



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



PEII



PEIIR



PGII



PGIIR



PAII



PAIIR



PSII



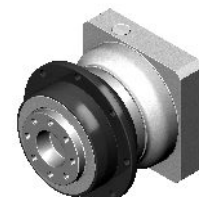
PSIIR



PNII



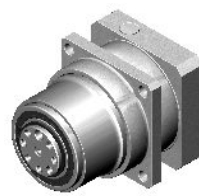
PNIIR



PD



PDR



PL



PLR

ORDERING CODE

PEII 090 – **010⁽¹⁾** – **()⁽²⁾** / **MOTOR**

PEIIR 090 – **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 : PEII 050, PEII 070, PEII 090, PEII 120, PEII 155

PGII : PGII 040, PGII 060, PGII 080, PGII 120, PGII 160

PAII : PAII 042, PAII 060, PAII 090, PAII 115, PAII 142

PSII : PSII A, PSII B, PSII C, PSII D, PSII E

PNII : PNII 017, PNII 023, PNII 034, PNII 042, PNII 056

PD : PD 053, PD 064, PD 090, PD 110

PL : PL 070, PL 090, PL 120,

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

Gearbox Size:

PEIIR : PEIIR 050, PEIIR 070, PEIIR 090, PEIIR 120, PEIIR 155

PGIIR : PGIIR 040, PGIIR 060, PGIIR 080, PGIIR 120, PGIIR 160

PAIIR : PAIIR 042, PAIIR 060, PAIIR 090, PAIIR 115, PAIIR 142

PSIIR : PSIIR A, PSIIR B, PSIIR C, PSIIR D, PSIIR E

PNIIR : PNIIR 017, PNIIR 023, PNIIR 034, PNIIR 042, PNIIR 056

PDR : PDR 053, PDR 064, PDR 090, PDR 110

PLR : PLR 070, PLR 090, PLR 120

Ordering Example : PEIIR 090 - 010 / SIEMENS 1FT6 041 - 4AF71
PAIIR 090 - 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 | PEII 070 | PEII 090 | PEII 120 | PEII 155 | |
|--|-----------|----------------------------------|--------|-----------|------------------------------|-----------|-----------|-----------|-------------------------------|
| | | | | PEIIR 050 | PEIIR 070 | PEIIR 090 | PEIIR 120 | PEIIR 155 | |
| Nominal Output Torque T_{2N} | 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 | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2 | 3~100 | All | | | | | $T_{2B} = 60\%$ of T_{2NOT} |
| No Load Running Torque ⁽⁴⁾ | 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⁾ | 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 |
| 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 |
| Max. bending moment based on the gearbox input flange M_b ⁽⁵⁾ | Nm | 1,2 | 3~100 | PEII | 5 | 12 | 22 | 45 | 54 |
| | | | | PEIIR | 3 | 6 | 10 | 17 | 19 |
| Efficiency η | % | 1 | 3~10 | PEII | $\geq 97\%$ | | | | |
| | | | | PEIIR | $\geq 93\%$ | | | | |
| | | 2 | 15~100 | PEII | $\geq 94\%$ | | | | |
| | | | | PEIIR | $\geq 90\%$ | | | | |

(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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times M_b}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

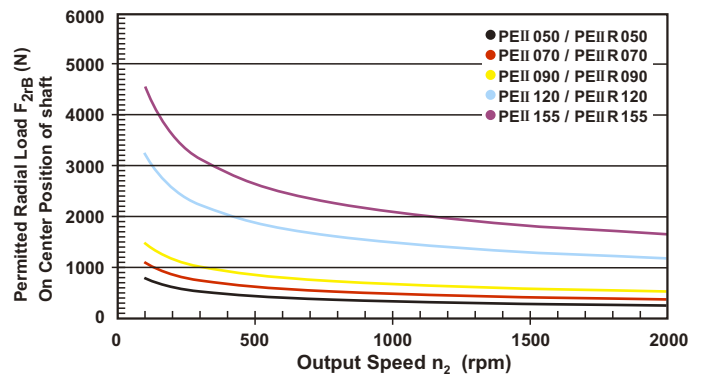
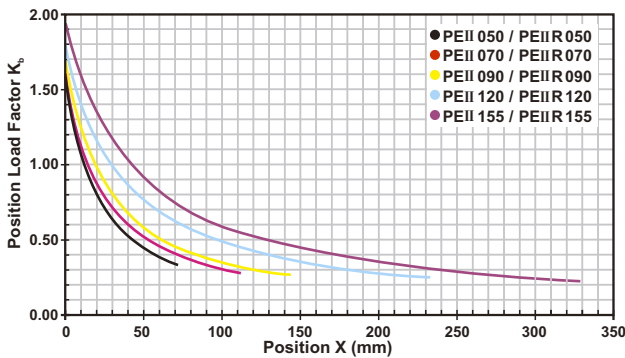
PEII Gearbox Inertia

| Model No. | PEII 050 | | PEII 070 | | PEII 090 | | PEII 120 | | PEII 155 | |
|--------------------------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.10 | 0.10 | 0.12 | 0.10 | - | - | - | - | - | - |
| 11 | 0.16 | 0.16 | 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 | - | 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 | |
|--------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.18 | 0.18 | 0.36 | 0.36 | - | - | - | - | - | - |
| 11 | 0.20 | 0.20 | 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 | - | 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)



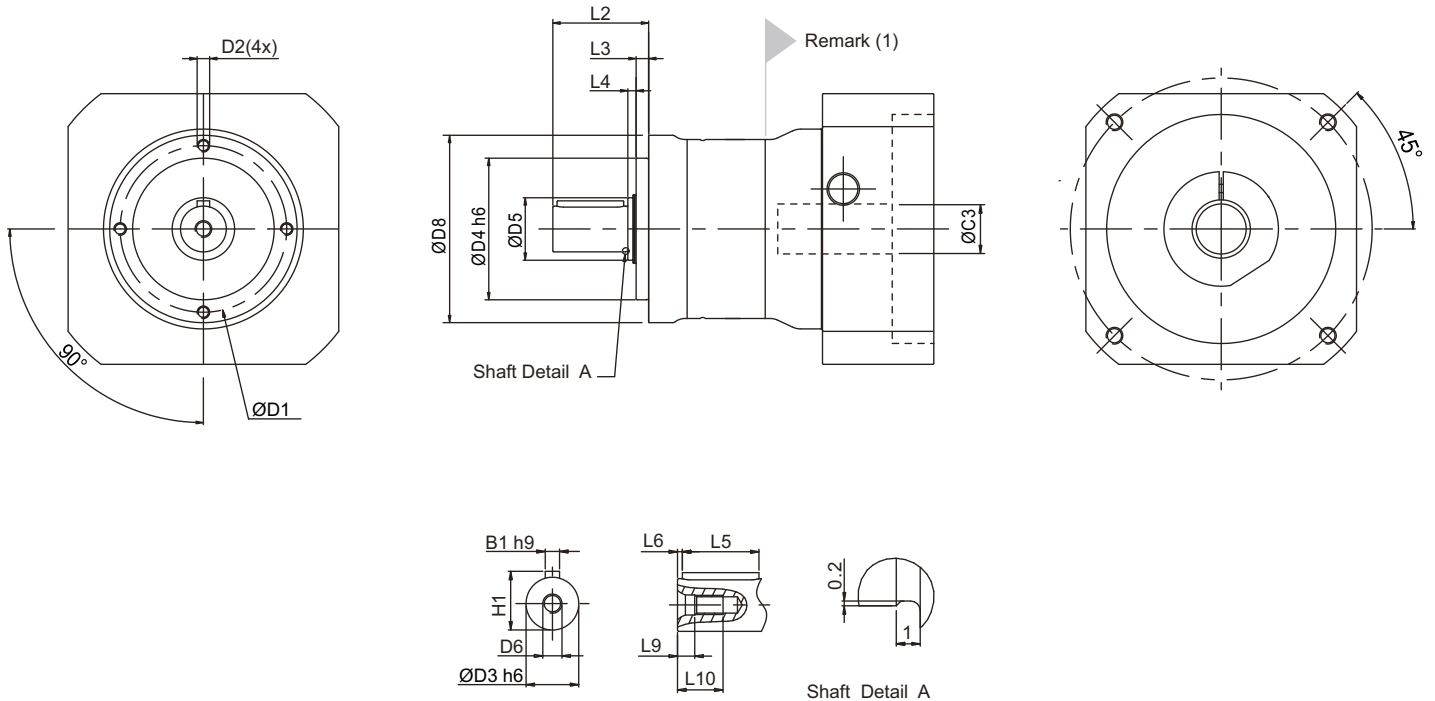
If radial force F_{zr} is not exerted on the center of the output shaft $X < 1/2 L$ or $X > 1/2 L$, the permitted radial and axial loads can be calculated by the position load factor K_s on the above diagram.

