APEX DYNAMICS, INC.

PLANETARY GEARBOX
NEW GENERATION P-SERIES

PEII / PGII / PAII / PSII / PNII / PD / PL
PEIIR / PGIIR / PAIIR / PSIIR / PNIIR / PDR / PLR

New Generation P 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

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


PEII


PEIIR


PGII


PGIIR


PAII

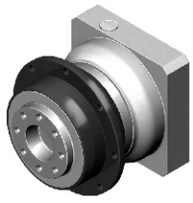

PAIIR


PSII


PSIIR


PNII


PNIIR


PD


PDR


PL


PLR

ORDERING CODE

PEⅡ090	–	010(1)	–	( )(2)	/	MOTOR
PEⅡR090	–	010(1)	–	( )(2)	/	MOTOR

Motor Type :
Manufacturer and Model

Ratio(1):
1-stage: 3, 4, 5, 7 ,9(3) ,10
2-stage: 12(5),15, 16, 20, 25, 30, 35, 40, 50, 70, 81(3), 100
3-stage(4): 120, 160, 200, 280, 350, 500, 700, 1000

Gearbox Size:
PEⅡ: PEⅡ050, PEⅡ070, PEⅡ090, PEⅡ120, PEⅡ155
PGⅡ: PGⅡ040, PGⅡ060, PGⅡ080, PGⅡ120, PGⅡ160
PAⅡ: PAⅡ042, PAⅡ060, PAⅡ090, PAⅡ115, PAⅡ142
PSⅡ: PSⅡA, PSⅡB, PSⅡC, PSⅡD, PSⅡE
PNⅡ: PNⅡ017, PNⅡ023, PNⅡ034, PNⅡ042, PNⅡ056
PD : PD053, PD064, PD090, PD110
PL : PL070, PL090, PL120,

Ordering Example : PEⅡ090 - 010 / SIEMENS 1FT6 041 - 4AF71
PAⅡ090 - 010 - S1 / SIEMENS 1FT6 041 - 4AF71

Gearbox Size:
PEⅡR : PEⅡR050, PEⅡR070, PEⅡR090, PEⅡR120, PEⅡR155
PGⅡR : PGⅡR040, PGⅡR060, PGⅡR080, PGⅡR120, PGⅡR160
PAⅡR : PAⅡR042, PAⅡR060, PAⅡR090, PAⅡR115, PAⅡR142
PSⅡR : PSⅡRA, PSⅡRB, PSⅡRC, PSⅡRD, PSⅡRE
PNⅡR : PNⅡR017, PNⅡR023, PNⅡR034, PNⅡR042, PNⅡR056
PDR : PDR053, PDR064, PDR090, PDR110
PLR : PLR070, PLR090, PLR120

Ordering Example : PEⅡR090 - 010 / SIEMENS 1FT6 041 - 4AF71
PAⅡR090 - 010 - S1 / SIEMENS 1FT6 041 - 4AF71

(1) Ratio ($i = N_{in} / N_{out}$).
(2) S1 = Smooth Output Shaft. S1 shaft is only provided for PAⅡ / PAⅡR series.
S2 = Output Shaft with Key. This is the standard shaft for PⅡ / PⅡR gearbox.
(3) Only provided for PSⅡ/PSⅡR and PAⅡ/PAⅡR series.
(4) Only provided for PGII and PGIIR series.
(5) Only provided for PL and PLR series.

PEII / PEIIR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PEII 050 / PEIIR 050	PEII 070 / PEIIR 070	PEII 090 / PEIIR 090	PEII 120 / PEIIR 120	PEII 155 / PEIIR 155
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217	430
			4		16	42	113	223	440
			5		15	40	118	220	435
			7		12	35	96	198	366
			10		10	27	68	155	295
		2	15		15	40	109	213	424
			16		16	42	116	228	452
			20		16	42	116	230	454
			25		15	40	123	228	450
			30		15	40	108	212	422
			35		12	35	100	206	382
			40		16	43	117	232	459
			50		15	40	123	228	450
			70		12	35	100	206	382
			100		10	27	70	162	308
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	All	3 times T_{2N}				
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	All	T_{2B} = 60% of T_{2NOT}				
No Load Running Torque(4)	Nm	1	3~10	PEII	0.05	0.10	0.40	0.80	2.50
				PEIIR	0.10	0.15	0.45	0.85	2.55
		2	15~100	PEII	0.05	0.10	0.30	0.40	0.80
				PEIIR	0.10	0.15	0.35	0.45	0.85
Backlash(2)	arcmin	1	3~10	PEII	≦ 8	≦ 7	≦ 6	≦ 6	≦ 6
				PEIIR	≦ 12	≦ 11	≦ 10	≦ 10	≦ 10
		2	15~100	PEII	≦ 10	≦ 9	≦ 8	≦ 8	≦ 8
				PEIIR	≦ 14	≦ 13	≦ 12	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	0.9	2.2	8	12	16
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,500	4,000	3,600	3,600	2,500
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	8,000	6,000	6,000	4,800	3,600
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	810	1,150	1,530	3,260	4,550
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	405	575	765	1,630	2,275
Service Life(5)	hr	1,2	3~100	All	20,000				
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C				
Degree of Gearbox Protection		1,2	3~100	All	IP65				
Lubrication		1,2	3~100	All	Synthetic lubrication grease				
Mounting Position		1,2	3~100	All	All directions				
Running Noise(4)	dB(A)	1,2	3~100	PEII	≦ 60	≦ 62	≦ 64	≦ 66	≦ 68
				PEIIR	≦ 70	≦ 72	≦ 74	≦ 75	≦ 77
Efficiency η	%	1	3~10	PEII	≧ 97%				
				PEIIR	≧ 93%				
		2	15~100	PEII	≧ 94%				
				PEIIR	≧ 90%				

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

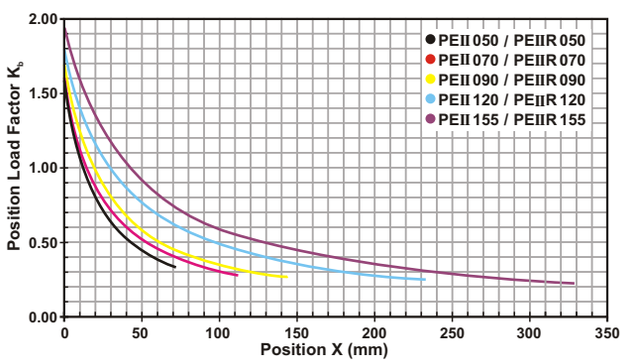
PEII Gearbox Inertia

Model No.		PEII 050		PEII 070		PEII 090		PEII 120		PEII 155	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.10	0.10	0.12	0.10	-	-	-	-	-	-
11		0.16	0.16	0.19	0.16	-	-	-	-	-	-
14		0.20	0.20	0.22	0.20	0.36	0.24	-	-	-	-
19		-	-	1.53	1.51	1.70	1.58	2.20	1.73	-	2.18
24		-	-	-	-	2.24	2.12	2.74	2.27	4.52	2.73
28		-	-	-	-	2.68	2.55	3.17	2.70	4.94	3.15
32		-	-	-	-	-	-	7.77	7.30	9.70	7.91
35		-	-	-	-	-	-	10.80	10.30	12.80	11.00
38		-	-	-	-	-	-	14.00	13.50	16.00	14.20
42		-	-	-	-	-	-	-	-	24.50	-

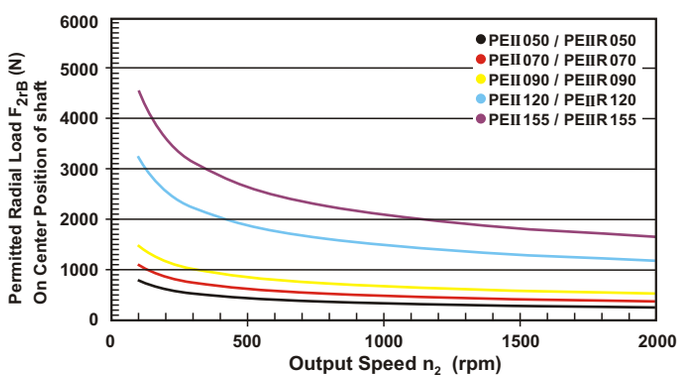
PEIIR Gearbox Inertia

Model No.		PEIIR 050		PEIIR 070		PEIIR 090		PEIIR 120		PEIIR 155	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.18	0.18	0.36	0.36	-	-	-	-	-	-
11		0.20	0.20	0.39	0.39	-	-	-	-	-	-
14		0.24	0.24	0.43	0.43	1.87	1.87	-	-	-	-
19		-	-	1.24	1.24	2.67	2.67	6.80	6.80	-	13.57
24		-	-	-	-	2.97	2.97	7.10	7.10	13.87	13.87
28		-	-	-	-	3.47	3.47	7.59	7.59	14.36	14.36
32		-	-	-	-	-	-	10.56	10.56	17.33	17.33
35		-	-	-	-	-	-	11.97	11.97	18.74	18.74
38		-	-	-	-	-	-	13.95	13.95	20.79	20.79
42		-	-	-	-	-	-	-	-	26.54	-

Permitted Radial And Axial Loads[B]



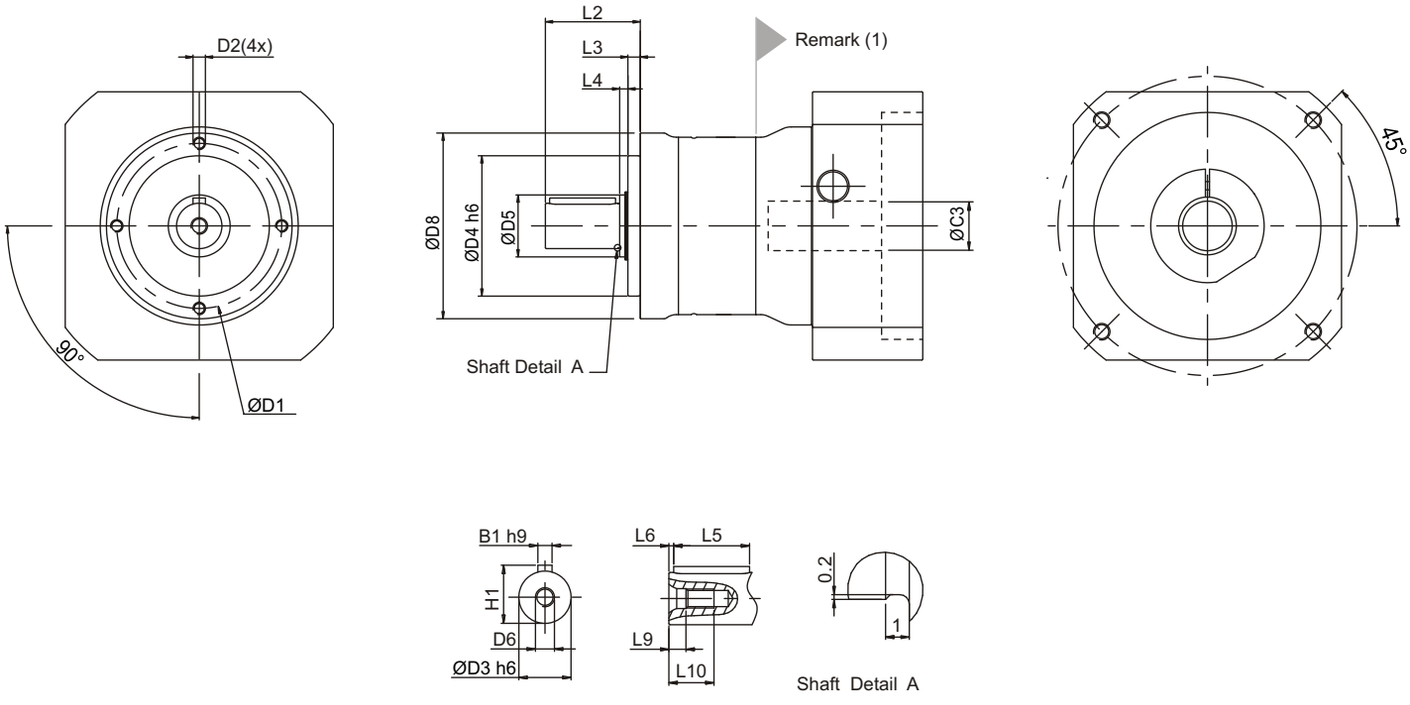
If radial force F_{2r} is not exerted on the center of the output shaft X<1/2 L or X>1/2 L, the permitted radial and axial loads can be calculated by the position load factor K_b on the above diagram.



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

(A) Ø = Input shaft diameter.
(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.
(C) For Continuous Operation(S1), the service life reduced to 50%.

