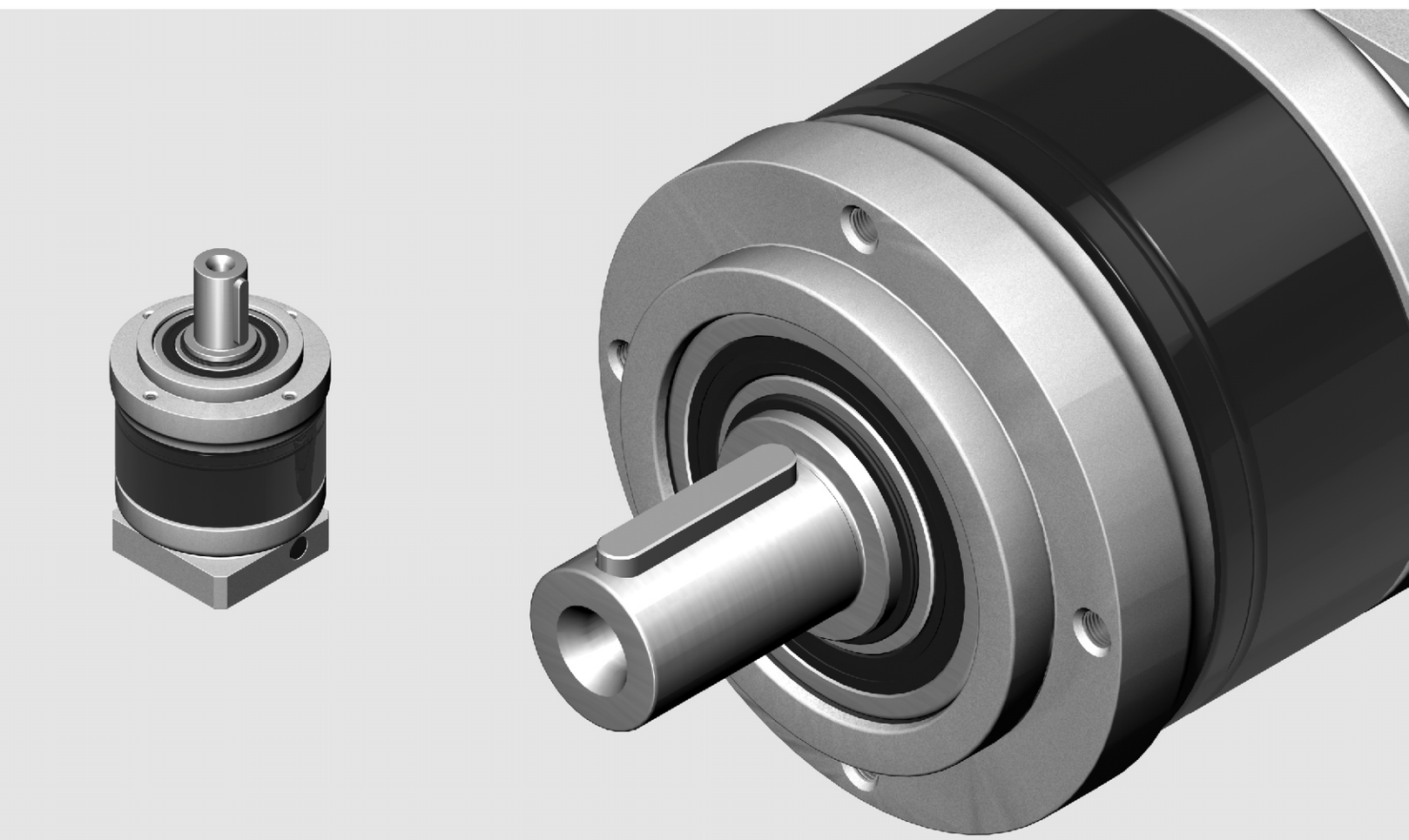
APEX DYNAMICS, INC.

PEII- SERIES
PLANETARY GEARBOX
NEW GENERATION



PEII Series

Features:

Economic
High efficiency
Low noise
Reduced backlash
Optimized Inertia moment
Limited temperature rise
Long service life
Flexible mounting diameters
Minimized size and weight

Your motor's perfect match!!

The brand new APEX PII series. The PII series is an economic high precision planetary gearbox with excellent performance and quality. Our innovative PII series design features minimal size, light weight and high efficiency.

Ordering Code

PEII090	—	010	— (2)	/	MOTOR

Motor Designation:
Manufacture Type And Model

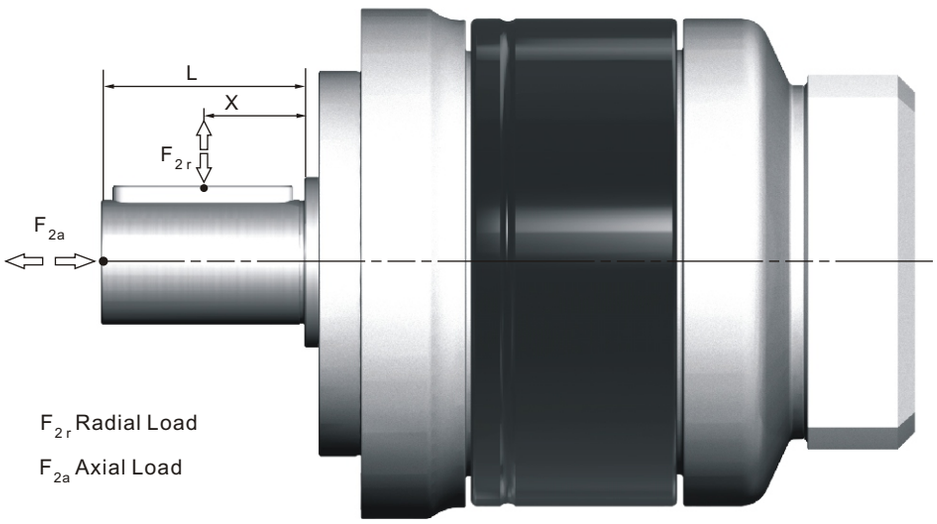
Ratio(1):
1 stage: 3, 4, 5, 7, 10
2 stage: 15, 16, 20, 25, 30, 35, 40, 50, 70, 100

Gear Size:
PEII: PEIIA, PEIIB, PEIIC, PEIID, PEIIE

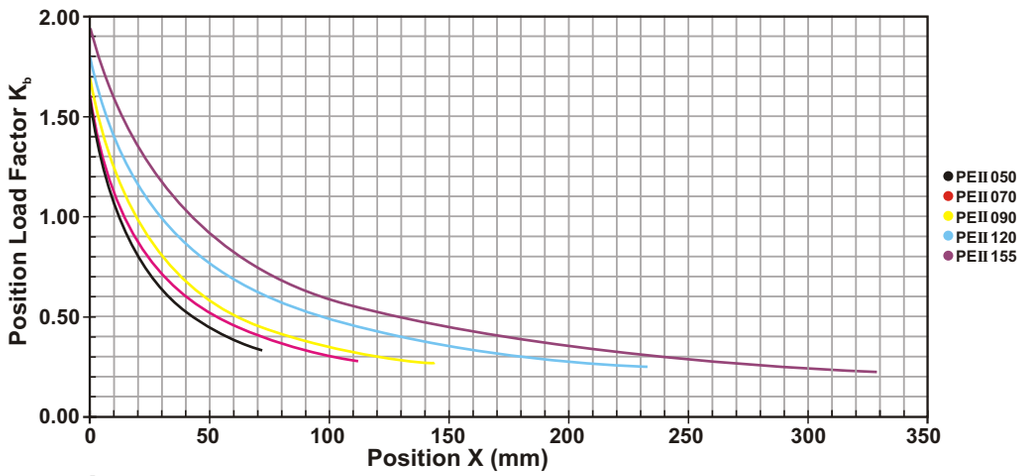
Ordering Example : PEII 090-010 / SIEMENS 1FT6 041-4AF71
PEII 090-010-S1 / SIEMENS 1FT6 041-4AF71

(1) Other ratios are available, please contact APEX.
(2) For PSII, PEII and PGII series, the output shaft with key (S2) is standard.
For PAII series, the S1 and S2 are both available.

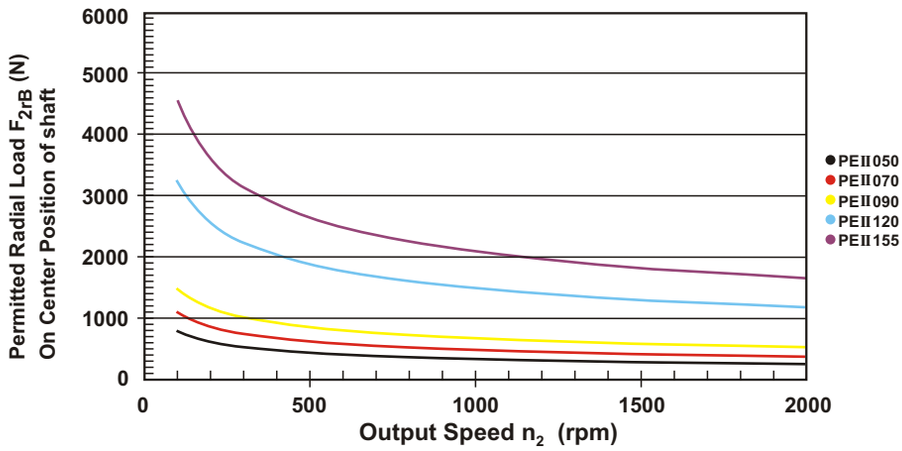
Permitted Radial And Axial Loads On Output Shaft



The permitted radial and axial loads on output shaft of the gearbox depend on the design of the gearbox supporting bearings.