Permitted radial load F_{zr} on center of output shaft $X = 1/2 L$ for various output speeds.

(A) \varnothing = Input shaft diameter.

(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.

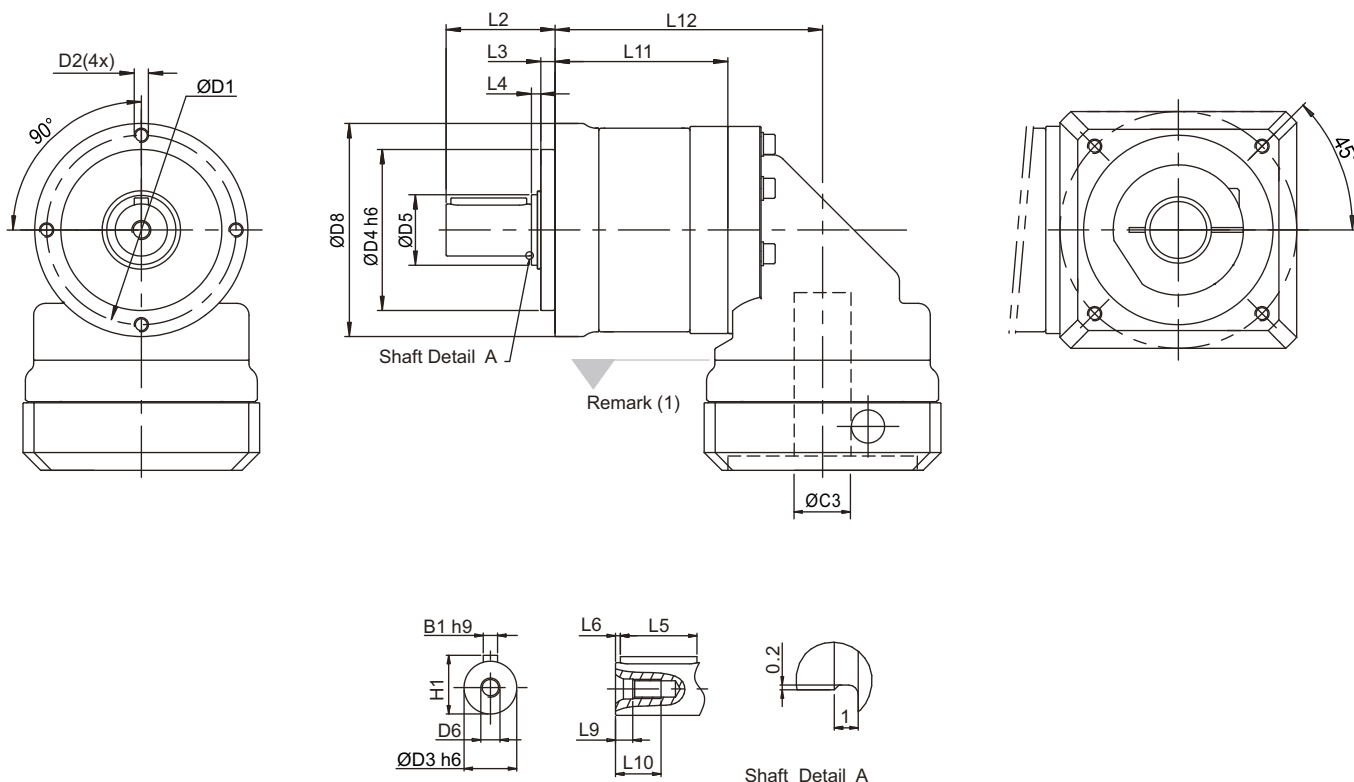
PEII Series Dimension



| 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 | 55 | 62 | 70 | 80 |
| D4 | h6 | 35 | 52 | 68 | 90 | 120 | 155 | 200 | 250 | 315 |
| 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 | 15 | 18 | 22 | 28 |
| H1 | 13.5 | | 18 | | 24.5 | | 35 | | 43 | |

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

PEIR Series Dimension



| Dimension | PEIR 050 | | PEIR 070 | | PEIR 090 | | PEIR 120 | | PEIR 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 | PGII 060 | PGII 080 | PGII 120 | PGII 160 |
|---|-----------|-----------------------|----------------------|-------|-------------------------------|-----------|-----------|-----------|-----------|
| | | | | | PGIIR 040 | PGIIR 060 | PGIIR 080 | PGIIR 120 | PGIIR 160 |
| Nominal Output Torque T_{2N} | Nm | 1 | 3 | AII | 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 | AII | 3 times T_{2N} | | | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2,3 | 3~1000 | AII | $T_{2B} = 60\%$ 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 | AII | 0.5 | 2 | 8 | 12 | 16 |
| Nominal Input Speed n_{1N} | rpm | 1,2,3 | 3~1000 | AII | 4,500 | 4,000 | 3,600 | 3,600 | 2,500 |
| Max. Input Speed n_{1B} | rpm | 1,2,3 | 3~1000 | AII | 8,000 | 6,000 | 6,000 | 4,800 | 3,600 |
| Max. Radial Load $F_{2rB}^{(3)}$ | N | 1,2,3 | 3~1000 | AII | 520 | 1,030 | 1,570 | 3,590 | 4,690 |
| Max. Axial Load $F_{2aB}^{(3)}$ | N | 1,2,3 | 3~1000 | AII | 260 | 515 | 785 | 1,795 | 2,345 |
| Operating Temp | °C | 1,2,3 | 3~1000 | AII | 0° C ~ +90° C | | | | |
| Degree of Gearbox Protection | | 1,2,3 | 3~1000 | AII | IP65 | | | | |
| Lubrication | | 1,2,3 | 3~1000 | AII | Synthetic lubrication grease | | | | |
| Mounting Position | | 1,2,3 | 3~1000 | AII | All directions | | | | |
| Running Noise ⁽⁴⁾ | dB(A) | 1,2,3 | 3~1000 | PGII | ≤ 60 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 68 |
| | | | | PGIIR | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 75 | ≤ 77 |
| Max. bending moment based on the gearbox input flange $M_b^{(5)}$ | Nm | 1,2,3 | 3~1000 | PGII | 5 | 12 | 22 | 45 | 54 |
| | | | | PGIIR | 3 | 6 | 10 | 17 | 19 |
| Efficiency η | % | 1 | 3~10 | PGII | $\geq 97\%$ | | | | |
| | | | | PGIIR | $\geq 93\%$ | | | | |
| | | 2 | 15~100 | PGII | $\geq 94\%$ | | | | |
| | | | | PGIIR | $\geq 90\%$ | | | | |
| | | 3 | 120~1000 | PGII | $\geq 91\%$ | | | | |
| | | | | PGIIR | $\geq 87\%$ | | | | |

(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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), or ratio 1,000 (3-stage) no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times Mb}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

