



CT-CRV[®] SERIES

REDUCER PRODUCT BROCHURE



Contents

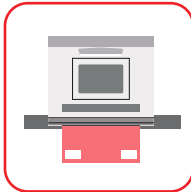
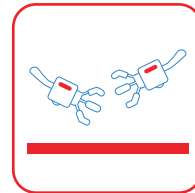
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1. With its unique tooth design and modification technology, Chietom is able to produce the parts with optimized load distribution, strong anti-abrasion ability and self-adaptability to manufacturing error. The products also show superior quality in stable transmission and low noise.



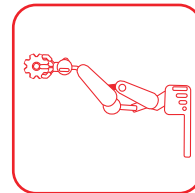
2. Chietom's factories are equipped with customized world-class CNC manufacturing equipments, which ensure high precision, efficiency, and stability of mass production.

3. With company's self-designed manufacturing technology and clamping device, the final products are manufactured with high precision and efficiency.



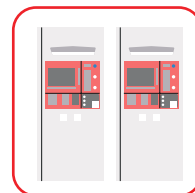
4. Chietom's technology enables fast measurement, real-time data acquisition and analysis through self-designed measuring equipments, testing rigs and experimental devices.

5. With company's self-designed assembly tools and tolerance allocation technology, Chietom is able to assemble the final products very efficiently in large quantities.



6. Chietom also develops specialized heat treatment equipment to fulfill the design performance and product uniformity requirements.

7. The professional testing platform (with the same standard of National Testing Center) allows Chietom to fully test various performances of final products and issue test reports.



Main Purpose

ROBOT

4,6-axis joint robot (series robot)
parallel robot
SCARA robot
truss robot
semiconductor robot (stacker, LCD robot)

AUTOMATIC

positioner
circular dividing table
moveable slider

MACHINE TOOL

pipe bending machine, bending machine
5-axis machining center
tool library

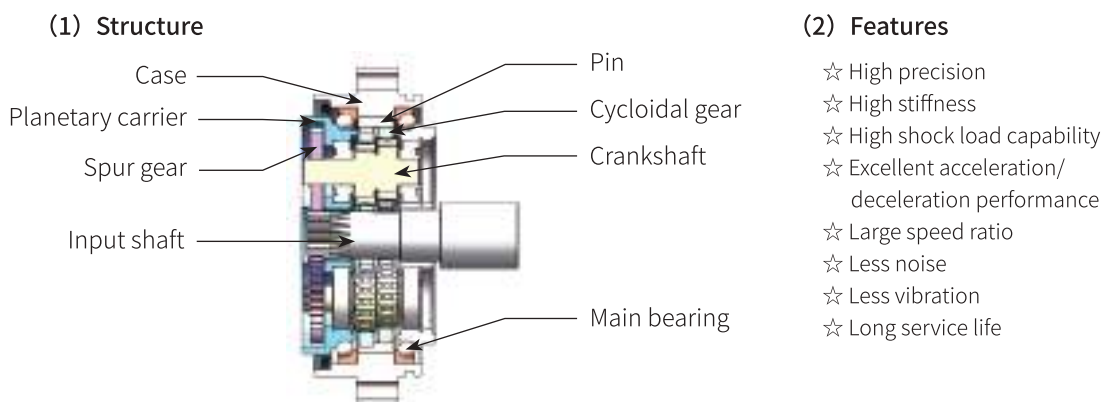
OTHERS

medical equipment (CT machine)
semiconductor equipment
human exoskeleton
Angle deflection of wind and solar equipment
printing machine

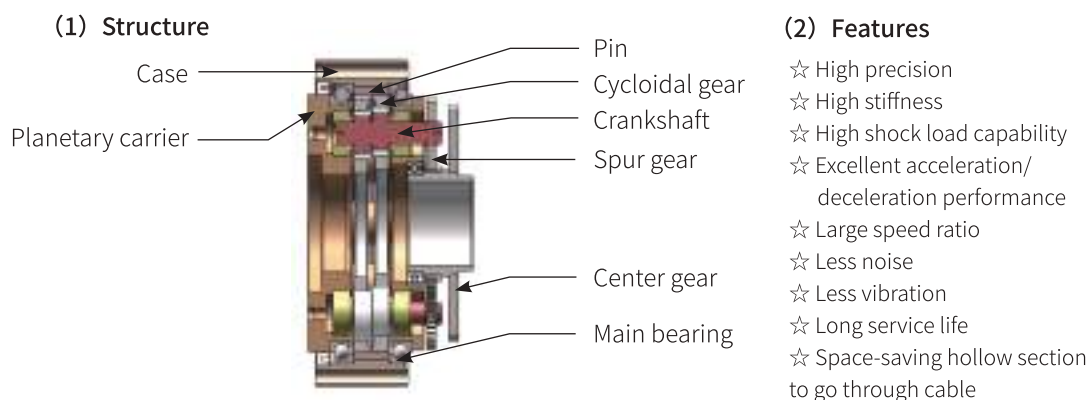


1. Structure, features and principle of CT-CRV-P series

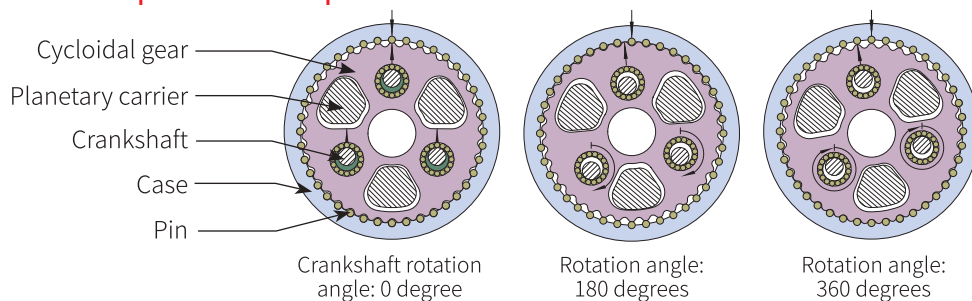
1.1 Structure and features of CT-CRV-E series



1.2 Structure and features of CT-CRV-C series



1.3 Principle of CT-CRV speed reduction



The first stage is spur gear reduction, and the rotation of the input shaft is transferred from the input gear to the spur gear, and the speed is reduced according to the gear ratio.

The second stage is cycloidal pin-wheel reduction. The spur gear is connected with the crankshaft. The rotation of the crankshaft drives the cycloidal wheel to do eccentric motion, when the crankshaft rotates for one cycle, the cycloid wheel will rotate a tooth along the opposite direction of the crankshaft.

2. Speed ratio calculation of CT-CRV series

CT-CRV-E series input shaft speed ratio

$$R = 1 + \frac{Z_2}{Z_1} \cdot Z_3$$

R : Speed ratio

Z_1 : Number of teeth on input gear

Z_2 : Number of teeth on planetary gear

Z_3 : Number of pins

CT-CRV-C series center gear speed ratio

$$R = 1 + \frac{Z_2}{Z_1} \cdot Z_3$$

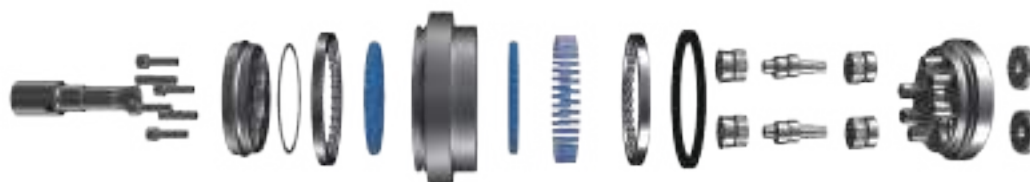
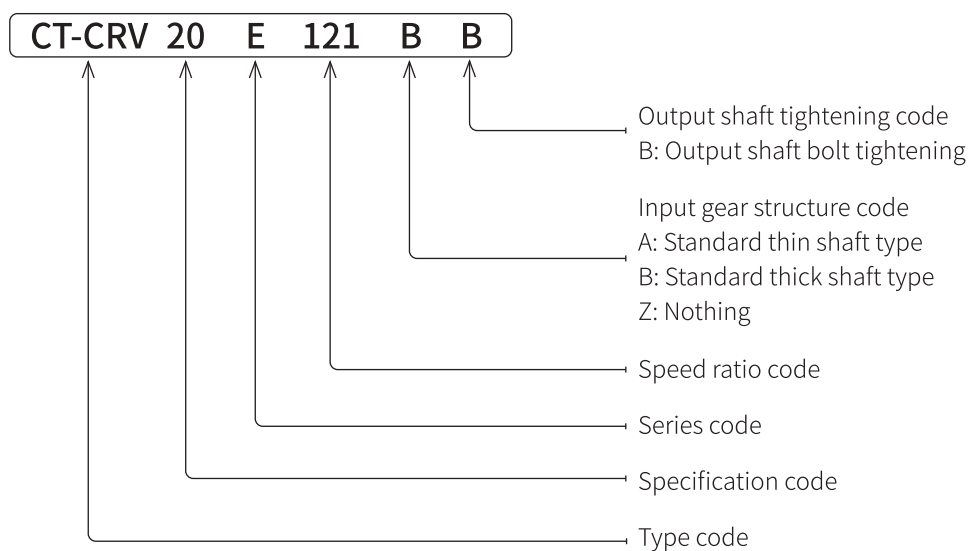
R : Speed ratio

Z_1 : Number of teeth on center gear

Z_2 : Number of teeth on planetary gear

Z_3 : Number of pins

1. CT-CRV-E Explanation of Codes



Exploded view of CT-CRV-E reducer

2. CT-CRV-E Rating Table

	Output speed r/min			5	10	15	20	25	30	40	50	60
Model	Speed ratio	Speed ratio		Output torque N.m Input power kW								
		Shaft rotation	Case rotation									
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									
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									
80E	57	57	56	1088 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	153	152									
110E	81	81	80	1499 1.05	1215 1.70	1078 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									
160E	81	81	80	2176 1.52	1774 2.48	1568 3.28	1441 4.02	1343 4.69	1274 5.34			
	101	101	100									
	129	129	128									
	145	145	144									
	171	171	170									
320E	81	81	80	4361 3.04	3538 4.94	3136 6.57	2881 8.05	2695 9.41	2548 10.7			
	101	101	100									
	118.5	118.5	117.5									
	129	129	128									
	141	141	140									
	171	171	170									
320E3	185	185	184	4361 3.04	3538 4.94	3136 6.57	2881 8.05	2695 9.41	2548 10.7			
	81	81	80									
	101	101	100									
	118.5	118.5	117.5									
	129	129	128									
	141	141	140									
	171	171	170									
	185	185	184									
450E	201	201	200	6135 4.28	4978 6.95	4410 9.24	4047 11.3	3783 13.2				
	81	81	80									
	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									

Remarks:

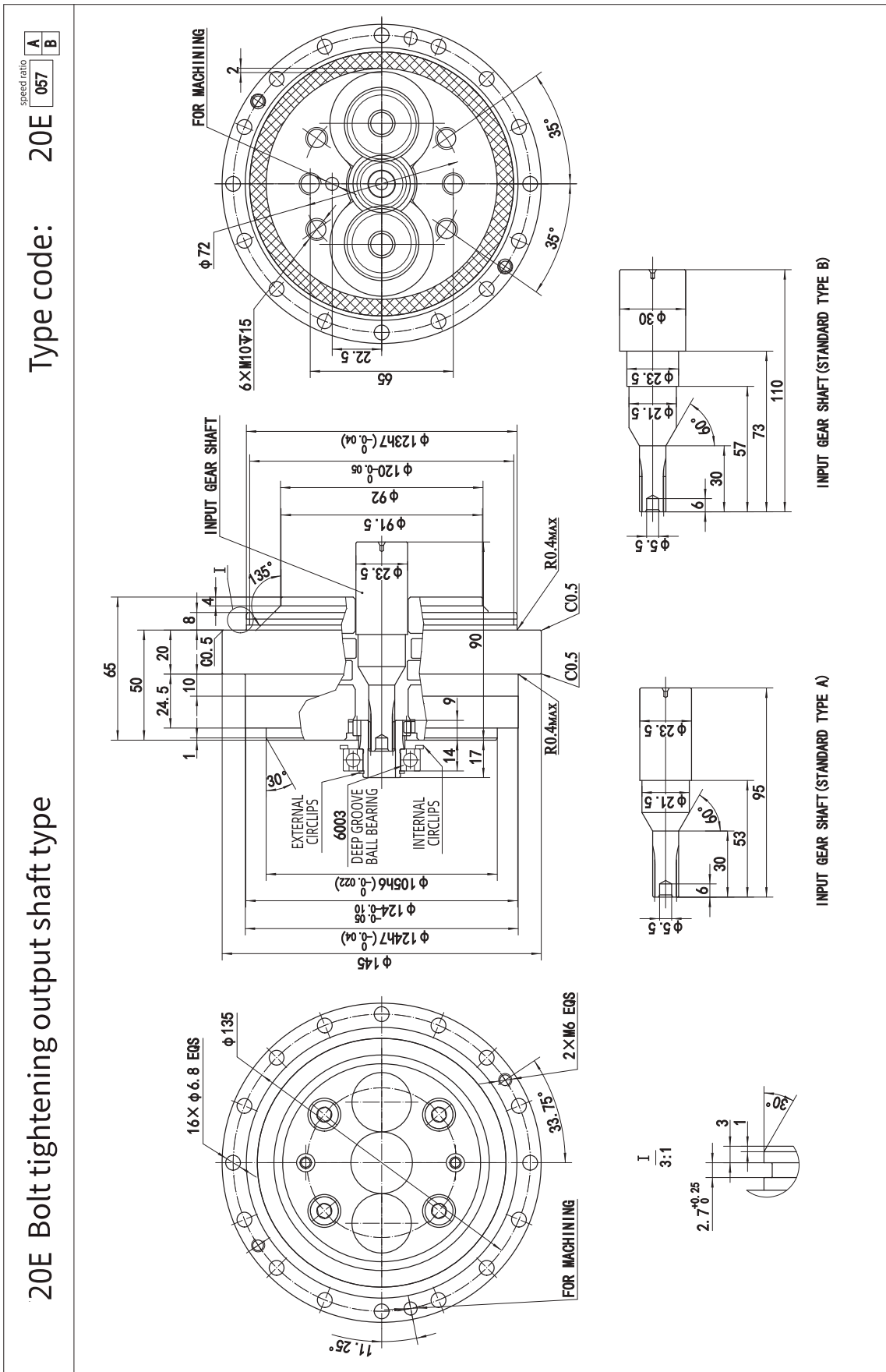
(1)The rated torque is the output torque under an output speed of 15 r/min, which is the basis for calculating the service life.

(2)The maximum speed of the input shaft must not be greater than the allowable maximum output speed multiplied by the speed ratio. If you need a speed ratio other than those above, please consult our company.

Maximum Allowable Output Speed r/min	Allowable Acceleration/ Deceleration Torque N·m	Momentary Maximum Allowable Torque N·m	Allowable Bending Moment N·m	Momentary Maximum Allowable Bending Moment N·m	Torsional Rigidity N·m/arcmin	Maximum Lost Motion arcmin	Backlash arcmin	Angle Transmission Error arcsec	Allowable Radial Load N	Moment of Inertia Kgm ²	Rated life h	Weight Kg
75	412	833	882	1764	49	1.0	1.0	70	7785	9.66×10^{-6}	6000	4.7
										6.07×10^{-6}		
										4.32×10^{-6}		
										3.56×10^{-6}		
										2.88×10^{-6}		
70	1029	2058	1666	3332	108	1.0	1.0	60	11594	2.39×10^{-6}	6000	9.3
										3.25×10^{-5}		
										2.20×10^{-5}		
										1.63×10^{-5}		
										1.37×10^{-5}		
70	1960	3920	2156	4312	196	1.0	1.0	50	12988	1.01×10^{-5}	6000	13.1
										8.16×10^{-5}		
										6.00×10^{-5}		
										4.82×10^{-5}		
										3.96×10^{-5}		
50	2695	5390	2940	5880	294	1.0	1.0	50	16648	2.98×10^{-5}	6000	17.4
										9.88×10^{-5}		
										6.96×10^{-5}		
										4.36×10^{-5}		
45	3920	7840	3920	7840	392	1.0	1.0	50	18587	3.89×10^{-5}	6000	26.4
										1.77×10^{-4}		
										1.40×10^{-4}		
										1.06×10^{-4}		
35	7840	15680	7056	14112	980	1.0	1.0	50	28067	0.87×10^{-4}	6000	44.3
										0.74×10^{-4}		
										4.83×10^{-4}		
										3.79×10^{-4}		
										3.15×10^{-4}		
										2.84×10^{-4}		
25	7840	15680	7840	15680	1078	1.0	1.0	50	30165	2.54×10^{-4}	10000	47
										1.97×10^{-4}		
										1.77×10^{-4}		
										1.88×10^{-4}		
										4.83×10^{-4}		
										3.79×10^{-4}		
25	11025	22050	8820	17640	1176	1.0	1.0	50	30133	3.15×10^{-4}	6000	66.4
										2.84×10^{-4}		
										2.54×10^{-4}		
										1.97×10^{-4}		
										1.77×10^{-4}		
										1.88×10^{-4}		

Remarks: The moment of inertia is the value of the reducer unit, and the moment of inertia of the center gear and input gear is not considered.