If radial force F_{2r} is not exerted on the center of the output shaft X<1/2xL or X>1/2xL, the permitted radial and axial loads can be calculated by the position load factor Kb on the above diagram.



Permitted radial load F_{2r} on center of output shaft X=1/2 x L for various output speeds. Values provided are for 20,000 hours(*) life.

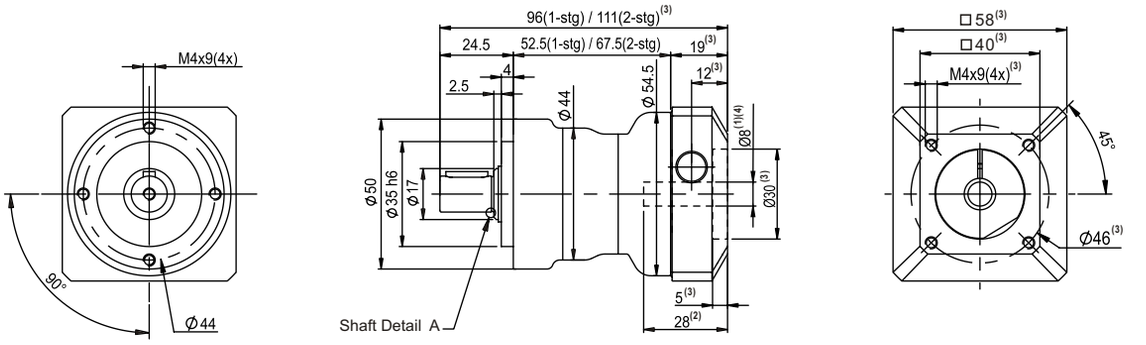
(*) For Continuous Operation(S1), the service life reduced to 50%.

PEII Series Specifications

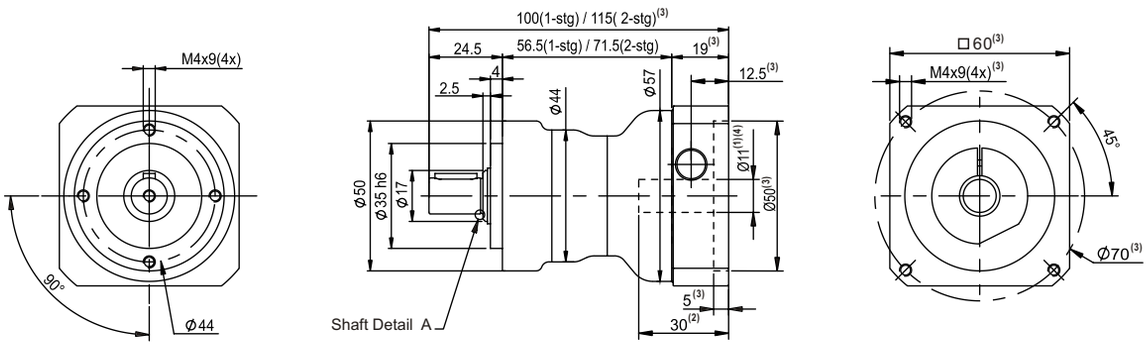
PEII050			1-stage					2-stage									
			Ratio (1) (2)					Ratio (1) (2)									
			3	4	5	7	10	15	16	20	25	30	35	40	50	70	100
Nominal Output Torque T_{2N}	Nm		4.4	6.1	5.9	5.4	5.3	4.3	5.9	5.9	6.2	4.3	5.8	5.8	6.1	5.8	5.7
Emergency Stop Torque T_{2NOT}	Nm		3 times T_{2N}														
Max. Acceleration Torque T_{2B}	Nm		7.9	11	10.6	9.7	9.5	7.7	10.6	10.6	11.2	7.7	10.4	10.4	11	10.4	10.3
No Load Running Torque(8)	Nm		0.05					0.05									
Backlash(3)	arcmin		≦ 7					≦ 9									
Torsional Rigidity	Nm/arcmin		0.9					0.9									
Nominal Input Speed n_{1N}	rpm		4,500														
Max. Input Speed n_{1B}	rpm		8,000														
Max. Radial Load F_{2rB}(4)	N		840														
Max. Axial Load F_{2aB}(4)	N		420														
Service Life(7)	hr		20,000														
Operating Temperature	° C		0° C~ +90° C														
Lubrication			Synthetic lubrication grease														
Mounting Position			All directions														
Running Noise(6) (8)	dB(A)		≦ 60					≦ 60									
Efficiency η	%		≧ 97%					≧ 94%									
Weight	kg		Ø(5)≦8, 11, 14= 0.7					Ø(5)≦8, 11, 14= 0.8									
Moment of Inertia J_1	kg.cm²	Ø(5)≦8	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
		Ø(5)≦11	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
		Ø(5)≦14	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

(1) Ratio (i= N_{in} / N_{out}).
(2) Other ratios are available, please contact APEX.
(3) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(4) Applied to the output shaft center at 100 rpm.
(5) Ø = Input shaft diameter.
(6) These values are measured at 3000 rpm without load.
(7) For continuous operation, the service life is 10000 hrs.
(8) These values are measured with ratio=10 (1-stage) and ratio=100 (2-stage) at 3000 rpm.

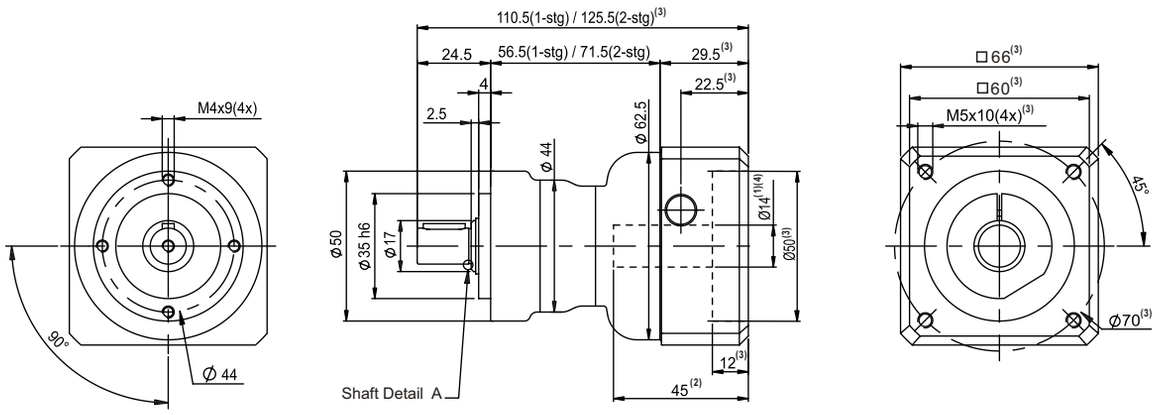
PEII Series Dimension



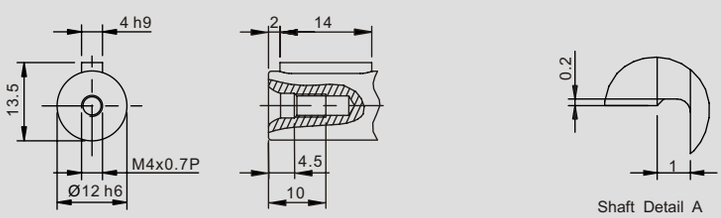
Ø(5)≦8



Ø(5)≦11



Ø(5)≦14



Shaft Detail

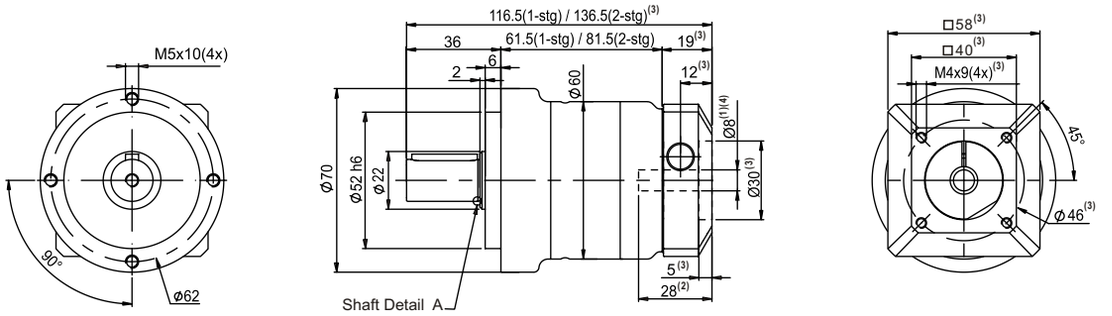
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Specifications