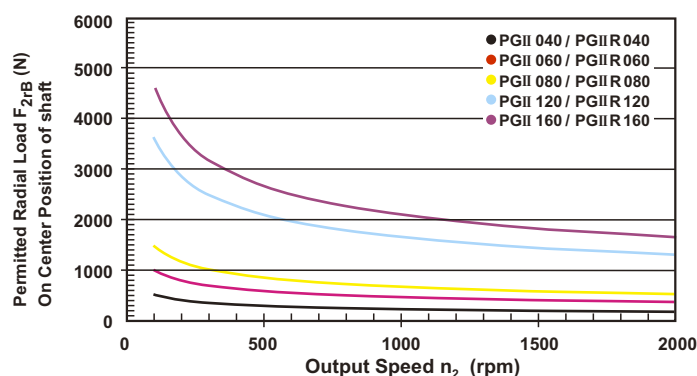
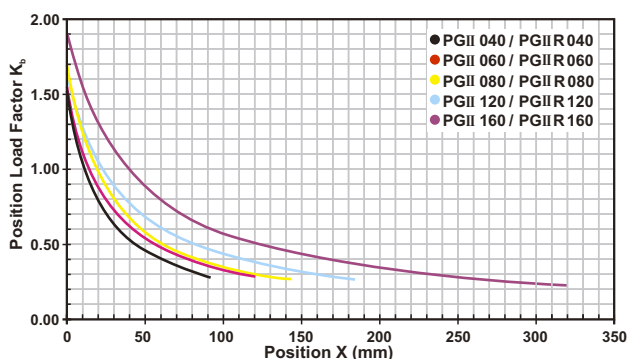
PGII Gearbox Inertia

| Model No. | | PGII 040 | | | PGII 060 | | | PGII 080 | | | PGII 120 | | PGII 160 | |
|--------------------------|--------------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|----------|-------|----------|-------|
| $\varnothing^{(A)}$ (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.cm ² | 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 | | - | - | - | 0.22 | 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 | |
|--------------------------|--------------------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-----------|-------|
| $\varnothing^{(A)}$ (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.cm ² | 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 | | - | - | - | 0.43 | 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)



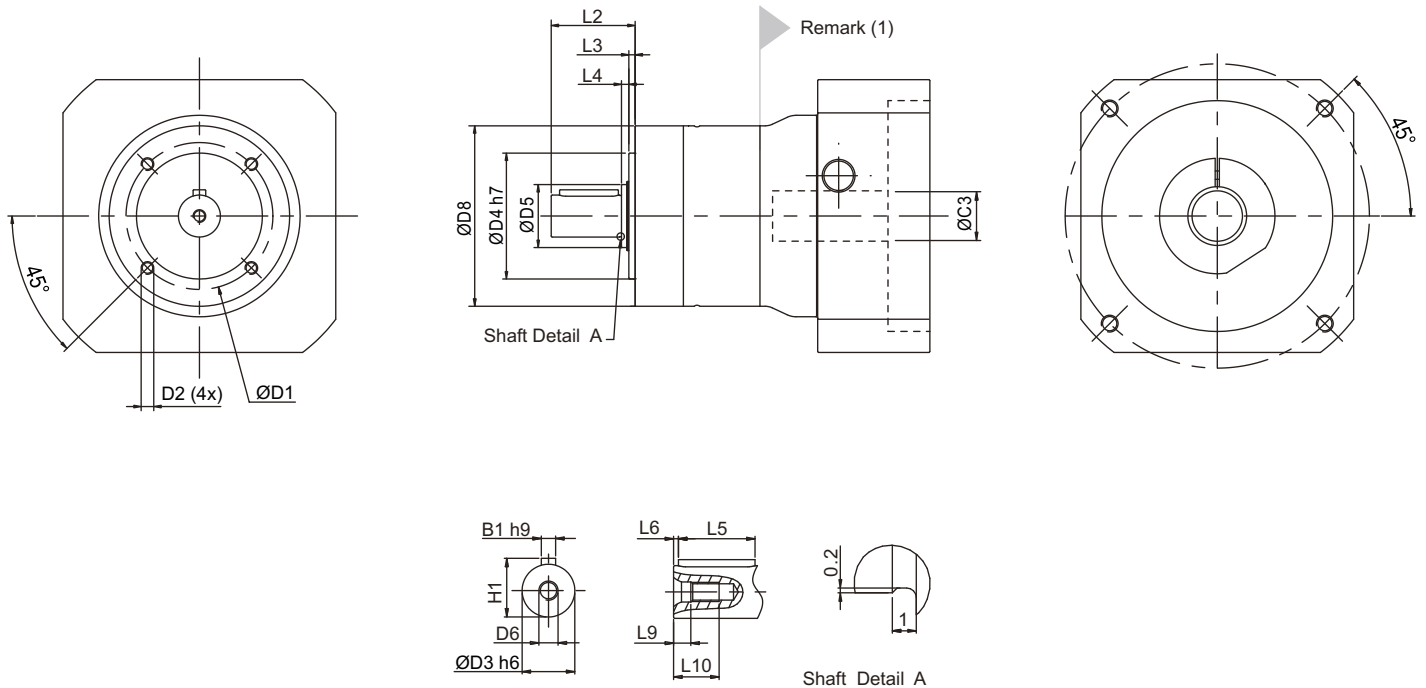
If radial force F_{zr} is not exerted on the center of the output shaft $X < 1/2 L$ or $X > 1/2 L$, the permitted radial and axial loads can be calculated by the position load factor K_s on the above diagram.

Permitted radial load F_{zr} on center of output shaft $X = 1/2 L$ for various output speeds.

(A) \varnothing = Input shaft diameter.

(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.

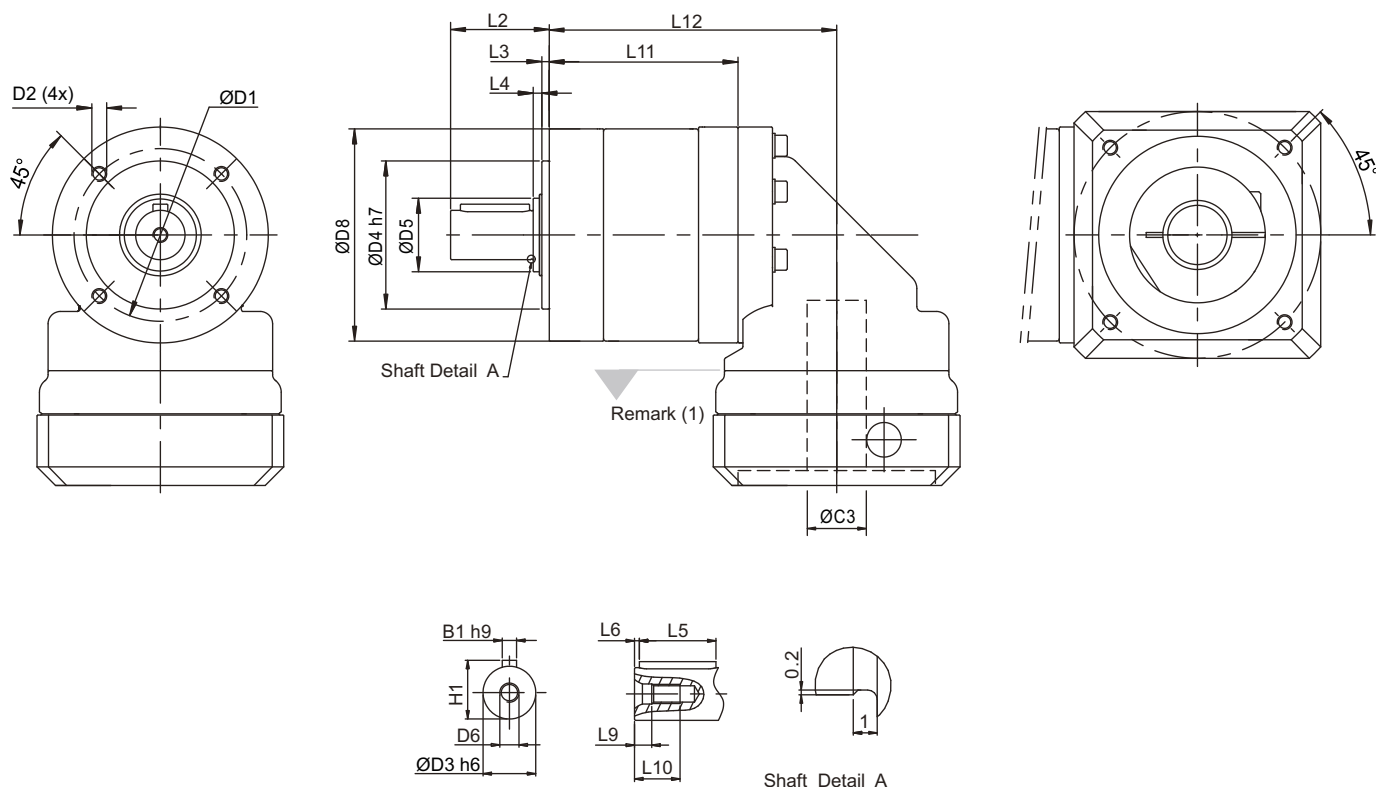
PGII Series Dimension



| 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 | | 40 | | 55 | |
| D4 | h7 | 26 | | 40 | | 60 | | 80 | | 130 | | 130 | | 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 | | 12 | | 12 | |
| H1 | 11.2 | | | 16 | | | 22.5 | | | 28 | | | 43 | | |