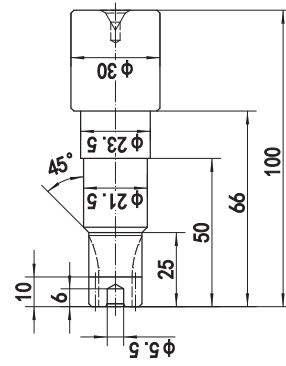
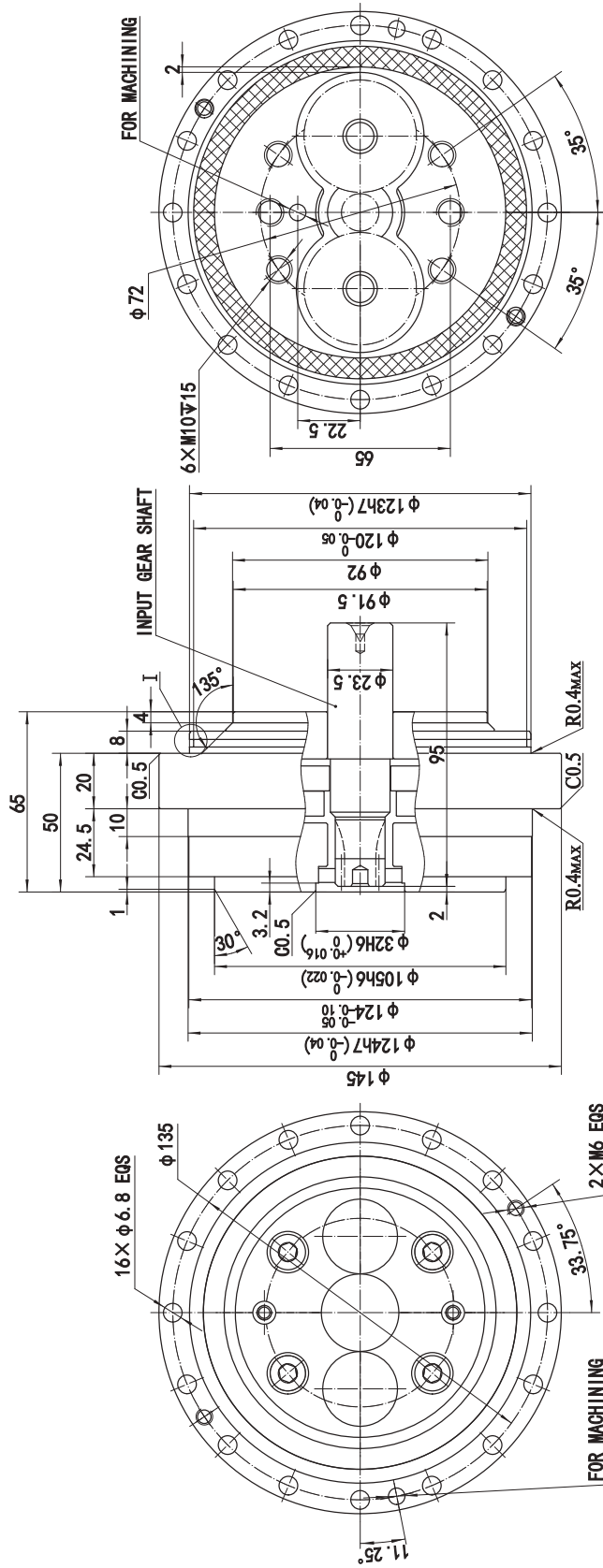
3. CT-CRV-E External Dimensions



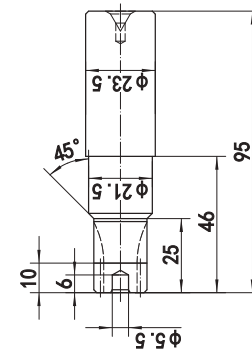
20E Bolt tightening output shaft type

Type code: 20E

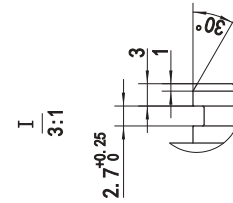
speed ratio ☐ A ☐ B



INPUT GEAR SHAFT (STANDARD TYPE B)



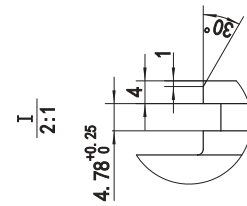
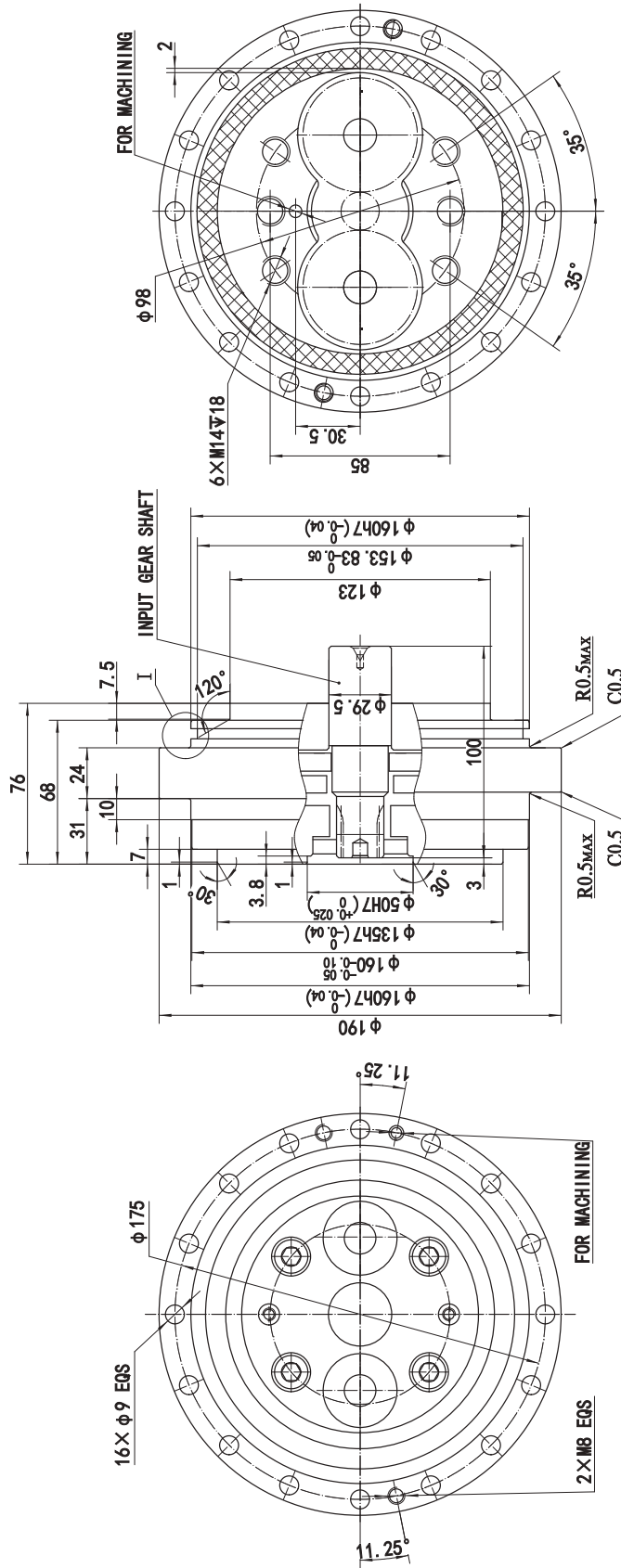
INPUT GEAR SHAFT (STANDARD TYPE A)



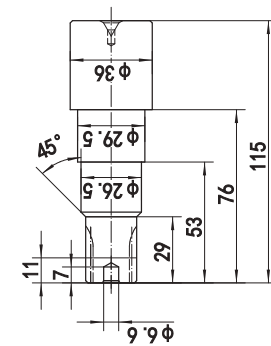
40E Bolt tightening output shaft type

Type code: 40E A B

speed ratio



INPUT GEAR SHAFT (STANDARD TYPE A)



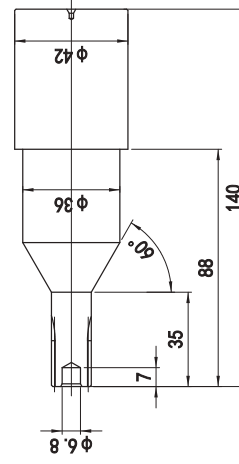
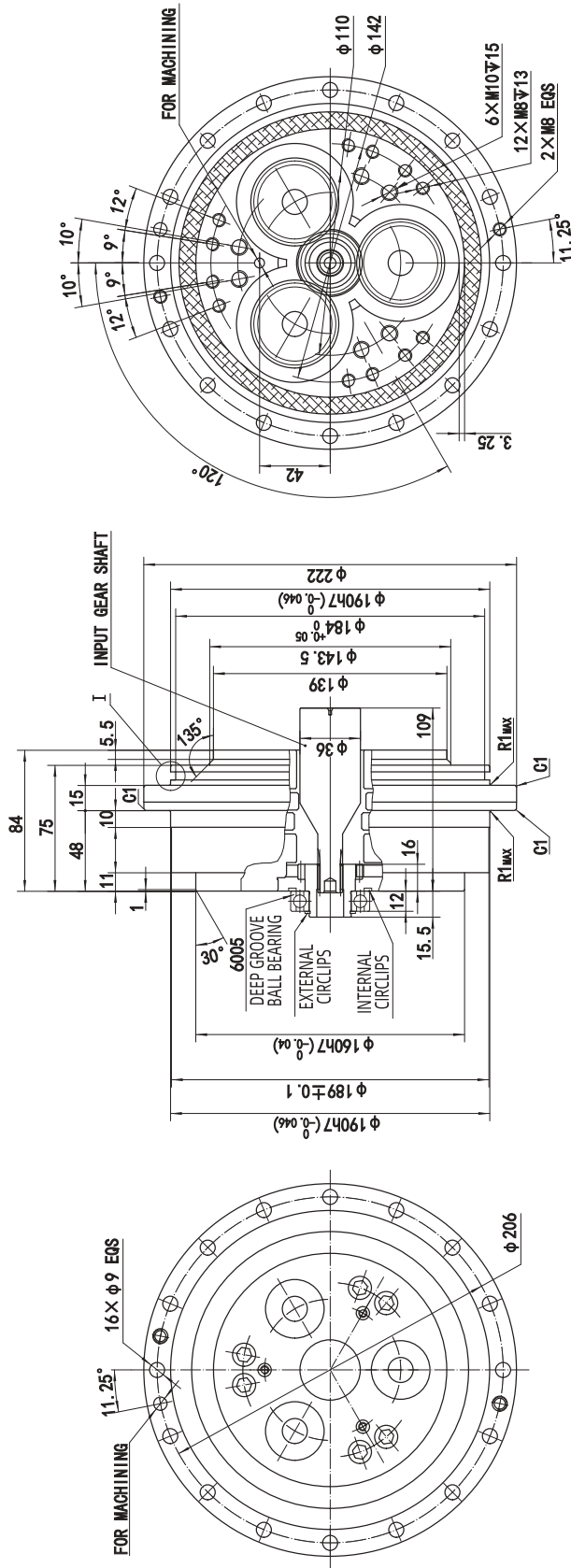
INPUT GEAR SHAFT (STANDARD TYPE B)

80E Bolt tightening output shaft type

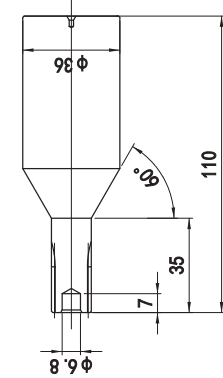
Type code:

80E 057 A B

speed ratio



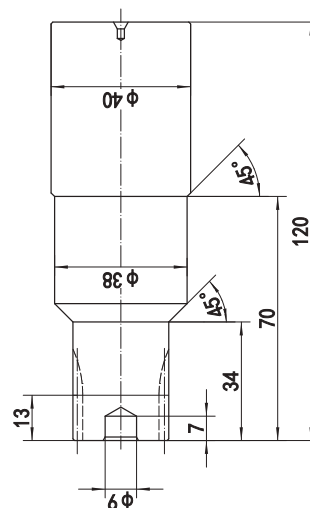
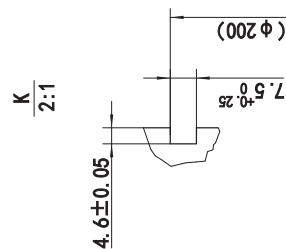
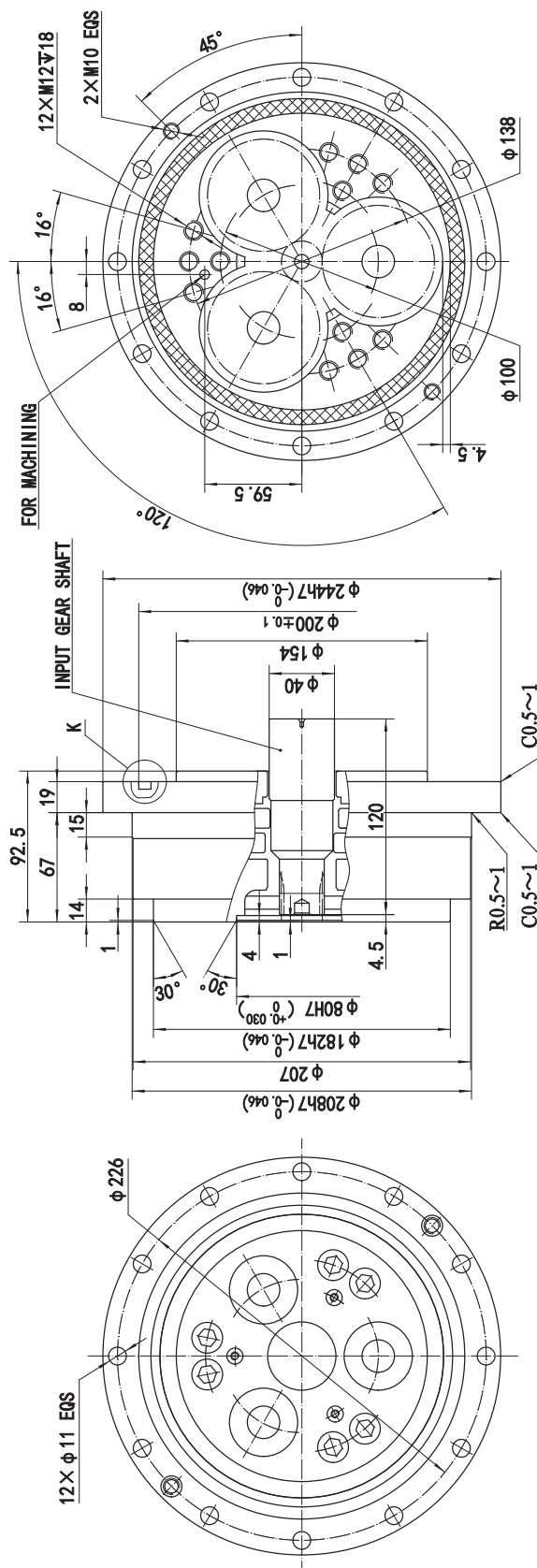
INPUT GEAR SHAFT (STANDARD TYPE B)



INPUT GEAR SHAFT (STANDARD TYPE A)



110E Bolt tightening output shaft type

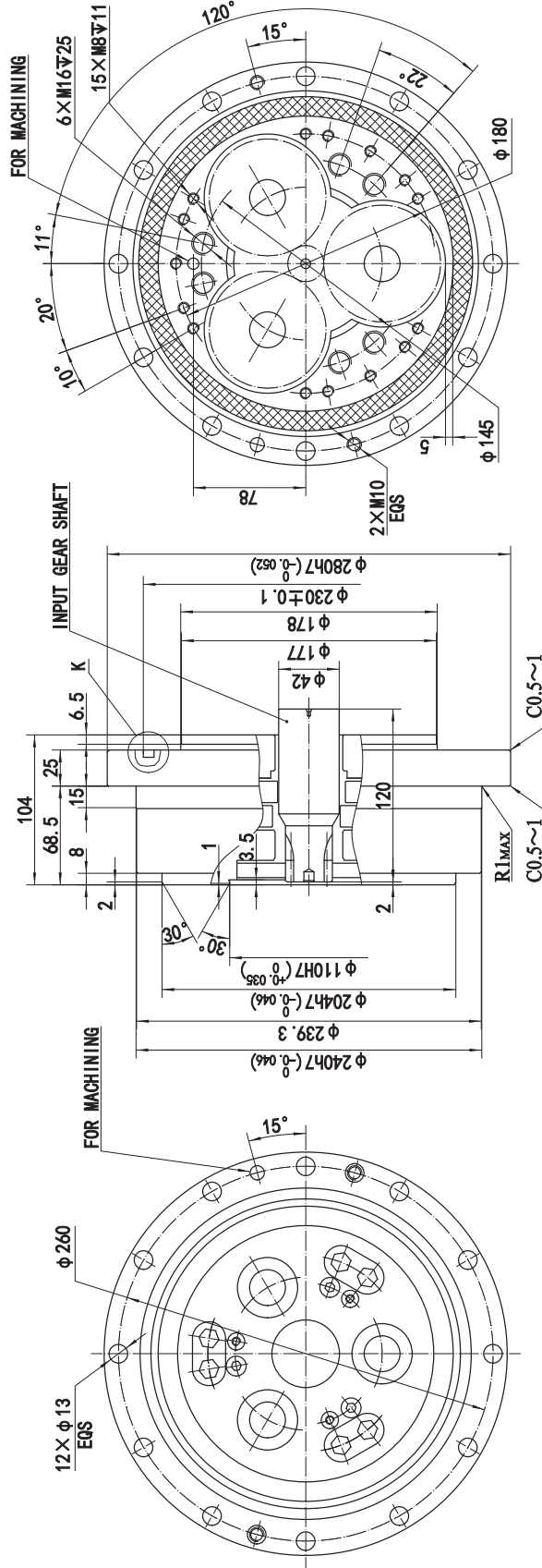


INPUT GEAR SHAFT (STANDARD TYPE)

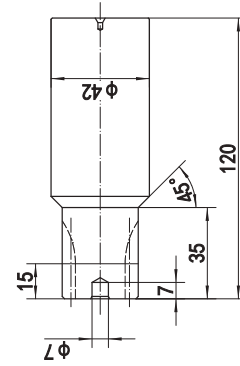
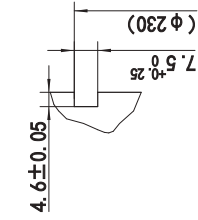
160E Bolt tightening output shaft type

Type code: 160E A B

speed ratio



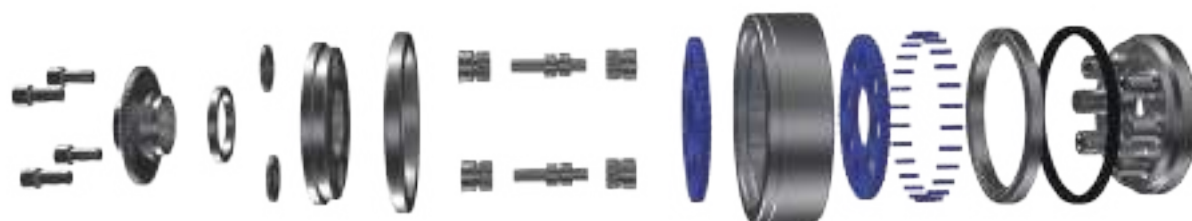
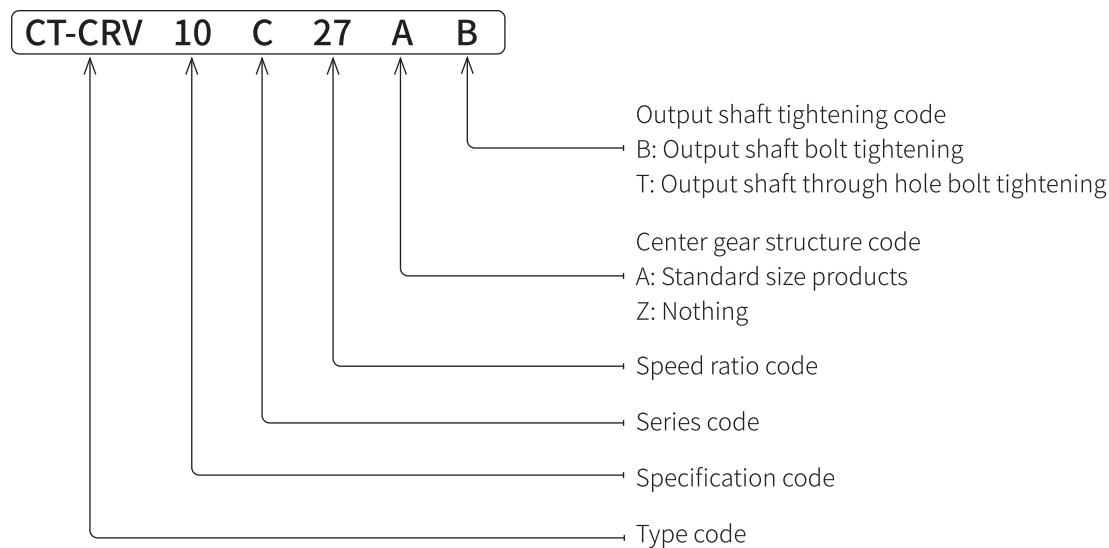
K
1.6:1



INPUT GEAR SHAFT (STANDARD TYPE A)

INPUT GEAR SHAFT (STANDARD TYPE B)

1. CT-CRV-C Explanation of Codes



Exploded view of CT-CRV-C reducer

2.CRV-C Rating Table

	Output Speed r/min			5	10	15	20	25	30	40	50	60
Model	Speed Ratio	Reduction ratio		Output Torque N.m Input Power kW								
		Shaft rotation	Case rotation									
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
27C	36.57	1390/38	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
50C	32.54	1985/61	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	
100C	36.75	36.75	35.75	1362 0.95	1107 1.55	980 2.05	899 2.51	841 2.94	796 3.33	730 4.08		
120C	36.75	36.75	35.75	1422 0.992	1308 1.825	1176 2.46	1085 3.03	907 3.61	823 3.45	765 4.27		
200C	34.86	1499/43	1456/43	2724 1.90	2215 3.09	1960 4.11	1803 5.04	1686 5.88	1597 6.69			
320C	35.61	2778/78	2700/78	4361 3.04	3538 4.94	3136 6.57	2881 8.05	2690 9.41				
320CA	211	211	210	4361 3.04	3538 4.94	3136 6.57	2881 8.05	2690 9.41				
500C	37.34	3099/83	3016/83	6811 4.75	5537 7.73	4900 10.26	4498 12.56					