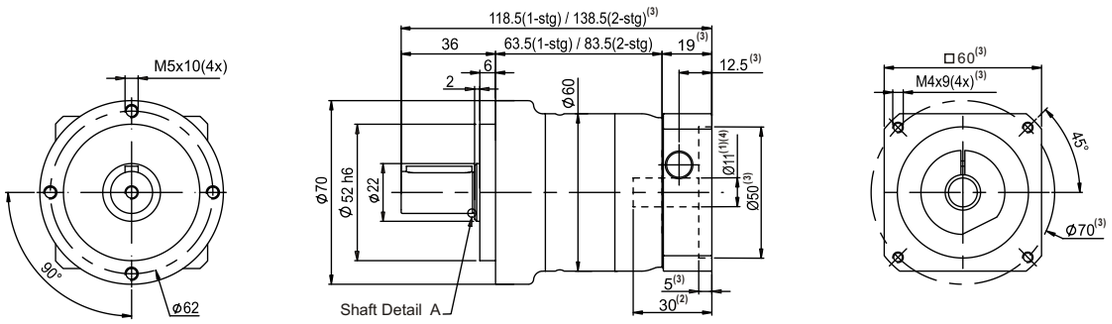
PEII070			1-stage					2-stage									
			Ratio (1) (2)					Ratio (1) (2)									
			3	4	5	7	10	15	16	20	25	30	35	40	50	70	100
Nominal Output Torque T_{2N}	Nm		15	21	19.5	18	17.7	14.5	20	20	21	14	19.3	19.2	20	19.6	18.8
Emergency Stop Torque T_{2NOT}	Nm		3 times T_{2N}														
Max. Acceleration Torque T_{2B}	Nm		27	37.8	35.1	32.4	31.9	26.1	36	36	37.8	25.2	34.7	34.6	36	35.3	33.8
No Load Running Torque (8)	Nm		0.1					0.1									
Backlash (3)	arcmin		≦ 6					≦ 8									
Torsional Rigidity	Nm/arcmin		2.2					2.2									
Nominal Input Speed n_{1N}	rpm		4,000														
Max. Input Speed n_{1B}	rpm		6,000														
Max. Radial Load F_{2rB} (4)	N		1,290														
Max. Axial Load F_{2aB} (4)	N		645														
Service Life (7)	hr		20,000														
Operating Temperature	° C		0° C~ +90° C														
Lubrication			Synthetic lubrication grease														
Mounting Position			All directions														
Running Noise (6) (8)	dB(A)		≦ 62					≦ 62									
Efficiency η	%		≧ 97%					≧ 94%									
Weight	kg		Ø(5)≦8, 11, 14= 1.2 Ø(5)≦19= 1.9					Ø(5)≦8, 11, 14= 1.5 Ø(5)≦19= 2.2									
Moment of Inertia J_1	$kg.cm^2$	Ø(5)≦8	0.13	0.11	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
		Ø(5)≦11	0.19	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
		Ø(5)≦14	0.25	0.23	0.22	0.22	0.22	0.22	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
		Ø(5)≦19	1.54	1.52	1.52	1.51	1.51	1.52	1.52	1.52	1.52	1.51	1.52	1.51	1.51	1.51	1.51

(1) Ratio (i= N_{in} / N_{out}).
(2) Other ratios are available, please contact APEX.
(3) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(4) Applied to the output shaft center at 100 rpm.
(5) Ø = Input shaft diameter.
(6) These values are measured at 3000 rpm without load.
(7) For continuous operation, the service life is 10000 hrs.
(8) These values are measured with ratio=10 (1-stage) and ratio=100 (2-stage) at 3000 rpm.

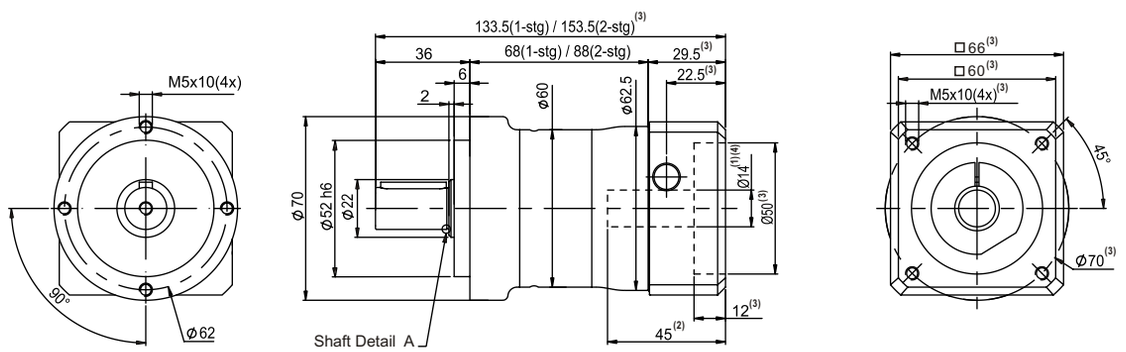
PEII Series Dimension



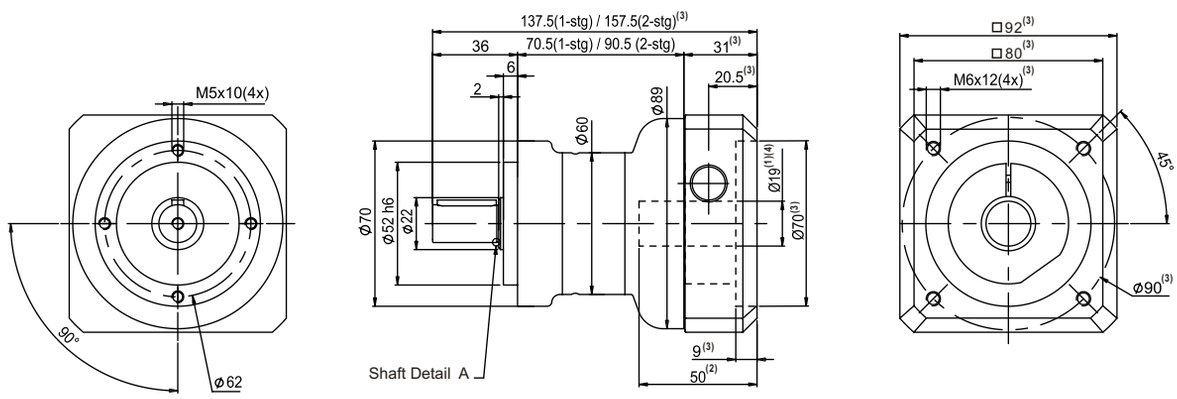
Ø(5)≦8



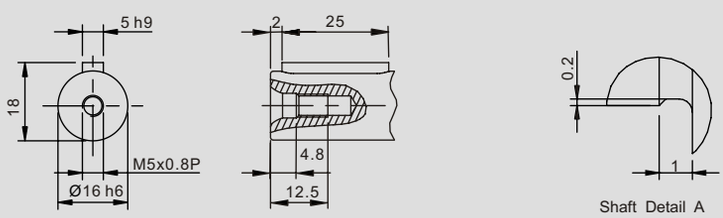
Ø(5)≦11



Ø(5)≦14



Ø(5)≦19



Shaft Detail

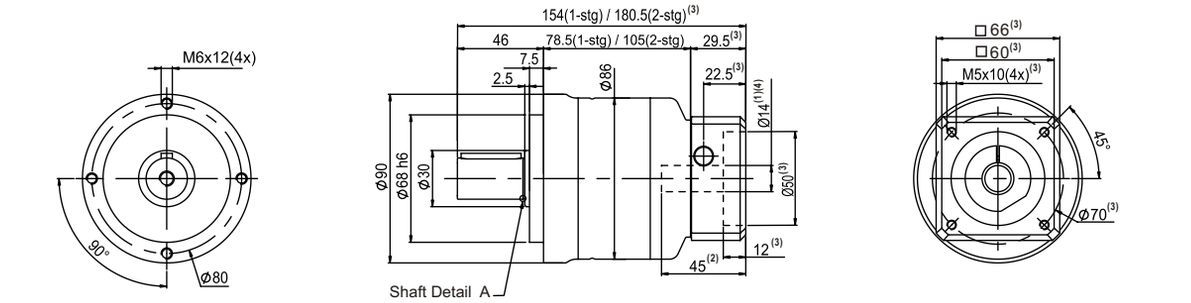
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Specifications