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

PGII R Series Dimension



| Dimension | PGII R 040 | | | PGII R 060 | | | PGII R 080 | | | PGII R 120 | | | PGII R 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 | | 130 | | | |
| D4 | h7 | 26 | | 40 | | 60 | | 80 | | 130 | | 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 | | 43 | | | |
| H1 | 11.2 | | | 16 | | | 22.5 | | | 28 | | | 43 | | |

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

PA II / PA IIR 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} | 1 | 3 | AII | 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 | AII 3 times T_{2N} | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2 | 3~100 | AII $T_{2B} = 60\%$ of T_{2NOT} | | | | | |
| No Load Running Torque ⁽⁴⁾ | 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⁾ | 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 | AII | 0.9 | 2.2 | 8 | 12 | 16 |
| Nominal Input Speed n_{1N} | rpm | 1,2 | 3~100 | AII | 4,500 | 4,000 | 3,600 | 3,600 | 2,500 |
| Max. Input Speed n_{1B} | rpm | 1,2 | 3~100 | AII | 8,000 | 6,000 | 6,000 | 4,800 | 3,600 |
| Max. Radial Load F_{2rB} ⁽³⁾ | N | 1,2 | 3~100 | AII | 810 | 1,150 | 1,530 | 3,470 | 4,640 |
| Max. Axial Load F_{2aB} ⁽³⁾ | N | 1,2 | 3~100 | AII | 405 | 575 | 765 | 1,735 | 2,320 |
| Operating Temp | °C | 1,2 | 3~100 | AII | 0° C ~ +90° C | | | | |
| Degree of Gearbox Protection | | 1,2 | 3~100 | AII | IP65 | | | | |
| Lubrication | | 1,2 | 3~100 | AII | Synthetic lubrication grease | | | | |
| Mounting Position | | 1,2 | 3~100 | AII | All directions | | | | |
| Running Noise ⁽⁴⁾ | dB(A) | 1,2 | 3~100 | PAII | ≤ 60 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 68 |
| | | | | PAIIR | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 75 | ≤ 77 |
| Max. bending moment based on the gearbox input flange M_b ⁽⁵⁾ | Nm | 1,2 | 3~100 | PAII | 5 | 12 | 22 | 45 | 54 |
| | | | | PAIIR | 3 | 6 | 10 | 17 | 19 |
| Efficiency η | % | 1 | 3~10 | PAII | $\geq 97\%$ | | | | |
| | | | | PAIIR | $\geq 93\%$ | | | | |
| | | 2 | 15~100 | PAII | $\geq 94\%$ | | | | |
| | | | | PAIIR | $\geq 90\%$ | | | | |

(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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times M_b}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

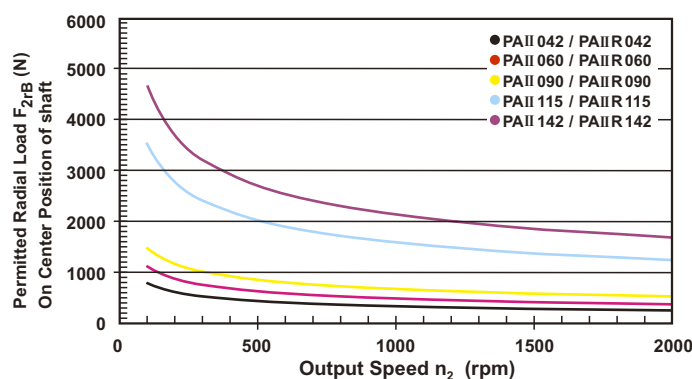
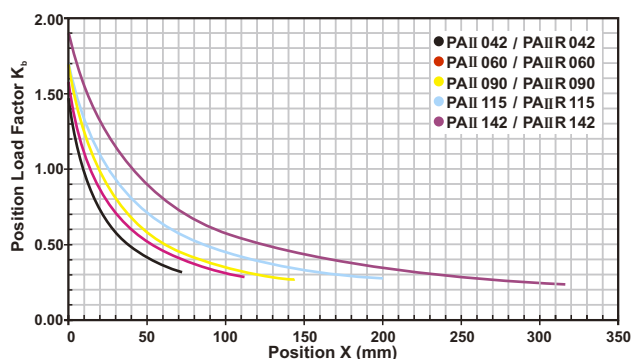
PA II Gearbox Inertia

| Model No. | PAII 042 | | PAII 060 | | PAII 090 | | PAII 115 | | PAII 142 | |
|--------------------------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.10 | 0.10 | 0.12 | 0.10 | - | - | - | - | - | - |
| 11 | 0.16 | 0.16 | 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 | - | 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 | - |

PAII R Gearbox Inertia

| Model No. | PAII R 042 | | PAII R 060 | | PAII R 090 | | PAII R 115 | | PAII R 142 | |
|--------------------------|------------|---------|------------|---------|------------|---------|------------|---------|------------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.18 | 0.18 | 0.36 | 0.36 | - | - | - | - | - | - |
| 11 | 0.20 | 0.20 | 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 | - | 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)



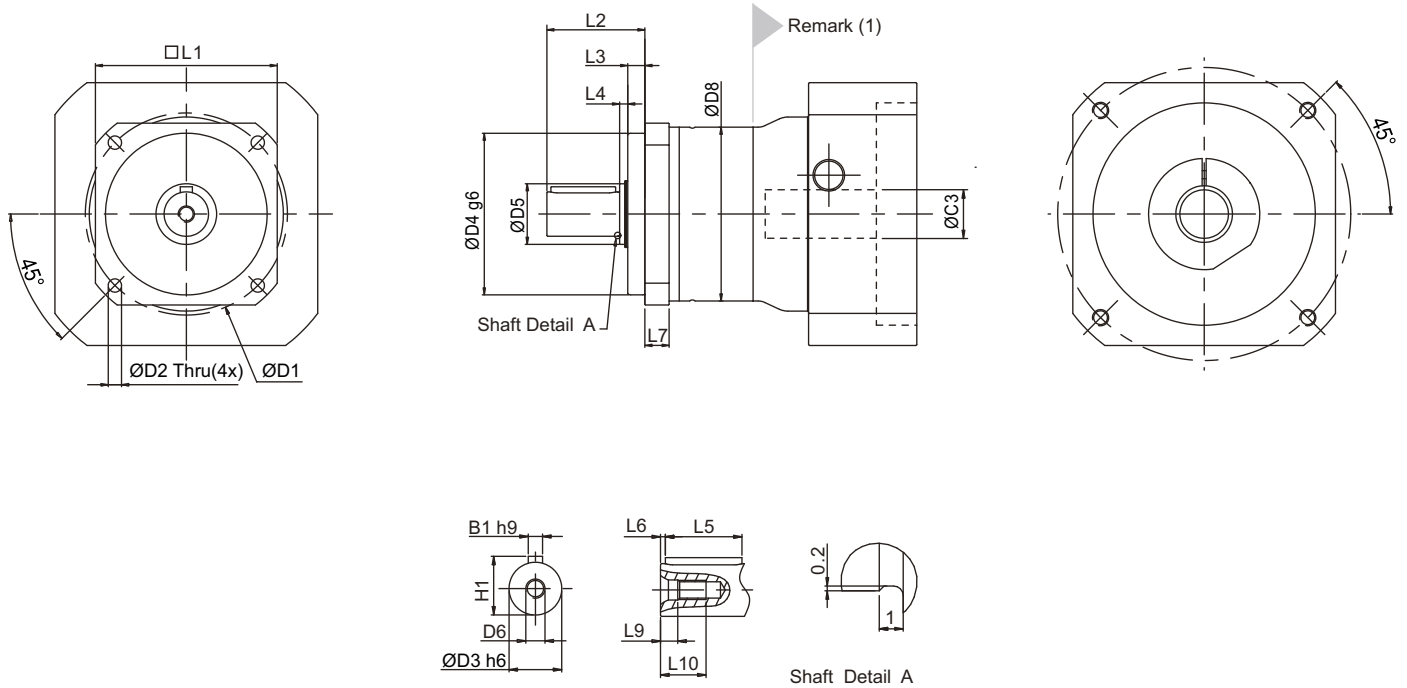
If radial force F_{zr} is not exerted on the center of the output shaft $X < 1/2 L$ or $X > 1/2 L$, the permitted radial and axial loads can be calculated by the position load factor K_s on the above diagram.