Maximum Allowable Output Speed r/min	Allowable Acceleration/Deceleration Torque N.m	Momentary Maximum Allowable Torque N.m	Allowable Bending Moment N.m	Momentary Maximum Allowable Bending Moment N.m	Torsional Rigidity N.m/arcmin	Maximum Lost Motion arcmin	Backlash arcmin	Angle Transmission Error arcsec	Allowable Radial Load N	Conversion Value of Inertia Moment of Input Shaft Kg ^m	Inertia Moment of Standard Center Gear Kg ^m	Rated life h	Weight Kg
80	245	490	686	1372	47	1.0	1.0	70	5755	1.38×10^{-5}	0.678×10^{-3}	6000	4.6
60	662	1323	980	1960	147	1.0	1.0	70	6520	0.55×10^{-4}	0.563×10^{-3}	6000	8.5
50	1225	2450	1764	3528	255	1.0	1.0	60	9428	1.82×10^{-4}	0.363×10^{-2}	6000	14.6
40	2450	4900	2450	4900	510	1.0	1.0	50	11802	0.475×10^{-3}	0.953×10^{-2}	6000	19.5
40	2940	5880	3920	7840	588	1.0	1.0	50	18700	0.475×10^{-3}	0.953×10^{-2}	6000	21
30	4900	9800	8820	17640	980	1.0	1.0	50	31455	1.39×10^{-3}	1.94×10^{-2}	6000	55.6
25	7840	15680	20580	39200	1960	1.0	1.0	50	57087	0.518×10^{-2}	0.405×10^{-1}	6000	79.5
25	7840	15680	20580	39200	1960	1.0	1.0	50	57087	4.59×10^{-4}		6000	92.1
20	12250	24500	34300	78400	3430	1.0	1.0	50	82970	0.996×10^{-2}	1.014×10^{-1}	6000	154

Remarks:

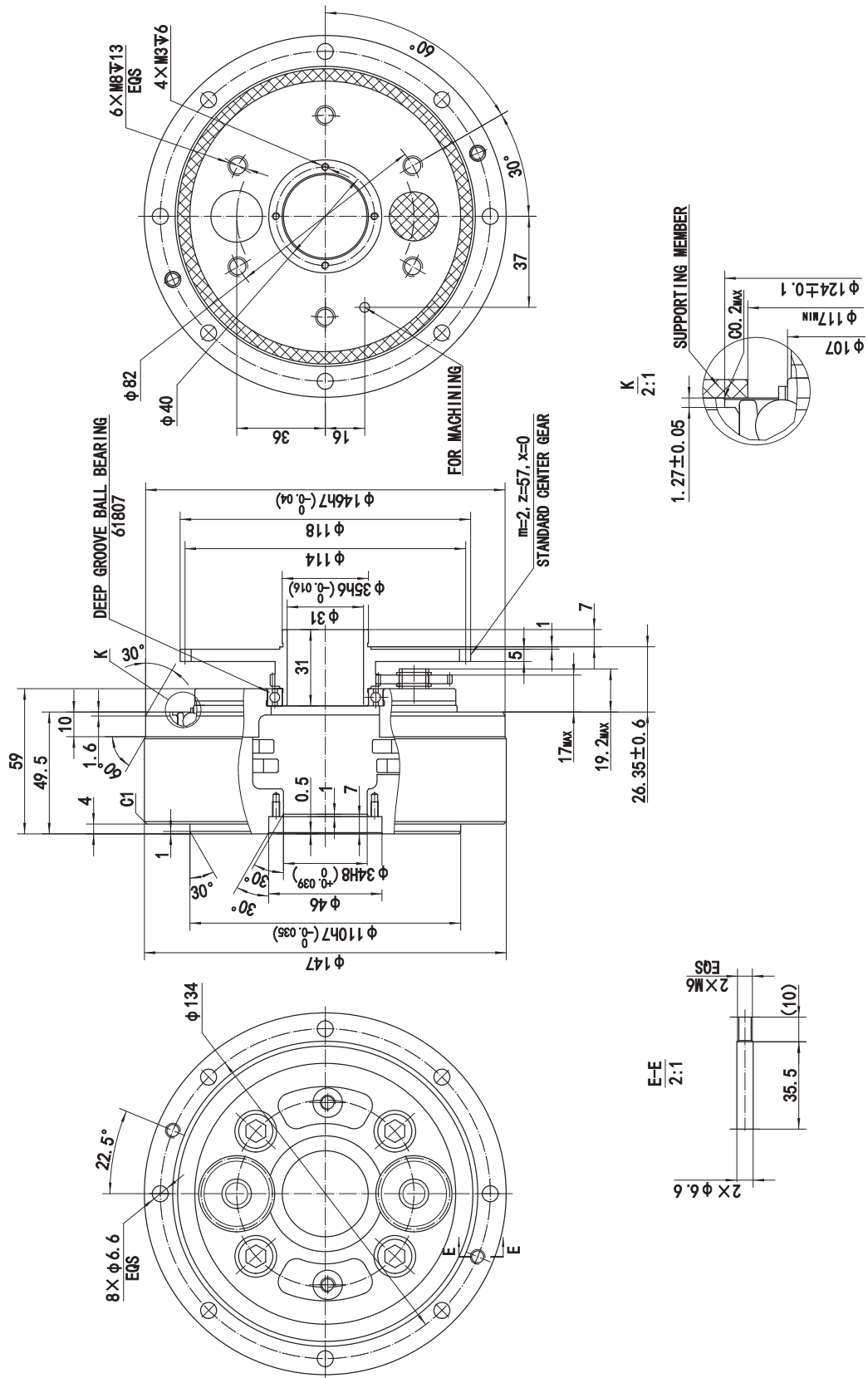
- (1)The rated torque is the output torque under an output speed of 15 r/min, which is the basis for calculating the service life.
- (2)The maximum speed of the input shaft must not be greater than the allowable maximum output speed multiplied by the speed ratio. If you need a speed ratio other than those above, please consult our company.
- (3)The moment of inertia is the value of the reducer unit, and the moment of inertia of the center gear and input gear is not considered. Therefore, refer to the following formula for the moment of inertia of the motor shaft.

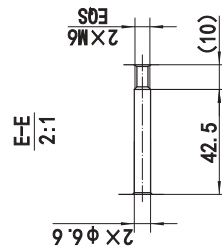
$$\frac{\text{Moment of inertia (Reducer unit)} + \text{moment of inertia of center gear}}{(\text{The number of teeth of the central gear's bull gear} / \text{Number of teeth of input gear})^2} + \text{moment of inertia of input gear}$$

3.CRV-C External Dimensions

10C Bolt tightening output shaft type

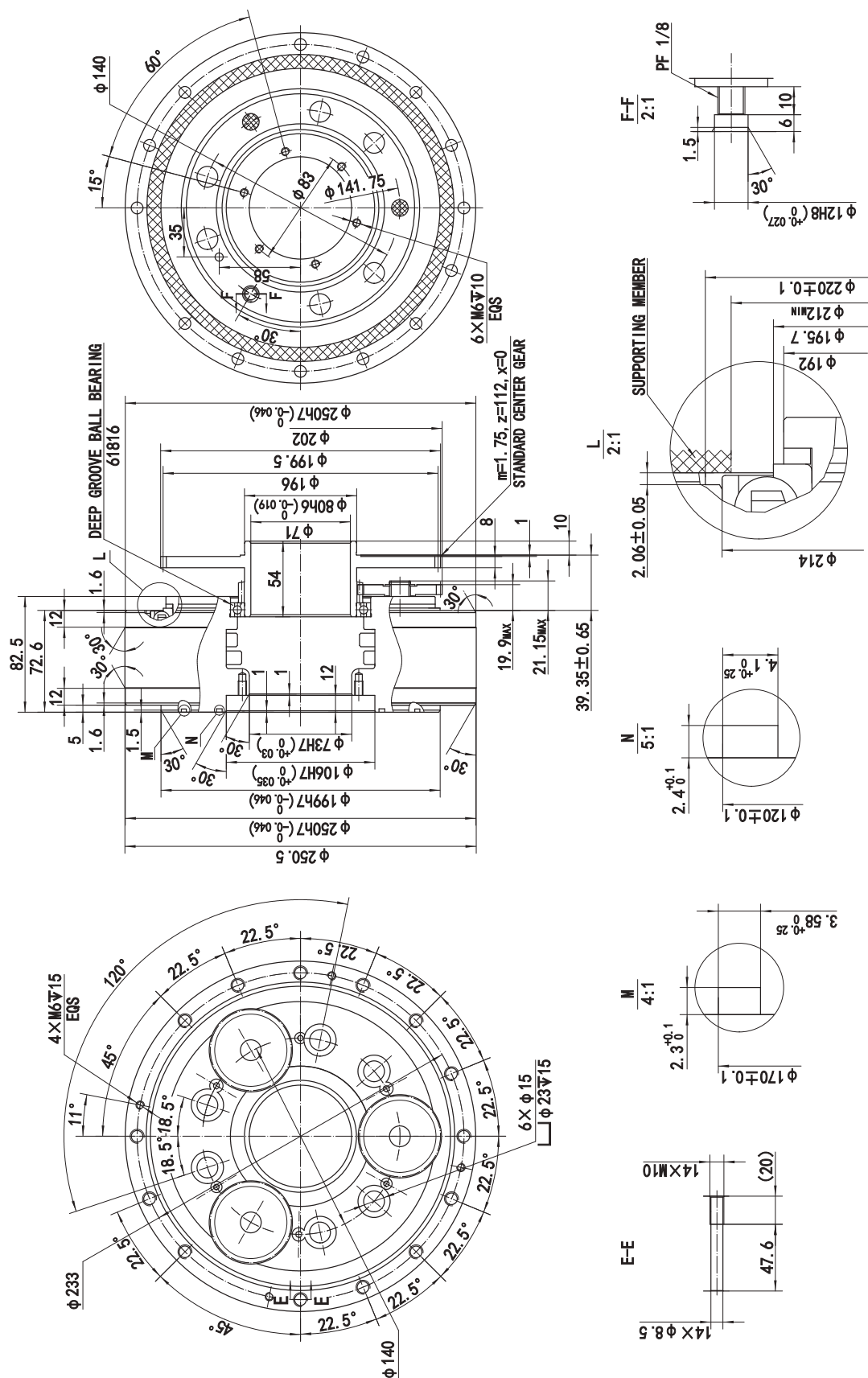
Type code: 10C 27 A B



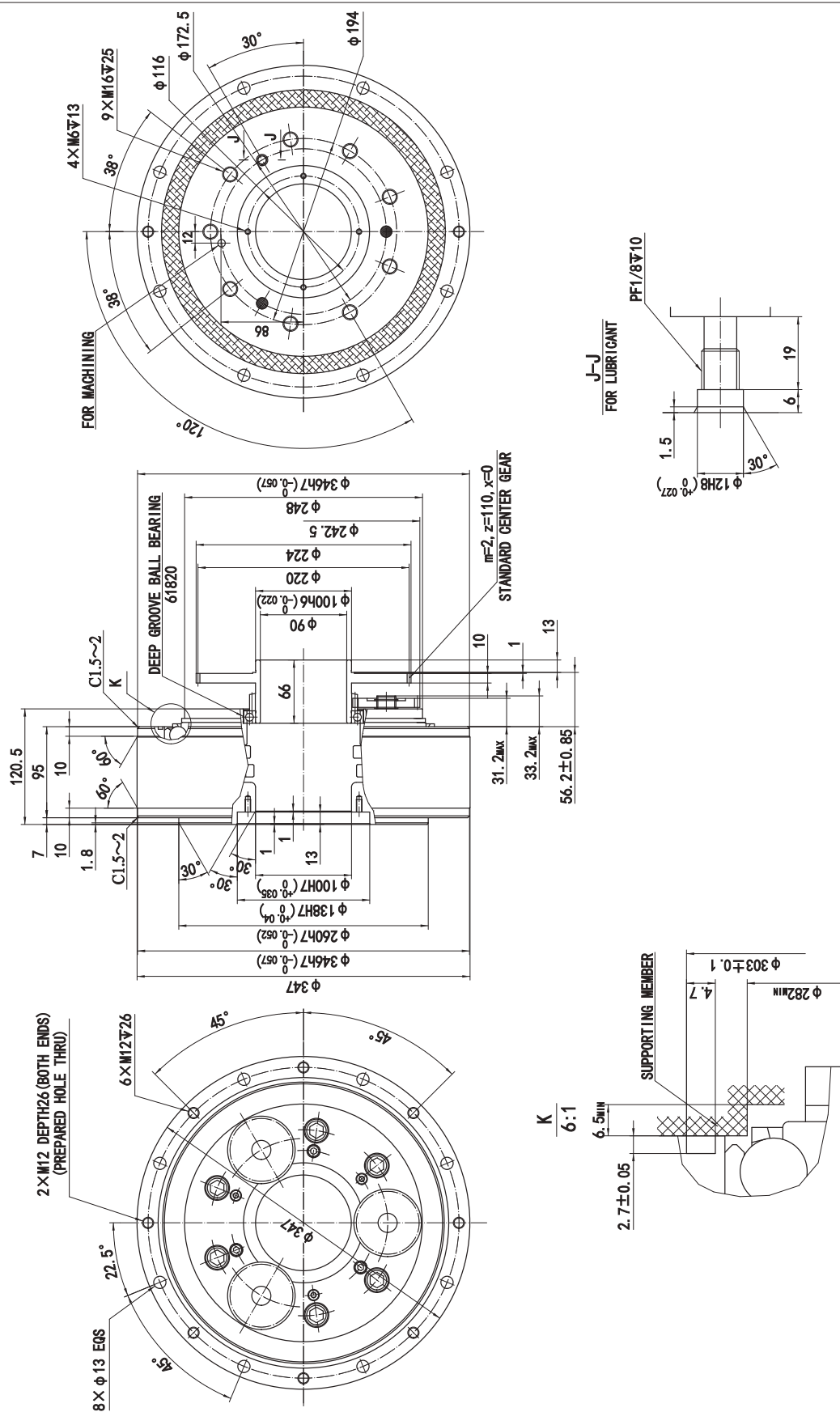


120C Bolt tightening output shaft type

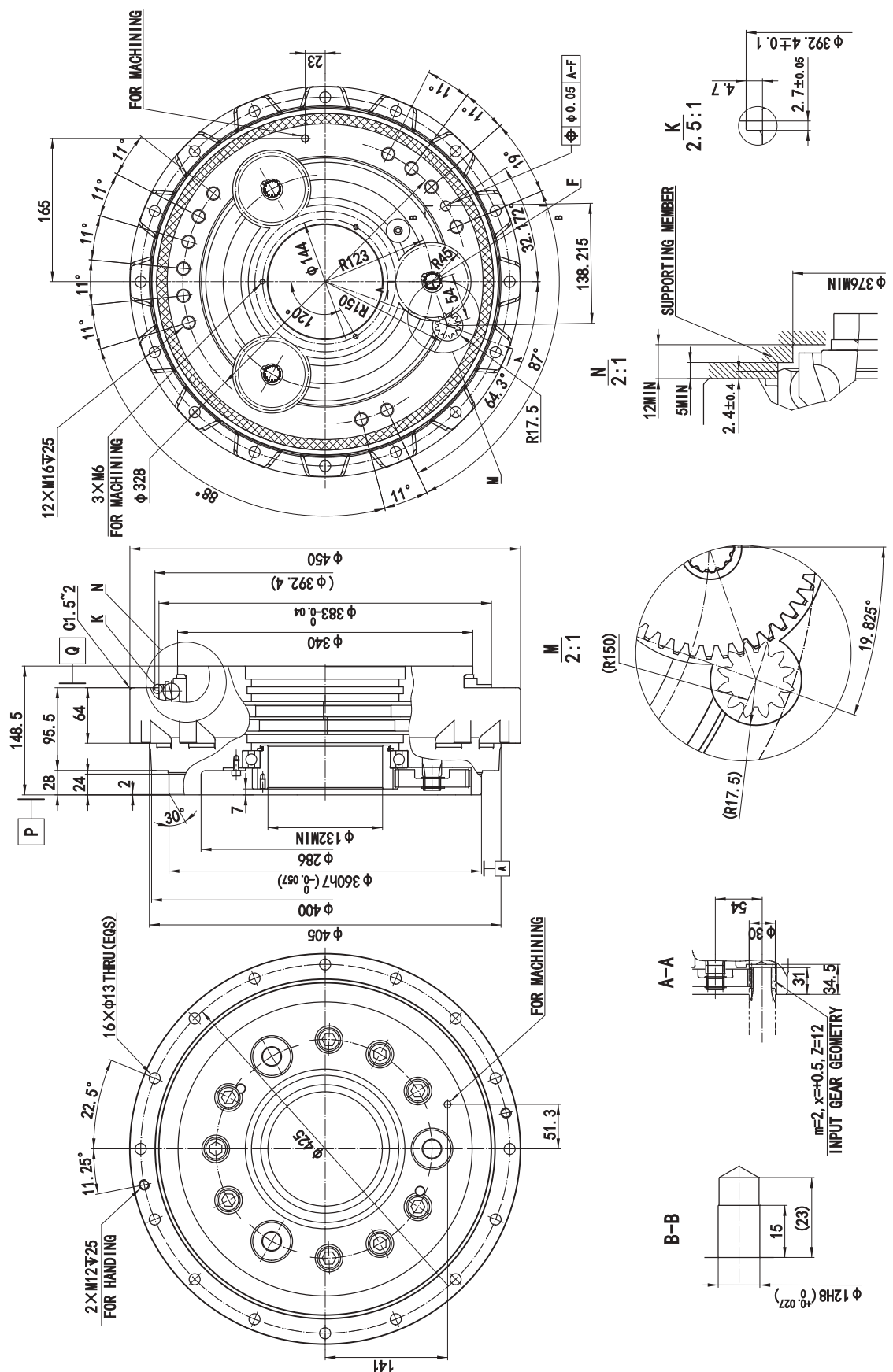
120C 36.75 A T speed ratio

speed ratio

200C Bolt tightening output shaft type



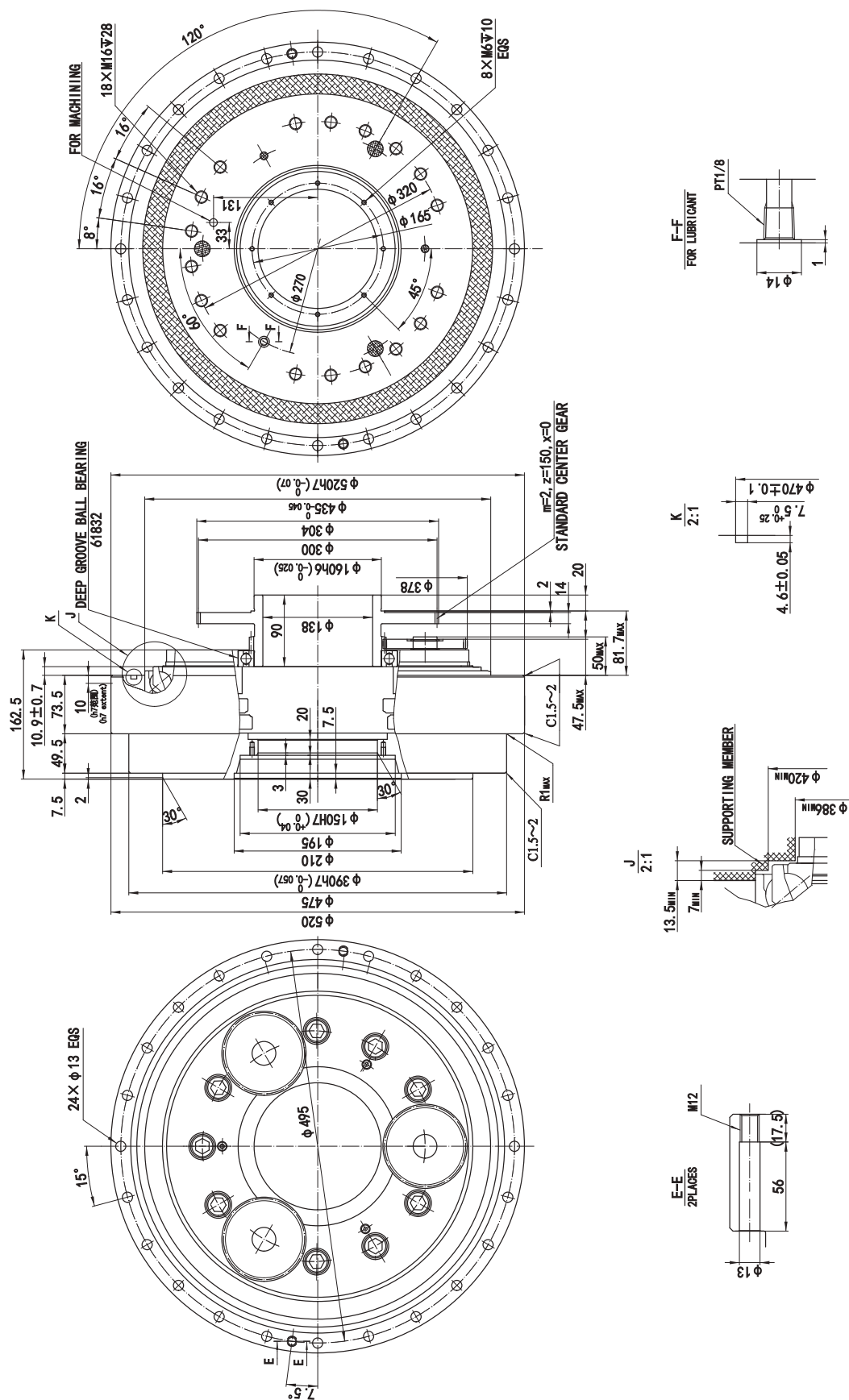
320CA Bolt tightening output shaft type



Type code: 500C speed ratio

A	B
37.34	

500C Bolt tightening output shaft type



1. Glossary

● Rated service life

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

● Allowable acceleration/deceleration torque

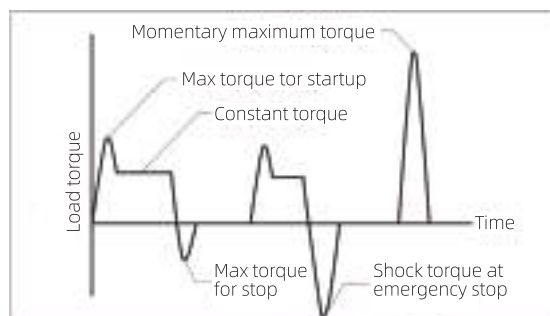
When the machine starts or stops, the load torque to be applied to the reduction gear is larger than the constant-speed load torque due to the effect of the inertia torque of the rotating part. In such a situation, the allowable torque during acceleration/deceleration is referred to as "allowable acceleration/deceleration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