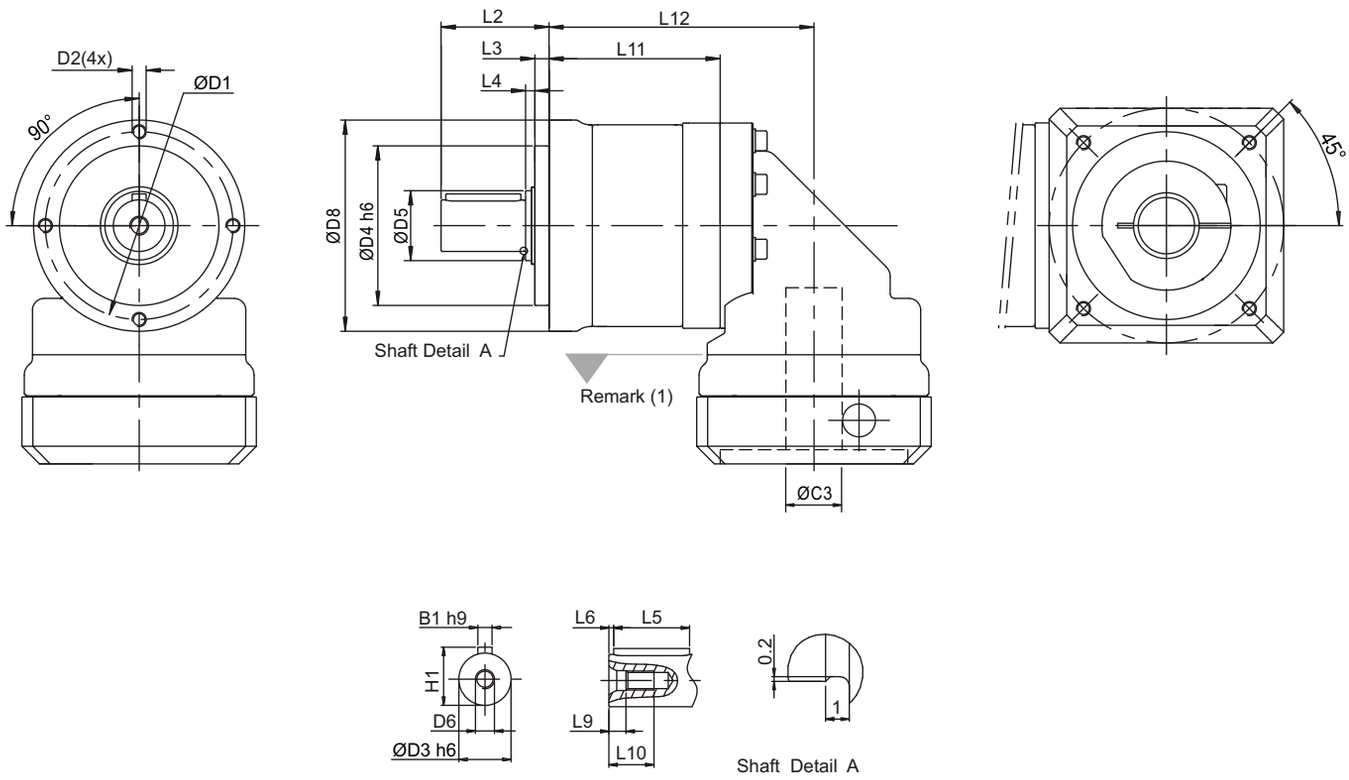
PEII Series Dimension



Dimension		PEII 050		PEII 070		PEII 090		PEII 120		PEII 155	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		44		62		80		108		140	
D2		M4X9		M5X10		M6X12		M8X15		M10X18	
D3	h6	12		16		22		32		40	
D4	h6	35		52		68		90		120	
D5		17		22		30		40		55	
D6		M4X0.7P		M5X0.8P		M8X1.25P		M12X1.75P		M16X2P	
D8		50		70		90		120		155	
L2		24.5		36		46		70		97	
L3		4		4.5		6		7		9.5	
L4		2.5		3.5		4		5		5.5	
L5		14		25		32		50		70	
L6		2		2		2		4		6	
L9		4.5		4.8		7.2		10		12	
L10		10		12.5		19		28		36	
B1	h9	4		5		6		10		12	
H1		13.5		18		24.5		35		43	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PEIIR Series Dimension



Dimension		PEIIR 050		PEIIR 070		PEIIR 090		PEIIR 120		PEIIR 155	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		44		62		80		108		140	
D2		M4X9		M5X10		M6X12		M8X15		M10X18	
D3	h6	12		16		22		32		40	
D4	h6	35		52		68		90		120	
D5		17		22		30		40		55	
D6		M4X0.7P		M5X0.8P		M8X1.25P		M12X1.75P		M16X2P	
D8		50		70		90		120		155	
L2		24.5		36		46		70		97	
L3		4		4.5		6		7		9.5	
L4		2.5		3.5		4		5		5.5	
L5		14		25		32		50		70	
L6		2		2		2		4		6	
L9		4.5		4.8		7.2		10		12	
L10		10		12.5		19		28		36	
L11		49.5	64.5	60	80	73	99.5	101	137	121	168.5
L12		74.5	89.5	89.5	109.5	113	139.5	152	188	178	225.5
B1	h9	4		5		6		10		12	
H1		13.5		18		24.5		35		43	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PGII / PGIIR Gearbox Performance

Model No.		Stages[6]	Ratio[1]	Type	PGII 040 / PGIIR 040	PGII 060 / PGIIR 060	PGII 080 / PGIIR 080	PGII 120 / PGIIR 120	PGII 160 / PGIIR 160
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217	430
			4		16	42	113	223	440
			5		15	40	118	220	435
			7		12	35	96	198	366
			10		10	27	68	155	295
		2	15		15	40	109	213	424
			16		16	42	116	228	452
			20		16	42	116	230	454
			25		15	40	123	228	450
			30		15	40	108	212	422
			35		12	35	100	206	382
			40		16	43	117	232	459
			50		15	40	123	228	450
			70		12	35	100	206	382
			100		10	27	70	162	308
		3	120		19	50	137	-	-
			160		16	43	118	-	-
			200		16	43	118	-	-
			280		12	35	99	-	-
			350		12	35	99	-	-
			500		15	40	122	-	-
			700		12	35	99	-	-
			1000		10	27	70	-	-
Emergency Stop Torque T_{2NOT}	Nm	1,2,3	3~1000	All	3 times T_{2N}				
Max. Acceleration Torque T_{2B}	Nm	1,2,3	3~1000	All	T_{2B} = 60% of T_{2NOT}				
No Load Running Torque[4]	Nm	1	3~10	PGII	0.05	0.10	0.40	0.80	2.50
				PGIIR	0.10	0.15	0.45	0.85	2.55
		2	15~100	PGII	0.05	0.10	0.30	0.40	0.80
				PGIIR	0.10	0.15	0.35	0.45	0.85
		3	120~1000	PGII	0.05	0.10	0.40	-	-
				PGIIR	0.10	0.15	0.45	-	-
Backlash[2]	arcmin	1	3~10	PGII	≦ 8	≦ 7	≦ 6	≦ 6	≦ 6
				PGIIR	≦ 12	≦ 11	≦ 10	≦ 10	≦ 10
		2	15~100	PGII	≦ 10	≦ 9	≦ 8	≦ 8	≦ 8
				PGIIR	≦ 14	≦ 13	≦ 12	≦ 12	≦ 12
		3	120~1000	PGII	≦ 12	≦ 11	≦ 10	-	-
				PGIIR	≦ 16	≦ 15	≦ 14	-	-
Torsional Rigidity	Nm/arcmin	1,2,3	3~1000	All	0.5	2	8	12	16
Nominal Input Speed n_{1N}	rpm	1,2,3	3~1000	All	4,500	4,000	3,600	3,600	2,500
Max. Input Speed n_{1B}	rpm	1,2,3	3~1000	All	8,000	6,000	6,000	4,800	3,600
Max. Radial Load F_{2rB}[3]	N	1,2,3	3~1000	All	520	1,030	1,570	3,590	4,690
Max. Axial Load F_{2aB}[3]	N	1,2,3	3~1000	All	260	515	785	1,795	2,345
Service Life[5]	hr	1,2,3	3~1000	All	20,000				
Operating Temp	° C	1,2,3	3~1000	All	0° C~ +90° C				
Degree of Gearbox Protection		1,2,3	3~1000	All	IP65				
Lubrication		1,2,3	3~1000	All	Synthetic lubrication grease				
Mounting Position		1,2,3	3~1000	All	All directions				
Running Noise[4]	dB(A)	1,2,3	3~1000	PGII	≦ 60	≦ 62	≦ 64	≦ 66	≦ 68
				PGIIR	≦ 70	≦72	≦ 74	≦ 75	≦77
Efficiency η	%	1	3~10	PGII	≧ 97%				
				PGIIR	≧ 93%				
		2	15~100	PGII	≧ 94%				
				PGIIR	≧ 90%				
		3	120~1000	PGII	≧ 91%				
				PGIIR	≧ 87%				

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage), ratio = 100 (2-stage) and ratio = 1,000 (3-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.
(6) 3-stage is available for following types: PGII040, PGII060,PGII080, PGIIR040, PGIIR060 and PGIIR080.

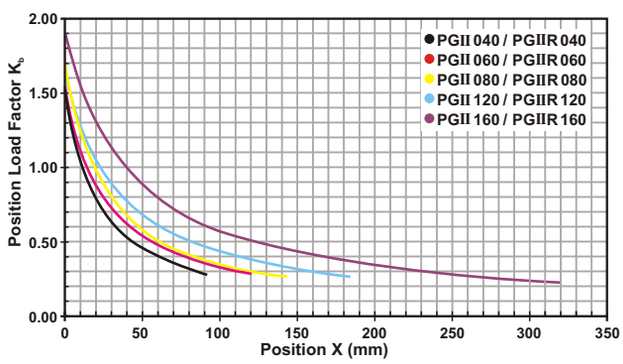
PGII Gearbox Inertia

Model No.		PGII 040			PGII 060			PGII 080			PGII 120		PGII 160	
Ø(A) (C3)		1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	1-st.	2-st.
8	kg.cm²	0.10	0.10	0.10	0.12	0.10	0.10	-	-	-	-	-	-	-
11		0.16	0.16	0.16	0.19	0.16	0.16	-	-	-	-	-	-	-
14		0.20	0.20	0.19	0.22	0.20	0.20	0.36	0.24	0.20	-	-	-	-
19		-	-	-	1.53	1.51	1.51	1.70	1.58	1.54	2.20	1.73	-	2.18
24		-	-	-	-	-	-	2.24	2.12	2.09	2.74	2.27	4.52	2.73
28		-	-	-	-	-	-	2.68	2.55	2.52	3.17	2.70	4.94	3.15
32		-	-	-	-	-	-	-	-	-	7.77	7.30	9.70	7.91
35		-	-	-	-	-	-	-	-	-	10.80	10.30	12.80	11.00
38		-	-	-	-	-	-	-	-	-	14.00	13.50	16.00	14.20
42		-	-	-	-	-	-	-	-	-	-	-	24.50	-

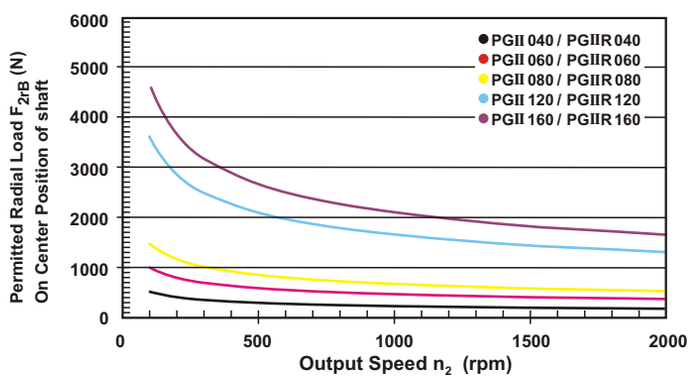
PGIIR Gearbox Inertia

Model No.		PGIIR 040			PGIIR 060			PGIIR 080			PGIIR 120		PGIIR 160	
Ø(A) (C3)		1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	1-st.	2-st.
8	kg.cm²	0.18	0.18	0.18	0.36	0.36	0.36	-	-	-	-	-	-	-
11		0.20	0.20	0.20	0.39	0.39	0.39	-	-	-	-	-	-	-
14		0.24	0.24	0.24	0.43	0.43	0.43	1.87	1.87	1.87	-	-	-	-
19		-	-	-	1.24	1.24	1.24	2.67	2.67	2.67	6.80	6.80	-	13.57
24		-	-	-	-	-	-	2.97	2.97	2.97	7.10	7.10	13.87	13.87
28		-	-	-	-	-	-	3.47	3.47	3.47	7.59	7.59	14.36	14.36
32		-	-	-	-	-	-	-	-	-	10.56	10.56	17.33	17.33
35		-	-	-	-	-	-	-	-	-	11.97	11.97	18.74	18.74
38		-	-	-	-	-	-	-	-	-	13.95	13.95	20.79	20.79
42		-	-	-	-	-	-	-	-	-	-	-	26.54	-

Permitted Radial And Axial Loads(B)



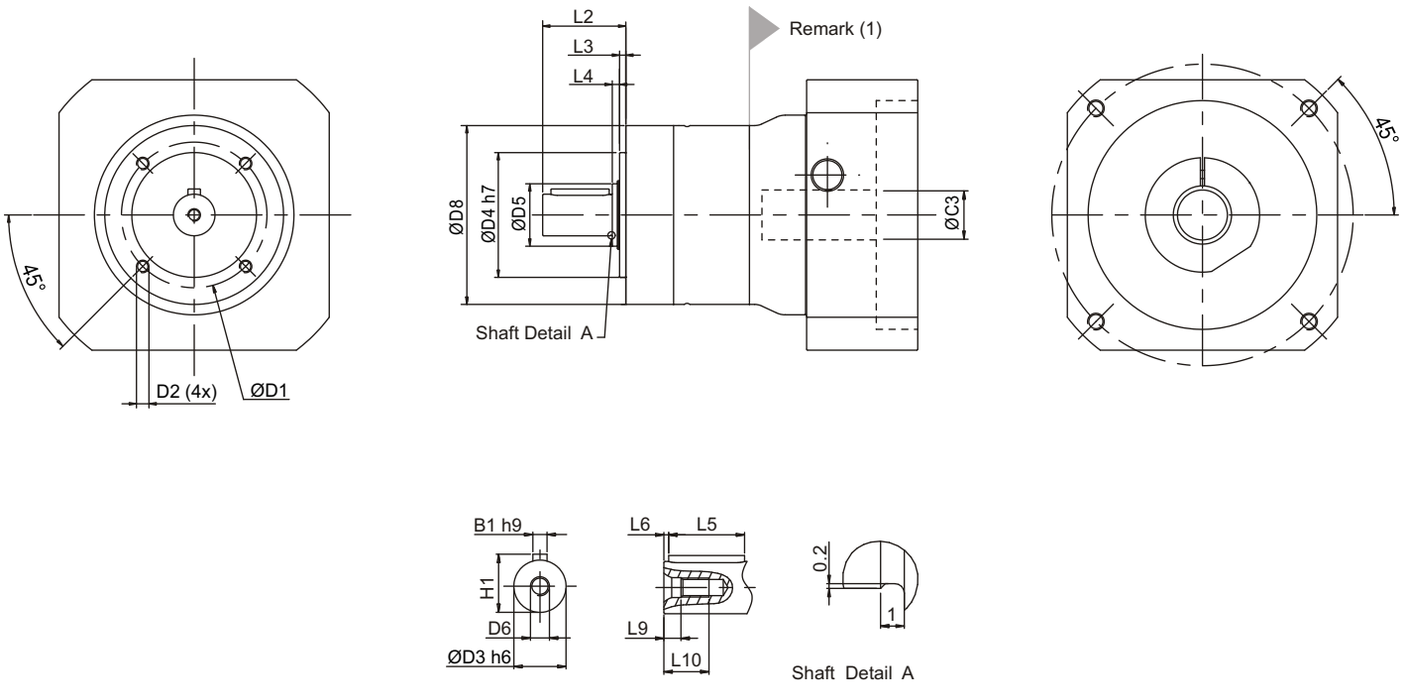
If radial force F_{2r} is not exerted on the center of the output shaft X<1/2 L or X>1/2 L, the permitted radial and axial loads can be calculated by the position load factor K_b on the above diagram.