Permitted radial load F_{zr} on center of output shaft $X = 1/2 L$ for various output speeds.

(A) \varnothing = Input shaft diameter.

(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.

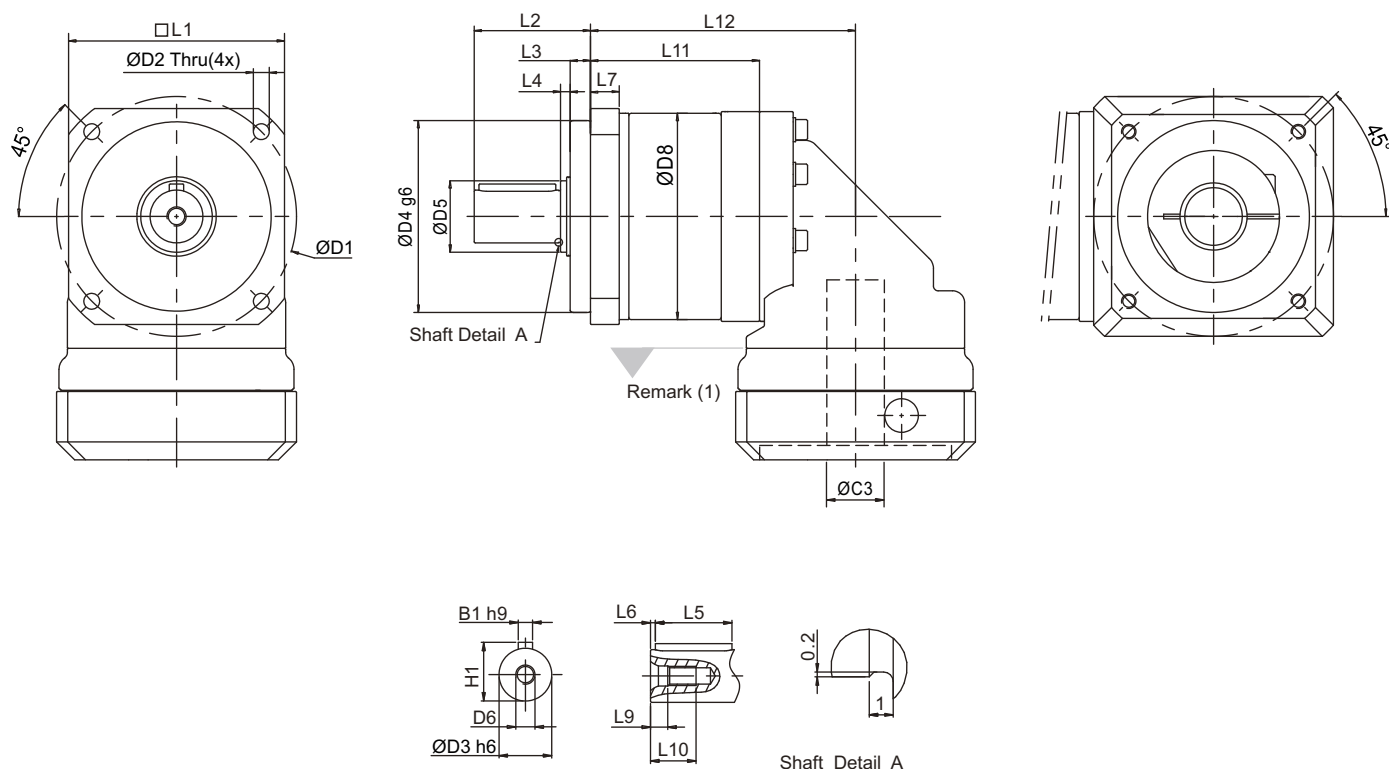
PA II Series Dimension



| 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.

PA IIR 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 / PSIIIR Gearbox Performance

| Model No. | Stages | Ratio ⁽¹⁾ | Type | PSII A | PSII B | PSII C | PSII D | PSII E | |
|---|-----------|---|--------|----------|--|----------|----------|-------------------------|-------|
| | | | | PSIIIR A | PSIIIR B | PSIIIR C | PSIIIR D | PSIIIR E | |
| Nominal Output Torque T _{2N} | 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⁾ | 1 | 3~10 | PSII | 0.05 | 0.10 | 0.40 | 0.80 | 2.50 | |
| | | | PSIIIR | 0.10 | 0.15 | 0.45 | 0.85 | 2.55 | |
| | 2 | 15~100 | PSII | 0.05 | 0.10 | 0.30 | 0.40 | 0.80 | |
| | | | PSIIIR | 0.10 | 0.15 | 0.35 | 0.45 | 0.85 | |
| Backlash ⁽²⁾ | 1 | 3~10 | PSII | ≤ 8 | ≤ 7 | ≤ 6 | ≤ 6 | ≤ 6 | |
| | | | PSIIIR | ≤ 12 | ≤ 11 | ≤ 10 | ≤ 10 | ≤ 10 | |
| | 2 | 15~100 | PSII | ≤ 10 | ≤ 9 | ≤ 8 | ≤ 8 | ≤ 8 | |
| | | | PSIIIR | ≤ 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 |
| 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 |
| | | | | PSIIIR | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 75 | ≤ 77 |
| Max. bending moment based on the gearbox input flange Mb ⁽⁵⁾ | Nm | 1,2 | 3~100 | PSII | 5 | 12 | 22 | 45 | 54 |
| | | | | PSIIIR | 3 | 6 | 10 | 17 | 19 |
| Efficiency η | % | 1 | 3~10 | PSII | ≥ 97% | | | | |
| | | | | PSIIIR | ≥ 93% | | | | |
| | | 2 | 15~100 | PSII | ≥ 94% | | | | |
| | | | | PSIIIR | ≥ 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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times Mb}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

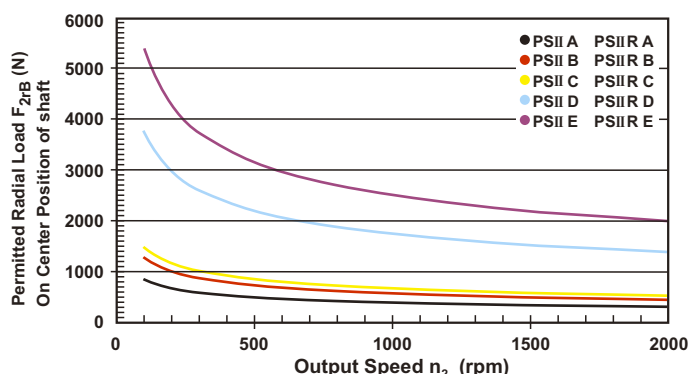
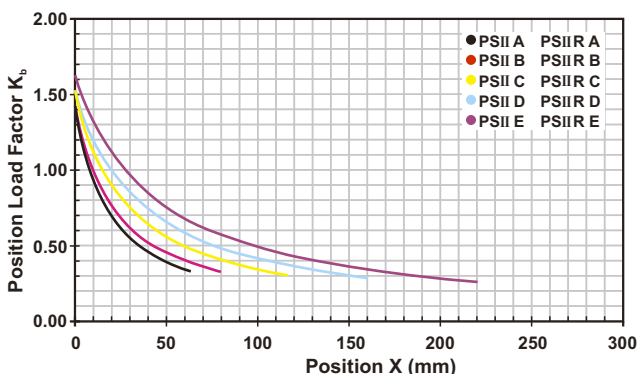
PSII Gearbox Inertia

| Model No. | PSII A | | PSII B | | PSII C | | PSII D | | PSII E | |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.10 | 0.10 | 0.12 | 0.10 | - | - | - | - | - | - |
| 11 | 0.16 | 0.16 | 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 | - | 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 | |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.18 | 0.18 | 0.36 | 0.36 | - | - | - | - | - | - |
| 11 | 0.20 | 0.20 | 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 | - | 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)