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

● Momentary maximum allowable torque

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

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



● Allowable input speed

The allowable value for the reducer's input speed is referred to as the "allowable input speed".

Notes: Depending on the speed ratio, the reducer temperature may rise significantly even when the speed is under the allowable speed. In such a case, use the reducer at a speed that keeps the surface temperature at 60°C or lower.

● Allowable output speed

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

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

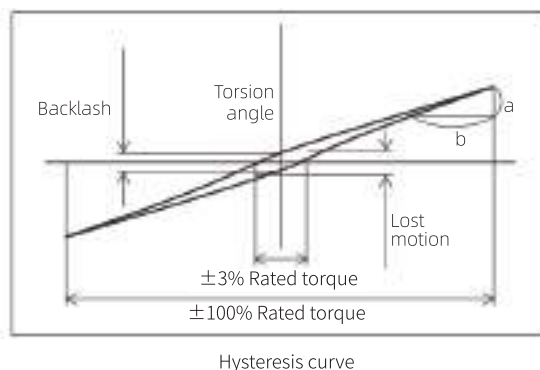
● Allowable output speed reference

When the reducer rotates continuously in one direction, the allowable value of the output speed with temperature rise below 40°C value is referred to as the "allowable output speed".

Note: Please use the reducer at a speed that keeps the surface temperature at 60°C or lower.

● 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 $\pm 3\%$ 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".



● Startup efficiency

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

● No-load running torque (input shaft)

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

● Allowable moment and allowable thrust

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

● Rated moment of input shaft

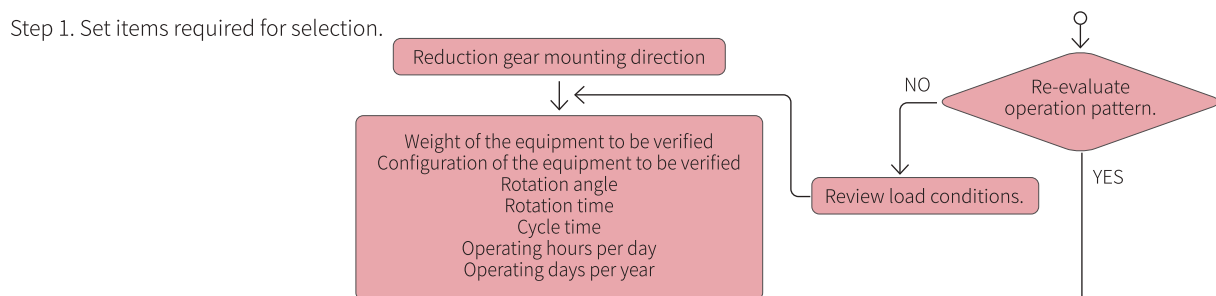
The moment for the input shaft that satisfies the rated service life is referred to as the "rated moment of input shaft". Generally, the moment applied to the input shaft should be less than the rated moment.

● Allowable moment of input shaft

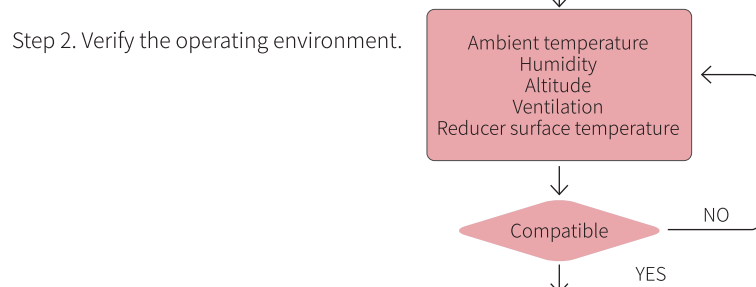
The moment for the input shaft when the reducer starts or stops is referred to as the "allowable moment of input shaft".

2. Product Selection Flowchart

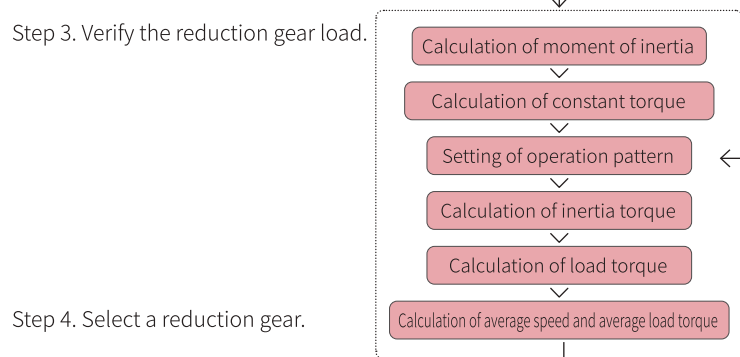
Step 1. Set items required for selection.



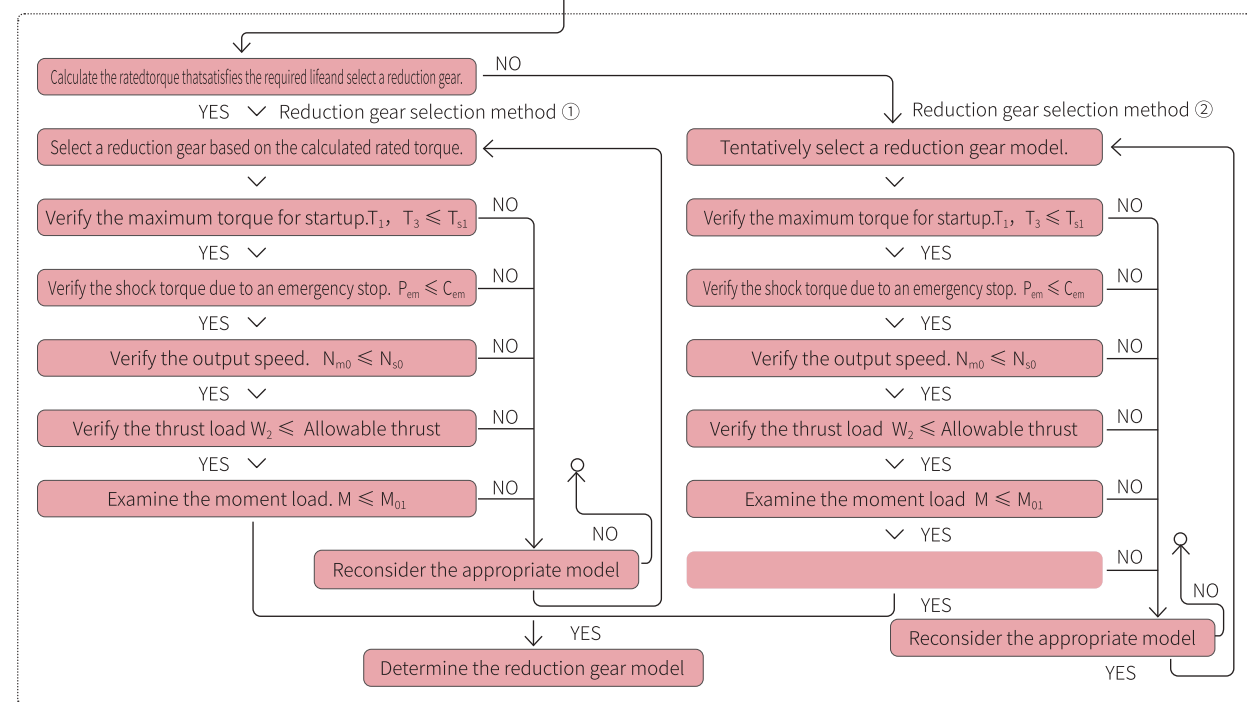
Step 2. Verify the operating environment.



Step 3. Verify the reduction gear load.



Step 4. Select a reduction gear.



If it is used in special conditions (such as vacuum, water or requirements like flame-retardant and salt-fog resistance, ect.), please contact us.

3. Model code selection examples

With horizontal rotational transmission

Step 1. Set the items required for selection.

Setting item	Setting
Reduction gear mounting direction	Vertical shaft installation
Equipment weight to be considered	
W_A —Disk weight (kg)	180
W_B —Work weight (kg)	20×4
Equipment configuration to be considered	
D_1 —Disk: D dimension (mm)	1200
a —Work piece: a dimension (mm)	100
b —Work piece: b dimension (mm)	300
D_2 —Disk: D dimension (mm)	1000
Operation conditions	
θ —Rotation angle (°)	180
$[t_1+t_2+t_3]$ —Rotation time (s)	2.5
$[t_4]$ —Cycle time (s)	20
Q_1 —Equipment operation hours per day (hours/day)	12
Q_2 —Equipment operation days per year (days/year)	365

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

Step 2. Verify the operating environment.

Checkpoint	Standard value
S_0 —Ambient temperature (°C)	-10~40
S_1 —Reduction gear surface temperature (°C)	60 or less

Step 3-1. Examine the reduction gear load

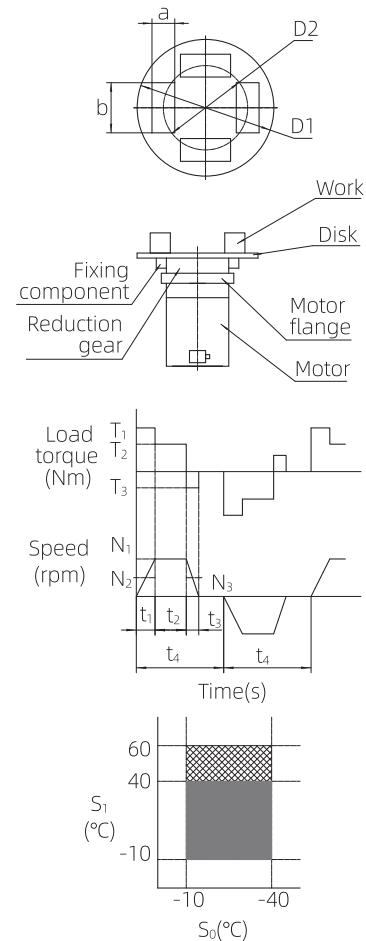
Setting item	Calculation formula	Selection examples
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① Calculate the inertia moment

I_R	Load moment of inertia (kgm²) $I_{R1} = \frac{W_A \times \left(\frac{D_1}{2 \times 1000}\right)^2}{2}$ $I_{R2} = \left[\frac{W_B}{12} \left\{ \left(\frac{a}{1000}\right)^2 + \left(\frac{b}{1000}\right)^2 \right\} + W_B \times \left(\frac{D_2}{2 \times 1000}\right)^2 \right] \times n$ I_{R1}=Disk moment of inertia I_{R2}=Work inertia $I_R = I_{R1} + I_{R2}$ n=Number of work pieces	$I_{R1} = \frac{180 \times \left(\frac{1200}{2 \times 1000}\right)^2}{2} = 32.4 (\text{kgm}^2)$ $I_{R2} = \left[\frac{20}{12} \left\{ \left(\frac{100}{1000}\right)^2 + \left(\frac{300}{1000}\right)^2 \right\} + 20 \times \left(\frac{1000}{2 \times 1000}\right)^2 \right] \times 4$ $= 20.7 (\text{kgm}^2)$ $I_R = 32.4 + 20.7 = 53.1 (\text{kgm}^2)$
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② Examine the constant torque.

T_R	Constant torque (Nm) $T_R = (W_A + W_B) \times 9.8 \times \frac{D_{in}}{2 \times 1000} \times \mu$ μ= Friction factor Note: Use 0.015 for this example as the load is applied to the bearing of the CT-CRV precision reduction gear. D_{in}= Rolling diameter: Use the pilot diameter which is almost equivalent to the rolling diameter in this selection calculation. If the reduction gear model is not determined, select the following pilot diameter: Maximum pilot diameter E series = 328 (mm) C series = 520 (mm)	$T_R = (180 + 20 \times 4) \times 9.8 \times \frac{328}{2 \times 1000} \times 0.015$ $= 6.3 (\text{Nm})$
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With vertical rotational transfer

Step 1. Set the items required for selection.

Setting item	Setting
Reduction gear mounting direction	Horizontal shaft installation
Equipment weight to be considered	
W_c —— Mounted work weight (kg)	490
Equipment configuration to be considered	
a —— a dimension(mm)	500
b —— b dimension(mm)	500
R —— R dimension(mm)	320
Operation conditions	
θ ——Rotation angle(°)	90
$[t_1+t_2+t_3]$ ——Rotation time(s)	1.5
$[t_4]$ —— Cycle time(s)	20
Q_1 ——Equipment operation hours per day (hours/day)	24
Q_2 ——Equipment operation days per year (days/year)	365

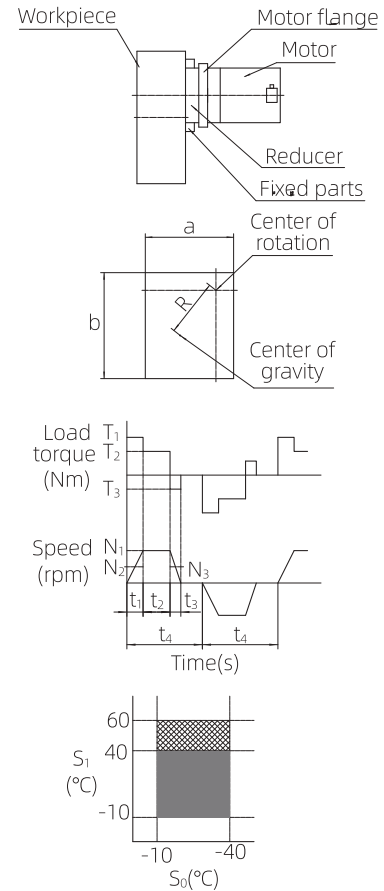
When the range of the rotation angle is small (10 degrees or less), the rating life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

Step 2. Verify the operating environment.

Checkpoint	Standard value
S_0 ——Ambient temperature(°C)	-10~40
S_1 ——Reduction gear surface temperature(°C)	60 or less

Step 3-1. Examine the reduction gear load

Setting item	Calculation formula	Selection examples
① Calculate the inertia moment		
I_R Load moment of inertia (kgm ²)	$I_R = \frac{W_c}{12} \left\{ \left(\frac{a}{1000} \right)^2 + \left(\frac{b}{1000} \right)^2 \right\} + W_c \times \left(\frac{R}{1000} \right)^2$	$I_R = \frac{490}{12} \times \left\{ \left(\frac{500}{1000} \right)^2 + \left(\frac{500}{1000} \right)^2 \right\} + 490 \times \left(\frac{320}{1000} \right)^2 = 70.6(\text{kgm}^2)$
② Examine the constant torque		
T_R Constant torque(Nm)	$T_R = W_c \times 9.8 \times \frac{R}{1000}$	$T_R = 490 \times 9.8 \times \frac{320}{1000} = 1537(\text{Nm})$



Step 3-2. Set items required for selection

Setting item	Calculation formula	Selection examples (With horizontal rotational transfer)
③ Set the acceleration/deceleration time, constant-speed operation time, and output speed.		
t_1 ——Acceleration time (s) t_2 ——Constant-speed operation time (s) t_3 ——Deceleration time (s) N_2 ——Constant speed (rpm)	The operation pattern does not need to be verified if it is already set. If the operation pattern has not been determined, use the following formula to calculate the reference operation pattern. Note: 1. Assume that t_1 and t_3 are the same. Note: 2. $N_2 = 15$ rpm if the reduction gear output speed (N_2) is not known. Note: 3. If t_1 and t_3 is less than 0, increase the output speed or extend the rotation time. $t_2 = \text{Rotation} [t_1 + t_2 + t_3] - (t_1 + t_3)$ $t_1 = t_3 = \text{Rotation} [t_1 + t_2 + t_3] - \frac{\theta}{\left(\frac{N_2}{60} \times 360\right)}$	Examine the operation pattern using $N_2 = 15$ rpm as the reduction gear output speed is unknown. $t_1 = t_3 = 2.5 - \frac{180}{\left(\frac{15}{60} \times 360\right)} = 0.5(s)$ $t_2 = 2.5 - (0.5 + 0.5) = 1.5(s)$ $t_1 = t_3 = 0.5(s)$ $t_2 = 1.5(s)$ $N_2 = 15(rpm)$
N_1 ——Average speed for startup (rpm)	$N_1 = \frac{N_2}{2}$	$N_1 = \frac{15}{2} = 7.5(rpm)$
N_3 ——Average speed for stop (rpm)	$N_3 = \frac{N_2}{2}$	$N_3 = \frac{15}{2} = 7.5(rpm)$
④ Calculate the inertia torque for acceleration/deceleration.		
T_A ——Inertia torque for acceleration(Nm)	$T_A = \left\{ \frac{I_R \times (N_2 - 0)}{t_1} \right\} \times \frac{2\pi}{60}$	$T_A = \left\{ \frac{53.1 \times (15 - 0)}{0.5} \right\} \times \frac{2\pi}{60} = 166.8(Nm)$
T_D ——Inertia torque for deceleration(Nm)	$T_D = \left\{ \frac{I_R \times (0 - N_2)}{t_3} \right\} \times \frac{2\pi}{60}$	$T_D = \left\{ \frac{53.1 \times (0 - 15)}{0.5} \right\} \times \frac{2\pi}{60} = -166.8(Nm)$
⑤ Calculate the load torque for acceleration/deceleration.		
T_1 ——Maximum torque for startup(Nm)	$T_1 = T_A + T_R $ TR: Constant torque With horizontal rotational transfer Refer to page 32 With vertical rotational transfer Refer to page 33	$T_1 = 166.8 + 6.3 = 173.1(Nm)$
T_2 ——Constant maximum torque(Nm)	$T_2 = T_R $	$T_2 = 6.3(Nm)$
T_3 ——Maximum torque for stop(Nm)	$T_3 = T_D + T_R $ TR: Constant torque With horizontal rotational transfer Refer to page 32 With vertical rotational transfer Refer to page 33	$T_3 = -166.8 + 6.3 = 160.5(Nm)$
⑥ Calculate the average speed.		
N_m ——Average speed(rpm)	$N_m = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_1 + t_2 + t_3}$	$N_m = \frac{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}{0.5 + 1.5 + 0.5} = 12(rpm)$
⑦ Calculate the average load torque.		
T_m ——Average load torque(Nm)	$T_m = \frac{\sqrt[10]{t_1 \times N_1 \times T_1^{\frac{10}{3}} + t_2 \times N_2 \times T_2^{\frac{10}{3}} + t_3 \times N_3 \times T_3^{\frac{10}{3}}}}{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}$	$T_m = \sqrt[10]{\frac{0.5 \times 7.5 \times 173.1^{\frac{10}{3}} + 1.5 \times 15 \times 6.3^{\frac{10}{3}} + 0.5 \times 7.5 \times 160.5^{\frac{10}{3}}}{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}}$ $= 110.0(Nm)$

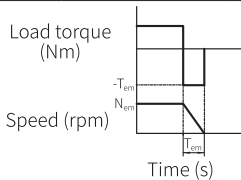
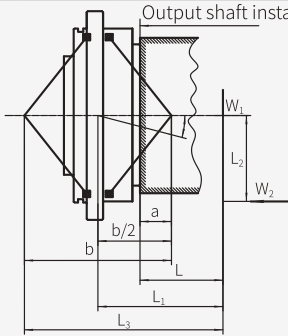
Go to page 35 if the reduction gear model is verified based on the required life. Go to page 37 if the service life is verified based on the reduction gear model.