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

(A) Ø = Input shaft diameter.
(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.
(C) For Continuous Operation(S1), the service life reduced to 50%.

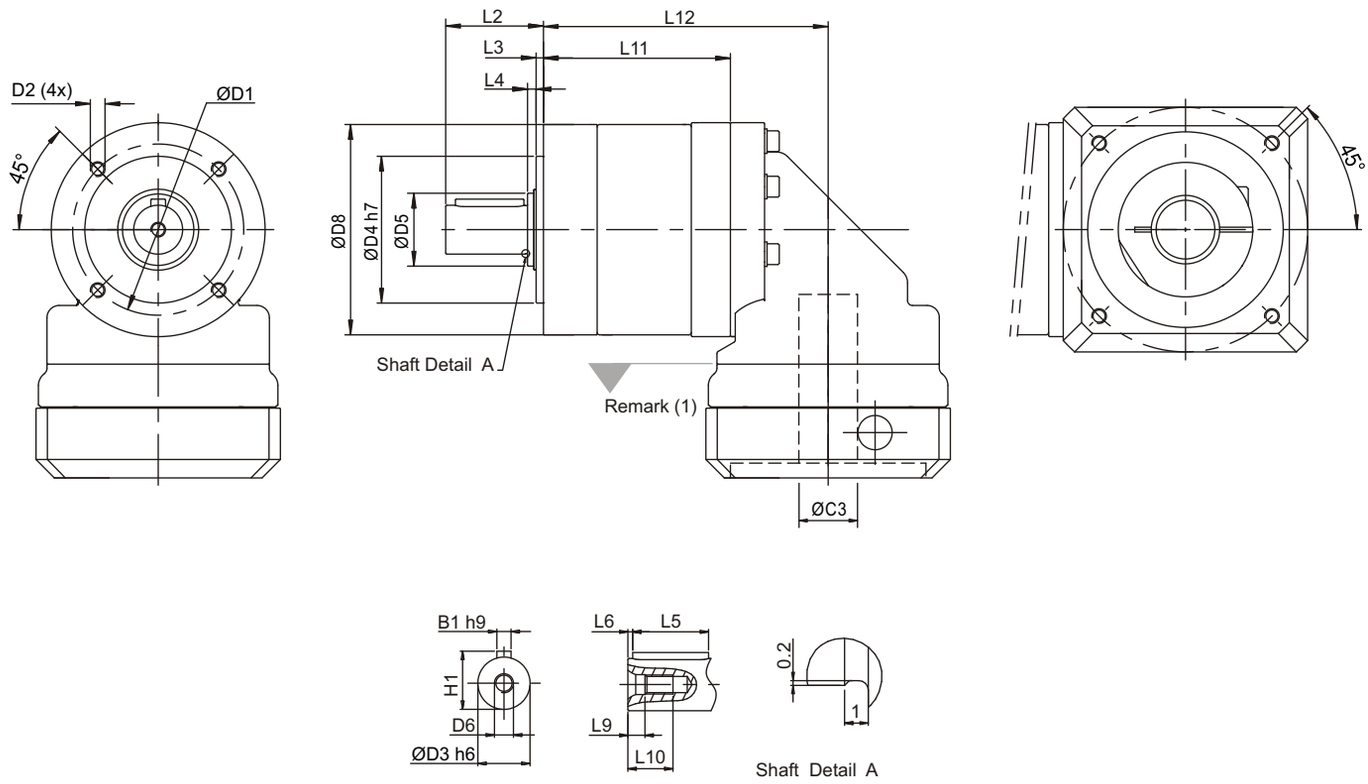
PGII Series Dimension



Dimension		PGII 040			PGII 060			PGII 080			PGII 120			PGII 160		
		1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	-	1-st.	2-st.	-
D1		34			52			70			100			145		
D2		M4X9			M5X10			M6X12			M10X18			M12X22		
D3	h6	10			14			20			25			40		
D4	h7	26			40			60			80			130		
D5		17			17			30			40			55		
D6		M3X0.5P			M5X0.8P			M6X1P			M10X1.5P			M16X2P		
D8		44			60			86			114			160		
L2		26			35			40			55			87		
L3		2			3			3			4			5		
L4		1			2			3.5			5			5.5		
L5		18			25			28			40			65		
L6		2.5			2.5			4			5			8		
L9		2.6			4.8			5			7.5			12		
L10		9			12.5			16.5			22			36		
B1	h9	3			5			6			8			12		
H1		11.2			16			22.5			28			43		

(1) Dimensions are related to motor interface. Please contact APEX for details.

PGIIR Series Dimension



Dimension		PGIIR 040			PGIIR 060			PGIIR 080			PGIIR 120			PGIIR 160		
		1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	3-st.	1-st.	2-st.	-	1-st.	2-st.	-
D1		34			52			70			100			145		
D2		M4X9			M5X10			M6X12			M10X18			M12X22		
D3	h6	10			14			20			25			40		
D4	h7	26			40			60			80			130		
D5		17			17			30			40			55		
D6		M3X0.5P			M5X0.8P			M6X1P			M10X1.5P			M16X2P		
D8		44			60			86			114			160		
L2		26			35			40			55			87		
L3		2			3			3			4			5		
L4		1			2			3.5			5			5.5		
L5		18			25			28			40			65		
L6		2.5			2.5			4			5			8		
L9		2.6			4.8			5			7.5			12		
L10		9			12.5			16.5			22			36		
L11		53	68	82	66.5	86.5	105.5	76.5	103	128.5	104	140	-	125.5	173	-
L12		78	93	107	96	116	135	116.5	143	168.5	155	191	-	182.5	230	-
B1	h9	3			5			6			8			12		
H1		11.2			16			22.5			28			43		

(1) Dimensions are related to motor interface. Please contact APEX for details.

PAII / PAIIR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PAII 042	PAII 060	PAII 090	PAII 115	PAII 142
					PAIIR 042	PAIIR 060	PAIIR 090	PAIIR 115	PAIIR 142
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217	430
			4		16	42	113	223	440
			5		15	40	118	220	435
			7		12	35	96	198	366
			9		8	24	60	125	273
			10		10	27	68	155	295
		2	15		15	40	109	213	424
			16		16	42	116	228	452
			20		16	42	116	230	454
			25		15	40	123	228	450
			30		15	40	108	212	422
			35		12	35	100	206	382
			40		16	43	117	232	459
			50		15	40	123	228	450
			70		12	35	100	206	382
			81		8	24	59	131	285
			100		10	27	70	162	308
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	All	3 times T_{2N}				
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	All	T_{2B} = 60% of T_{2NOT}				
No Load Running Torque(4)	Nm	1	3~10	PAII	0.05	0.10	0.40	0.80	2.50
				PAIIR	0.10	0.15	0.45	0.85	2.55
		2	15~100	PAII	0.05	0.10	0.30	0.40	0.80
				PAIIR	0.10	0.15	0.35	0.45	0.85
Backlash(2)	arcmin	1	3~10	PAII	≦ 8	≦ 7	≦ 6	≦ 6	≦ 6
				PAIIR	≦ 12	≦ 11	≦ 10	≦ 10	≦ 10
		2	15~100	PAII	≦ 10	≦ 9	≦ 8	≦ 8	≦ 8
				PAIIR	≦ 14	≦ 13	≦ 12	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	0.9	2.2	8	12	16
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,500	4,000	3,600	3,600	2,500
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	8,000	6,000	6,000	4,800	3,600
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	810	1,150	1,530	3,470	4,640
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	405	575	765	1,735	2,320
Service Life(5)	hr	1,2	3~100	All	20,000				
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C				
Degree of Gearbox Protection		1,2	3~100	All	IP65				
Lubrication		1,2	3~100	All	Synthetic lubrication grease				
Mounting Position		1,2	3~100	All	All directions				
Running Noise(4)	dB(A)	1,2	3~100	PAII	≦ 60	≦ 62	≦ 64	≦ 66	≦ 68
				PAIIR	≦ 70	≦ 72	≦ 74	≦ 75	≦ 77
Efficiency η	%	1	3~10	PAII	≧ 97%				
				PAIIR	≧ 93%				
		2	15~100	PAII	≧ 94%				
				PAIIR	≧ 90%				

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

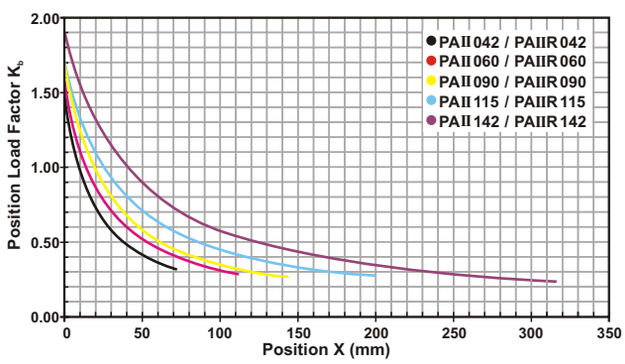
PAII Gearbox Inertia

Model No.		PAII 042		PAII 060		PAII 090		PAII 115		PAII 142	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.10	0.10	0.12	0.10	-	-	-	-	-	-
11		0.16	0.16	0.19	0.16	-	-	-	-	-	-
14		0.20	0.20	0.22	0.20	0.36	0.24	-	-	-	-
19		-	-	1.53	1.51	1.70	1.58	2.20	1.73	-	2.18
24		-	-	-	-	2.24	2.12	2.74	2.27	4.52	2.73
28		-	-	-	-	2.68	2.55	3.17	2.70	4.94	3.15
32		-	-	-	-	-	-	7.77	7.30	9.70	7.91
35		-	-	-	-	-	-	10.80	10.30	12.80	11.00
38		-	-	-	-	-	-	14.00	13.50	16.00	14.20
42		-	-	-	-	-	-	-	-	24.50	-

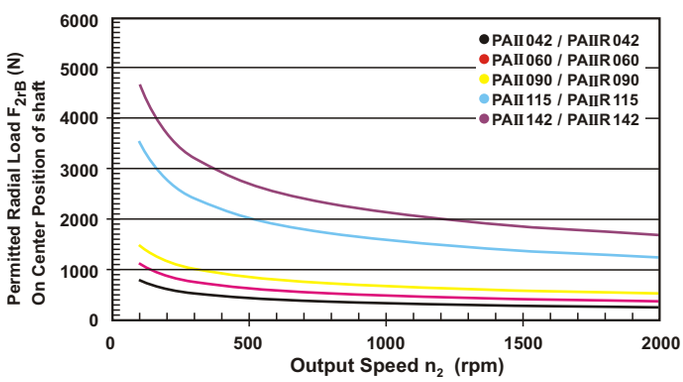
PAIIR Gearbox Inertia

Model No.		PAIIR 042		PAIIR 060		PAIIR 090		PAIIR 115		PAIIR 142	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.18	0.18	0.36	0.36	-	-	-	-	-	-
11		0.20	0.20	0.39	0.39	-	-	-	-	-	-
14		0.24	0.24	0.43	0.43	1.87	1.87	-	-	-	-
19		-	-	1.24	1.24	2.67	2.67	6.80	6.80	-	13.57
24		-	-	-	-	2.97	2.97	7.10	7.10	13.87	13.87
28		-	-	-	-	3.47	3.47	7.59	7.59	14.36	14.36
32		-	-	-	-	-	-	10.56	10.56	17.33	17.33
35		-	-	-	-	-	-	11.97	11.97	18.74	18.74
38		-	-	-	-	-	-	13.95	13.95	20.79	20.79
42		-	-	-	-	-	-	-	-	26.54	-

Permitted Radial And Axial Loads[B]



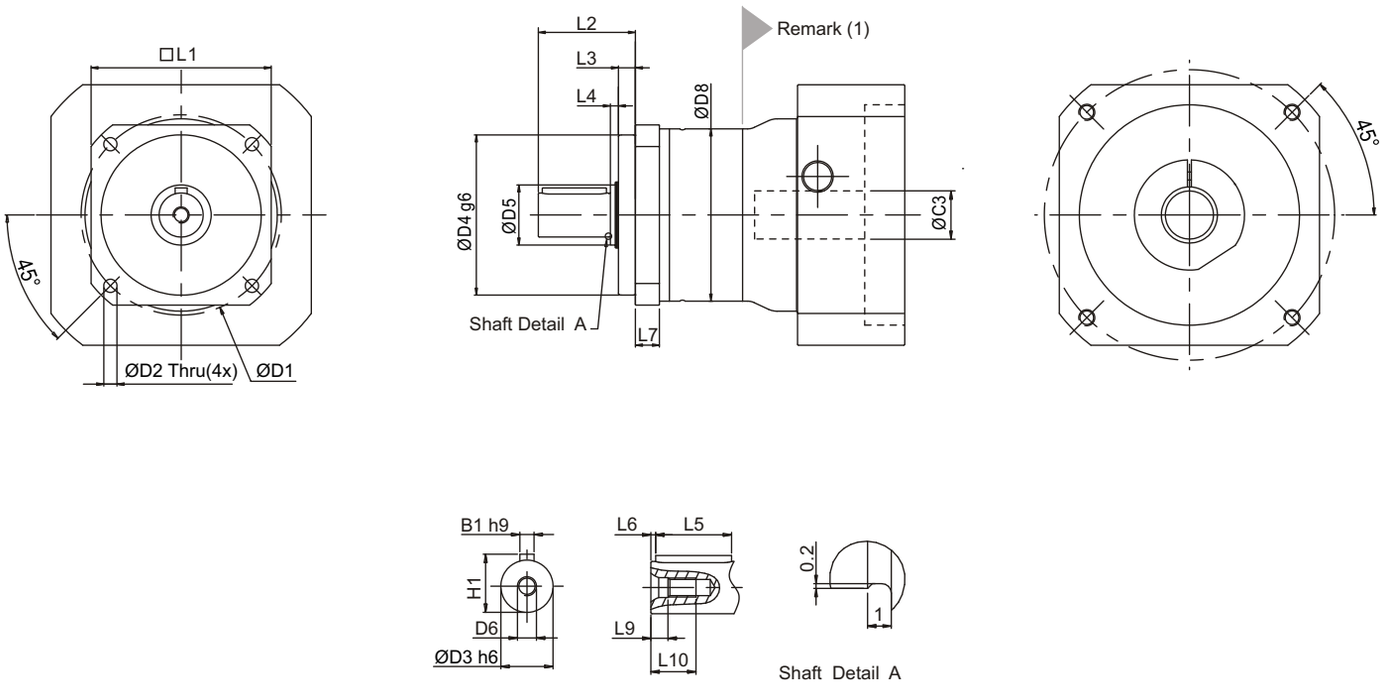
If radial force F_{2r} is not exerted on the center of the output shaft X<1/2 L or X>1/2 L, the permitted radial and axial loads can be calculated by the position load factor K_b on the above diagram.