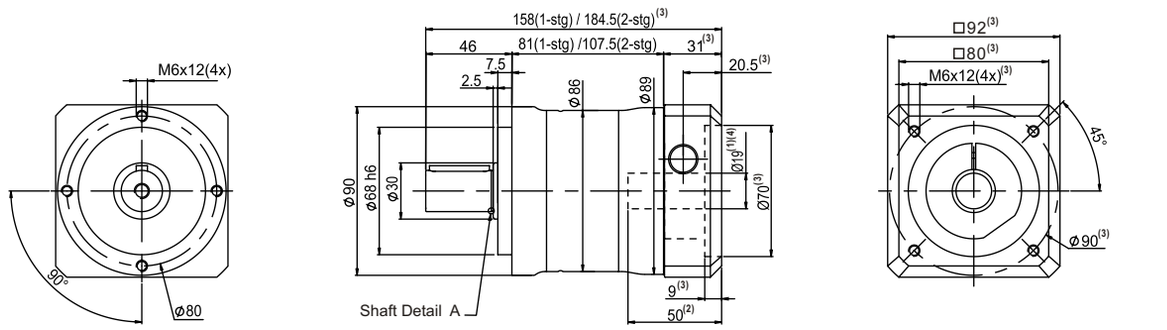
PEII090			1-stage					2-stage									
			Ratio (1) (2)					Ratio (1) (2)									
			3	4	5	7	10	15	16	20	25	30	35	40	50	70	100
Nominal Output Torque T_{2N}	Nm		33	46	48	49	46	32	44	44	46	32	54	43	45	54	48
Emergency Stop Torque T_{2NOT}	Nm		3 times T_{2N}														
Max. Acceleration Torque T_{2B}	Nm		59.4	82.8	86.4	88.2	82.8	57.6	79.2	79.2	82.8	57.6	97.2	77.4	81	97.2	86.4
No Load Running Torque (8)	Nm		0.4					0.3									
Backlash (3)	arcmin		≦ 5					≦ 7									
Torsional Rigidity	Nm/arcmin		8					8									
Nominal Input Speed n_{1N}	rpm		3,600														
Max. Input Speed n_{1B}	rpm		6,000														
Max. Radial Load F_{2rB} (4)	N		1,510														
Max. Axial Load F_{2aB} (4)	N		755														
Service Life (7)	hr		20,000														
Operating Temperature	° C		0° C~ +90° C														
Lubrication			Synthetic lubrication grease														
Mounting Position			All directions														
Running Noise (6) (8)	dB(A)		≦ 64					≦ 64									
Efficiency η	%		≧ 97%					≧ 94%									
Weight	kg		Ø(5)≦14= 2.4 Ø(5)≦19, 24, 28= 3.4					Ø(5)≦14= 3.3 Ø(5)≦19, 24, 28= 4.3									
Moment of Inertia J_1	$kg.cm^2$	Ø(5)≦14	0.38	0.27	0.25	0.24	0.24	0.25	0.27	0.25	0.25	0.24	0.25	0.24	0.24	0.24	0.24
		Ø(5)≦19	1.77	1.66	1.64	1.63	1.63	1.64	1.66	1.64	1.64	1.63	1.64	1.63	1.63	1.63	1.63
		Ø(5)≦24	2.33	2.22	2.20	2.19	2.19	2.20	2.22	2.20	2.20	2.19	2.20	2.19	2.19	2.19	2.19
		Ø(5)≦28	2.86	2.75	2.73	2.72	2.71	2.73	2.75	2.73	2.73	2.71	2.73	2.71	2.71	2.71	2.71

(1) Ratio (i= N_{in} / N_{out}).
(2) Other ratios are available, please contact APEX.
(3) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(4) Applied to the output shaft center at 100 rpm.
(5) Ø = Input shaft diameter.
(6) These values are measured at 3000 rpm without load.
(7) For continuous operation, the service life is 10000 hrs.
(8) These values are measured with ratio=10 (1-stage) and ratio=100 (2-stage) at 3000 rpm.

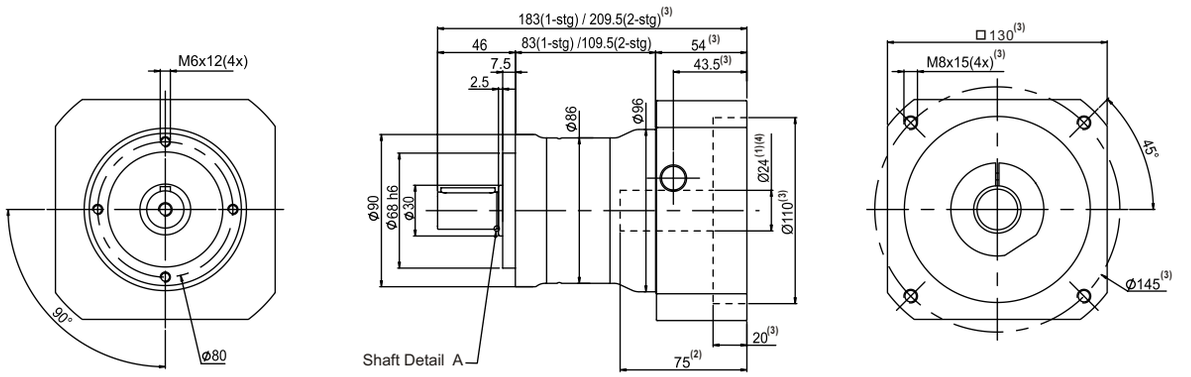
PEII Series Dimension



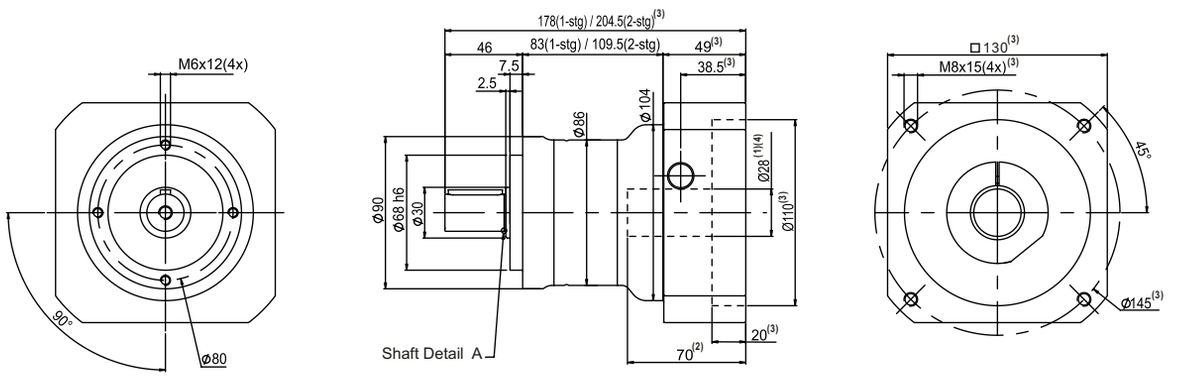
Ø(5)≦14



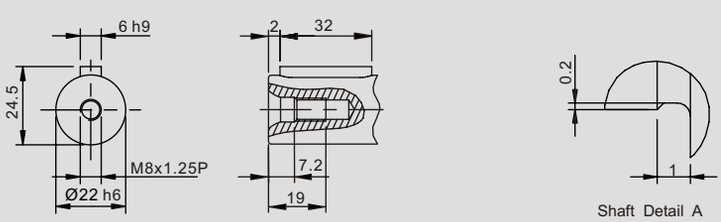
Ø(5)≦19



Ø(5)≦24



Ø(5)≦28



Shaft Detail

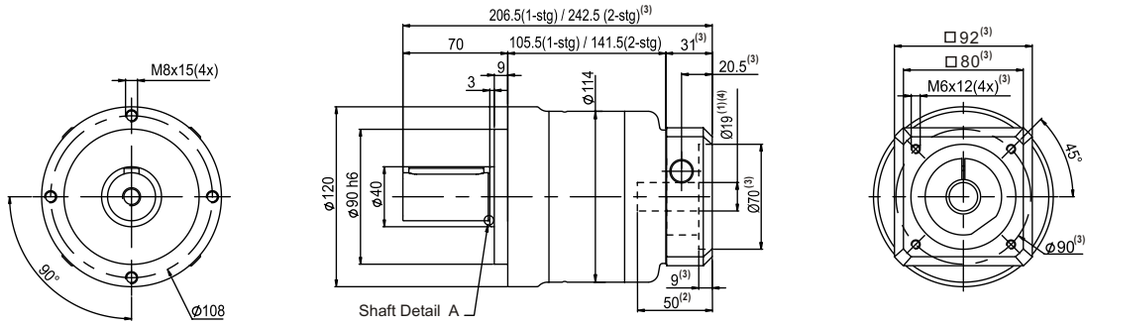
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Specifications