Step 4. Select a reduction gear

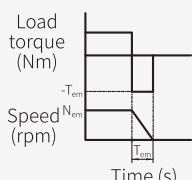
Reduction gear selection method (1) Calculate the required torque based on the load conditions and required life and select a reduction gear.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
① Calculate the rated torque for the reduction gear that satisfies the required life.		
L_{ex} ——Required life (year)	Based on the operation conditions	5 years
Q_{1cy} ——Number of cycles per day(times)	$Q_{1cy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 \text{ (times)}$
Q_3 ——Operating hours of reduction gear per day(h)	$Q_3 = \frac{Q_{1cy} \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_3 = \frac{2160 \times (0.5 + 1.5 + 0.5)}{60 \times 60} = 1.5(h)$
Q_4 ——Operating hours of reduction gear per year(h)	$Q_4 = Q_3 \times Q_2$	$Q_4 = 1.5 \times 365 = 548(h)$
L_{hour} ——Reduction gear service life (h)	$L_{hour} = Q_4 \times L_{ex}$	$L_{hour} = 548 \times 5 = 2740(h)$
T_0' ——Reduction gear rated torque that satisfies the required life(Nm)	$T_0' = T_m \times \left(\frac{10}{3}\right)^{\frac{1}{3}} \sqrt{\frac{L_{hour} \times N_m}{K \times N_0}}$	$T_0' = 110.2 \times \left(\frac{10}{3}\right)^{\frac{1}{3}} \sqrt{\frac{2740 \times 12}{6000 \times 15}} = 81.5(Nm)$
② Tentatively select a reduction gear model based on the calculated rated torque.		
Tentative selection of the reduction gear	Select a reduction gear for which the rated torque of the reduction gear $[T_0]$ is equal to or greater than the rated torque of the reduction gear that satisfies the required life $[T_0']$.	CRV-20E that meets the following condition is tentatively selected: $[T_0] \geq [T_0']$ 167 (Nm) $\geq [T_0']$ 81.5 (Nm)
③ Verify the maximum torque for startup and stop.		
Verification of maximum torque for startup and stop	Check the following conditions:The allowable acceleration/deceleration torque $[T_{s1}]$ is equal to or greater than the maximum starting torque $[T_1]$ and maximum stopping torque $[T_3]$	$[T_{s1}] \geq [T_1]$ 412 (Nm) $\geq [T_1]$ 173.1 (Nm) $[T_3] \geq [T_3]$ 160.5 (Nm) According to the above conditions, the tentatively selected model should be no problem.
④ Verify the output speed.		
N_{m0} ——Average speed per cycle(rpm)	$N_{m0} = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_4}$	$N_{m0} = \frac{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}{20} = 1.5(rpm)$
Verification of output speed	Check the following condition:The allowable output speed $[N_{s0}]$ is equal to or greater than the average speed per cycle $[N_{m0}]$ If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model. Contact us regarding use of the model at a speed outside the allowable output speed $[N_{s0}]$. Note: The value of $[N_{s0}]$ is the speed at which the case temperature is balanced at 60°C for 30 minutes.	$[N_{s0}] \geq [N_{m0}]$ 75 (rpm) $\geq [N_{m0}]$ 1.5 (rpm) According to the above condition, the tentatively selected model should be no problem.

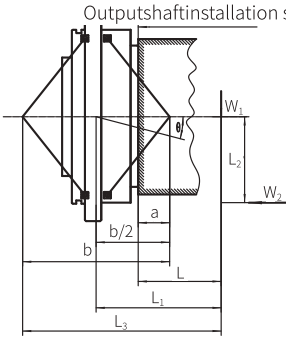
Reduction gear selection method (1) Calculate the required torque based on the load conditions and required life and select a reduction gear.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)																																			
⑤ Verify the shock torque at the time of an emergency stop.																																					
P_{em} ——Expected number of emergency stop times (times)	Based on the operation conditions.	For example, an emergency stop occurs once a month. $[P_{em}] = 1 \times 12 \times \text{required life (year)} [L_{ex}] = 12 \times 5 = 60$ (times)																																			
T_{em} ——Shock torque due to an emergency stop (Nm)		For example, $[T_{em}] = 500$ (Nm)																																			
N_{em} ——Speed at the time of an emergency stop (rpm)		For example, $[N_{em}] = 15$ (rpm)																																			
t_{em} ——Deceleration time at the time of an emergency stop (s)		For example, $[t_{em}] = 0.05$ (s)																																			
	Set the operation conditions that meet the following requirement: Shock torque due to an emergency stop $[T_{em}]$ is equal to or less than the momentary maximum allowable torque $[T_{s2}]$																																				
Z_4 ——Number of pins for reduction gear	<table><tr><th>Model</th><th>Num</th><th></th><th>Model</th><th>Num</th></tr><tr><td>20E</td><td rowspan="8">40</td><td></td><td>10C</td><td rowspan="4">52</td></tr><tr><td>40E</td><td></td><td>27C</td></tr><tr><td>80E</td><td></td><td>50C</td></tr><tr><td>110E</td><td></td><td>100C</td></tr><tr><td>160E</td><td></td><td>200C</td><td>56</td></tr><tr><td>320E</td><td></td><td>320C</td><td>60</td></tr><tr><td>320E3</td><td></td><td>320CA</td><td>30</td></tr><tr><td>450E</td><td></td><td>500C</td><td>58</td></tr></table>	Model	Num		Model	Num	20E	40		10C	52	40E		27C	80E		50C	110E		100C	160E		200C	56	320E		320C	60	320E3		320CA	30	450E		500C	58	Number of pins for CT-CRV-20E: 40
Model	Num		Model	Num																																	
20E	40		10C	52																																	
40E			27C																																		
80E			50C																																		
110E			100C																																		
160E			200C	56																																	
320E			320C	60																																	
320E3			320CA	30																																	
450E			500C	58																																	
C_{em} ——Allowable number of shock torque application times	$C_{em} = \frac{775 \times \left(\frac{T_{s2}}{T_{em}} \right)^{\frac{10}{3}}}{Z_4 \times \frac{N_{em}}{60} \times t_{em}}$	$C_{em} = \frac{775 \times \left(\frac{833}{500} \right)^{\frac{10}{3}}}{40 \times \frac{15}{60} \times 0.05} = 8,497 \text{ (times)}$																																			
Verification of shock torque due to an emergency stop	Check the following condition: The allowable shock torque application count $[C_{em}]$ is equal to or greater than the expected emergency stop count $[P_{em}]$. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear	$[C_{em}] 8,497 \geq [P_{em}] 60$ According to the above condition, the tentatively selected model should be no problem.																																			
⑥ Verify the thrust load and moment load. (It is not necessary to determine these for the Original series.)																																					
W_1 ——Radial load (N)		0 (N)																																			
l ——Distance to the point of radial load application (mm)		0 (mm)																																			
W_2 ——Thrust load (N)		In this example, $W_2 = W_A + W_B = (180 + 20 \times 4) \times 9.8 = 2,458$ (N)																																			
l_2 ——Distance to the point of thrust load application (mm)		0 (mm) (As the workpiece center is located on the rotation axis)																																			
		CT-CRV-20E As dimension $a = 20.1$ (mm) and dimension $b = 113.3$ (mm):																																			
M ——Moment load (Nm)	$M = \frac{W_1 \times (L + b - a) + W_2 \times L_2}{1000}$																																				
Verify the thrust load and moment load	Check that the thrust load and moment load are within the range in the allowable moment diagram. When radial load W_1 is applied within dimension b , use the reduction gear within the allowable radial load. W_1 : Allowable radial load, refer to the rating table. Refer to the individual rating tables. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.	For this example, Thrust load $[W_2] = 2,548$ (N) Moment load $[M] = 0$ (N) As the above values are within the range in the allowable moment diagram, the tentatively selected model should be no problem.																																			
Select the reduction gear model that satisfies all the conditions of the above verification items. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.		Based on the above verification result, CT-CRV-20E is selected.																																			

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

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)				
① Tentatively select a desired reduction gear model.						
Tentative selection of a reduction gear	Tentatively select a desired reduction gear model.	For example, tentatively select CT-CRV-20E.				
② Verify the maximum torque for startup and stop.						
Verification of maximum torque for startup and stop	Check the following conditions: The allowable acceleration/deceleration torque [Ts1] is equal to or greater than the maximum starting torque [T ₁] and maximum stopping torque [T ₃] If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.	[T _{s1}] 412 (Nm) ≥ [T ₁] 173.1 (Nm) [T ₃] 160.5 (Nm) According to the above conditions, the tentatively selected model should be no problem.				
③ Verify the output speed.						
N _{m0} —Average speed per cycle (rpm)	$N_{m0} = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_4}$	$N_{m0} = \frac{0.5 \times 7.5 + 1.5 \times 15 + 0.5 \times 7.5}{20} = 1.5 (rpm)$				
Verification of output speed	Check the following condition: The allowable output speed [N _{s0}] is equal to or greater than the average speed per cycle [N _{m0}]. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model. Contact us regarding use of the model at a speed outside the allowable output speed [N _{s0}]. Note: The value of [N _{s0}] is the speed at which the case temperature is balanced at 60°C for 30 minutes.	[N _{s0}] 75 (rpm) ≥ [N _{m0}] 1.5 (rpm) According to the above condition, the tentatively selected model should be no problem.				
④ Verify the shock torque at the time of an emergency stop.						
P _{em} —Expected number of emergency stop times (times)	Based on the operation conditions.	For example, an emergency stop occurs once a month. [P _{em}] = 1 x 12 x required life (year) [L _{ex}] = 12 x 5 = 60 (times)				
T _{em} —Shock torque due to an emergency stop (Nm)		For example, [T _{em}] =500 (Nm)				
N _{em} —Speed at the time of an emergency stop (rpm)		For example, [N _{em}] =15 (rpm)				
t _{em} —Deceleration time at the time of an emergency stop (s)		For example, [t _{em}] =0.05 (s)				
Z ₄ —Number of pins for reduction gear	Model	Num	Model	Num	Number of pins for CT-CRV-20E: 40	
	20E	40	10C	52		
	40E		27C			
	80E		50C			
	110E		100C	56		
	160E		200C			
	320E		320C			
	320E3		320CA			
	450E		500C			
C _{em} —Allowable number of shock torque application times	$C_{em} = \frac{775 \times \left(\frac{T_{s2}}{T_{em}} \right)^{\frac{10}{3}}}{Z_4 \times \frac{N_{em}}{60} \times t_{em}}$				$C_{em} = \frac{775 \times \left(\frac{833}{500} \right)^{\frac{10}{3}}}{40 \times \frac{15}{60} \times 0.05} = 8,497 \text{ (times)}$	
Verification of shock torque due to an emergency stop	Check the following condition: The allowable shock torque application count [C _{em}] is equal to or greater than the expected emergency stop count [P _{em}]. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.				[C _{em}] 8,497 ≥ [P _{em}] 60 According to the above condition, the tentatively selected model should be no problem.	

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

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
⑤ Verify the thrust load and moment load.		
W_1 ——Radial load (N) l ——Distance to the point of radial load application (mm) W_2 ——Thrust load (N) l_2 ——Distance to the point of thrust load application (mm)	 $M = \frac{W_1 \times (L + b - a) + W_2 \times L_2}{1000}$	$0(N)$ $0(mm)$ In this selection example, $W_2 = W_A + W_B = (180 + 20 \times 4) \times 9.8 = 2458(N)$ $0(mm)$ (As the workpiece center is located on the rotation axis) CRV-20E As dimension $a = 20.1 (mm)$ and dimension $b = 113.3 (mm)$: $M = \frac{0 \times (0 + 113.3 - 20.1) + 2548 \times 0}{1000} = 0(Nm)$
M——Moment load (Nm)		
Verify the thrust load and moment load	Check that the thrust load and moment load are within the range in the allowable moment diagram. W_r : Allowable radial load. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.	For this example, Thrust load $[W_2] = 2,548 (N)$ Moment load $[M] = 0 (N)$ As the above values are within the range in the allowable moment diagram, the tentatively selected model should be no problem.
⑥ Verify the reduction gear service life.		
L_h ——Life (h)	$L_h = 6000 \times \frac{N_0}{N_m} \times \left(\frac{T_0}{T_m} \right)^{\frac{10}{3}}$	$L_h = 6000 \times \frac{15}{12} \times \left(\frac{245}{110.3} \right)^{\frac{10}{3}} = 107,242(h)$
Q_{1cy} ——Number of cycles per day (times)	$Q_{1cy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$Q_{1cy} = \frac{12 \times 60 \times 60}{20} = 2,160 (\text{times})$
Q_3 ——Operating hours per day (h)	$Q_3 = \frac{Q_{1cy} \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_3 = \frac{2160 \times (0.5 + 1.5 + 0.5)}{60 \times 60} = 1.5(h)$
Q_4 ——Operating hours per year (h)	$Q_4 = Q_3 \times Q_2$	$Q_4 = 1.5 \times 365 = 548(h)$
L_{hour} ——Reduction gear service life (year)	$L_{hour} = \frac{L_h}{Q_4}$	$L_{hour} = \frac{107242}{548} = 195.7 (\text{year})$
L_{ex} ——Required life (year)	Based on the operation conditions	5 years
Verification of the service life	Check the following condition: $[L_{ex}]$ is equal to or less than $[L_{year}]$. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.	$[L_{ex}] 5 (\text{year}) \leq [L_{year}] 54.7 (\text{year})$ According to the above condition, the tentatively selected model should be no problem.
Select the reduction gear model that satisfies all the conditions of the above verification items. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.		Based on the above verification result, CRV-20E is selected.

Limitation on the motor torque

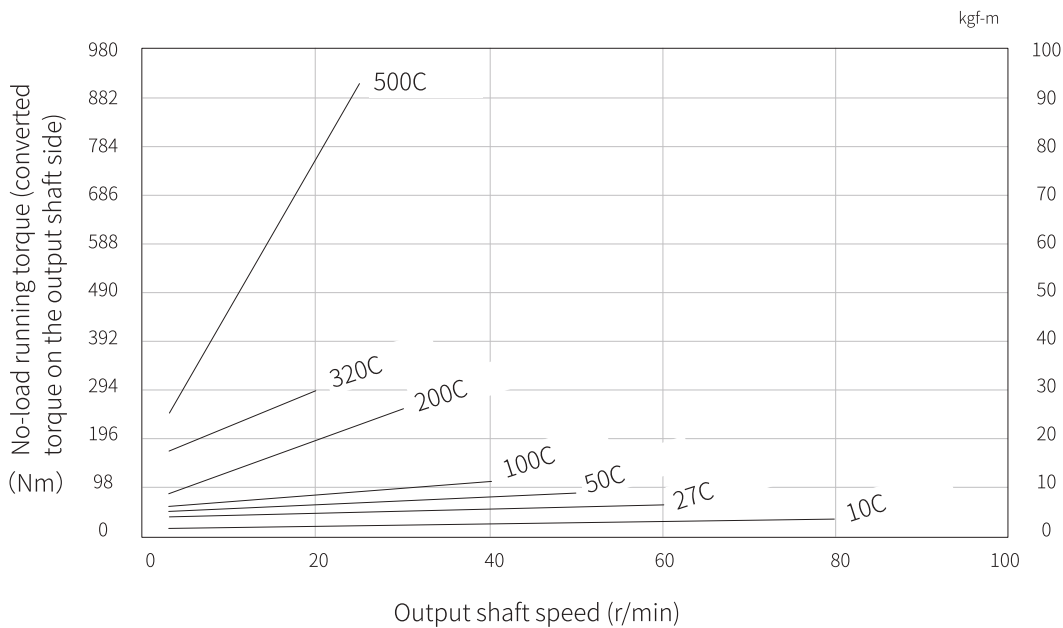
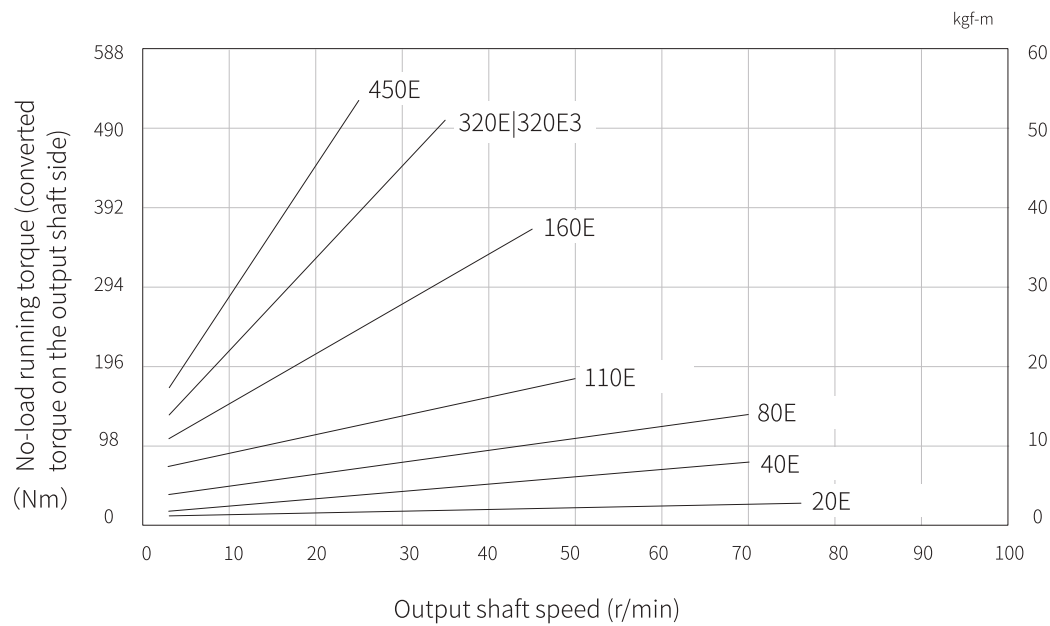
Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
T_{M1} ——Motor momentary maximum torque (Nm)	determined based on the motor specifications.	For example, $T_{M1} = 10 (Nm)$
T_{M1OUT} ——Maximum torque generated at the output shaft for the reduction gear (Nm), outside shock by an emergency stop or an motor stop	$T_{M1out} = T_{M1} \times R \times \frac{100}{\eta}$ R: Speed ratio η : Startupefficiency (%)	For example, calculate the maximum torque based on the specifications when CRV-20E-161 was selected. $T_{M1out} = 10 \times 161 \times \frac{100}{75} = 2147(Nm)$
T_{M2OUT} ——Maximum torque generated at the output shaft for the reduction gear (Nm), crash shock by the output shaft and obstacle	$T_{M2out} = T_{M1} \times R \times \frac{\eta}{100}$	$T_{M2out} = 10 \times 161 \times \frac{75}{100} = 1208(Nm)$
Limitation on motor torque value	Check the following condition: The momentary maximum allowable torque $[T_{s2}]$ is equal to or greater than the maximum torque generated at the output shaft for the reduction gear $[T_{M1OUT}]$ and $[T_{M2OUT}]$. If the above condition is not satisfied, a limitation is imposed on the maximum torque value of the motor.	$[T_{s2}] 833 (Nm) \leq [T_{M1OUT}] 2,147 (Nm)$ and $[T_{M2OUT}] 1,208 (Nm)$ According to the above condition, the torque limit is set for the motor.