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

(A) Ø = Input shaft diameter.
(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.
(C) For Continuous Operation(S1), the service life reduced to 50%.

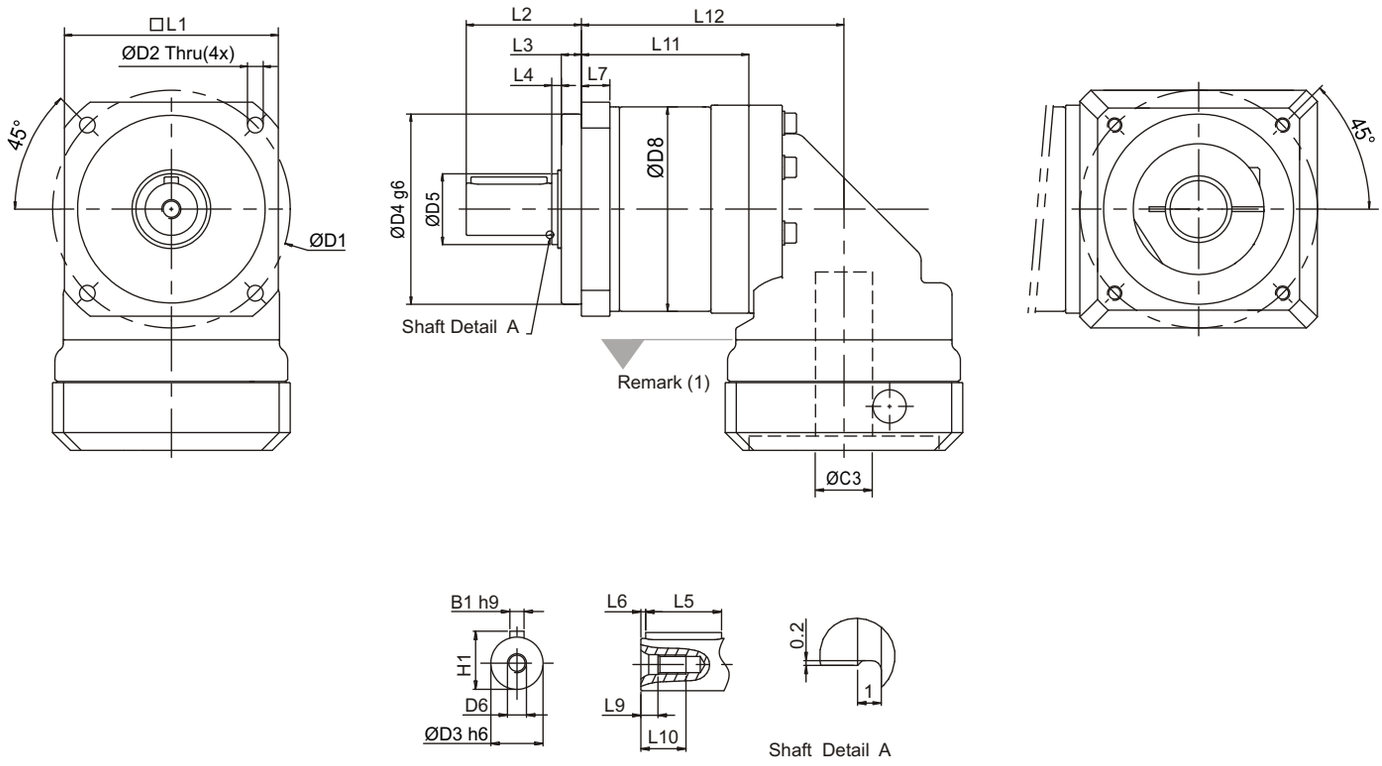
PAII Series Dimension



Dimension		PAII 042		PAII 060		PAII 090		PAII 115		PAII 142	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		50		70		100		130		165	
D2		3.4		5.5		6.6		9		11	
D3	h6	13		16		22		32		40	
D4	g6	35		50		80		110		130	
D5		17		22		30		40		55	
D6		M4X0.7P		M5X0.8P		M8X1.25P		M12X1.75P		M16X2P	
D8		44		60		86		114		140	
L1		42		60		90		115		142	
L2		26		37		48.5		65		97	
L3		5.5		5.5		8.5		10		12.5	
L4		2.5		3.5		4		5		5.5	
L5		14		25		32		40		63	
L6		2		2		2		5		5	
L7		6.5		10		12		16		20	
L9		4.5		4.8		7.2		10		12	
L10		10		12.5		19		28		36	
B1	h9	5		5		6		10		12	
H1		15		18		24.5		35		43	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PAIIR Series Dimension



Dimension		PAIIR 042		PAIIR 060		PAIIR 090		PAIIR 115		PAIIR 142	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		50		70		100		130		165	
D2		3.4		5.5		6.6		9		11	
D3	h6	13		16		22		32		40	
D4	g6	35		50		80		110		130	
D5		17		22		30		40		55	
D6		M4X0.7P		M5X0.8P		M8X1.25P		M12X1.75P		M16X2P	
D8		44		60		86		114		140	
L1		42		60		90		115		142	
L2		26		37		48.5		65		97	
L3		5.5		5.5		8.5		10		12.5	
L4		2.5		3.5		4		5		5.5	
L5		14		25		32		40		63	
L6		2		2		2		5		5	
L7		6.5		10		12		16		20	
L9		4.5		4.8		7.2		10		12	
L10		10		12.5		19		28		36	
L11		48	63	59	79	70.5	97	98	134	118	165.5
L12		73	88	88.5	108.5	110.5	137	149	185	175	222.5
B1	h9	5		5		6		10		12	
H1		15		18		24.5		35		43	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PSII / PSIIR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PSII A / PSIIR A	PSII B / PSIIR B	PSII C / PSIIR C	PSII D / PSIIR D	PSII E / PSIIR E
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217	430
			4		16	42	113	223	440
			5		15	40	118	220	435
			7		12	35	96	198	366
			9		8	24	60	125	273
			10		10	27	68	155	295
		2	15		15	40	109	213	424
			16		16	42	116	228	452
			20		16	42	116	230	454
			25		15	40	123	228	450
			30		15	40	108	212	422
			35		12	35	100	206	382
			40		16	43	117	232	459
			50		15	40	123	228	450
			70		12	35	100	206	382
			81		8	24	59	131	285
			100		10	27	70	162	308
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	All	3 times T_{2N}				
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	All	T_{2B} = 60% of T_{2NOT}				
No Load Running Torque(4)	Nm	1	3~10	PSII	0.05	0.10	0.40	0.80	2.50
				PSIIR	0.10	0.15	0.45	0.85	2.55
		2	15~100	PSII	0.05	0.10	0.30	0.40	0.80
				PSIIR	0.10	0.15	0.35	0.45	0.85
Backlash(2)	arcmin	1	3~10	PSII	≦ 8	≦ 7	≦ 6	≦ 6	≦ 6
				PSIIR	≦ 12	≦ 11	≦ 10	≦ 10	≦ 10
		2	15~100	PSII	≦ 10	≦ 9	≦ 8	≦ 8	≦ 8
				PSIIR	≦ 14	≦ 13	≦ 12	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	0.6	1.5	6	10.5	18
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,500	4,000	3,600	3,600	2,500
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	8,000	6,000	6,000	4,800	3,600
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	840	1,290	1,510	3,780	5,420
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	420	645	755	1,890	2,710
Service Life(5)	hr	1,2	3~100	All	20,000				
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C				
Degree of Gearbox Protection		1,2	3~100	All	IP65				
Lubrication		1,2	3~100	All	Synthetic lubrication grease				
Mounting Position		1,2	3~100	All	All directions				
Running Noise(4)	dB(A)	1,2	3~100	PSII	≦ 60	≦ 62	≦ 64	≦ 66	≦ 68
				PSIIR	≦ 70	≦ 72	≦ 74	≦ 75	≦ 77
Efficiency η	%	1	3~10	PSII	≧ 97%				
				PSIIR	≧ 93%				
		2	15~100	PSII	≧ 94%				
				PSIIR	≧ 90%				

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

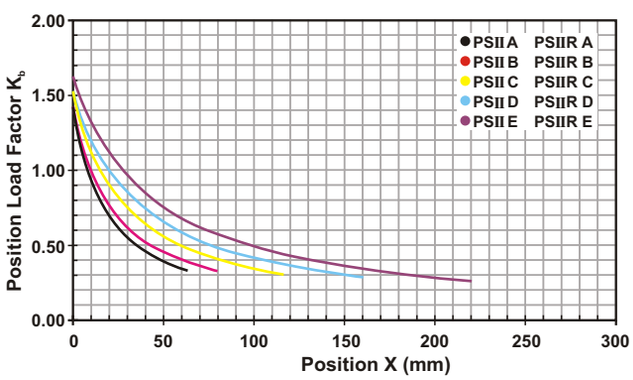
PSII Gearbox Inertia

Model No.		PSII A		PSII B		PSII C		PSII D		PSII E	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.10	0.10	0.12	0.10	-	-	-	-	-	-
11		0.16	0.16	0.19	0.16	-	-	-	-	-	-
14		0.20	0.20	0.22	0.20	0.36	0.24	-	-	-	-
19		-	-	1.53	1.51	1.70	1.58	2.20	1.73	-	2.18
24		-	-	-	-	2.24	2.12	2.74	2.27	4.52	2.73
28		-	-	-	-	2.68	2.55	3.17	2.70	4.94	3.15
32		-	-	-	-	-	-	7.77	7.30	9.70	7.91
35		-	-	-	-	-	-	10.80	10.30	12.80	11.00
38		-	-	-	-	-	-	14.00	13.50	16.00	14.20
42		-	-	-	-	-	-	-	-	24.50	-

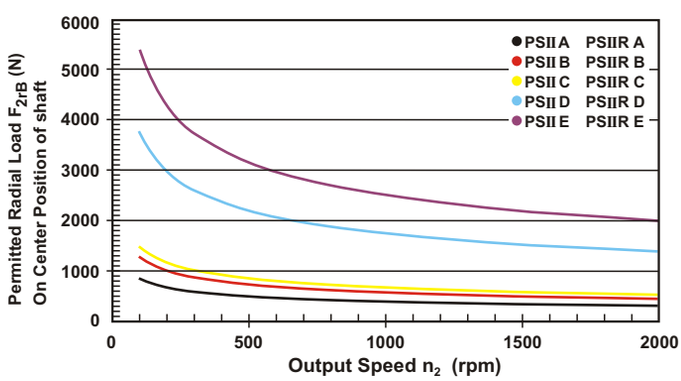
PSIIR Gearbox Inertia

Model No.		PSIIR A		PSIIR B		PSIIR C		PSIIR D		PSIIR E	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.18	0.18	0.36	0.36	-	-	-	-	-	-
11		0.20	0.20	0.39	0.39	-	-	-	-	-	-
14		0.24	0.24	0.43	0.43	1.87	1.87	-	-	-	-
19		-	-	1.24	1.24	2.67	2.67	6.80	6.80	-	13.57
24		-	-	-	-	2.97	2.97	7.10	7.10	13.87	13.87
28		-	-	-	-	3.47	3.47	7.59	7.59	14.36	14.36
32		-	-	-	-	-	-	10.56	10.56	17.33	17.33
35		-	-	-	-	-	-	11.97	11.97	18.74	18.74
38		-	-	-	-	-	-	13.95	13.95	20.79	20.79
42		-	-	-	-	-	-	-	-	26.54	-

Permitted Radial And Axial Loads[B]



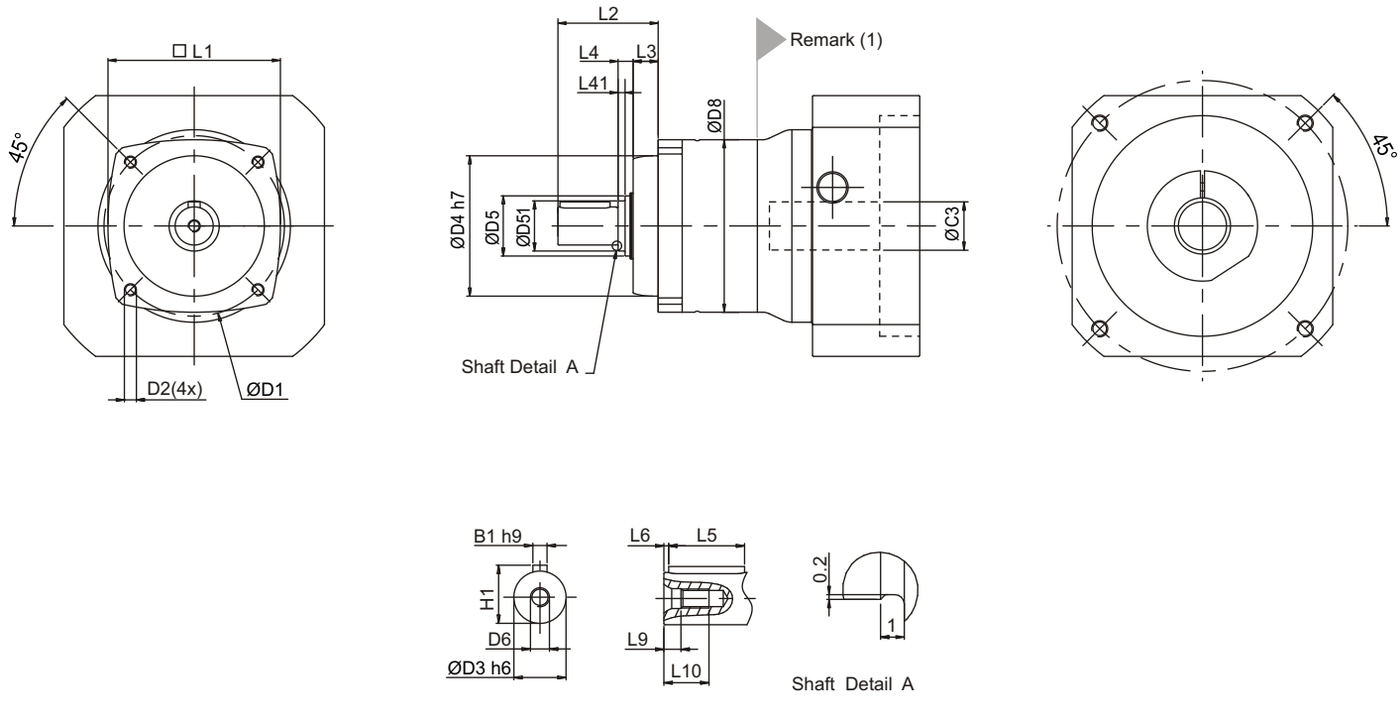
If radial force F_{2r} is not exerted on the center of the output shaft X<1/2 L or X>1/2 L, the permitted radial and axial loads can be calculated by the position load factor K_b on the above diagram.



