Transmission Error	ATE (arc.sec)	50	50	50	50	50	50	50	–	
Backlash – Standard Backlash	arcmin	<5.0	<4.0	<3.0	<3.0	<3.0	<3.0	<3.0	–	
Backlash – Precision Backlash	arcmin	<3.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	–	
Maximum Tilting Moment	Nm kgf-m	1372 (140)	1960 (200)	3528 (360)	4900 (500)	17640 (1800)	39200 (4000)	78400 (8000)	–	
Rated Radial Force	Nm	686	980	1764	2450	8820	20580	34300	–	
Max.Axial Force	N	5880	8820	11760	13720	19600	29400	39200	–	
Start Efficiency	%	65	70	70	80	80	80	80	–	
Weight	KG	10.7	20	34	46	100	176	–	–	

Please contact us for other ratio selections.Please be noted that the noise will be increased when the input speed (RPM:revolution per minute)of motor is higher than rated input speed; the operating temperature and motor service temperature should be under 70℃.

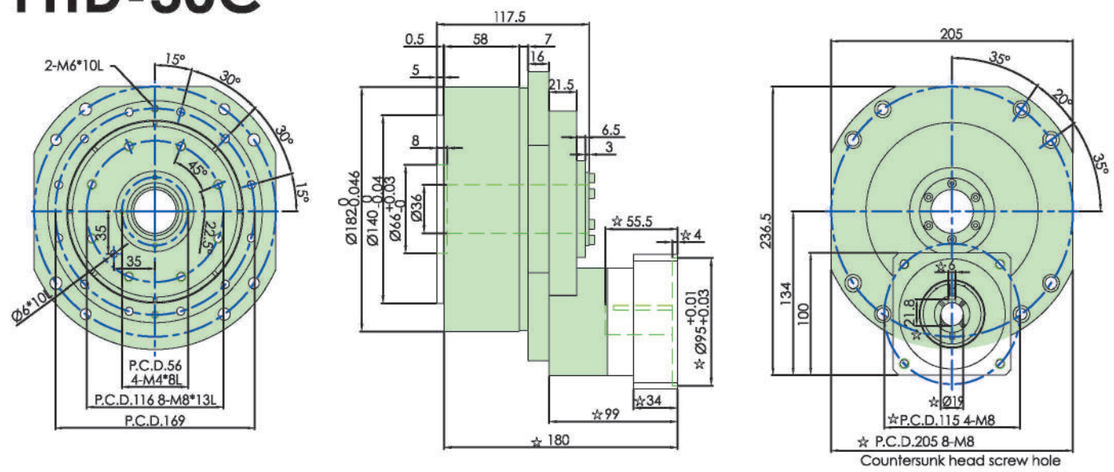
FHD–C
DRAWING & DIMENSION

FHD-10C



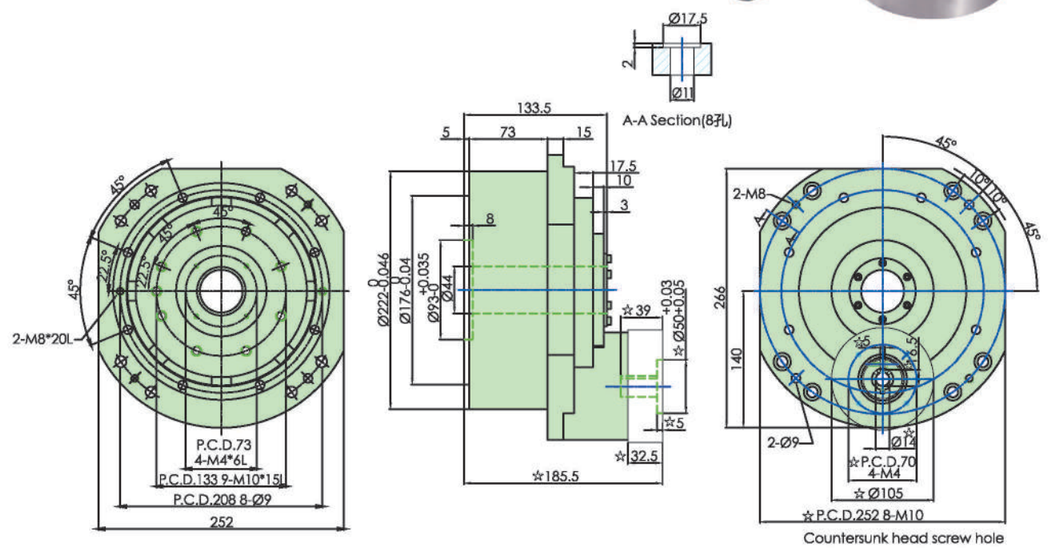
1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