1. No-load running torque

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

$$\text{No-load running torque converted to the motor (Nm)} = \frac{\text{Torque converted into the output shaft (Nm)}}{R} \quad (R: \text{speed ratio value})$$

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



2. Low-temperature characteristic

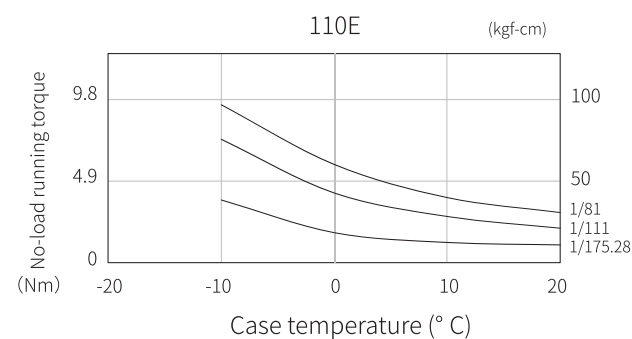
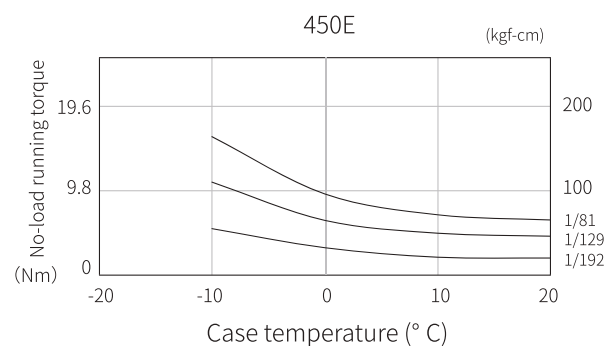
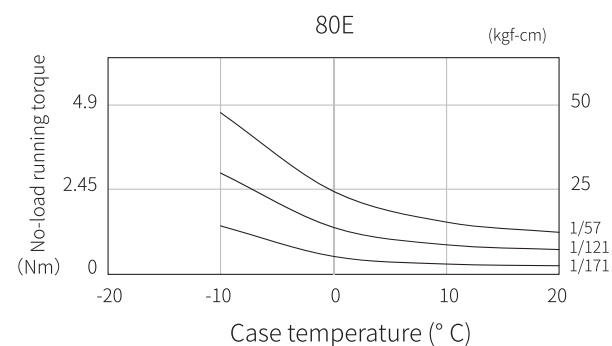
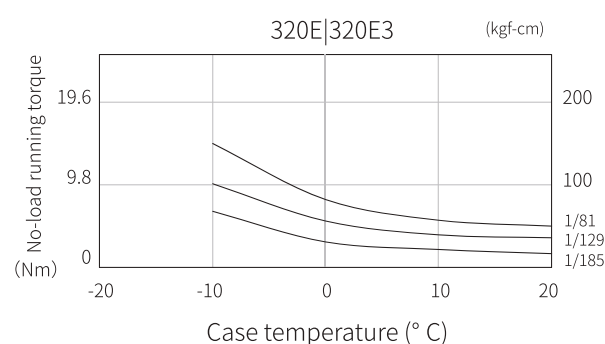
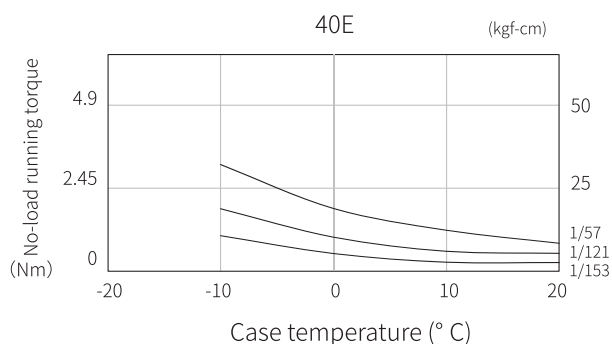
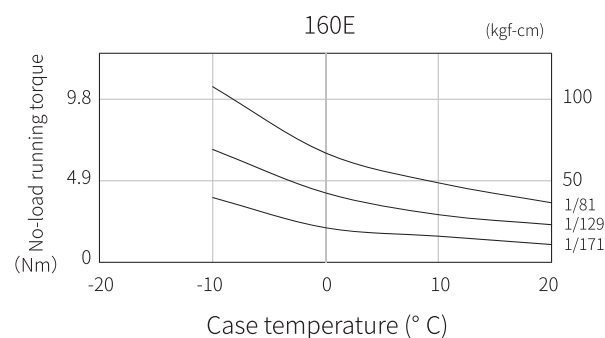
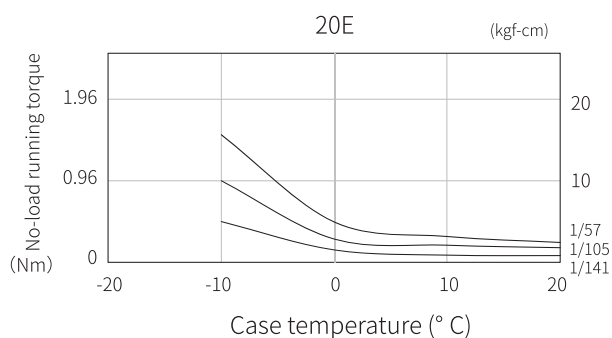
When the reduction gear is running at a low temperature, the viscosity of the lubricant will increase. Therefore, the no-load running torque will get larger.

The no-load running torque at low temperature is shown below.

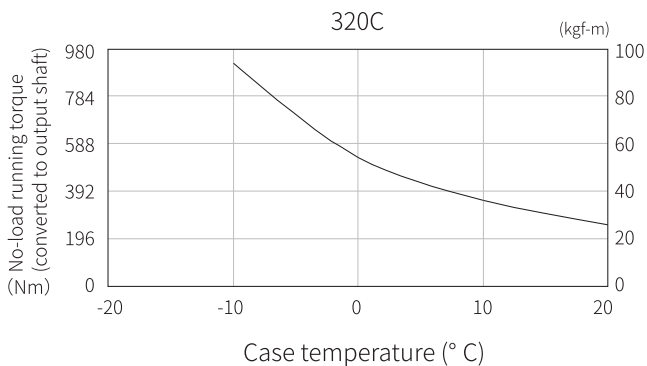
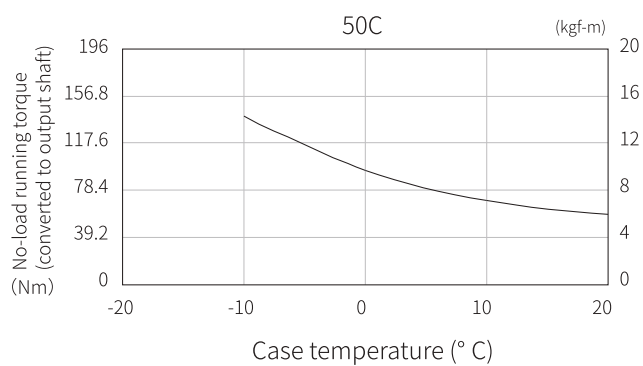
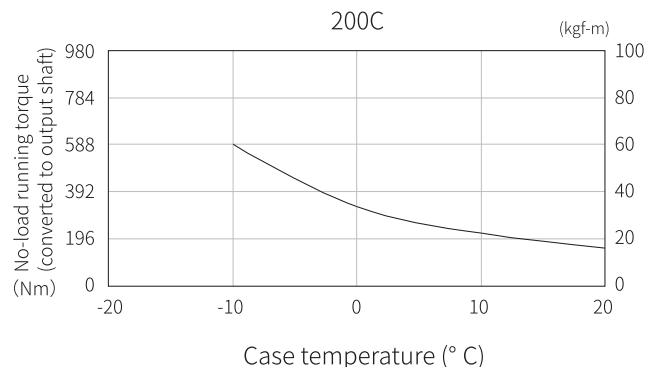
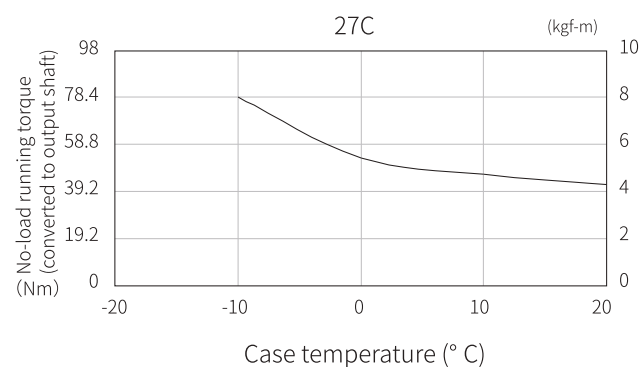
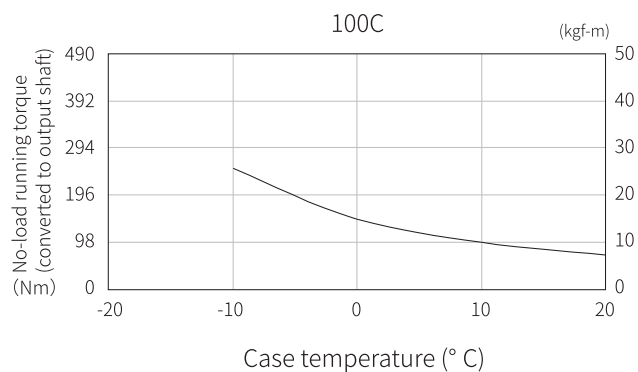
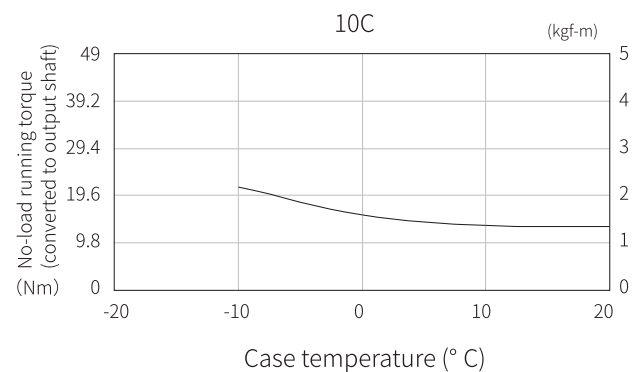
Use the following formula to calculate the no-load running torque converted to the input shaft.

No-load running torque converted to the input shaft (Nm) = Torque converted into the output shaft(Nm)/ R
(R: speed ratio value)

E series



C series



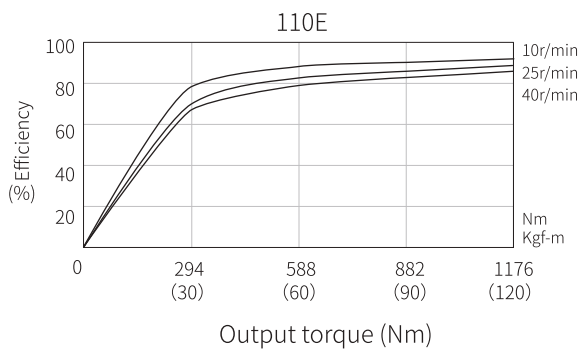
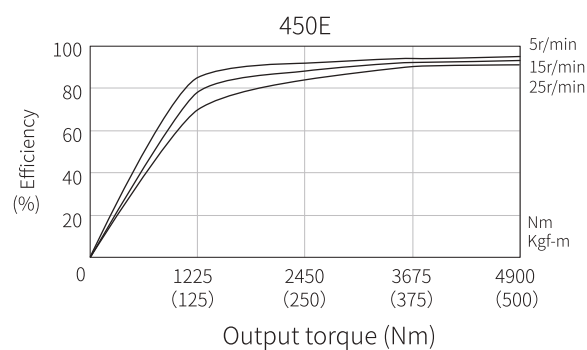
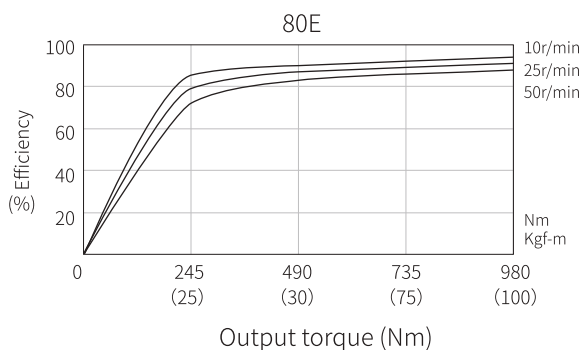
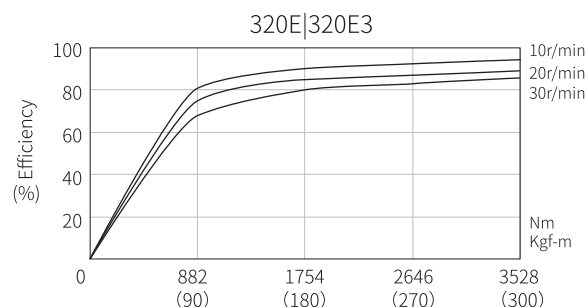
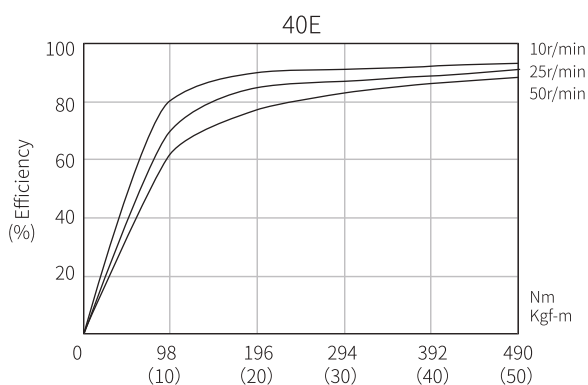
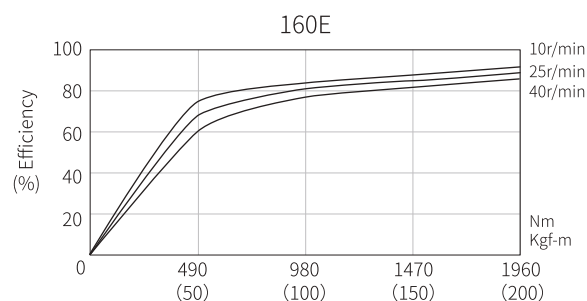
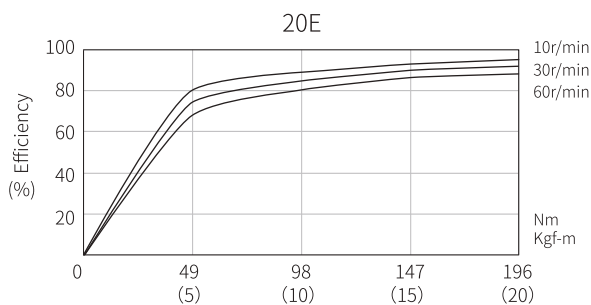
3. Efficiency table

Measurement conditions

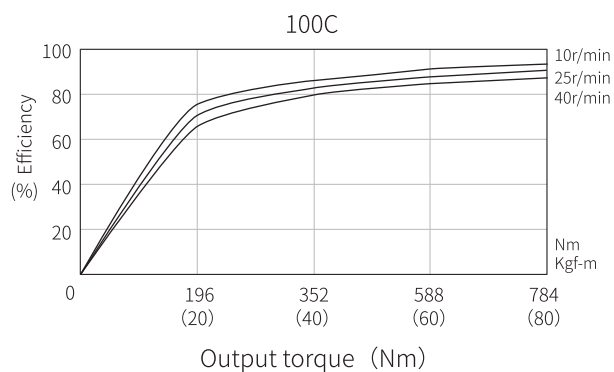
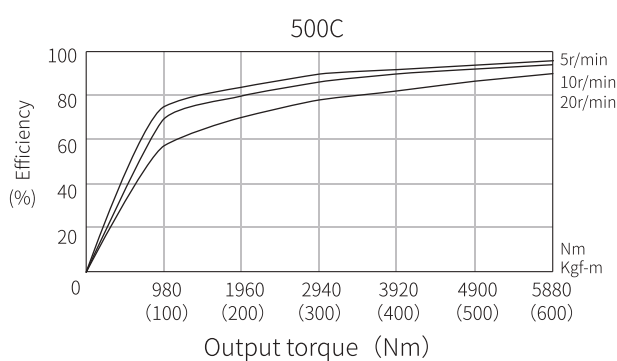
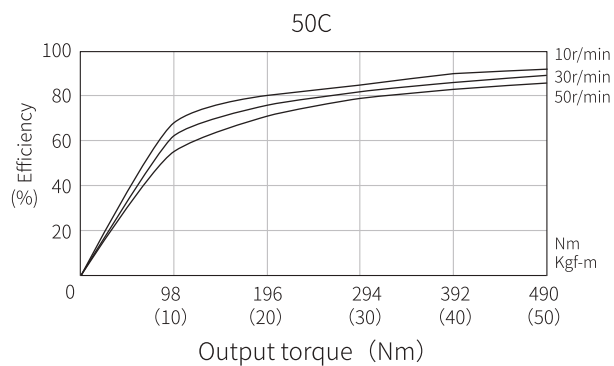
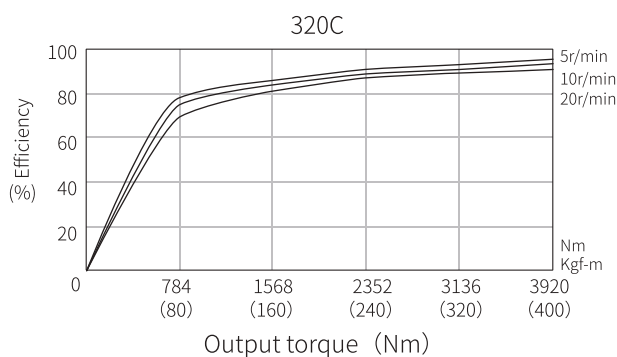
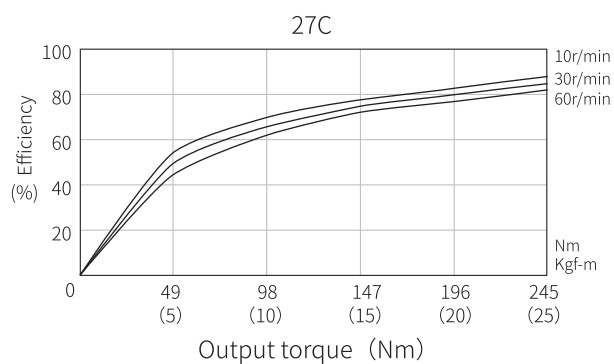
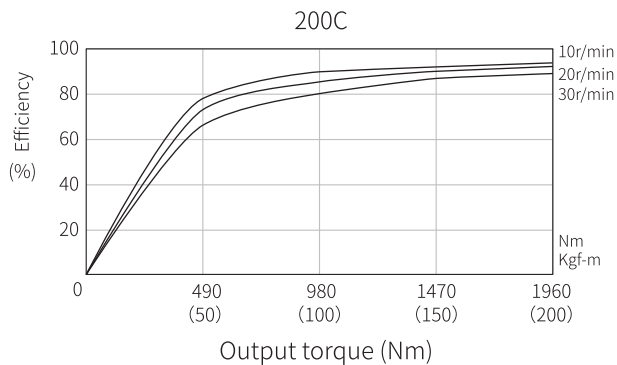
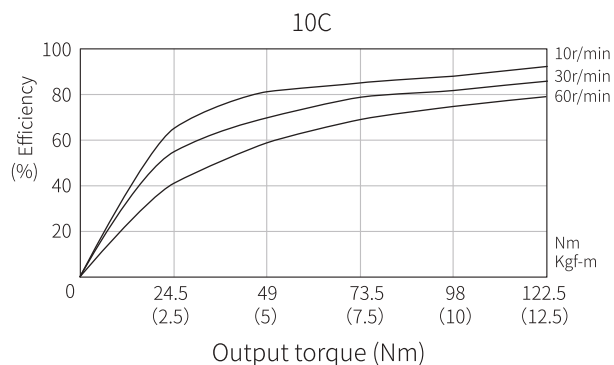
Case temperature: 30 (° C)