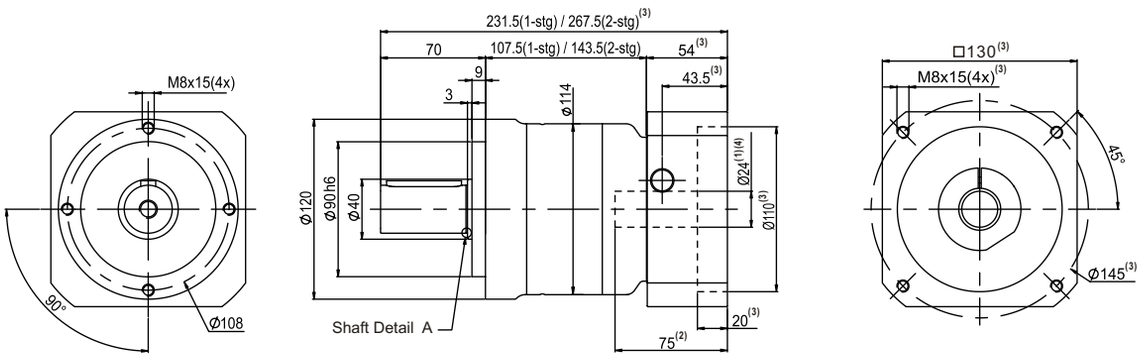
PEII120			1-stage					2-stage									
			Ratio (1) (2)					Ratio (1) (2)									
			3	4	5	7	10	15	16	20	25	30	35	40	50	70	100
Nominal Output Torque T_{2N}	Nm		51	72	76	91	74	50	70	70	73	50	88	68	71	86	77
Emergency Stop Torque T_{2NOT}	Nm		3 times T_{2N}														
Max. Acceleration Torque T_{2B}	Nm		91.8	130	137	164	133	90	126	126	131	90	158	122	128	155	139
No Load Running Torque(8)	Nm		0.8					0.4									
Backlash(3)	arcmin		≦ 5					≦ 7									
Torsional Rigidity	Nm/arcmin		12					12									
Nominal Input Speed n_{1N}	rpm		3,600														
Max. Input Speed n_{1B}	rpm		4,800														
Max. Radial Load F_{2rB}(4)	N		3,780														
Max. Axial Load F_{2aB}(4)	N		1,890														
Service Life(7)	hr		20,000														
Operating Temperature	° C		0° C~ +90° C														
Lubrication			Synthetic lubrication grease														
Mounting Position			All directions														
Running Noise(6) (8)	dB(A)		≦ 66					≦ 66									
Efficiency η	%		≧ 97%					≧ 94%									
Weight	kg		Ø(5)≦19, 24, 28= 6.5 Ø(5)≦32, 35= 8 Ø(5)≦38= 11.9					Ø(5)≦19, 24, 28= 8.5 Ø(5)≦32, 35= 10.1 Ø(5)≦38= 14									
Moment of Inertia J_1	$kg.cm^2$	Ø(5)≦19	2.41	1.96	1.88	1.84	1.83	1.88	1.96	1.88	1.88	1.83	1.88	1.83	1.83	1.83	1.83
		Ø(5)≦24	3.11	2.66	2.57	2.54	2.53	2.57	2.66	2.57	2.57	2.53	2.57	2.53	2.53	2.53	2.53
		Ø(5)≦28	3.40	2.96	2.87	2.84	2.83	2.87	2.96	2.87	2.87	2.83	2.87	2.83	2.83	2.83	2.83
		Ø(5)≦32	8.00	7.55	7.47	7.43	7.42	7.47	7.55	7.47	7.47	7.42	7.47	7.42	7.42	7.42	7.42
		Ø(5)≦35	10.97	10.52	10.44	10.40	10.39	10.44	10.52	10.44	10.44	10.39	10.44	10.39	10.39	10.39	10.39
		Ø(5)≦38	14.18	13.73	13.65	13.61	13.60	13.65	13.73	13.65	13.65	13.60	13.65	13.60	13.60	13.60	13.60

(1) Ratio (i= N_{in} / N_{out}).
(2) Other ratios are available, please contact APEX.
(3) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(4) Applied to the output shaft center at 100 rpm.
(5) Ø = Input shaft diameter.
(6) These values are measured at 3000 rpm without load.
(7) For continuous operation, the service life is 10000 hrs.
(8) These values are measured with ratio=10 (1-stage) and ratio=100 (2-stage) at 3000 rpm.

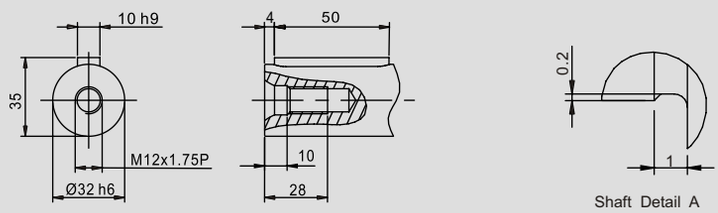
PEII Series Dimension



Ø(5)≦19



Ø(5)≦24

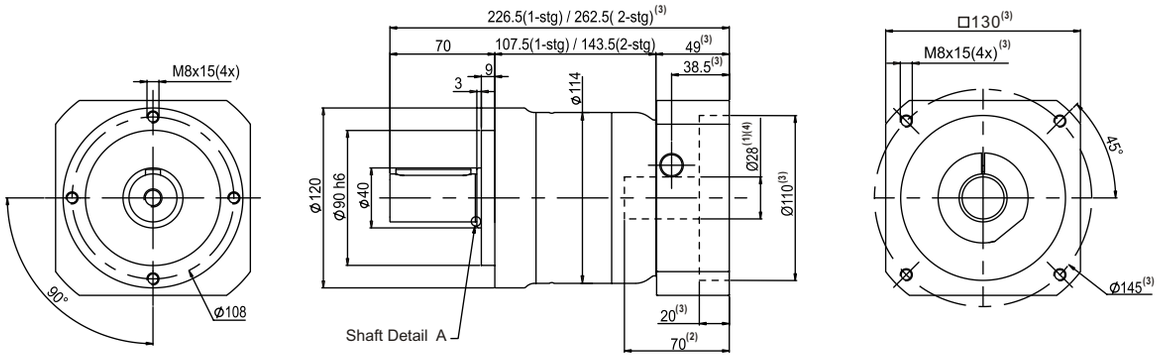


Shaft Detail

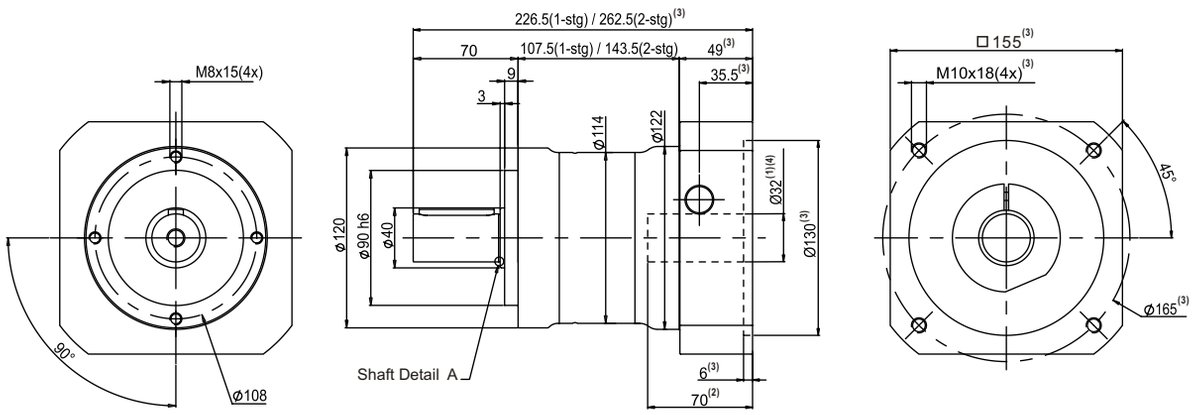
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Dimension

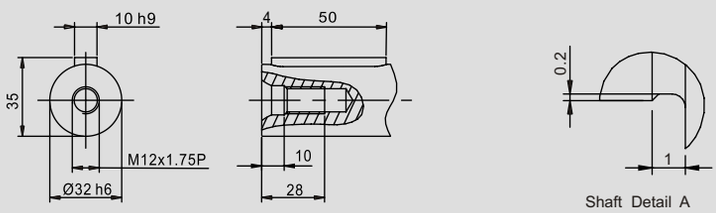
Ø(5)≦28



Ø(5)≦32



Shaft Detail



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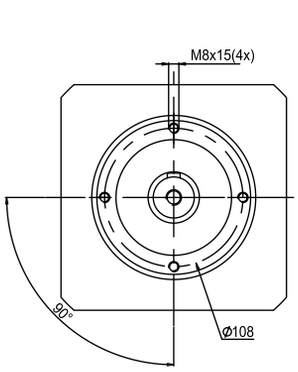
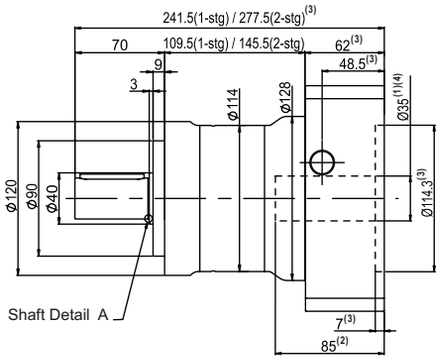
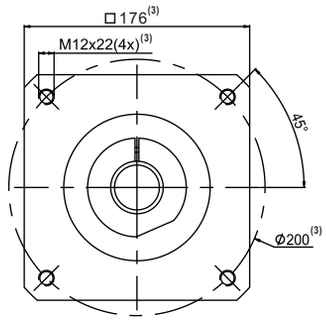
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