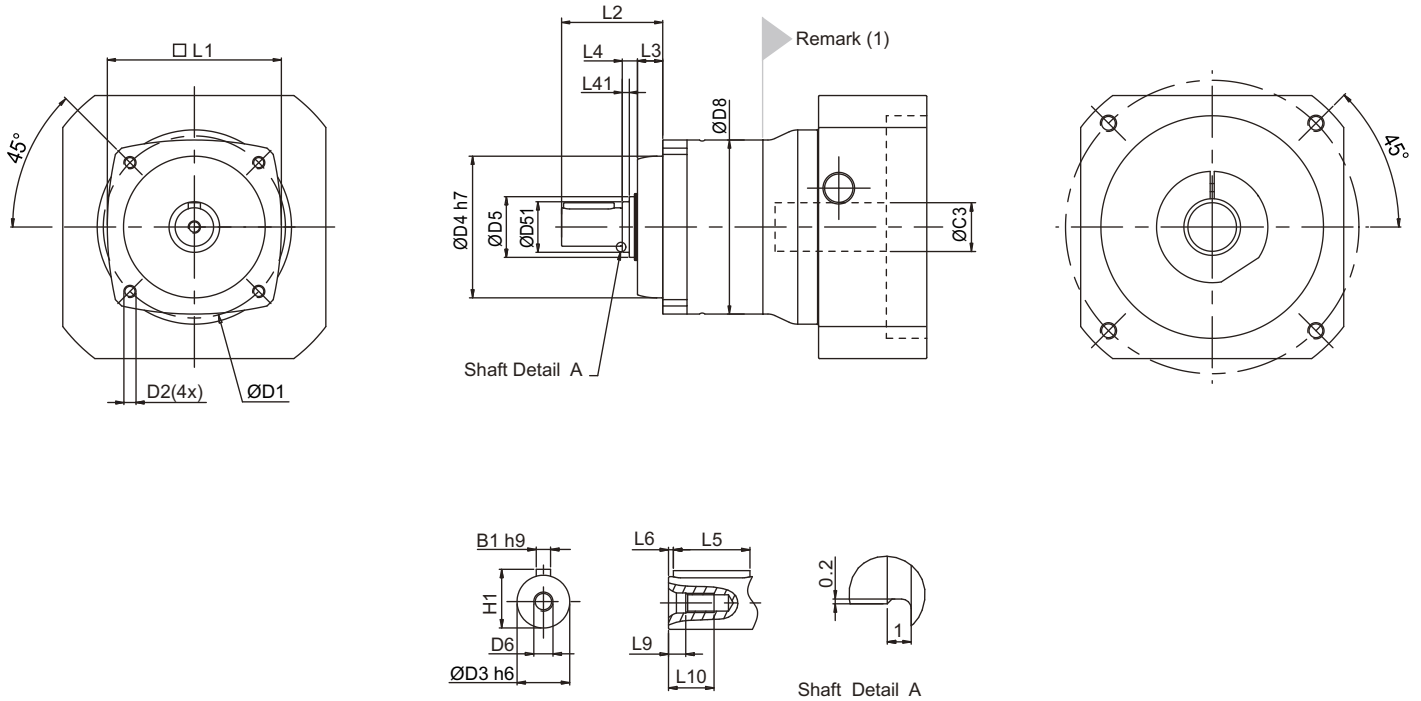
If radial force F_{zr} is not exerted on the center of the output shaft $X < 1/2 L$ or $X > 1/2 L$, the permitted radial and axial loads can be calculated by the position load factor K_s on the above diagram.

Permitted radial load F_{zr} on center of output shaft $X = 1/2 L$ for various output speeds.

(A) \varnothing = Input shaft diameter.

(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.

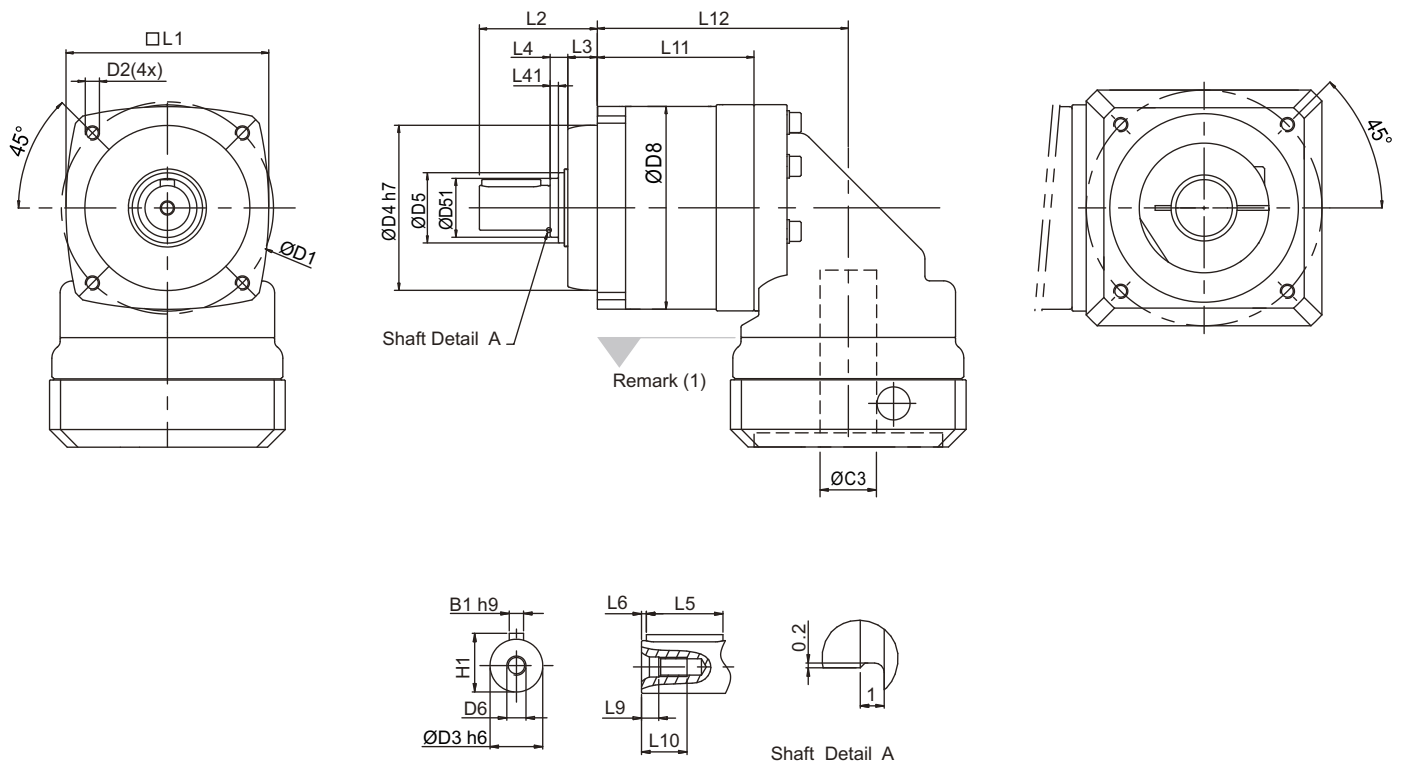
PSII Series Dimension



| 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 / PNII R Gearbox Performance