Lubricant: Grease (Molywhite RE00)

E series

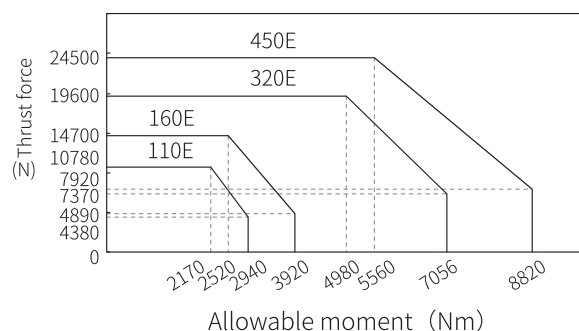
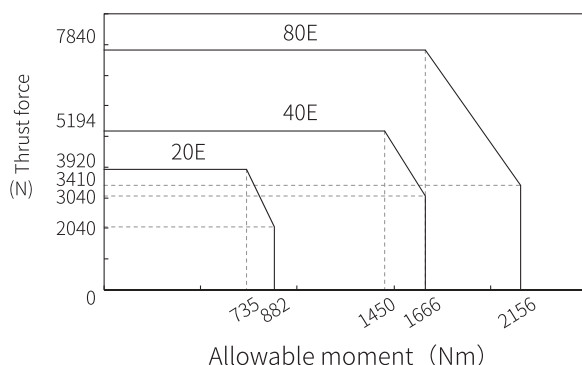


C series

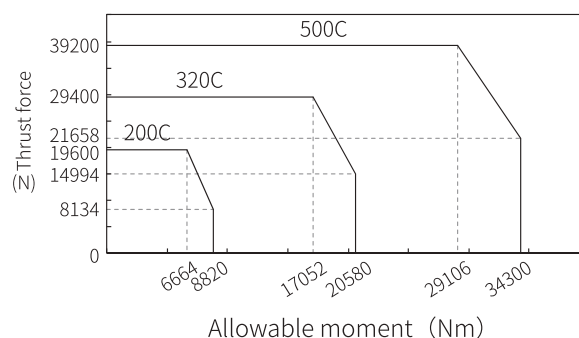
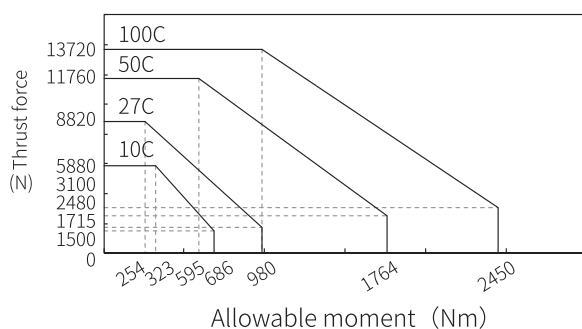


4. Allowable moment diagram

E series



C series



5. Backdriving torque

The backdriving torque refers to a torque required for starting the output shaft. If the input shaft is released while a torque equal to or more than the backdriving torque which is applied to the output shaft constantly, the input shaft starts running at an augmented speed. Please pay more attention.

E series

Model	Backdriving torque Nm
20E	42
40E	47
80E	70
110E	80
160E	110
320E	220
450E	270

C series

Model	Backdriving torque Nm
10C	10
27C	52
50C	95
100C	120
200C	150
320C	220
500C	300

6. Moment rigidity

When a load occurs to the reducer with an external moment, the output planetary carrier will tilt in proportion to the load moment. The overturning 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.

$$\theta = \frac{W_1 L_1 + W_2 L_2}{M_1 \times 10^3}$$

θ : Tilt angle of the output planetary carrier(arc.min.)

M_1 : Overturning rigidity (Nm/arc.min.)

W_1 、 W_2 : Load(N)

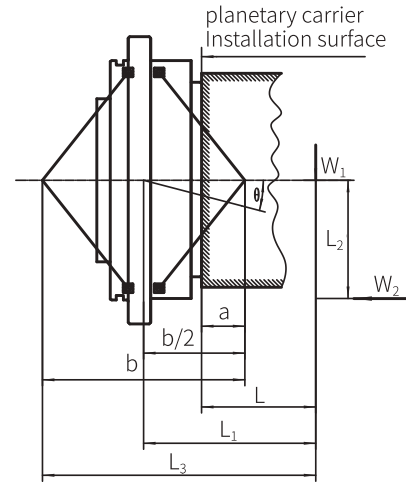
L_1 、 L_2 : Distance to the point of load application(mm)

$$L_1: L + \frac{b}{2} - a$$

L : Distance from the planetary carrier installation surface to the point of load application (mm)

M : moment

$$M = (L + b - a)W_1 + L_2 \times W_2$$



Model	Moment rigidity Nm/arc.min	Size(mm)	
		a	b
20E	372	20.1	113.3
40E	931	29.6	143.7
80E	1176	33.4	166.0
110E	1470	32.2	176.6
160E	2940	47.8	210.9
320E	4900	56.4	251.4
320E3	4950	56.4	251.4
450E	7448	69.0	292.7

Model	Moment rigidity Nm/arc.min	Size(mm)	
		a	b
10C	421	28.0	119.2
27C	1068	38.2	150.3
50C	1960	50.4	187.1
100C	2813	58.7	207.6
120C	4263	58.7	207.6
200C	9800	76.0	280.4
320C	12740	114.5	360.5
320CA	12740	114.5	360.5
500C	24500	125	413.4

7. Calculation of torsion angle

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

(1)When the load torque is 30 Nm,Torsion angle (ST_1) When the load torque is less than 3% of the rated torque.

$$ST_1 = \frac{30}{47} \times \frac{1(\text{arc.min.})}{2} = 0.32\text{arc.min. or less}$$

(2)When the load torque is 1,300 Nm, Torsion angle (ST_2)

When the load torque is more than 3% of the rated torque or less than the rated torque.

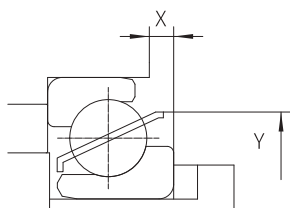
$$ST_2 = \frac{1}{2} + \frac{1,300 - 47.0}{392} = 3.70\text{arc.min.}$$

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

Model	Torsional rigidity Nm/arc.min	Lost motion		Backlash arc.min.	Model	Torsional rigidity Nm/arc.min	Lost motion		Backlash arc.min.
		Lost motion arc.min.	Measured torque Nm				Lost motion arc.min.	Measured torque Nm	
20E	49	1	±5.00	1	10C	47	1	±2.94	1
40E	108		±12.3		27C	147		±7.94	
80E	196		±23.5		50C	255		±14.7	
110E	294		±32.3		100C	510		±29.4	
160E	392		±47.0		200C	980		±58.8	
320E 320E3	980		±94.0		320C	1960		±94.1	
450E	1,176		±132.0		500C	3,430		±147.0	

To maximize the best performance of the CT-CRV-C and CT-CRV-E series, it is important to pay more attention to assembly precision, installation, lubrication, and sealing.

As angular ball bearings are used as the main bearings of CT-CRV-E and CT-CRV-C , you should design the mating component dimensions according to the table below to make sure that the bearing retainer does not come in contact with the motor mounting flange.



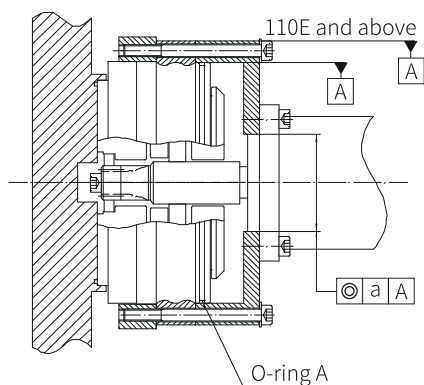
	X	Y
320E	MAX3.2	MAXΦ222.2
450E	MAX5.5	MAXΦ285

With other models, the retainer does not stick out from the casing.

1.Installation precision

1.1 CT-CRV-E series assembly precision

Design the motor mounting flange based on the following precision. Poor assembly precision will cause vibration and noise, and it will affect the certain service life.



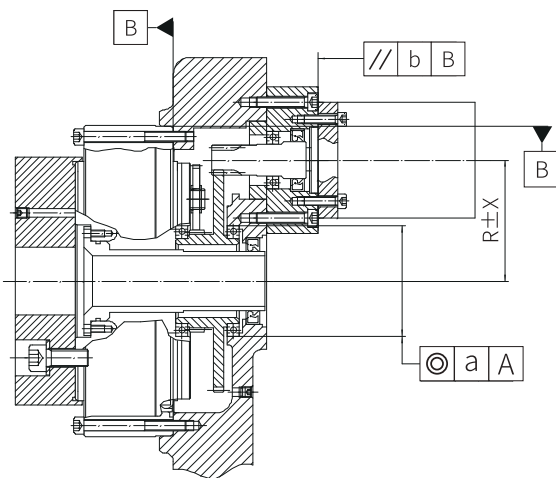
Model	Tolerance for concentricity a (mm)	Model	Tolerance for concentricity a (mm)
20E	MAXΦ0.03	160E	MAXΦ0.05
40E	MAXΦ0.03	320E	MAXΦ0.05
80E	MAXΦ0.03	320E3	MAXΦ0.05
110E	MAXΦ0.03	450E	MAXΦ0.05

Dimensions of O-ring A

Model	Nominal model	Inner diameter × Cross-sectional diameter	Model	Nominal model	Inner diameter × Cross-sectional diameter
20E	S120	Φ119.5×Φ2.0	160E	G220	Φ219.3×Φ5.7
40E	AS568-258	Φ151.99×Φ3.53	320E	G270	Φ269.3×Φ5.7
80E	AS568-263	Φ183.74×Φ3.53	320E3	G270	Φ269.3×Φ5.7
110E	G190	Φ189.3×Φ5.7	450E	G300	Φ299.3×Φ5.7

1.2 CT-CRV-E series assembly precision

Design the motor mounting flange based on the following accuracy. Poor assembly accuracy will cause vibration and noise, and it will affect the certain service life.



Model	Tolerance for center distance X (mm)	Tolerance for concentricity a (mm)	Parallelism tolerances
10 C	±0.03	MAX Φ0.03	MAX 0.03
27 C			
50 C			
100 C			
120 C			
200 C			
320 C			
320 CA			
500 C			

2. Installation instructions

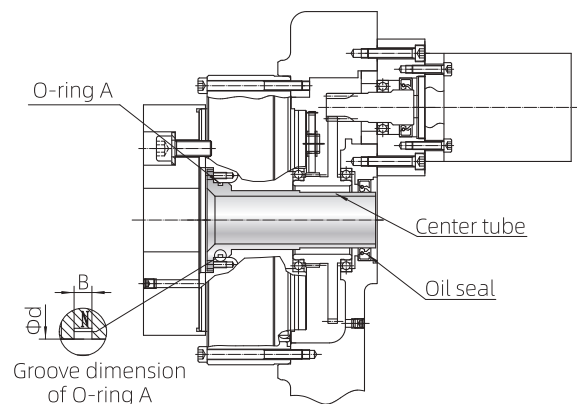
- ☆ Be sure to read "CT-CRV series Reducer instruction manual" carefully before installing (Each product is shipped with "CT-CRV series Reducer instruction manual").
- ☆ Be sure to apply the specified amount of the specified grease during assembly.
- ☆ Refer to the O-ring seals shown to make a seal design for the reducer input mounting side.
- ☆ The output of the reducer should be sealed. If O-ring cannot be used due to the structure, apply the appropriate liquid sealant from the table on the below.

Recommended liquid sealant	
Manufacturer	Characteristics and applications
ThreeBond 1211 (ThreeBond)	Silicone-based, solventless type Semi-dry gasket
HermeSeal SS-60F (Nihon-Hermetics)	Non-solvent elastic sealant Metal contact side seal
Loctite 515 (Henkel)	Anaerobic flange sealant Metal contact side seal

2.1 Other assembly requirements for CT-CRV-C series

(1) Assembly example of center tube

The center tube is used to protect the cable which runs through the hollow section and to seal grease filled in the reduction gear. The following figure shows the assembly of the center tube as a reference example.



Dimensions of O-ring A

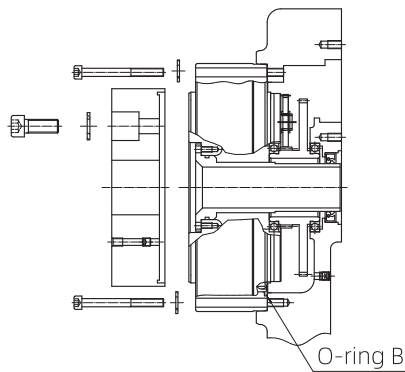
			10C	27C	50C	100C
Dimensions	O-ring	ID number	CO 0625	CO 0634	CO 0643	S70
		Wire dia.	$\Phi 2.4 \pm 0.07$	$\Phi 2.4 \pm 0.07$	$\Phi 3.5 \pm 0.1$	$\Phi 2.0 \pm 0.1$
		I.D.	$\Phi 29.7$	$\Phi 42.2$	$\Phi 59.6$	$\Phi 69.5$
	Groove dimensions	I.D.:d	$\Phi 30.2^{0}_{-0.08}$	$\Phi 43.2^{0}_{-0.08}$	$\Phi 60.3^{0}_{-0.10}$	$\Phi 70.0^{0}_{-0.05}$
		Width:B	$3.2^{+0.25}_{0}$	$3.2^{+0.25}_{0}$	$4.7^{+0.25}_{0}$	$2.7^{+0.25}_{0}$

			120C	200C	320C	500C
Dimensions	O-ring	ID number	S70	G95	G135	G145
		Wire dia.	$\Phi 2.0 \pm 0.1$	$\Phi 3.1 \pm 0.1$	$\Phi 3.1 \pm 0.1$	$\Phi 3.1 \pm 0.1$
		I.D.	$\Phi 69.5$	$\Phi 94.4$	$\Phi 134.4$	$\Phi 144.4$
	Groove dimensions	I.D.:d	$\Phi 70.0^{0}_{-0.05}$	$\Phi 95.0^{0}_{-0.10}$	$\Phi 135.0^{0}_{-0.08}$	$\Phi 145.0^{0}_{-0.10}$
		Width:B	$2.7^{+0.25}_{0}$	$4.1^{+0.25}_{0}$	$4.1^{+0.25}_{0}$	$4.1^{+0.25}_{0}$

(2) Assembly example with the bolt tightening output shaft type

(10C、27C、50C、100C、200C、320C、320CA、500C)

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



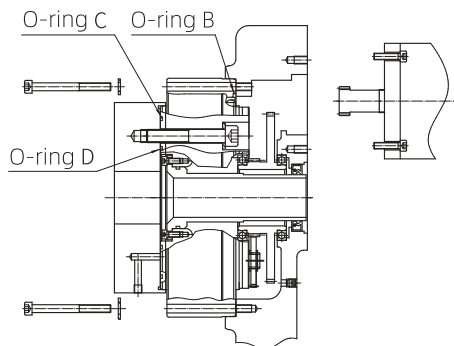
Dimensions of O-ring B

Model	ID number	I.D. × cross-sectional diameter
10C	AS568-048	$\Phi 120.37 \times \Phi 1.78$
27C	AS568-163	$\Phi 152.07 \times \Phi 2.62$
50C	AS568-169	$\Phi 190.17 \times \Phi 2.62$
100C	AS568-173	$\Phi 215.57 \times \Phi 2.62$
200C	AS568-277	$\Phi 291.69 \times \Phi 3.53$
320C	AS568-281	$\Phi 380.59 \times \Phi 3.53$
320CA	AS568-281	$\Phi 380.59 \times \Phi 3.53$
500C	G460	$\Phi 459.3 \times \Phi 5.7$

The O-ring (B) can be applied to both bolt tightening and through-bolt tightening output shaft types

(3) Assembly example of through-bolt tightening output shaft type (CT-CRV 120C)

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



Dimensions of O-ring C、D

	ID number	I.D. × cross-sectional diameter
O-ring C	G115	$\Phi 114.4 \times \Phi 3.1$
O-ring D	AS568-165	$\Phi 164.77 \times \Phi 2.62$

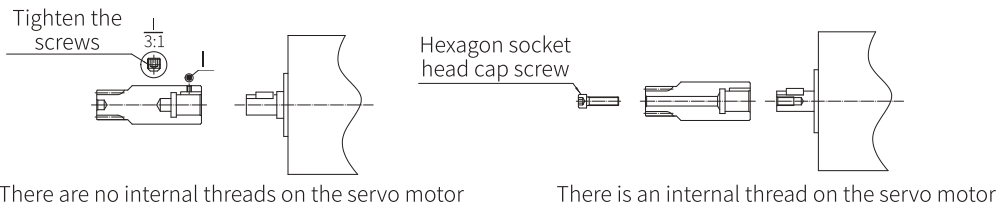
3. Installation of input gear shaft

3.1 Installation of input gear shaft

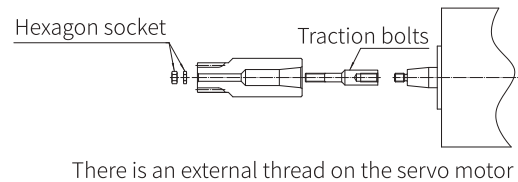
(1) The standard gear shaft is not machined with motor mounting holes, and Chietom can customize the input gear according to customer needs.

The input gear and motor shaft installation of the reducer are mainly in the following ways, customers need to prepare their own detent screws, traction screws, and hexagon socket head cap screw.