FHD-30C



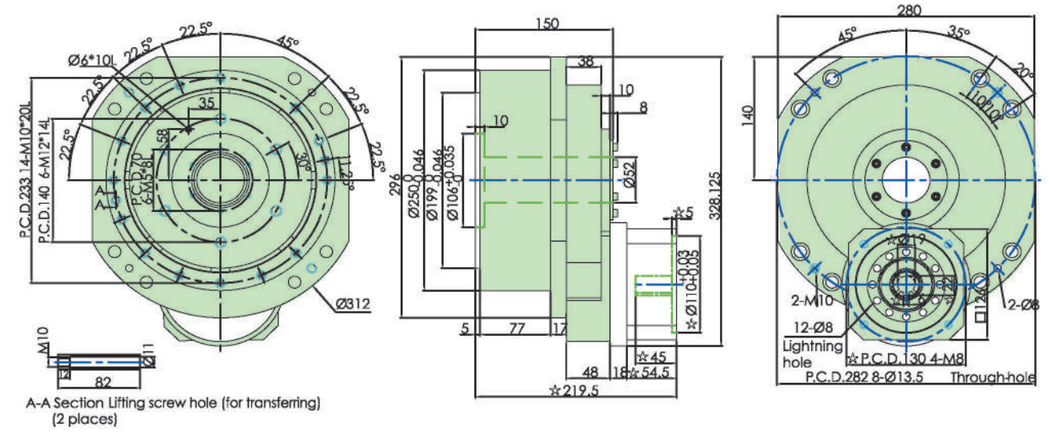
1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