| Model No. | Stages | Ratio ⁽¹⁾ | Type | PNII 017 | PNII 023 | PNII 034 | PNII 042 | PNII 056 | |
|--|-----------|----------------------------------|--------|-----------------------------------|------------------------------|------------|----------------------|------------|-------|
| | | | | PNII R 017 | PNII R 023 | PNII R 034 | PNII R 042 | PNII R 056 | |
| Nominal Output Torque T_{2N} | 1 | 3 | AII | 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 | AII 3 times T_{2N} | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2 | 3~100 | AII $T_{2B} = 60\%$ of T_{2NOT} | | | | | |
| No Load Running Torque ⁽⁴⁾ | 1 | 3~10 | PNII | 0.05 | 0.10 | 0.40 | 0.80 | 2.50 | |
| | | | PNII R | 0.10 | 0.15 | 0.45 | 0.85 | 2.55 | |
| | 2 | 15~100 | PNII | 0.05 | 0.10 | 0.30 | 0.40 | 0.80 | |
| | | | PNII R | 0.10 | 0.15 | 0.35 | 0.45 | 0.85 | |
| Backlash ⁽²⁾ | 1 | 3~10 | PNII | ≤ 8 | ≤ 7 | ≤ 6 | ≤ 6 | ≤ 6 | |
| | | | PNII R | ≤ 12 | ≤ 11 | ≤ 10 | ≤ 10 | ≤ 10 | |
| | 2 | 15~100 | PNII | ≤ 10 | ≤ 9 | ≤ 8 | ≤ 8 | ≤ 8 | |
| | | | PNII R | ≤ 14 | ≤ 13 | ≤ 12 | ≤ 12 | ≤ 12 | |
| Torsional Rigidity | Nm/arcmin | 1,2 | 3~100 | AII | 0.90 | 1.50 | 6 | 12 | 14 |
| Nominal Input Speed n_{1N} | rpm | 1,2 | 3~100 | AII | 4,500 | 4,000 | 3,600 | 3,600 | 2,500 |
| Max. Input Speed n_{1B} | rpm | 1,2 | 3~100 | AII | 8,000 | 6,000 | 6,000 | 4,800 | 3,600 |
| Max. Radial Load F_{2rB} ⁽³⁾ | N | 1,2 | 3~100 | AII | 480 | 1,100 | 1,580 | 3,500 | 5,420 |
| Max. Axial Load F_{2aB} ⁽³⁾ | N | 1,2 | 3~100 | AII | 240 | 550 | 790 | 1,750 | 2,710 |
| Operating Temp | °C | 1,2 | 3~100 | AII | 0° C ~ +90° C | | | | |
| Degree of Gearbox Protection | | 1,2 | 3~100 | AII | IP65 | | | | |
| Lubrication | | 1,2 | 3~100 | AII | Synthetic lubrication grease | | | | |
| Mounting Position | | 1,2 | 3~100 | AII | All directions | | | | |
| Running Noise ⁽⁴⁾ | dB(A) | 1,2 | 3~100 | PNII | ≤ 60 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 68 |
| | | | | PNII R | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 75 | ≤ 77 |
| Max. bending moment based on the gearbox input flange M_b ⁽⁵⁾ | Nm | 1,2 | 3~100 | PNII | 5 | 12 | 22 | 45 | 54 |
| | | | | PNII R | 3 | 6 | 10 | 17 | 19 |
| Efficiency η | % | 1 | 3~10 | PNII | ≥ 97% | | | | |
| | | | | PNII R | ≥ 93% | | | | |
| | | 2 | 15~100 | PNII | ≥ 94% | | | | |
| | | | | PNII R | ≥ 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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times M_b}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

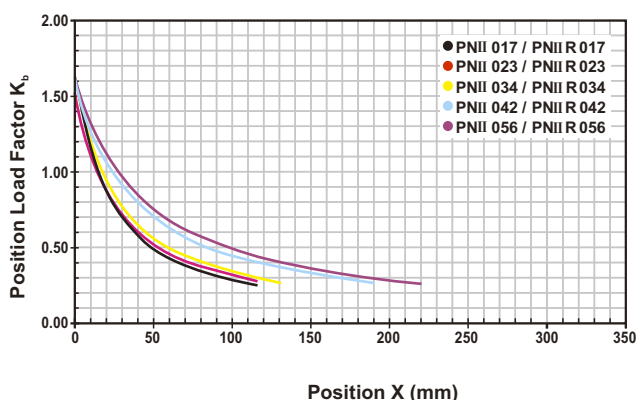
PNII Gearbox Inertia

| Model No. | PNII 017 | | PNII 023 | | PNII 034 | | PNII 042 | | PNII 056 | |
|--------------------------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.10 | 0.10 | 0.12 | 0.10 | - | - | - | - | - | - |
| 11 | 0.16 | 0.16 | 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 | - | 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 | - |

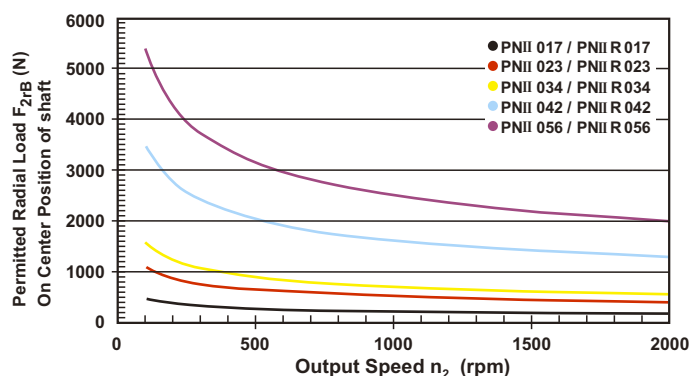
PNII R Gearbox Inertia

| Model No. | PNII R 017 | | PNII R 023 | | PNII R 034 | | PNII R 042 | | PNII R 056 | |
|--------------------------|------------|---------|------------|---------|------------|---------|------------|---------|------------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.18 | 0.18 | 0.36 | 0.36 | - | - | - | - | - | - |
| 11 | 0.20 | 0.20 | 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 | - | 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 K_b on the above diagram.

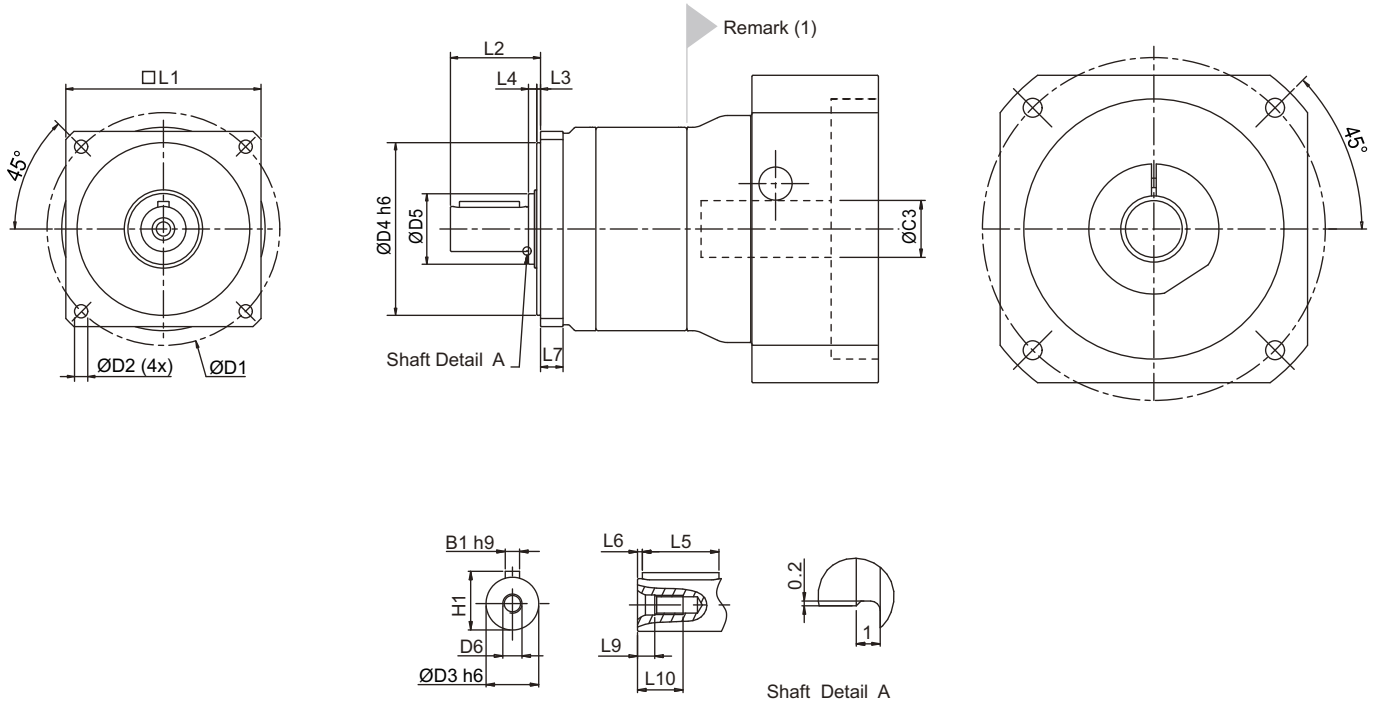


Permitted radial load F_{2r} on center of output shaft $X = 1/2 \times L$ for various output speeds.

(A) \varnothing = Input shaft diameter.

(B) Permitted loading values on the output shaft. Please refer to P. 33 glossary.