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

(A) Ø = Input shaft diameter.
(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.
(C) For Continuous Operation(S1), the service life reduced to 50%.

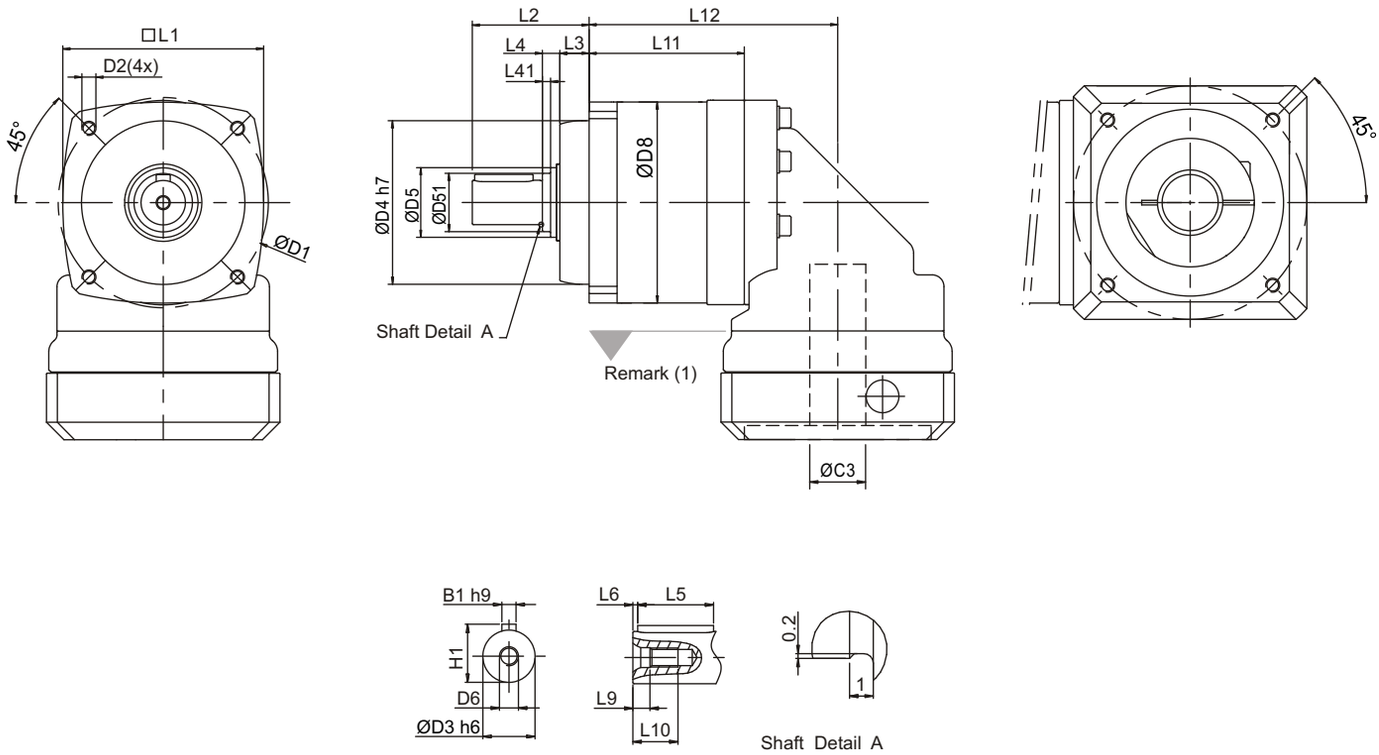
PSII Series Dimension



Dimension		PSII A		PSII B		PSII C		PSII D		PSII E	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		47		60		90		115		135	
D2		M4X9		M5X10		M6X12		M8X18.5		M10X18	
D3	h6	10		12		19		24		32	
D4	h7	38		50		70		90		110	
D5		17		22		30		40		55	
D51		-		-		25		-		-	
D6		M3X0.5P		M4X0.7P		M6X1P		M8X1.25P		M12X1.75P	
D8		44		60		86		114		140	
L1		44		60		86		114		140	
L2		25		32		50		61		75	
L3		6.5		8.5		12.5		16		14.5	
L4		2.5		3.5		7.5		5		5.5	
L41		-		-		3.5		-		-	
L5		10		16		25		32		50	
L6		3		2		1		3		2	
L9		2.6		4.5		5		7.2		10	
L10		9		10		16.5		19		28	
B1	h9	3		4		6		8		10	
H1		11.2		13.5		21.5		27		35	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PSⅡR Series Dimension



Dimension		PSⅡR A		PSⅡR B		PSⅡR C		PSⅡR D		PSⅡR E	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		47		60		90		115		135	
D2		M4X9		M5X10		M6X12		M8X18.5		M10X18	
D3	h6	10		12		19		24		32	
D4	h7	38		50		70		90		110	
D5		17		22		30		40		55	
D51		-		-		25		-		-	
D6		M3X0.5P		M4X0.7P		M6X1P		M8X1.25P		M12X1.75P	
D8		44		60		86		114		140	
L1		44		60		86		114		140	
L2		25		32		50		61		75	
L3		6.5		8.5		12.5		16		14.5	
L4		2.5		3.5		7.5		5		5.5	
L41		-		-		3.5		-		-	
L5		10		16		25		32		50	
L6		3		2		1		3		2	
L9		2.6		4.5		5		7.2		10	
L10		9		10		16.5		19		28	
L11		47	62	56	76	66.5	93	92	128	116	163.5
L12		72	87	85.5	105.5	106.5	133	143	179	173	220.5
B1	h9	3		4		6		8		10	
H1		11.2		13.5		21.5		27		35	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PNII / PNIIR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PNII 017 / PNIIR 017	PNII 023 / PNIIR 023	PNII 034 / PNIIR 034	PNII 042 / PNIIR 042	PNII 056 / PNIIR 056
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217	430
			4		16	42	113	223	440
			5		15	40	118	220	435
			7		12	35	96	198	366
			10		10	27	68	155	295
		2	15		15	40	109	213	424
			16		16	42	116	228	452
			20		16	42	116	230	454
			25		15	40	123	228	450
			30		15	40	108	212	422
			35		12	35	100	206	382
			40		16	43	117	232	459
			50		15	40	123	228	450
			70		12	35	100	206	382
			100		10	27	70	162	308
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	All	3 times T_{2N}				
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	All	T_{2B} = 60% of T_{2NOT}				
No Load Running Torque(4)	Nm	1	3~10	PNII	0.05	0.10	0.40	0.80	2.50
				PNIIR	0.10	0.15	0.45	0.85	2.55
		2	15~100	PNII	0.05	0.10	0.30	0.40	0.80
				PNIIR	0.10	0.15	0.35	0.45	0.85
Backlash(2)	arcmin	1	3~10	PNII	≦ 8	≦ 7	≦ 6	≦ 6	≦ 6
				PNIIR	≦ 12	≦ 11	≦ 10	≦ 10	≦ 10
		2	15~100	PNII	≦ 10	≦ 9	≦ 8	≦ 8	≦ 8
				PNIIR	≦ 14	≦ 13	≦ 12	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	0.90	1.50	6	12	14
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,500	4,000	3,600	3,600	2,500
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	8,000	6,000	6,000	4,800	3,600
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	480	1,100	1,580	3,500	5,420
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	240	550	790	1,750	2,710
Service Life(5)	hr	1,2	3~100	All	20,000				
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C				
Degree of Gearbox Protection		1,2	3~100	All	IP65				
Lubrication		1,2	3~100	All	Synthetic lubrication grease				
Mounting Position		1,2	3~100	All	All directions				
Running Noise(4)	dB	1,2	3~100	PNII	≦ 60	≦ 62	≦ 64	≦ 66	≦ 68
				PNIIR	≦ 70	≦ 72	≦ 74	≦ 75	≦ 77
Efficiency η	%	1	3~10	PNII	≧ 97%				
				PNIIR	≧ 93%				
		2	15~100	PNII	≧ 94%				
				PNIIR	≧ 90%				

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

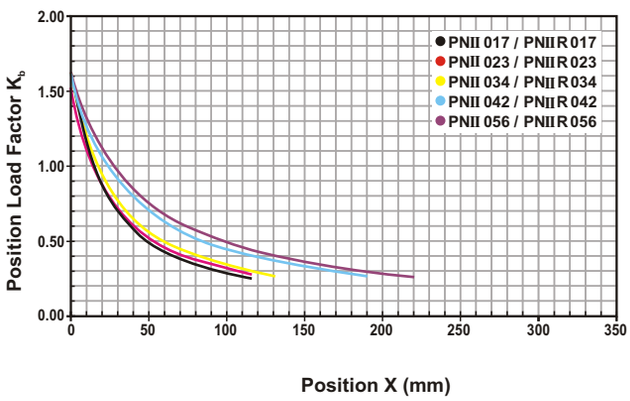
PNII Gearbox Inertia

Model No.		PNII 017		PNII 023		PNII 034		PNII 042		PNII 056	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.10	0.10	0.10~0.12	0.10	-	-	-	-	-	-
11		0.16	0.16	0.16~0.19	0.16	-	-	-	-	-	-
14		0.19~0.20	0.19~0.20	0.20~0.22	0.20	0.20~0.36	0.20~0.24	-	-	-	-
19		-	-	1.51~1.53	1.51	1.54~1.70	1.54~1.58	1.60~2.20	1.60~1.73	-	1.69~2.18
24		-	-	-	-	2.09~2.24	2.09~2.12	2.14~2.74	2.14~2.27	2.23~4.52	2.23~2.73
28		-	-	-	-	2.52~2.68	2.52~2.55	2.57~3.17	2.57~2.70	2.65~4.94	2.65~3.15
32		-	-	-	-	-	-	7.17~7.77	7.17~7.30	7.41~9.70	7.41~7.91
35		-	-	-	-	-	-	10.20~10.80	10.20~10.30	10.50~12.80	10.50~11.00
38		-	-	-	-	-	-	13.40~14.00	13.40~13.50	13.70~16.00	13.70~14.20
42		-	-	-	-	-	-	-	-	22.20~24.50	-

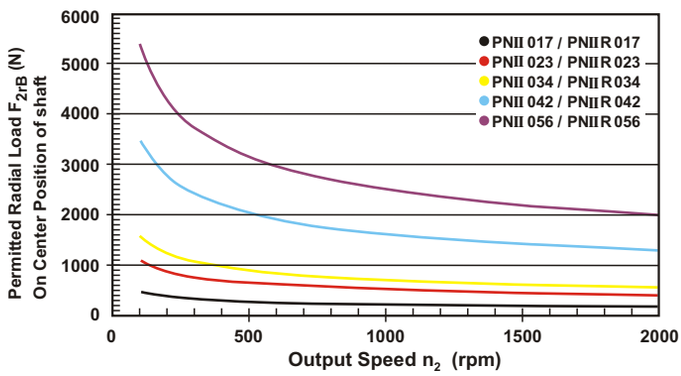
PNIIR Gearbox Inertia

Model No.		PNIIR 017		PNIIR 023		PNIIR 034		PNIIR 042		PNIIR 056	
Ø[A] (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.18	0.18	0.36	0.36	-	-	-	-	-	-
11		0.20	0.20	0.39	0.39	-	-	-	-	-	-
14		0.24	0.24	0.43	0.43	1.87	1.87	-	-	-	-
19		-	-	1.24	1.24	2.67	2.67	6.80	6.80	-	13.57
24		-	-	-	-	2.97	2.97	7.10	7.10	13.87	13.87
28		-	-	-	-	3.47	3.47	7.59	7.59	14.36	14.36
32		-	-	-	-	-	-	10.56	10.56	17.33	17.33
35		-	-	-	-	-	-	11.97	11.97	18.74	18.74
38		-	-	-	-	-	-	13.95	13.95	20.79	20.79
42		-	-	-	-	-	-	-	-	26.54	-

Permitted Radial And Axial Loads[B]



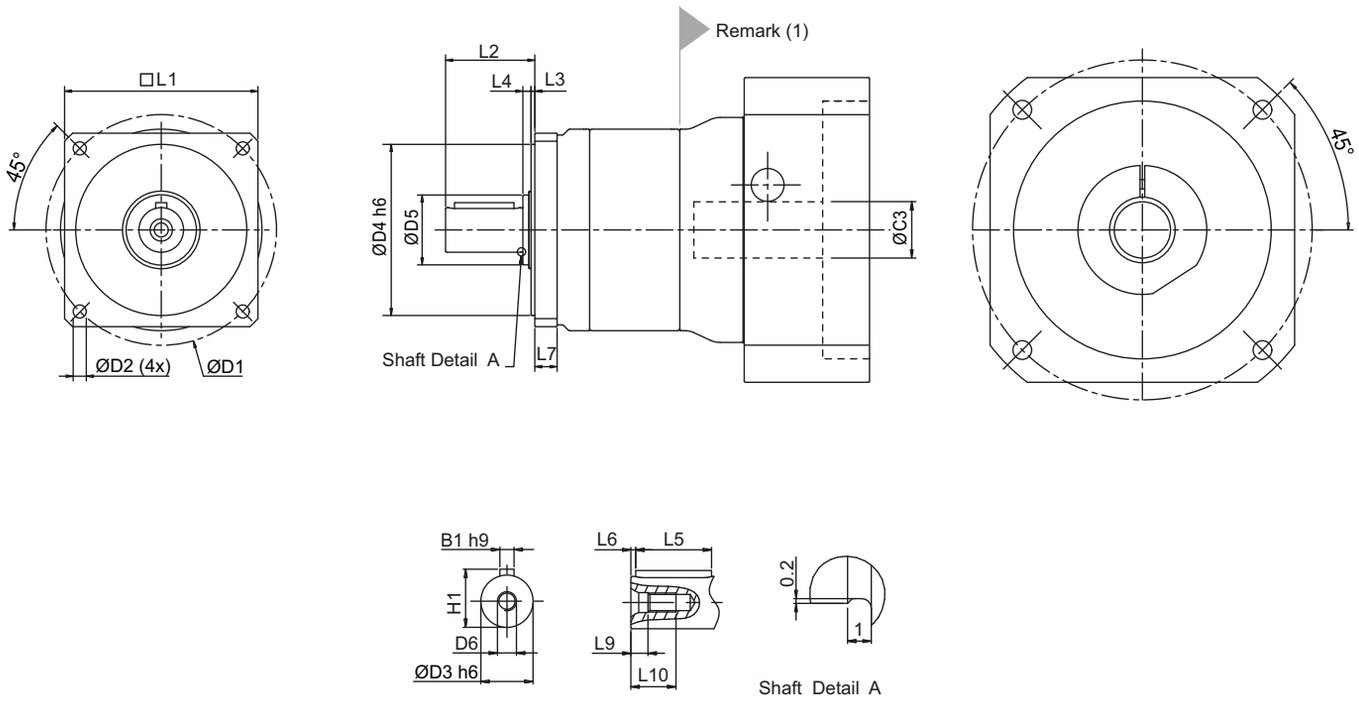
If radial force F_{2r} is not exerted on the center of the output shaft X<1/2xL or X>1/2xL, the permitted radial and axial loads can be calculated by the position load factor Kb on the above diagram.