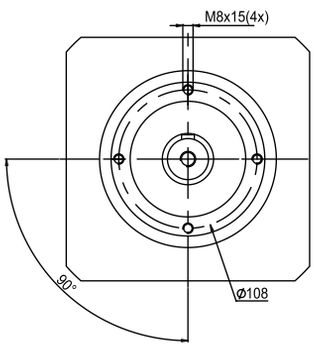
PEII Series Dimension

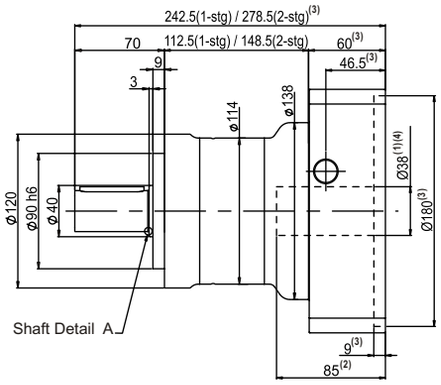


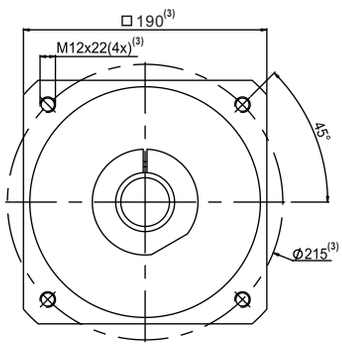




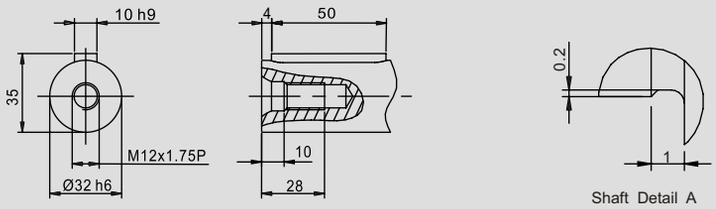
Ø(5)≦35







Ø(5)≦38



Shaft Detail

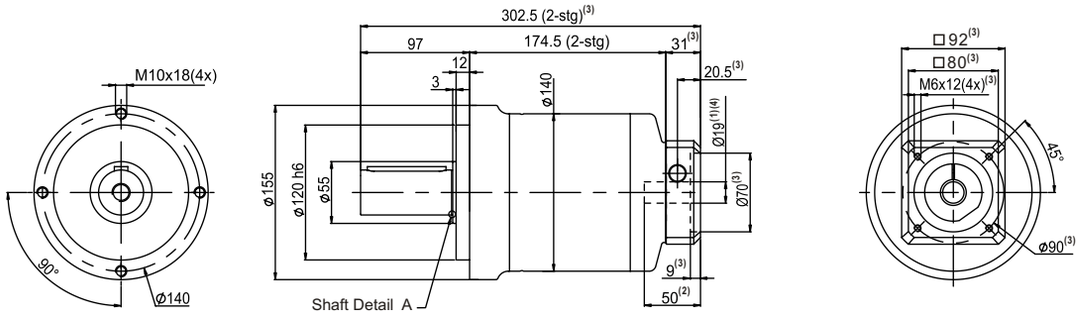
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Specifications

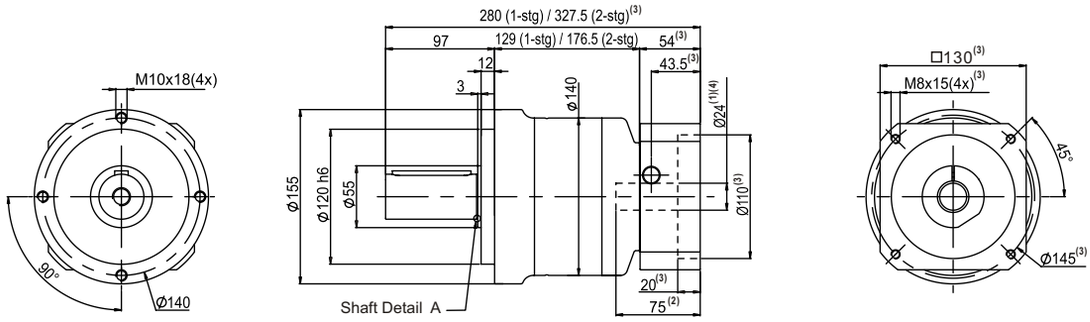
PEII155			1-stage					2-stage									
			Ratio (1) (2)					Ratio (1) (2)									
			3	4	5	7	10	15	16	20	25	30	35	40	50	70	100
Nominal Output Torque T_{2N}	Nm		102	143	150	178	123	101	140	140	145	99	174	136	140	171	128
Emergency Stop Torque T_{2NOT}	Nm		3 times T_{2N}														
Max. Acceleration Torque T_{2B}	Nm		184	257	270	320	221	182	252	252	261	178	313	245	252	308	230
No Load Running Torque(8)	Nm		2.5					0.8									
Backlash(3)	arcmin		≦ 5					≦ 7									
Torsional Rigidity	Nm/arcmin		16					16									
Nominal Input Speed n_{1N}	rpm		2,500														
Max. Input Speed n_{1B}	rpm		3,600														
Max. Radial Load F_{2rB}(4)	N		4,600														
Max. Axial Load F_{2aB}(4)	N		2,300														
Service Life(7)	hr		20,000														
Operating Temperature	° C		0° C~ +90° C														
Lubrication			Synthetic lubrication grease														
Mounting Position			All directions														
Running Noise(6) (8)	dB(A)		≦ 68					≦ 68									
Efficiency η	%		≧ 97%					≧ 94%									
Weight	kg		Ø(5)≦24, 28= 11.2 Ø(5)≦32, 35= 12.8 Ø(5)≦38, 42= 16.8					Ø(5)≦19, 24, 28= 15.2 Ø(5)≦32, 35= 16.8 Ø(5)≦38= 20.7									
Moment of Inertia J_1	kg.cm²	Ø(5)≦19	-	-	-	-	-	2.18	2.50	2.18	2.18	2.00	2.18	2.00	2.00	2.00	2.00
		Ø(5)≦24	4.80	3.06	2.74	2.60	2.56	2.74	3.06	2.74	2.74	2.56	2.74	2.56	2.56	2.56	2.56
		Ø(5)≦28	5.22	3.49	3.16	3.02	2.99	3.16	3.49	3.16	3.16	2.99	3.16	2.99	2.99	2.99	2.99
		Ø(5)≦32	10.74	9.00	8.68	8.53	8.50	8.68	9.00	8.68	8.68	8.50	8.68	8.50	8.50	8.50	8.50
		Ø(5)≦35	14.14	12.40	12.08	11.93	11.90	12.08	12.40	12.08	12.08	11.90	12.08	11.90	11.90	11.90	11.90
		Ø(7)≦38	17.20	15.46	15.14	15.00	14.96	15.14	15.46	15.14	15.14	14.96	15.14	14.96	14.96	14.96	14.96
		Ø(7)≦42	25.85	24.12	23.79	23.65	23.62	-	-	-	-	-	-	-	-	-	-

(1) Ratio (i= N_{in} / N_{out}).
(2) Other ratios are available, please contact APEX.
(3) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(4) Applied to the output shaft center at 100 rpm.
(5) Ø = Input shaft diameter.
(6) These values are measured at 3000 rpm without load.
(7) For continuous operation, the service life is 10000 hrs.
(8) These values are measured with ratio=10 (1-stage) and ratio=100 (2-stage) at 3000 rpm.