FHD-50C



1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

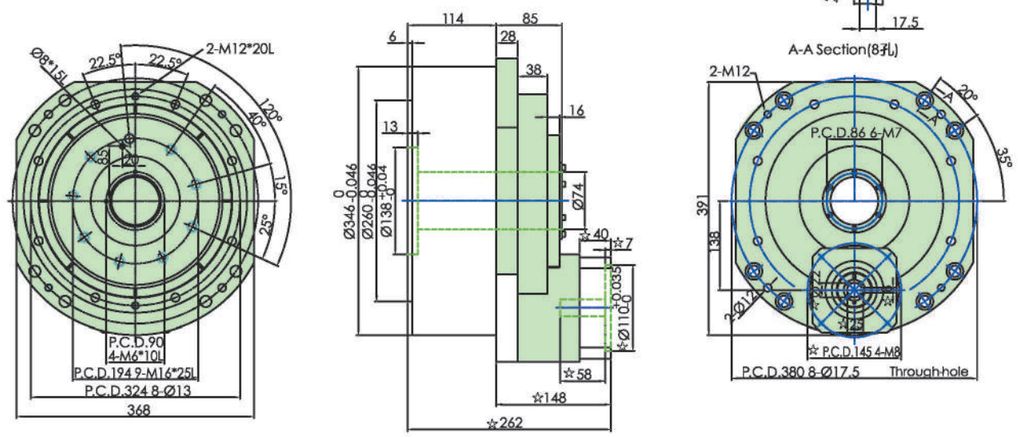
FHD-105C



1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

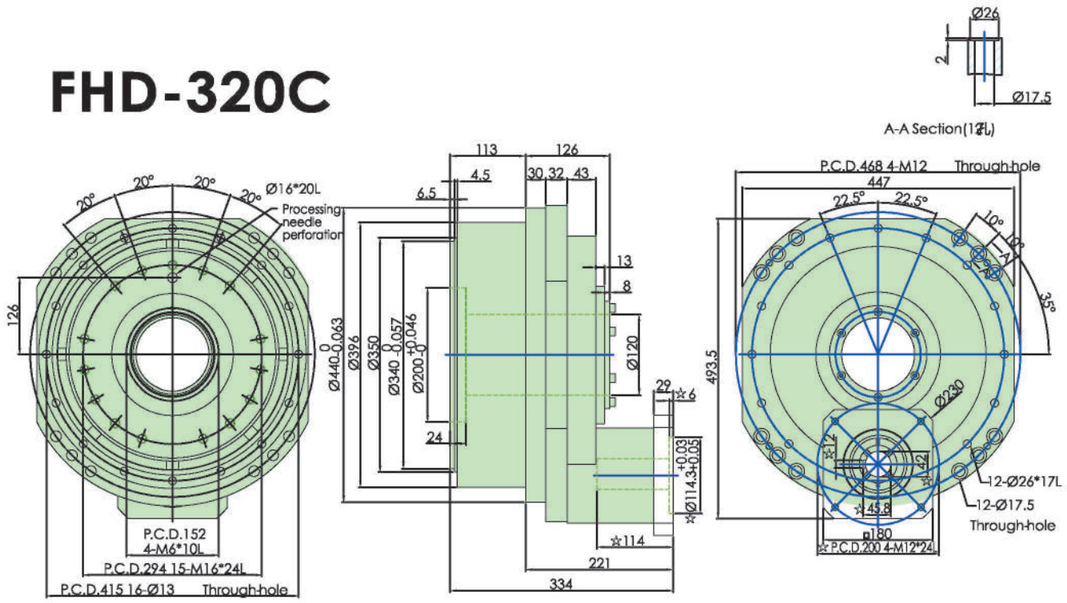
FHD–C
DRAWING & DIMENSION

FHD-200C



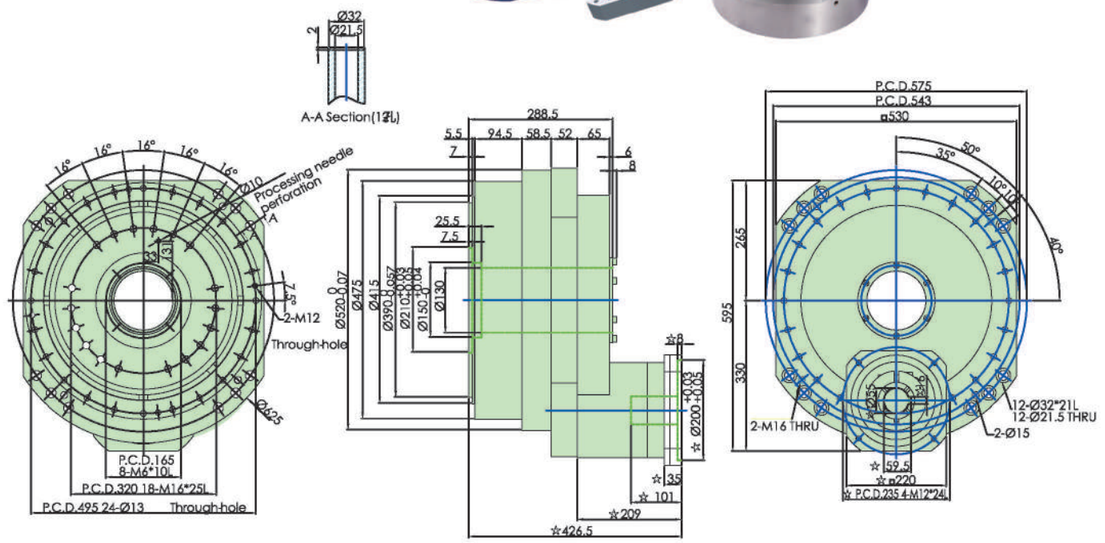
1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

FHD-320C



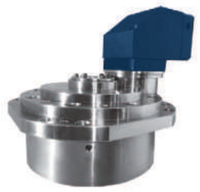
1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

FHD-500C

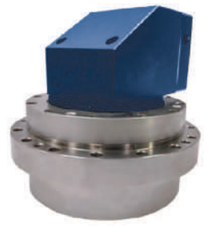


1. "☆"The dimensions modify with motor specification.
2. The drawing is for output flange rotation (shaft run)

New Production

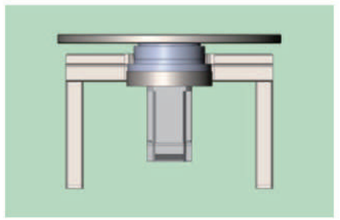


FHDR-C series
Hollow design Shortest height

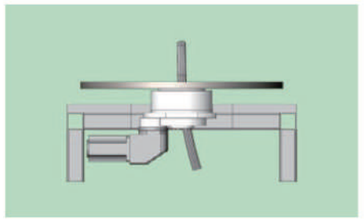


FHAR-E series
Compact design
Narrowest width

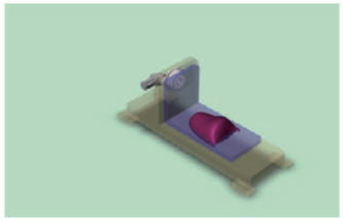
Feature : In order to meeting lots of requirements from customer side,are rotary table as low as possible,trunnion axis as short as possible, which make the whole machine compact and space-saving.Therefore,we now release these two series to solve this terrible problem and provide successfully customersthe excellent convenience.



Typical Profile
Height too tall space-wasting



THDR-C Profile
Low height space-saving



THAR-E Profile
Short width easy display