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[C] life.

(A) Ø = Input shaft diameter.
(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.
(C) For Continuous Operation(S1), the service life reduced to 50%.

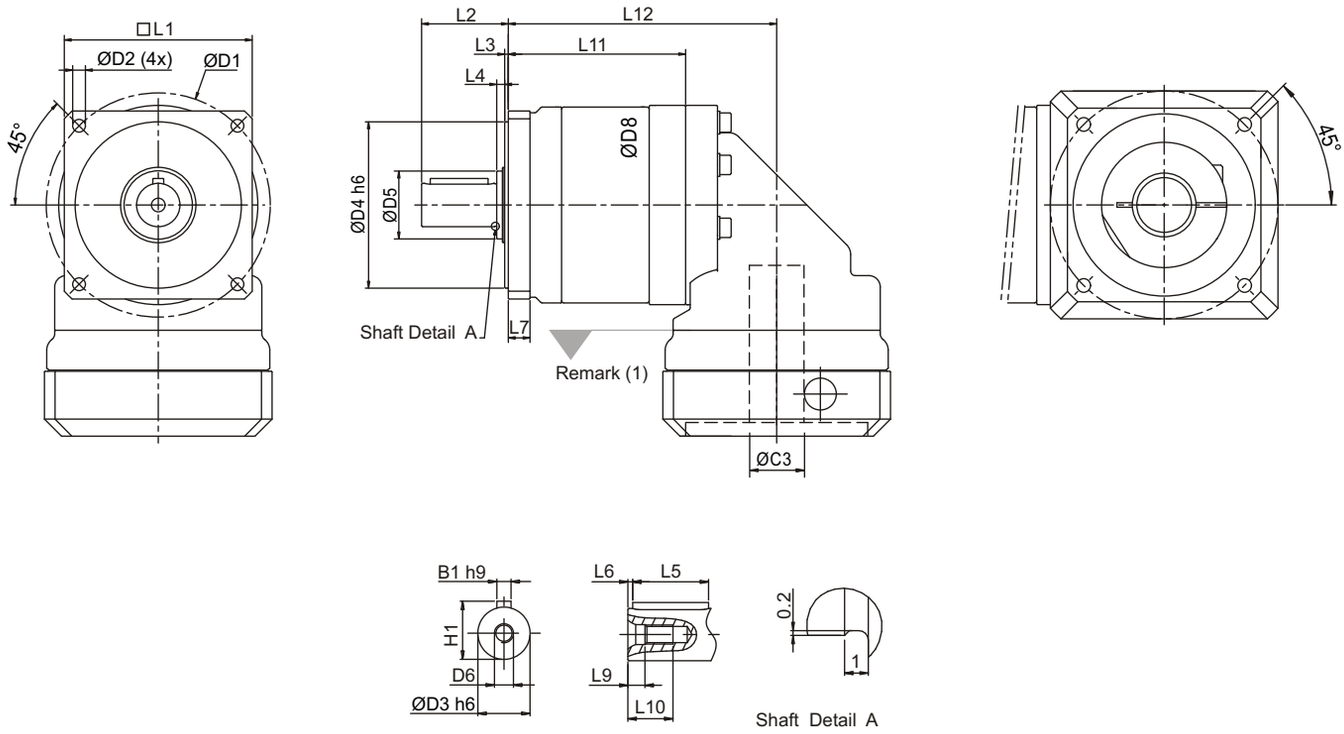
PNII Series Dimension



Dimension		PNII 017		PNII 023		PNII 034		PNII 042		PNII 056	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		43.815		66.675		98.425		125.73		177.8	
D2		3.4		5.2		5.6		7.2		10.5	
D3	h6	12.7		12.7		19.05		25.4		38.1	
D4	h6	22		38.1		73.025		55.55		114.3	
D5		17		17		30		40		55	
D6		M4X0.7P		M4X0.7P		M6X1P		M10X1.5P		M16X2P	
L1		41.91		57.15		82.55		106.68		146.05	
L2		31.75		31.75		38.1		50.8		63.5	
L3		1.6		1.6		1.6		1.6		3.2	
L4		1		1		3.5		1.5		5.5	
L5		19.05		19.05		25.4		31.75		38.1	
L6		3.788		3.788		3.807		5.175		8.563	
L7		6.35		9.525		9.525		12.7		19.05	
L9		4.5		4.5		5		7.5		12	
L10		10		10		16.5		22		36	
B1	h9	3.175		3.175		4.763		6.35		9.525	
H1		14.125		14.125		21.163		28.2		42.275	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PNⅡR Series Dimension



Dimension		PNⅡR 017		PNⅡR 023		PNⅡR 034		PNⅡR 042		PNⅡR 056	
		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1		43.815		66.675		98.425		125.73		177.8	
D2		3.4		5.2		5.6		7.2		10.5	
D3	h6	12.7		12.7		19.05		25.4		38.1	
D4	g6	22		38.1		73.025		55.55		114.3	
D5		17		17		30		40		55	
D6		M4X0.7P		M4X0.7P		M6X1P		M10X1.5P		M16X2P	
L1		41.91		57.15		82.55		106.68		146.05	
L2		31.75		31.75		38.1		50.8		63.5	
L3		1.6		1.6		1.6		1.6		3.2	
L4		1		1		3.5		1.5		5.5	
L5		19.05		19.05		25.4		31.75		38.1	
L6		3.788		3.788		3.807		5.715		8.563	
L7		6.35		9.525		9.525		12.7		19.05	
L9		4.5		4.5		5		7.5		12	
L10		10		10		16.5		22		36	
L11		47.06	62.06	58.38	78.38	77.9	104.4	111.41	147.41	127.31	174.81
L12		72.06	87.06	87.88	107.88	117.9	144.4	162.41	198.41	184.31	231.81
B1	h9	3.175		3.175		4.763		6.35		9.525	
H1		14.125		14.125		21.163		28.2		42.275	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PD / PDR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PD 053 / PDR 053	PD 064 / PDR 064	PD 090 / PDR 090	PD 110 / PDR 110
Nominal Output Torque T_{2N}	Nm	1	3	All	16	42	110	217
			4		16	42	113	223
			5		15	40	118	220
			7		12	35	96	198
			10		10	27	68	155
		2	15		15	40	109	213
			16		16	42	116	228
			20		16	42	116	230
			25		15	40	123	228
			30		15	40	108	212
			35		12	35	100	206
			40		16	43	117	232
			50		15	40	123	228
			70		12	35	100	206
			100		10	27	70	162
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	All	3 times T_{2N}			
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	All	T_{2B} = 60% of T_{2NOT}			
No Load Running Torque(4)	Nm	1	3~10	PD	0.05	0.10	0.40	0.80
				PDR	0.10	0.15	0.45	0.85
		2	15~100	PD	0.05	0.10	0.30	0.40
				PDR	0.10	0.15	0.35	0.45
Backlash(2)	arcmin	1	3~10	PD	≦ 8	≦ 7	≦ 6	≦ 6
				PDR	≦ 12	≦ 11	≦ 10	≦ 10
		2	15~100	PD	≦ 10	≦ 9	≦ 8	≦ 8
				PDR	≦ 14	≦ 13	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	1.2	3	10.8	16.2
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,500	4,000	3,600	3,600
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	8,000	6,000	6,000	4,800
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	1,045	880	1,615	3,675
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	523	440	808	1,838
Max. Tilting Torque M_{2K}	Nm	1,2	3~100	All	22	17	44	140
Service Life(5)	hr	1,2	3~100	All	20,000			
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C			
Degree of Gearbox Protection		1,2	3~100	All	IP65			
Lubrication		1,2	3~100	All	Synthetic lubrication grease			
Mounting Position		1,2	3~100	All	All directions			
Running Noise(4)	dB(A)	1,2	3~100	PD	≦ 60	≦ 62	≦ 64	≦ 66
				PDR	≦ 70	≦ 72	≦ 74	≦ 75
Efficiency η	%	1	3~10	PD	≧ 97%			
				PDR	≧ 93%			
		2	15~100	PD	≧ 94%			
				PDR	≧ 90%			

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

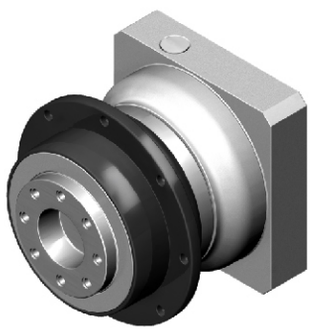
PD Gearbox Inertia

Model No.		PD 053		PD 064		PD 090		PD 110	
Ø(A) (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.10	0.10	0.12	0.10	-	-	-	-
11		0.16	0.16	0.19	0.16	-	-	-	-
14		0.20	0.20	0.22	0.20	0.36	0.24	-	-
19		-	-	1.53	1.51	1.70	1.58	2.20	1.73
24		-	-	-	-	2.24	2.12	2.74	2.27
28		-	-	-	-	2.68	2.55	3.17	2.70
32		-	-	-	-	-	-	7.77	7.30
35		-	-	-	-	-	-	10.80	10.30
38		-	-	-	-	-	-	14.00	13.50
42		-	-	-	-	-	-	-	-

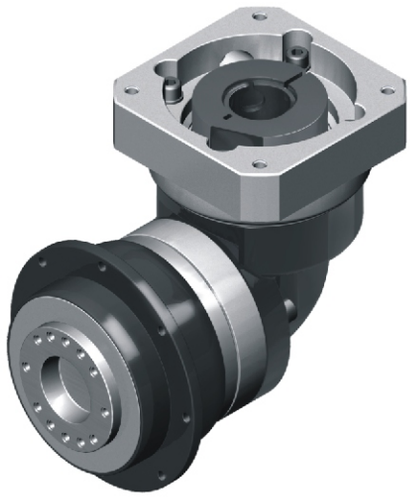
PDR Gearbox Inertia

Model No.		PDR 053		PDR 064		PDR 090		PDR 110	
Ø(A) (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.18	0.18	0.36	0.36	-	-	-	-
11		0.20	0.20	0.39	0.39	-	-	-	-
14		0.24	0.24	0.43	0.43	1.87	1.87	-	-
19		-	-	1.24	1.24	2.67	2.67	6.80	6.80
24		-	-	-	-	2.97	2.97	7.10	7.10
28		-	-	-	-	3.47	3.47	7.59	7.59
32		-	-	-	-	-	-	10.56	10.56
35		-	-	-	-	-	-	11.97	11.97
38		-	-	-	-	-	-	13.95	13.95
42		-	-	-	-	-	-	-	-

(A) Ø = Input shaft diameter.