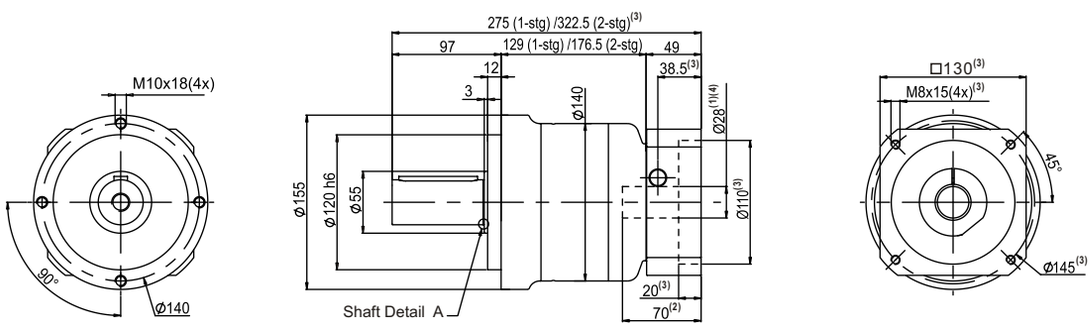
PEII Series Dimension



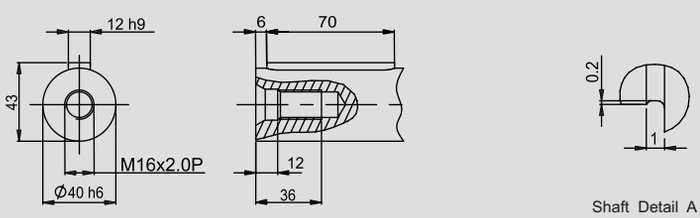
Ø(5)≦19



Ø(5)≦24



Ø(5)≦28

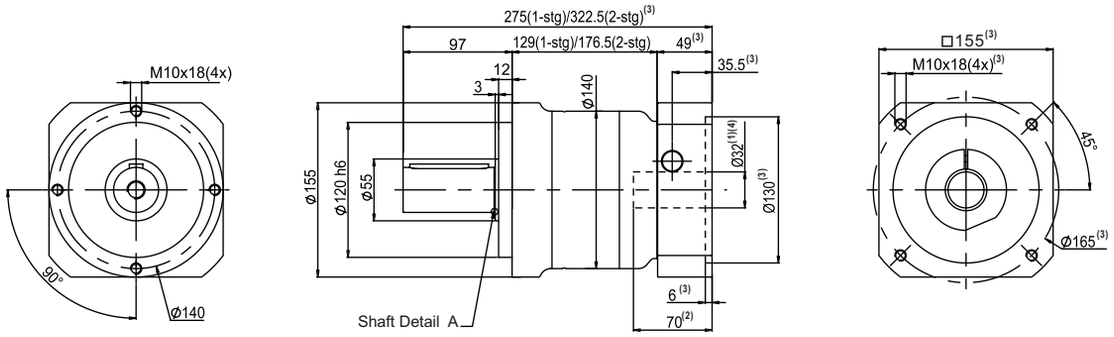


Shaft Detail

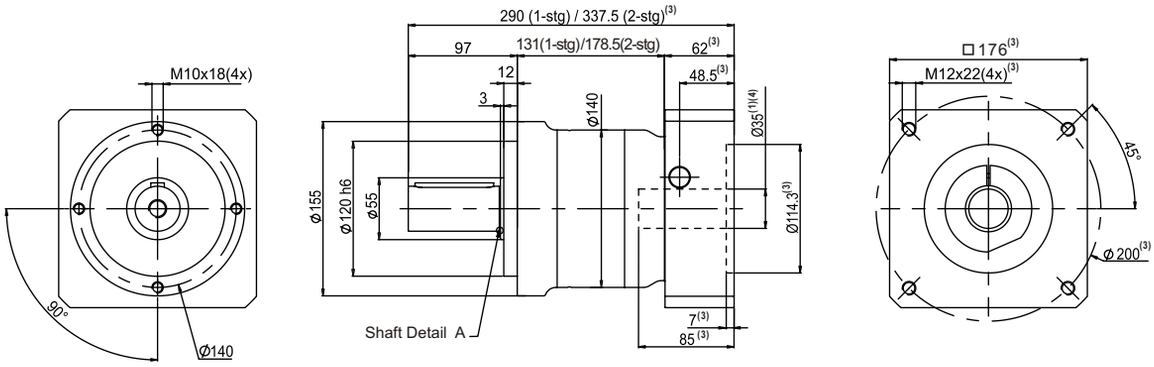
(1) This dimension refers to motor shaft diameter.
(2) The maximum motor shaft length. For other Motor specific dimensions, please contact APEX.
(3) Input dimensions vary according to motor flange.
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

PEII Series Dimension

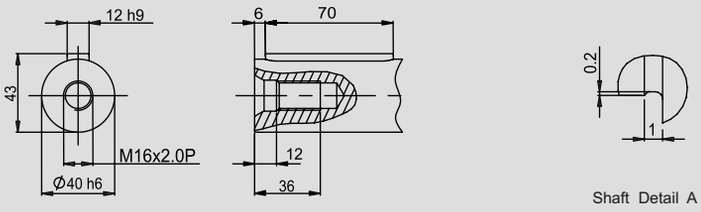
Ø(5)≦32



Ø(5)≦35



Shaft Detail



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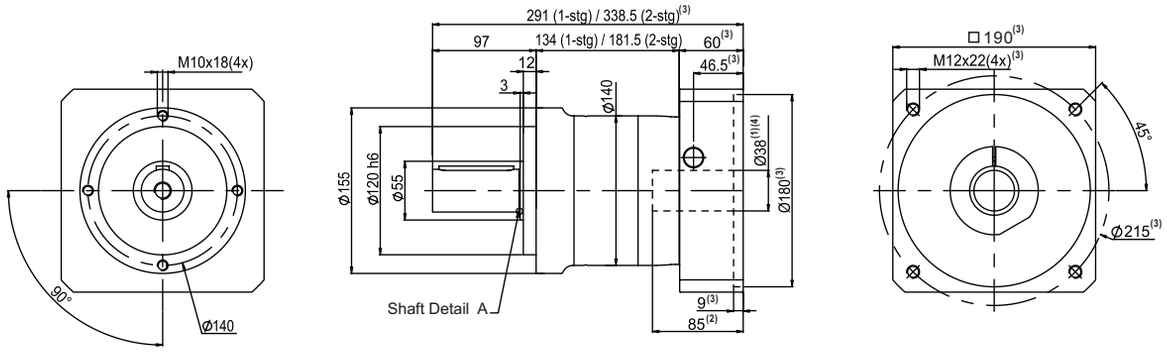
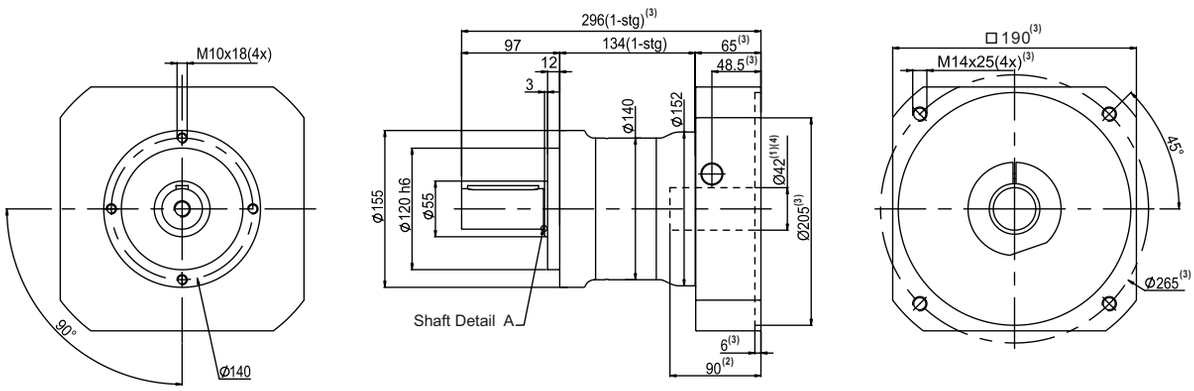
(5) Ø= Input shaft diameter.

PEII Series Dimension

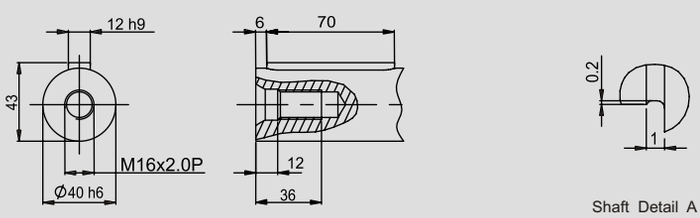


Ø(5)≦38



Ø(5)≦42

Shaft Detail



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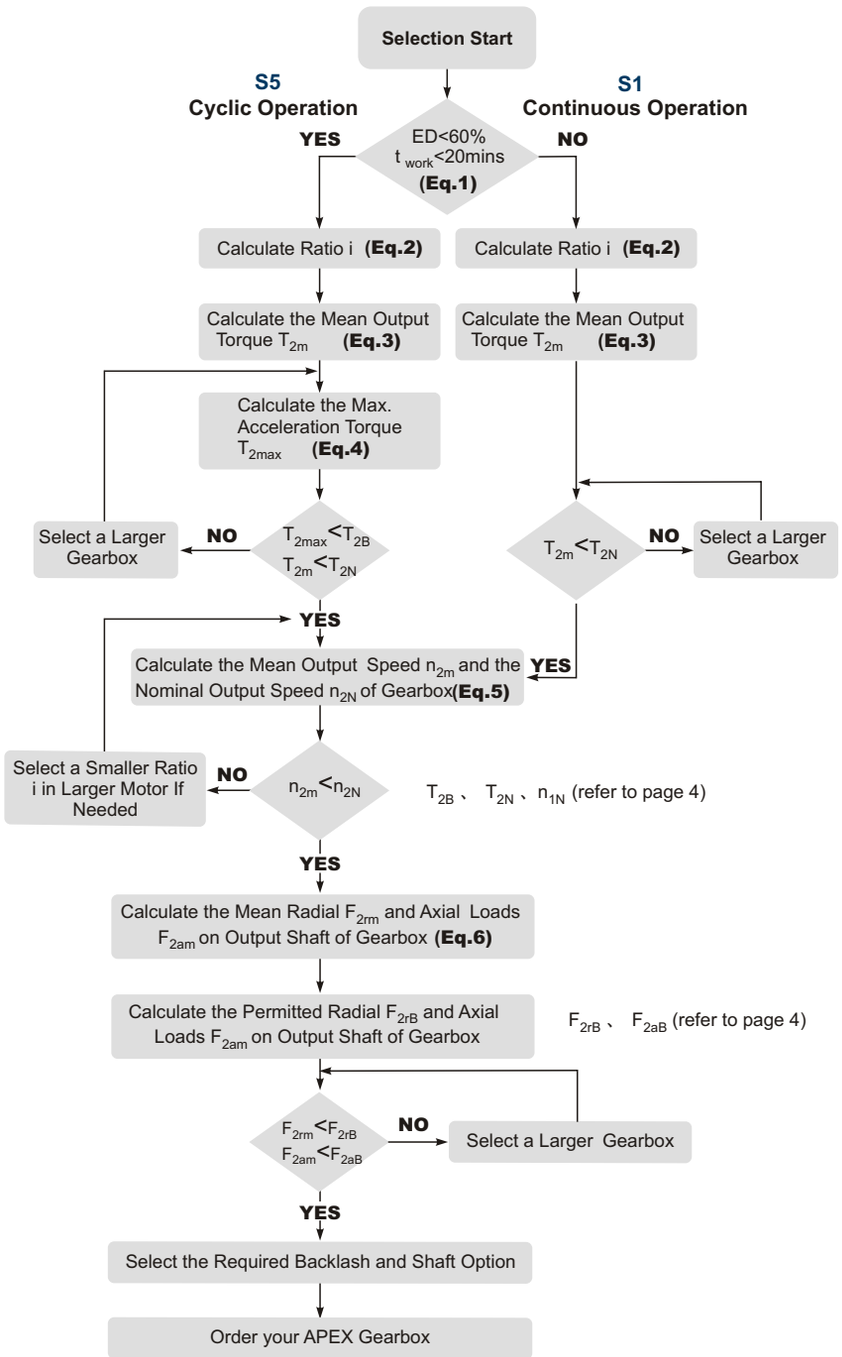
(4) Please contact APEX, if there is no proper dimension.
(5) Ø= Input shaft diameter.