Straight shaft

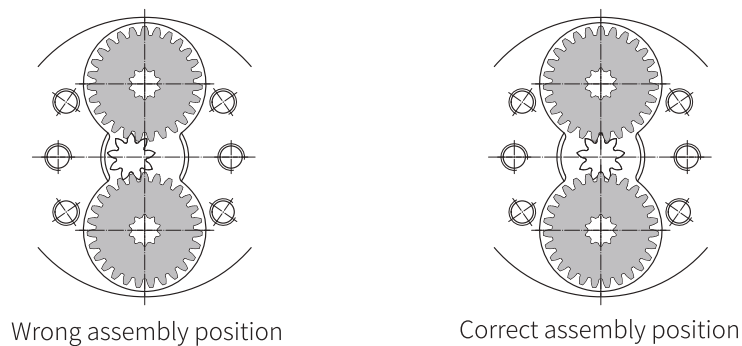


Tapered shaft

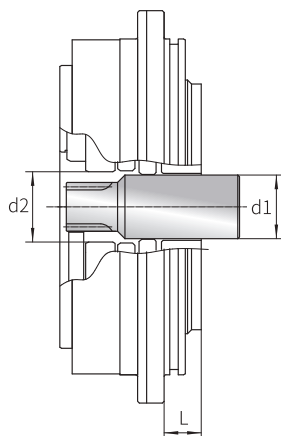


(2) CT-CRV-20E and CT-CRV-40E required precautions when installing

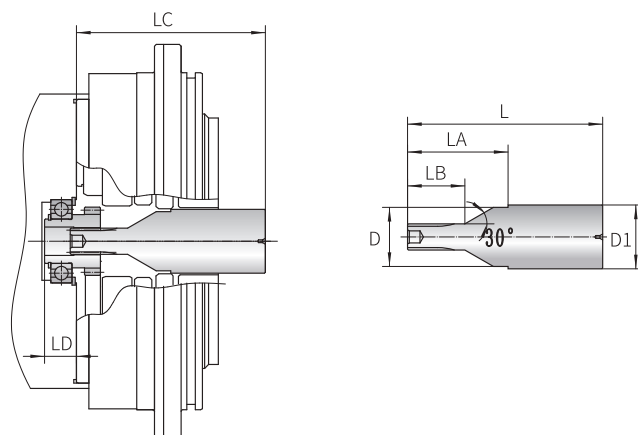
There are only two planetary gears for CT-CRV-20E and CT-CRV-40E. Therefore, to make sure the center axis is aligned, special attention needs to be paid to this matter when assembling. If the situation above happens, reducer and input gears will be damaged, so be sure to pay special attention to proper installation.



(3) Installation example diagram of the reducer which could be passed through



Installation example diagram of the reducer which could not be passed through



Speed ratio for through type

unit: mm

Model	Hole dia.		Depth	Speed ratio for through type	
	d1	d2		Shaft revolution	Case revolution
20E	22	24	18.5	41、81、105、121、41	40、80、104、120、140
40E	27	30	23.5	41、81、105、121、153	40、80、104、120、152
80E	37	40	23	81、101、121、153	80、100、120、152
110E	39	42	20	81、111、127.7、161、175.2	80、110、126.7、160、174.2
160E	43	47	30	81、101、129、145、171	80、100、128、144、170
320E	47	52	34	81、101、118.5、129、141、171、185	80、100、117.5、128、140、170、184
320E3	47	52	34	81、101、118.5、129、141、171、185	80、100、117.5、128、140、170、184
450E	57	62	40	81、101、118.5、129、155、171、192	80、100、117.5、128、154、170、191

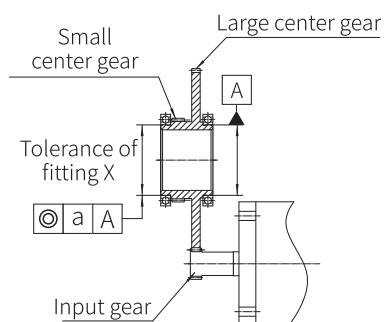
Speed ratio for through type

Model	L	LA	LB	LC	LD	Speed ratio for through type	
						Shaft revolution	Case revolution
20E	95	53	30	90	17	21、57	20、56
40E	105	58	30	103	19	21、57	20、56
80E	110	--	35	109	15.5	57	56
160E	130	--	38	128	21	66	65
320E	155	--	48	148	22	66	65
320E3	155	--	48	148	22	66	65
450E	200	--	48	195	26	66	65

3.2 Installation of center gear and input gear

Poor installation precision of center gear and input gear may affect performance, so design center gear and input gear based on the following precision.

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	MAXΦ0.03	JIS 5 class or lower	JIS 4 class or lower	JIS 5 class or lower



	Backlash between input gear and large center gear
10C	0.035~0.090
27C	0.040~0.110
50C	0.050~0.130
100C	0.060~0.140
120C	
200C	0.075~0.180
320C	
500C	

Specifications of small center gear tooth

	Module	Number of teeth	Shift coefficient
10C	1.0	48	-0.04
27C	1.0	57	+0.2
50C	1.25	61	0
100C	1.75	48	+0.3
120C	1.75	48	+0.3
200C	2.5	43	0
320C	2	78	0
500C	2	83	0

Specifications of standard large center gear

	Module	Number of teeth	Shift coefficient	Base tangent length(mm)	Number of teeth for measuring base tangent length
10C	2	57	0	39.974 ^{-0.02} _{-0.04}	7
27C	1.25	78	0	32.732 ^{-0.02} _{-0.04}	9
50C	2	78	0	52.371 ^{-0.02} _{-0.04}	9
100C	1.75	112	0	67.323 ^{-0.02} _{-0.04}	13
120C	1.75	112	0	67.323 ^{-0.02} _{-0.04}	13
200C	2	110	0	76.885 ^{-0.02} _{-0.04}	13
320C	2	125	0	89.113 ^{-0.02} _{-0.04}	15
500C	2	150	0	101.622 ^{-0.02} _{-0.04}	17

4. Lubricant

- ☆ Molywhite Re No,00 grease is recommended as the lubricant for the reducer.
- ☆ Reducers are not applied with lubricant when shipped. Be sure to design your equipment so that the necessary amount of our authorized lubricant can be applied. (set the pressure below 0.03 MPa.)
- ☆ The recommended fill size for grease inside the reducer is shown in the table below, where each amount does not include the space on the motor mounting side. Therefore, if there is a blank space, also fill the space. The actual filling amount is 85% of the total volume of the internal capacity of the reduction gear plus the space on the motor mounting side.
- ☆ The standard grease replacement time is 20,000 hours. However, When the grease is contaminated or used in a harsh environment, the state of the lubricant should be checked in advance and the grease should be replaced as early as necessary.

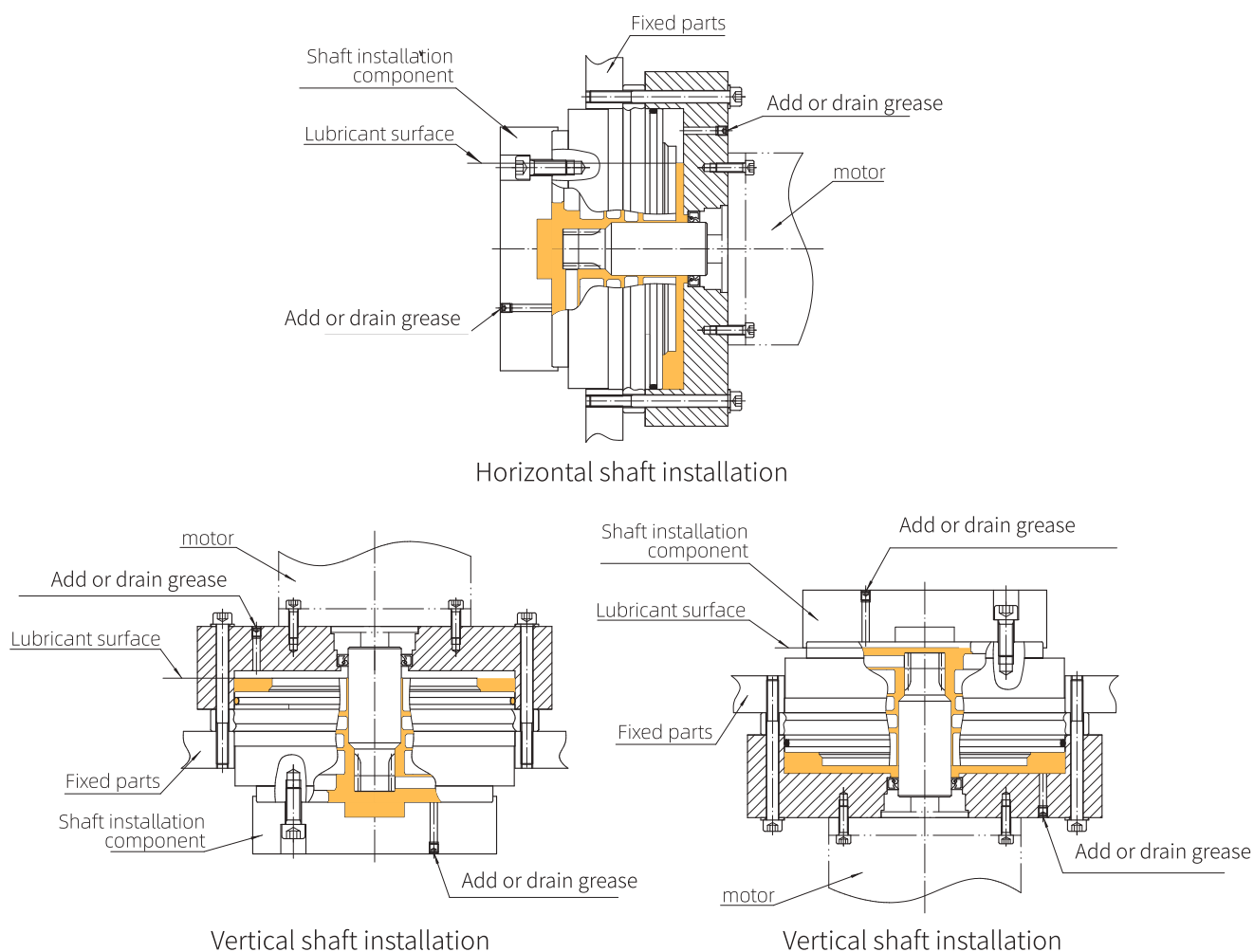
4.1 CT-CRV-E series lubricant

(1) The recommended fill size for grease inside the CT-CRV-E series reducer

Model	The recommended fill size for grease inside the reducer (Reference)			
	Horizontal shaft installation		Vertical shaft installation	
	cc	g	cc	g
20E	87	78	100	90
40E	195	176	224	202
80E	383	345	439	395
110E	432	389	495	446
160E	630	567	694	625
320E	1040	936	1193	1074
320E3	1040	936	1193	1074
450E	1596	1436	1831	1648

Note: Density of lubricant : 0.9 g/cc

(2) CT-CRV-E series reducer grease filling position (the yellow area is the grease filling position)



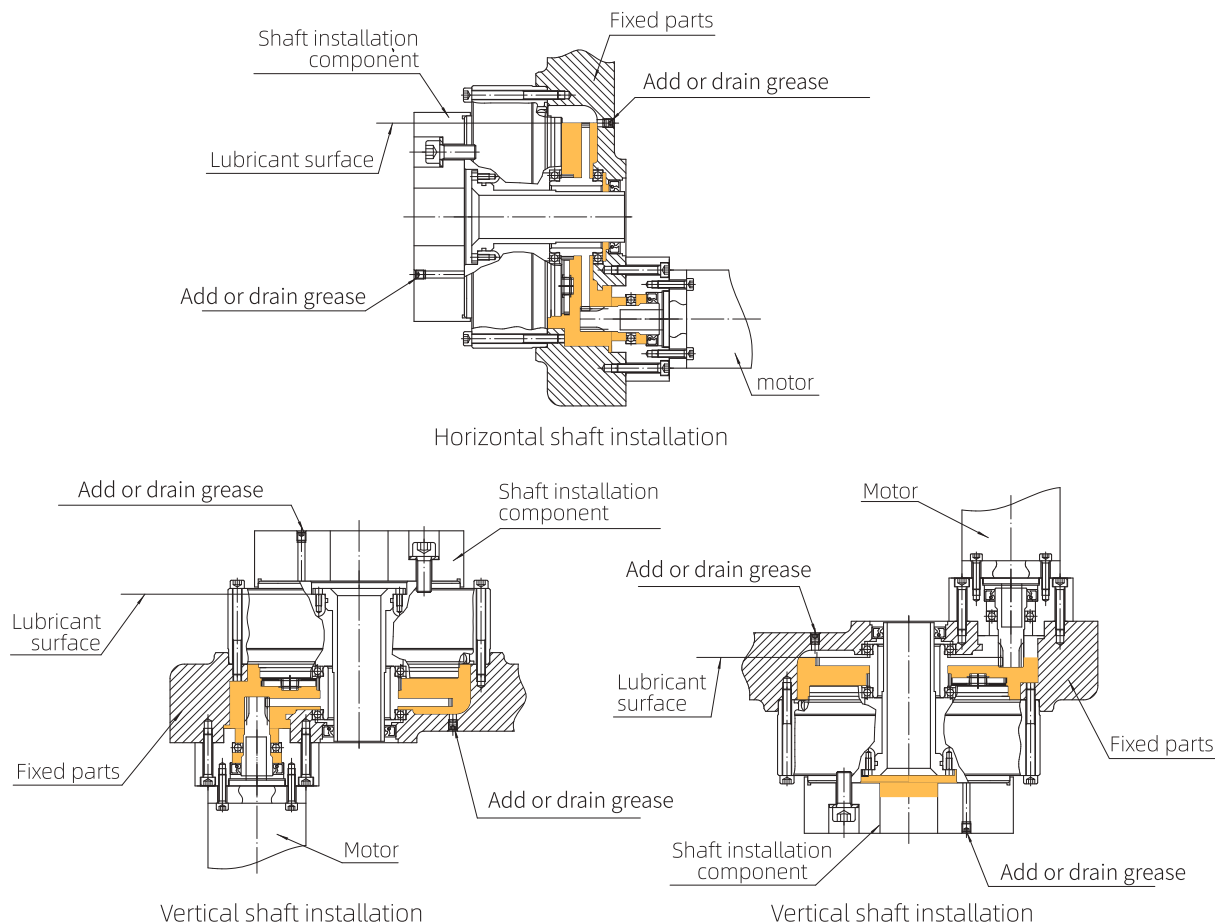
4.2 CT-CRV-C series lubricant

(1) The recommended fill size for grease inside the CT-CRV-C series reducer

Model	The recommended fill size for grease inside the reducer (Reference)			
	Horizontal shaft installation		Vertical shaft installation	
	cc	g	cc	g
10C	147	132	167	150
27C	266	239	305	275
50C	498	448	571	514
100C	756	680	857	771
120C	756	680	857	771
200C	1831	1648	2076	1868
320C	3536	3182	4047	3642
320CA	3536	3182	4047	3642
500C	5934	5341	6900	6210

Note: Density of lubricant :0.9 g/cc

(2) CT-CRV-C series reducer grease filling position (the yellow area is the grease filling position)



5. Bolt tightening torque and allowable transmission torque

When installing the reducer and mounting it to the output shaft, use hexagon socket head cap screws and tighten to the torque, as specified below. 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 nominal size × pitch(mm)	Tightening torque N.m	Tightening force N	Bolt specification
M5×0.8	9.01±0.49	9310	Hexagon socket head cap screw GB/T 70.1-2008 Performance level Grade 12.9 Thread GB/T 197-1981 6g
M6×1.0	15.6±0.78	13180	
M8×1.25	37.2±1.86	23960	
M10×1.5	73.5±3.43	38080	
M12×1.75	128.4±6.37	55100	
M14×2.0	204.8±10.2	75860	
M16×2.0	318.5±15.9	103410	
M18×2.5	441.0±22.1	126720	

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

Calculation of allowable transmission torque of bolts

$$T_1 = F \times \frac{D_1}{2} \times \mu \times n_1$$

T_1 : Allowable transmission torque by tightening bolt (Nm)

F : Bolt tightening force (N)

D_1 : Bolt mounting P.C.D (mm)

μ : Friction factor, $\mu=0.15$ When lubricant remains on the mating face.

$\mu=0.20$ When lubricant is removed from the mating face.

n_1 : Number of bolts

1. Troubleshooting checksheet

Check the following items in the case of trouble like abnormal noise, vibration, or malfunctions. When it is not possible to resolve an abnormality even after verifying the corresponding checkpoint, please contact our Customer Support Center.

Troubleshooting Checksheet

When?	Checkpoint	Is it abnormal?
The trouble started immediately after installation of the reducer.	Make sure the equipment section is not interfering with another component.	
	Make sure the required number of bolts are tightened uniformly with the specified tightening torque.	
	Make sure the reducer, motor, or your company's components are not installed at a slant.	
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).	
	Make sure the input gear is appropriately installed on the motor.	
	Make sure there is no damage to the surface of the input gear teeth.	
	Make sure the input gear specifications (precision, number of teeth, module, shift coefficient, dimensions of each part) are correct.	
	Make sure there are no components resonating in unity	
	Make sure the specified amount of Chietom-specified lubricant has been added.	
	Make sure there are no problems with the motor's parameter settings.	
	Make sure the flange and other components are designed and manufactured with the correct tolerances.	
The trouble started during operation	Make sure the equipment has not been in operation longer than the calculated service life.	
	Make sure the surface temperature of the reducer is not higher than normal during operation.	
	Make sure there are no loose or missing bolts.	
	Make sure the equipment's drive section is not interfering with another component.	
	Make sure the operation conditions have not been changed.	
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).	
	Make sure there are no external contaminants in the gear, such as moisture or metal powder.	
	Make sure an oil leak is not causing a drop in the amount of lubricant.	
	Make sure no lubricant other than that specified is being used.	

2. Warranty

- ☆ In the case where Chietom confirms that a defect of the Product was caused due to Chietom 's design or manufacture within the Warranty Period of the Product, Chietom shall return or replace such defective Product at its cost. The Warranty Period shall be from the delivery of the Product by Chietom to you ("Customer") until the end of one (1) year thereafter.
- ☆ The warranty obligations for the Product shall be limited to the repair or replacement set forth herein.
- ☆ Chietom will not be responsible for any performance or safety problems caused by the customer's unauthorized dismantling or reassembling of the reducer.

3. Application worksheet

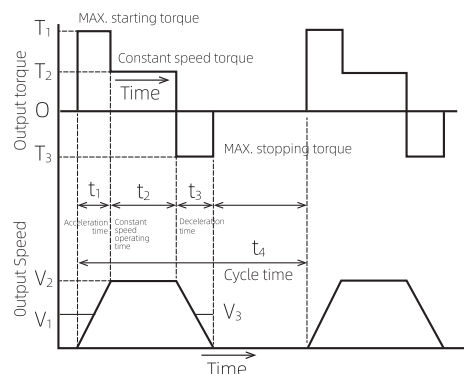
1. How used

Name of machine: _____

Applied to: _____

2. Model

3. Conditions of load



Max starting torque T_1 (Nm): _____

Constant torque T_2 (Nm): _____

Max stopping torque T_3 (Nm): _____

Average speed for starting V_1 (rpm): _____

Constant speed V_2 (rpm): _____

Average speed for stopping V_3 (rpm): _____

Acceleration time t_1 (s): _____

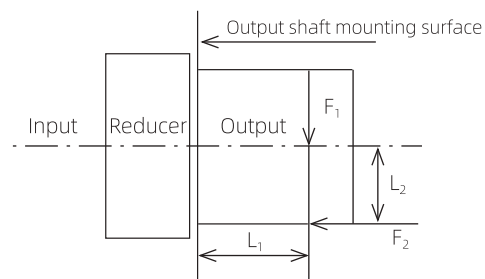
Constant time t_2 (s): _____

Deceleration time t_3 (s): _____

Cycle time t_4 (s): _____

Working hours: Cycle/Day: Day/Year: Year

4. External load conditions



Radial force F_1 (N): _____

Radial moment L_1 (mm): _____

Axial force F_2 (N): _____

Axial moment L_2 (mm): _____

5. Operating environment

Operating environment temperature ($^{\circ}\text{C}$): _____

6. Installation

☐ Horizontal installation

☐ Vertical installation(☐ Upper motor

☐ Lower motor))

Illustration for installation

7. Input gear specification

Reduction speed ratio: i = _____

☐ Standard size

☐ other

Input gear prepared by ☐ User

☐ Chietom

Required dimension of input gear (illustration)

8. Driving portion

☐ servo motor

☐ Other(_____)

Capacity: (kW): _____

Rated torque: (Nm): _____

Speed: (rpm): _____

Shape of the shaft: (mm): _____

9. Other



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