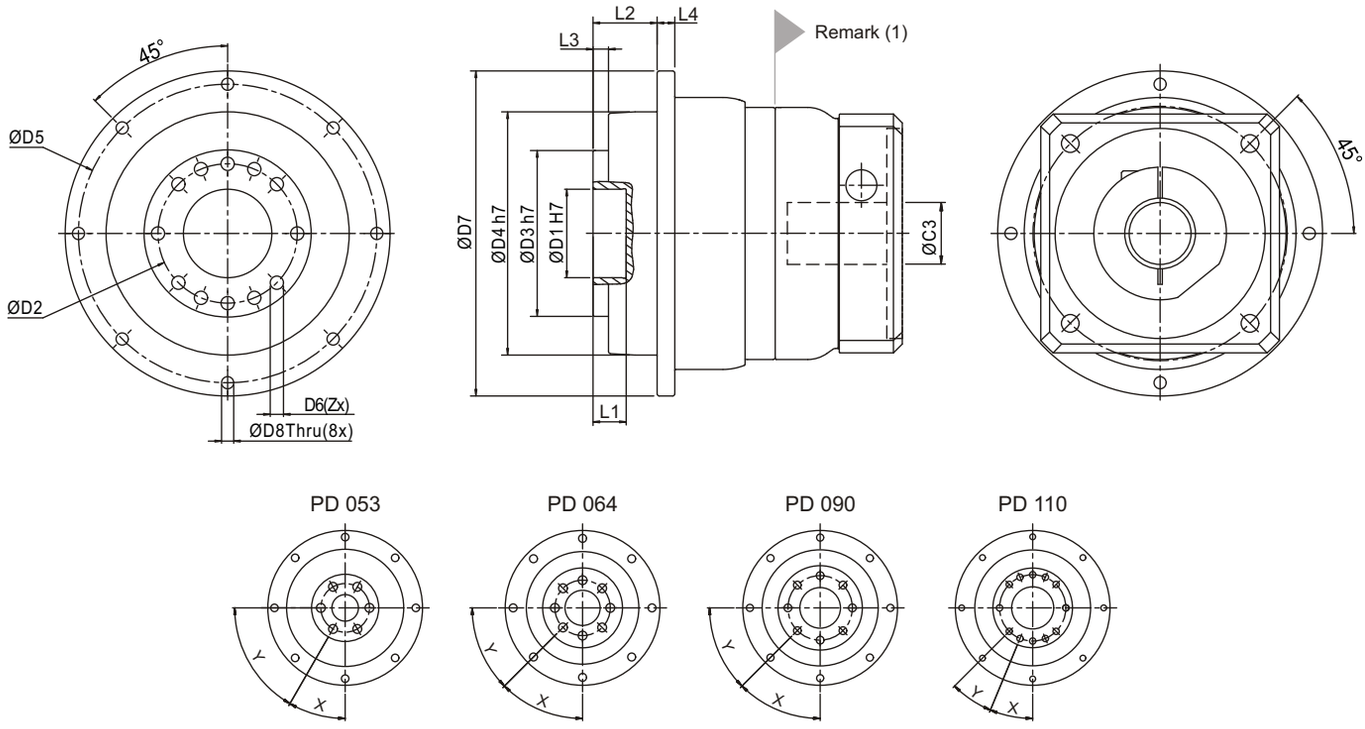


PD



PDR

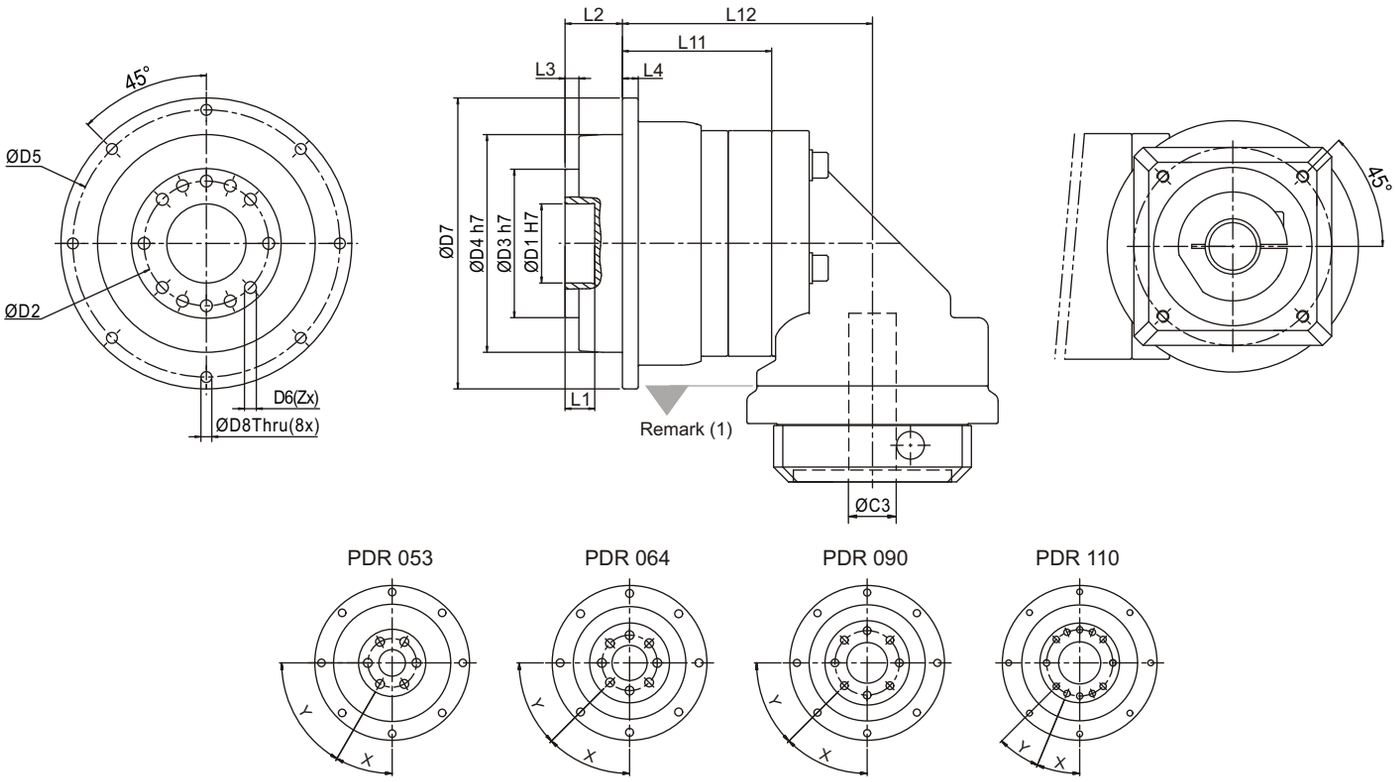
PD Series Dimension



Dimension	PD 053		PD 064		PD 090		PD 110	
	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1 H7	12		20		31.5		40	
D2	22		31.5		50		63	
D3 h7	28		40		63		75	
D4 h7	53		64		90		110	
D5	64		79		109		135	
D6	M4x0.7Px8L		M5xX0.8Px8L		M6x1Px13.5L		M6x1Px13.5L	
D7	70		88		120		147	
D8	3.4		4.5		5.5		5.5	
L1	4		8		15		15	
L2	14.5		19.5		30		29	
L3	3		4		7		7	
L4	5		5		7		8	
X in Degree	30°		45°		45°		22.5°	
Y in Degree	60°		45°		45°		22.5°	
Z	6		8		8		12	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PDR Series Dimension



Dimension	PDR 053		PDR 064		PDR 090		PDR 110	
	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1 H7	12		20		31.5		40	
D2	22		31.5		50		63	
D3 h7	28		40		63		75	
D4 h7	53		64		90		110	
D5	64		79		109		135	
D6	M4x0.7Px8L		M5X0.8Px8L		M6x1Px13.5L		M6X1Px13.5L	
D7	70		88		120		147	
D8	3.4		4.5		5.5		5.5	
L1	4		8		15		15	
L2	14.5		19.5		30		29	
L3	3		4		7		7	
L4	5		5		7		8	
L11	42.8	57.8	39.5	59.5	49.6	76.1	75.4	111.4
L12	67.8	82.8	69	89	89.6	116.1	126.4	162.4
X in Degree	30°		45°		45°		22.5°	
Y in Degree	60°		45°		45°		22.5°	
Z	6		8		8		12	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PL / PLR Gearbox Performance

Model No.		Stages	Ratio(1)	Type	PL 070	PL 090	PL 120
					PLR 070	PLR 090	PLR 120
Nominal Output Torque T_{2N}	Nm	1	3	All	30	67	107
			4		39	86	137
			5		40	89	140
			7		37	80	128
			10		27	59	93
		2	12		31	69	109
			15		31	70	110
			16		39	86	137
			20		39	88	141
			25		40	89	140
			30		32	72	111
			35		36	80	130
			40		41	92	143
			50		42	90	143
			70		37	81	131
			100		27	59	93
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~10	All	3 times T_{2N}		
Max. Acceleration Torque T_{2B}	Nm	1,2	3~10	All	T_{2B} = 60% of T_{2NOT}		
No Load Running Torque(4)	Nm	1	3~10	PL	0.10	0.40	0.80
				PLR	0.15	0.45	0.85
		2	12~100	PL	0.10	0.30	0.40
				PLR	0.15	0.35	0.45
Backlash(2)	arcmin	1	3~10	PL	≦ 7	≦ 6	≦ 6
				PLR	≦ 11	≦ 10	≦ 10
		2	12~100	PL	≦ 9	≦ 8	≦ 8
				PLR	≦ 13	≦ 12	≦ 12
Torsional Rigidity	Nm/arcmin	1,2	3~100	All	2.2	8	12
Nominal Input Speed n_{1N}	rpm	1,2	3~100	All	4,000	3,600	3,600
Max. Input Speed n_{1B}	rpm	1,2	3~100	All	6,000	6,000	4,800
Max. Radial Load F_{2rB}(3)	N	1,2	3~100	All	2,600	3,100	6,550
Max. Axial Load F_{2aB}(3)	N	1,2	3~100	All	1,300	1,550	3,275
Service Life(5)	hr	1,2	3~100	All	20,000		
Operating Temp	° C	1,2	3~100	All	0° C~ +90° C		
Degree of Gearbox Protection		1,2	3~100	All	IP65		
Lubrication		1,2	3~100	All	Synthetic lubrication grease		
Mounting Position		1,2	3~100	All	All directions		
Running Noise(4)	dB(A)	1,2	3~100	PL	≦ 62	≦ 64	≦ 66
				PLR	≦ 72	≦ 74	≦ 75
Efficiency η	%	1	3~10	PL	≧ 97%		
				PLR	≧ 93%		
		2	12~100	PL	≧ 94%		
				PLR	≧ 90%		

(1) Ratio (i= N_{in} / N_{out}) .
(2) Backlash is measured at 2% of Nominal Output Torque T_{2N}.
(3) Applied to the output shaft center at 100 rpm.
(4) These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm without load.
(5) For continuous operation, the service life time is less than 10,000 hrs.

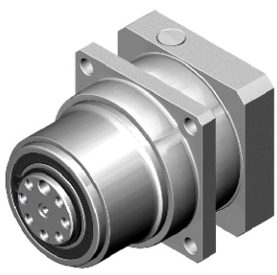
PL Gearbox Inertia

Model No.		PL 070		PL 090		PL 120	
Ø(A) (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.12	0.10	-	-	-	-
11		0.19	0.16	-	-	-	-
14		0.22	0.20	0.36	0.24	-	-
19		1.53	1.51	1.70	1.58	2.20	1.73
24		-	-	2.24	2.12	2.74	2.27
28		-	-	2.68	2.55	3.17	2.70
32		-	-	-	-	7.77	7.30
35		-	-	-	-	10.80	10.30
38		-	-	-	-	14.00	13.50
42		-	-	-	-	-	-

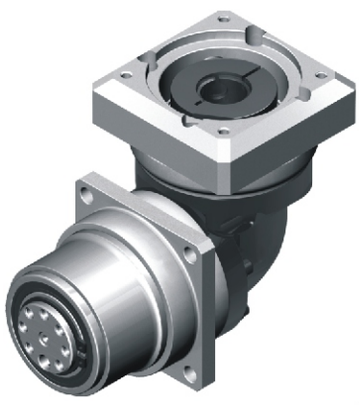
PLR Gearbox Inertia

Model No.		PLR 070		PLR 090		PLR 120	
Ø(A) (C3)		1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
8	kg.cm²	0.36	0.36	-	-	-	-
11		0.39	0.39	-	-	-	-
14		0.43	0.43	1.87	1.87	-	-
19		1.24	1.24	2.67	2.67	6.80	6.80
24		-	-	2.97	2.97	7.10	7.10
28		-	-	3.47	3.47	7.59	7.59
32		-	-	-	-	10.56	10.56
35		-	-	-	-	11.97	11.97
38		-	-	-	-	13.95	13.95
42		-	-	-	-	-	-

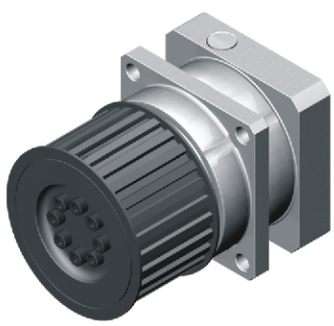
(A) Ø = Input shaft diameter.



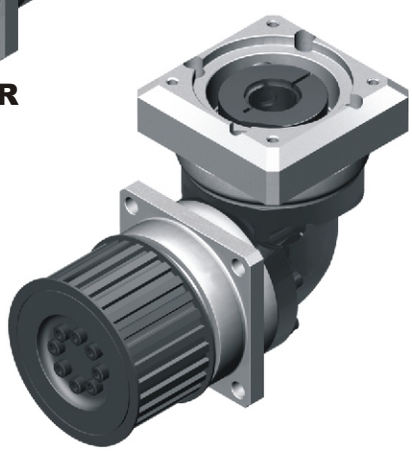
PL



PLR

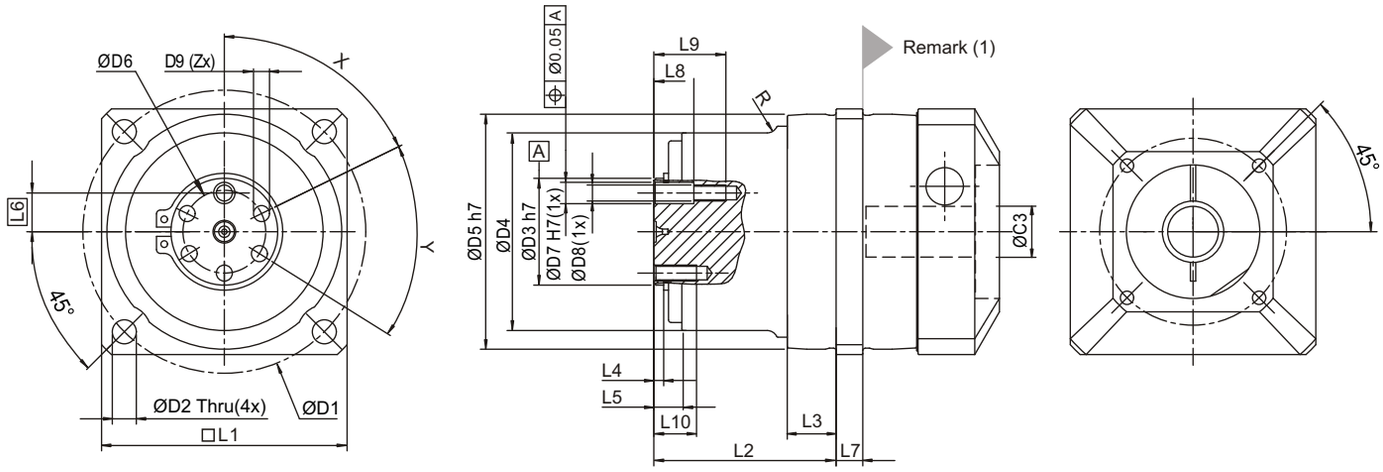


PL+Pulley



PLR+Pulley

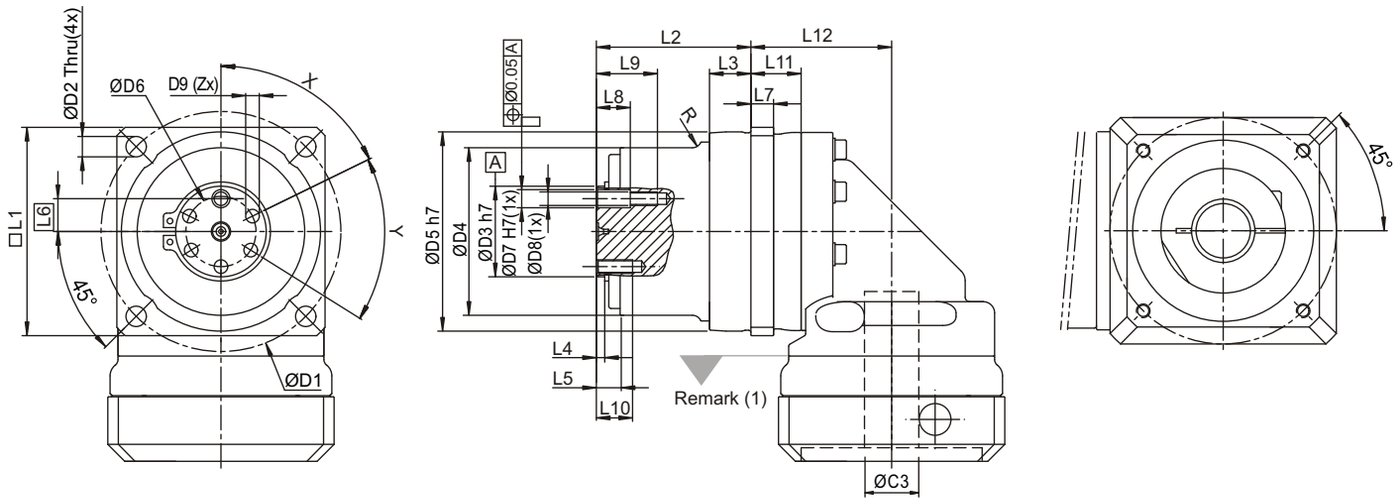
PL Series Dimension



Dimension	PL 070		PL 090		PL 120	
	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1	82		106		144	
D2	6.6		9		13	
D3 h7	25		40		50	
D4	58		74		100	
D5 h7	68		88		118	
D6	18		31		37	
D7 H7	6		8		8	
D8	M5X0.8P		M6X1P		M6X1P	
D9	M5X0.8P		M6X1P		M8X1.25P	
R	-		4		2	
L1	70		92		122	
L2	60.2		68.3		82.2	
L3	12.7		18.3		15.7	
L4	3.8		3.7		4.5	
L5	10		10.5		12.5	
L6	8.8		14.5		18.5	
L7	8		10		12	
L8	10		15		16	
L9	18.5		27		28	
L10	12		16		16	
X in Degree	64°		45°		45°	
Y in Degree	58°		45°		45°	
Z	5		7		7	

(1) Dimensions are related to motor interface. Please contact APEX for details.