Selection of the optimum gearbox



Recommended (for S5 Cycle Operation)

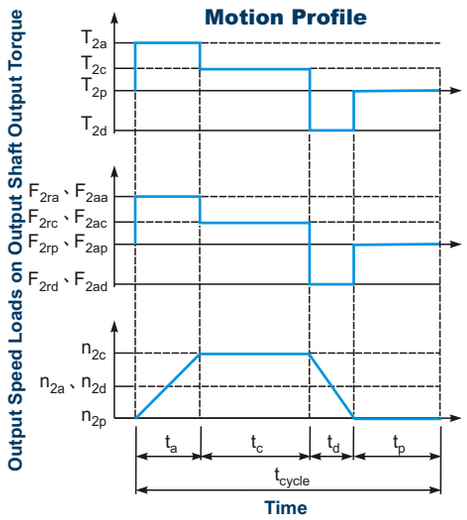
The general design is given for

$\frac{J_L}{i^2} \leq 4 \times J_m$

The optimal design is given for

J_L Load Inertia

J_m Motor Inertia



1. $ED = \frac{t_a + t_c + t_d}{t_{cycle}} \times 100\%$, $t_{work} = t_a + t_c + t_d$

Index : a. Acceleration, c. Constant,
d. Deceleration, p. Pause **(Eq.1)**

2. $i \cong \frac{n_m}{n_{work}}$

n_m Output Speed of the Motor

n_{work} Working Speed **(Eq.2)**

3. $T_{2m} = \sqrt[3]{\frac{n_{2a} \times t_a \times T_{2a}^{\ 3} + n_{2c} \times t_c \times T_{2c}^{\ 3} + n_{2d} \times t_d \times T_{2d}^{\ 3}}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$

(Eq.3)

4. $T_{2max} = T_{mB} \times i \times K_s \times \eta$

where K_s is

K_s	No. of Cycles / hr
1.0	0 ~ 1,000
1.1	1,000 ~ 1,500
1.3	1,500 ~ 2,000
1.6	2.000 ~ 3,000
1.8	3.000 ~ 5,000

T_{mB} Max. Output Torque of the Motor

η Efficency of the Gearbox **(Eq.4)**

5. $n_{2a} = n_{2d} = \frac{1}{2} \times n_{2c}$

$n_{2m} = \frac{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}{t_a + t_c + t_d}$

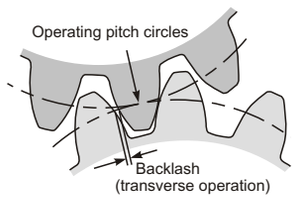
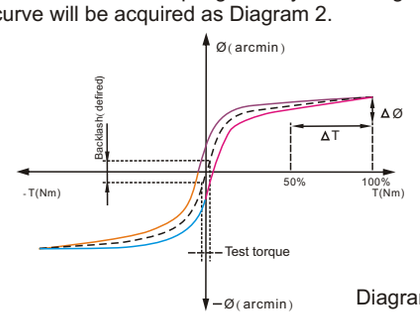
$n_{2N} = \frac{n_{1N}}{i}$ **(Eq.5)**

6. $F_{2rm} = \sqrt[3]{\frac{n_{2a} \times t_a \times F_{2ra}^{\ 3} + n_{2c} \times t_c \times F_{2rc}^{\ 3} + n_{2d} \times t_d \times F_{2rd}^{\ 3}}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$

$F_{2am} = \sqrt[3]{\frac{n_{2a} \times t_a \times F_{2aa}^{\ 3} + n_{2c} \times t_c \times F_{2ac}^{\ 3} + n_{2d} \times t_d \times F_{2ad}^{\ 3}}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$

(Eq.6)

Glossary

Emergency Stop Torque T_{2NOT}	Nm	The Emergency Stop Torque is the maximum permitted torque at the output of gearbox. This may happen only occasionally and may not exceed 1000 times during the whole service life.
Max. Acceleration Torque T_{2B}	Nm	Under the Cyclic Operation (S5), the Max. Acceleration Torque is the maximum torque which can be transmitted only briefly to the output of gearbox up to 1000 cycles/hr.
No Load Running Torque	Nm	The No Load Running Torque is the min. torque to overcome the internal friction of a gearbox without loading*.
Nominal Input Speed n_{1N}	rpm	The Nominal Input Speed is the permitted input speed of gearbox by the Continuous Operation (S1) while the housing temperature does not exceed 90°C. This value is measured at environment temperature 25°C.
Max. Input Speed n_{1B}	rpm	The Max. Input Speed is the max. permitted input speed of gearbox by the Cyclic operation (S5). This value is measured at environment temperature 25°C and serves as the absolute limit of the gearbox.
Backlash	arcmin	The Backlash is the maximum angular measurement between two teeth of gears when the transverse operation occurs (refer to Diagram 1). The arcmin is the measurement unit for the backlash. One arcmin equals 1/ 60 degree, symbolized as 1'.  Diagram 1
Torsional Rigidity	Nm/arcmin	Torsional Rigidity is the quotient (△T / △ Ø) between the applied torque and resulting torsion angle. This value indicates how many torque needed on gearbox to rotate the output shaft for 1 arcmin. The Torsional Rigidity can be determined by Hysteresis Curve. Hysteresis Curve When the input shaft is locked, increase torque at the output slowly up to T_{2B} in both directions and then release the torque gradually. According to the measured torque and torsion angle, a closed curve will be acquired as Diagram 2.  Diagram 2
Efficiency η	%	The transmission efficiency of the gears inside a gearbox (without friction).
Operating Temperature	° C	The Operating Temperature indicates the temperature of gearbox housing.
Lubrication		APEX uses synthetic lubrication grease. There are other grease available, please contact APEX.
Running Noise	dB(A)	The Running Noise is measured depends on gearbox size, the ratio and the speed*. Higher speed induces usually higher noise level, while higher ratio induces lower noise level.
Moment of Inertia J_1	$kg.cm^2$	The Moment of Inertia J1 is a measurement of the effort applied to an object to maintain its momentary condition at rest or rotating.
Breakaway Torque	Nm	The Breakaway Torque is the minimum torque to start the rotation from the input side of gearbox. A smaller size or a higher ratio gearbox requests less Breakaway Torque.
Back Driving Torque	Nm	The Back Driving Torque is the minimum torque to start the rotation from the output side of gearbox. A larger size or a higher ratio gearbox requests greater Back Driving Torque.

* This value is measured at environment temperature 25°C and the input speed 3000 rpm. If the Nominal Input Speed n_{1N} of gearbox is over 3000 rpm, this value is measured by that specific Nominal Input Speed.

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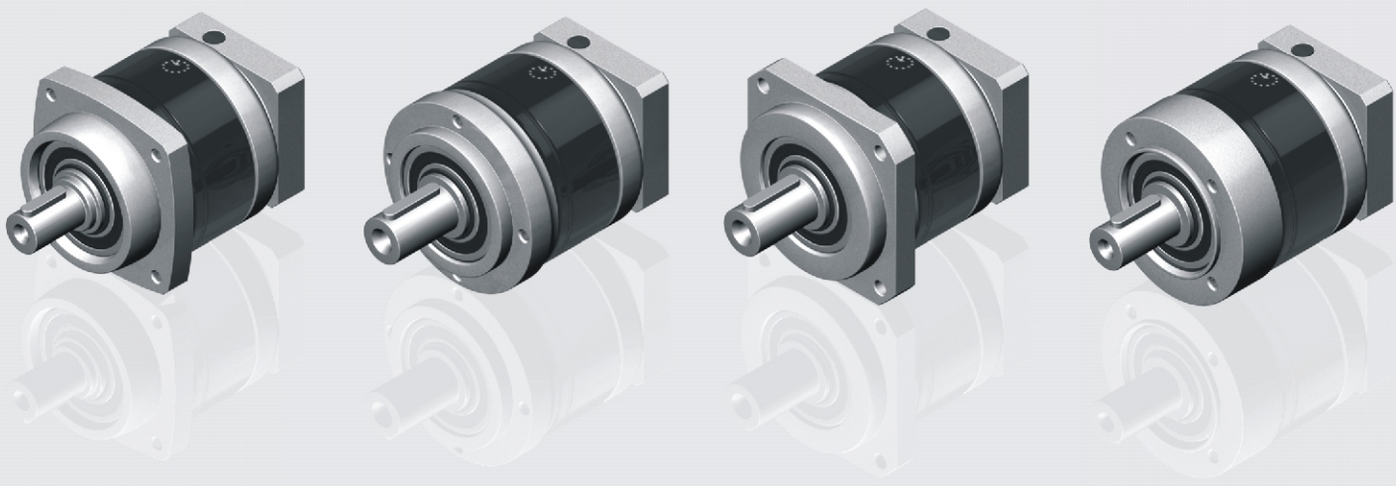
APEX-2013-04-PII SERIES-1.0E-2.0V