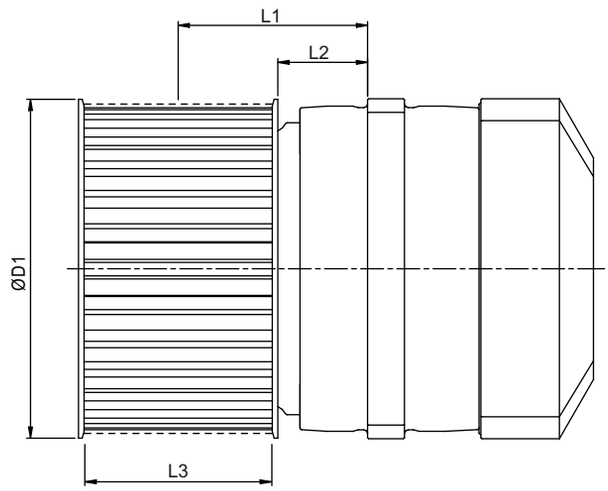
PLR Series Dimension



Dimension	PLR 070		PLR 090		PLR 120	
	1-stage	2-stage	1-stage	2-stage	1-stage	2-stage
D1	82		106		144	
D2	6.6		9		13	
D3 h7	25		40		50	
D4	58		74		100	
D5 h7	68		88		118	
D6	18		31		37	
D7 H7	6		8		8	
D8	M5X0.8P		M6X1P		M6X1P	
D9	M5X0.8P		M6X1P		M8X1.25P	
R	-		4		2	
L1	70		92		122	
L2	60.2		68.3		82.2	
L3	12.7		18.3		15.7	
L4	3.8		3.7		4.5	
L5	10		10.5		12.5	
L6	8.8		14.5		18.5	
L7	8		10		12	
L8	10		15		16	
L9	18.5		27		28	
L10	12		16		16	
L11	16.8	36.8	22.2	48.9	34.8	71.1
L12	46.3	66.3	62.2	88.9	85.8	122.1
X in Degree	64°		45°		45°	
Y in Degree	58°		45°		45°	
Z	5		7		7	

(1) Dimensions are related to motor interface. Please contact APEX for details.

PL+PULLEY Dimension



Reducer	Belt Pulley	D1	L1	L2	L3	Pitch P	No.of Teeth Z	Circumference Z*P	Interia J	Mass m
						mm		mm/rotation	$kgcm^2$	kg
PL 070 PLR 070	AT05-W50-T43	71	41.8	14.8	51	5	43	215	4.68	0.57
	HTD 5M-W50-T44	72.9	41.8	14.8	51	5	44	220	5.58	0.65
	5GT-W50-T44	72.9	41.8	14.8	51	5	44	220	5.58	0.65
PL 090 PLR 090	AT10-W50-T28	91.7	51.3	24.3	51	10	28	280	14.07	1.00
	HTD 8M-W50-T36	98.4	51.3	24.3	51	8	36	288	17.78	1.18
	8YU-W50-T36	98.4	51.3	24.3	51	8	36	288	17.78	1.18
PL 120 PLR 120	AT20-W75-T19	124.6	57.7	17.7	76	20	19	380	69.55	2.71
	HTD 14M-W75-T28	137	57.7	17.7	76	14	28	392	87.83	3.20

PULLEY ORDERING CODE

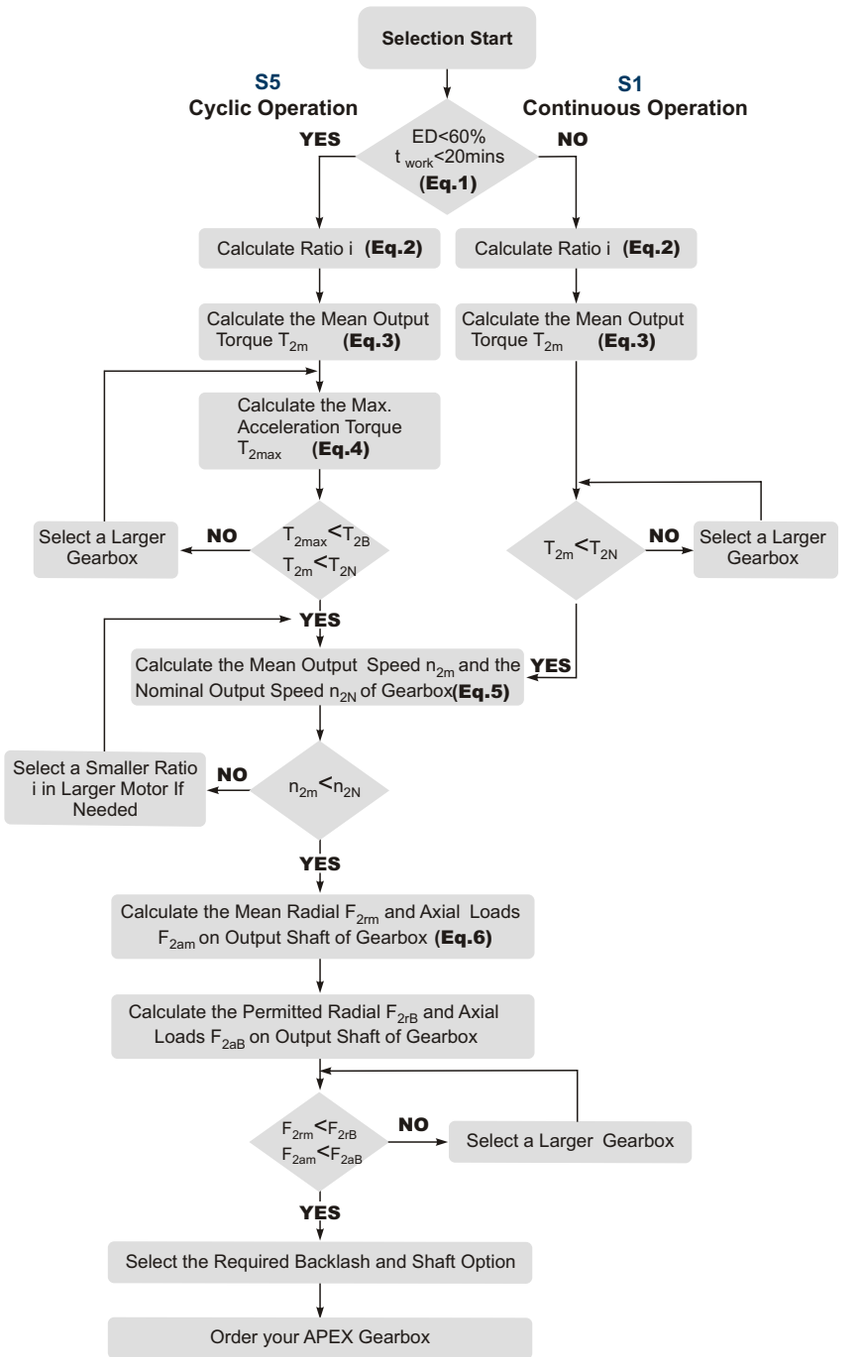
PUL070(1) – AT05(2) – B(3)

Pulley size corresponds to gearbox size:
PUL 070: PL 070, PLR 070
PUL 090: PL 090, PLR 090
PUL 120: PL 120, PLR 120

Ordering Example : PUL 070 - AT05 - B
PUL 090 - 8YU - N

(1) Pulley size.
(2) Pulley specification.
(3) Pulley appearance. B = Manganese phosphate blackening (Standard)
N = Nickel plating

Selection of the optimum gearbox



Recommended (for S5 Cycle Operation)

The general design is given for

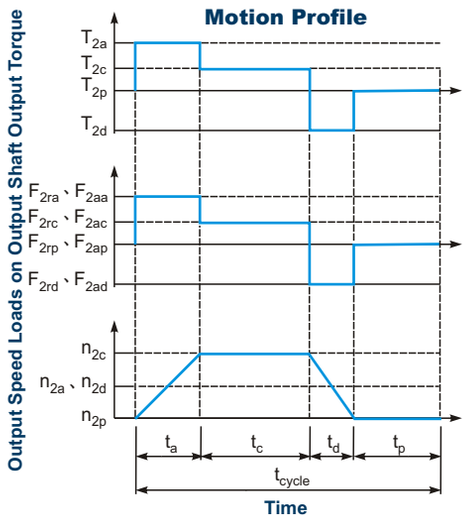
$$\frac{J_L}{i^2} \leq 4 \times J_m$$

The optimal design is given for

$$\frac{J_L}{i^2} \cong J_m$$

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

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

$$n_{2N} = \frac{n_{1N}}{i}$$

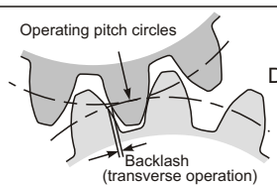
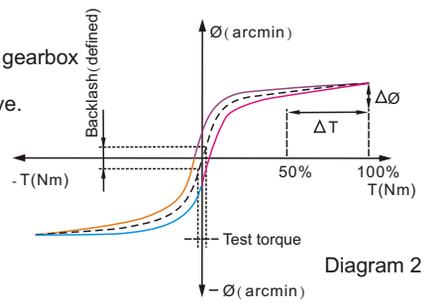
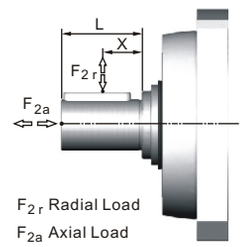
(Eq.5)

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 1,000 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 1,000 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 much torque is needed on the 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 in the Diagram 2.  Diagram 2
Radial Load And Axial Load	N	The permitted radial and axial loads on output shaft of the gearbox depend on the design of the gearbox supporting bearings. 
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.
Degree of Protection		IP code stands for International Protection standard. The IP65 as example: the first IP number stands for protection degree against dust; the second IP number stands for protection against liquid.
Lubrication		APEX uses synthetic lubrication grease. Alternate greases are available, please contact APEX.
Running Noise	dB(A)	The Running Noise is measured depends on gearbox size, the ratio and the speed*. Higher speed usually induces 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 requires greater Back Driving Torque.

* This value is measured at environment temperature 25°C and the input speed 3,000 rpm. If the Nominal Input Speed n_{1N} of gearbox is over 3,000 rpm, this value is measured by that specific Nominal Input Speed.

Note

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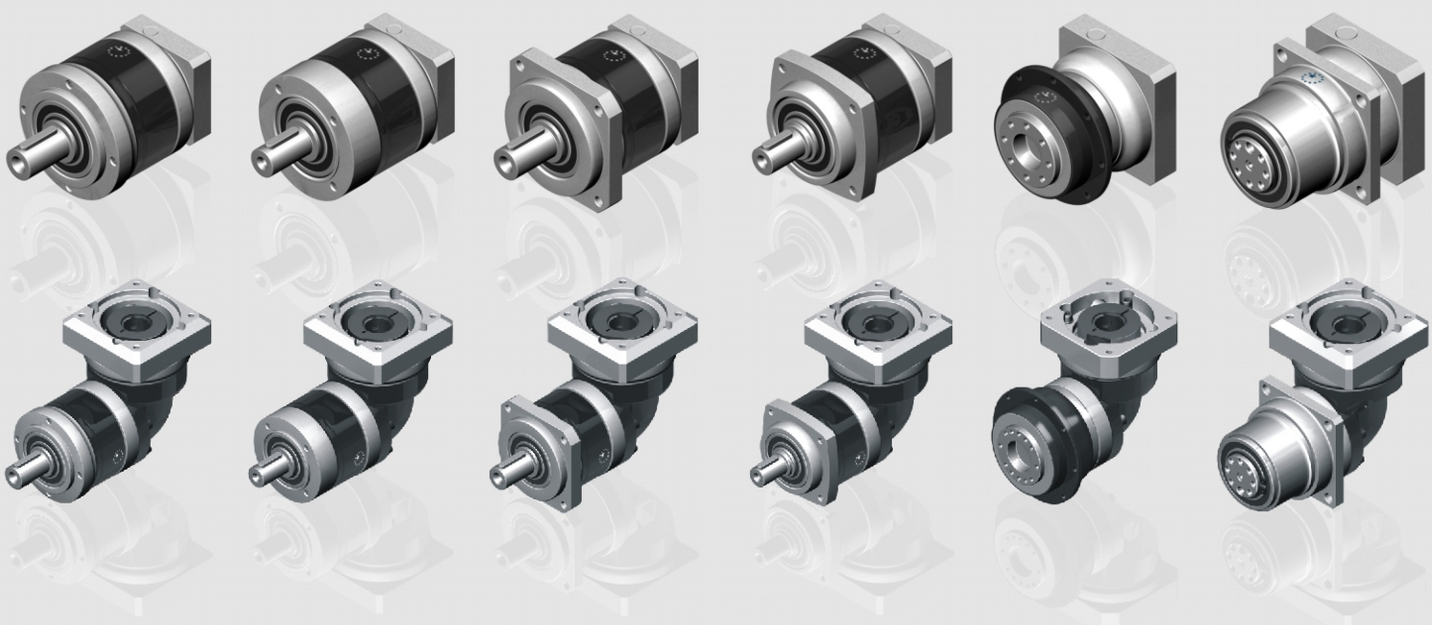

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APEX-2015-08-PII/PIIR SERIES-1.0E-1.0V