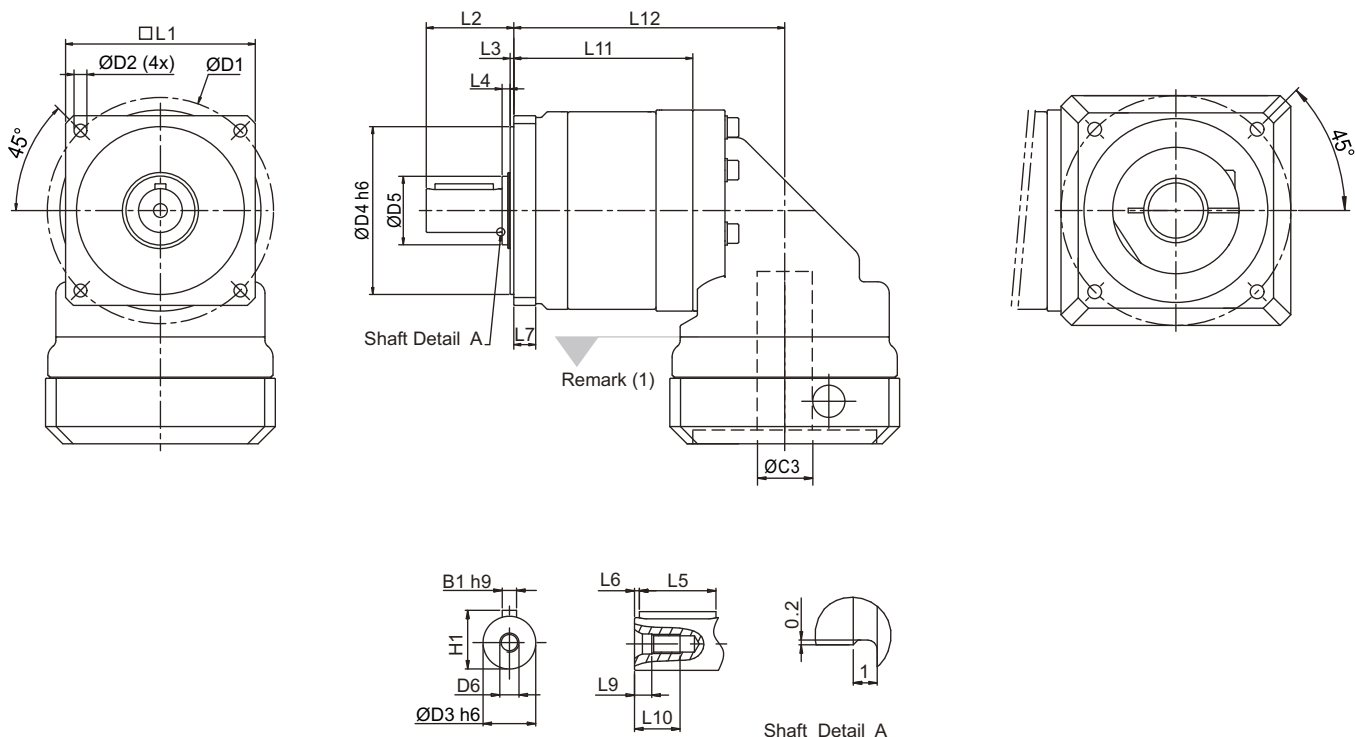
PNII Series Dimension



| 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 | 12.7 | 19.05 | 19.05 | 25.4 | 25.4 | 38.1 | 38.1 |
| D4 | h6 | 22 | 38.1 | 38.1 | 73.025 | 73.025 | 55.55 | 55.55 | 114.3 | 114.3 |
| D5 | 17 | | 17 | | 30 | | 35 | | 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 | 3.175 | 4.763 | 4.763 | 6.35 | 6.35 | 9.525 | 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.

PNIR Series Dimension



| Dimension | PNIR 017 | | PNIR 023 | | PNIR 034 | | PNIR 042 | | PNIR 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 | 12.7 | 19.05 | 19.05 | 25.4 | 25.4 | 38.1 | 38.1 |
| D4 | h6 | 22 | 38.1 | 38.1 | 73.025 | 73.025 | 55.55 | 55.55 | 114.3 | 114.3 |
| D5 | 17 | | 17 | | 30 | | 35 | | 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 | 53.4 | 68.4 | 67.9 | 87.9 | 77.9 | 104.4 | 111.4 | 147.4 | 127.3 | 174.8 |
| L12 | 78.4 | 93.4 | 97.4 | 117.4 | 117.9 | 144.4 | 162.4 | 198.4 | 184.3 | 231.8 |
| B1 | h9 | 3.175 | 3.175 | 3.175 | 4.763 | 4.763 | 6.35 | 6.35 | 9.525 | 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 | PD 064 | PD 090 | PD 110 | |
|--|----------------------------------|----------------------|--------|-----------|------------------------------|-----------|-----------|-------------------------------|
| | | | | PDR 053 | PDR 064 | PDR 090 | PDR 110 | |
| Nominal Output Torque T_{2N} | 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 | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2 | 3~100 | All | | | | $T_{2B} = 60\%$ of T_{2NOT} |
| No Load Running Torque ⁽⁴⁾ | 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⁾ | 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 Moment M_{2K} | Nm | 1,2 | 3~100 | All | 22 | 17 | 44 | 140 |
| 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 |
| Max. bending moment based on the gearbox input flange M_b ⁽⁵⁾ | Nm | 1,2 | 3~100 | PD | 7 | 16 | 31 | 56 |
| | | | | PDR | 4 | 9 | 16 | 25 |
| Efficiency η | % | 1 | 3~10 | PD | $\geq 97\%$ | | | |
| | | | | PDR | $\geq 93\%$ | | | |
| | | 2 | 15~100 | PD | $\geq 94\%$ | | | |
| | | | | PDR | $\geq 90\%$ | | | |

(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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times M_b}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

PD Gearbox Inertia

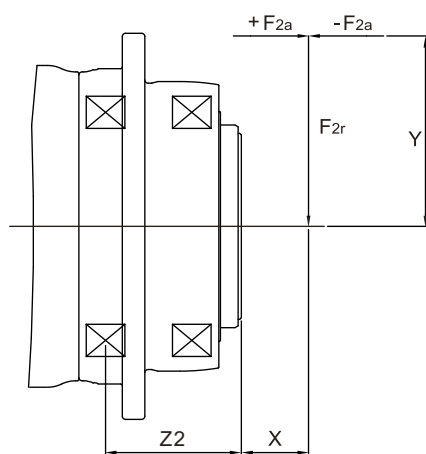
| Model No. | PD 053 | | PD 064 | | PD 090 | | PD 110 | |
|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| Ø ^(A) (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 0.10 | 0.10 | 0.12 | 0.10 | - | - | - | - |
| 11 | 0.16 | 0.16 | 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 | - | - | - | - | - | - | - | - |

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 | 0.18 | 0.18 | 0.36 | 0.36 | - | - | - | - |
| 11 | 0.20 | 0.20 | 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.

Max. Tilting Moment M_{2K}

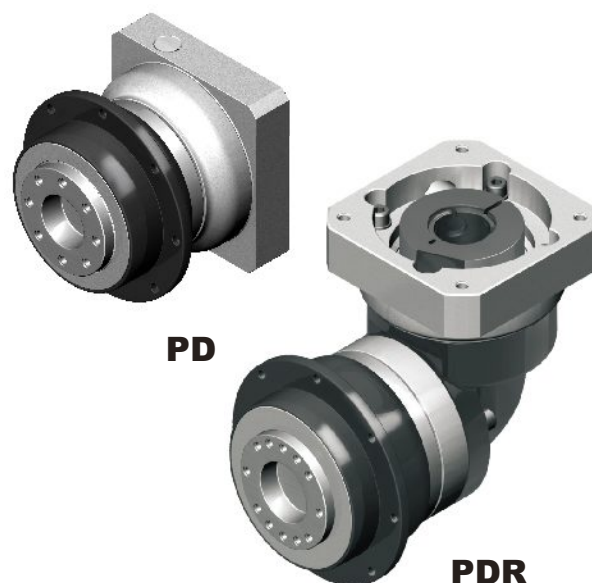


$$M_{2K} = \frac{F_{2a} * Y + F_{2r} * (X + Z2)}{1000}$$

M_{2K} : [Nm]

F_{2a}, F_{2r} : [N]

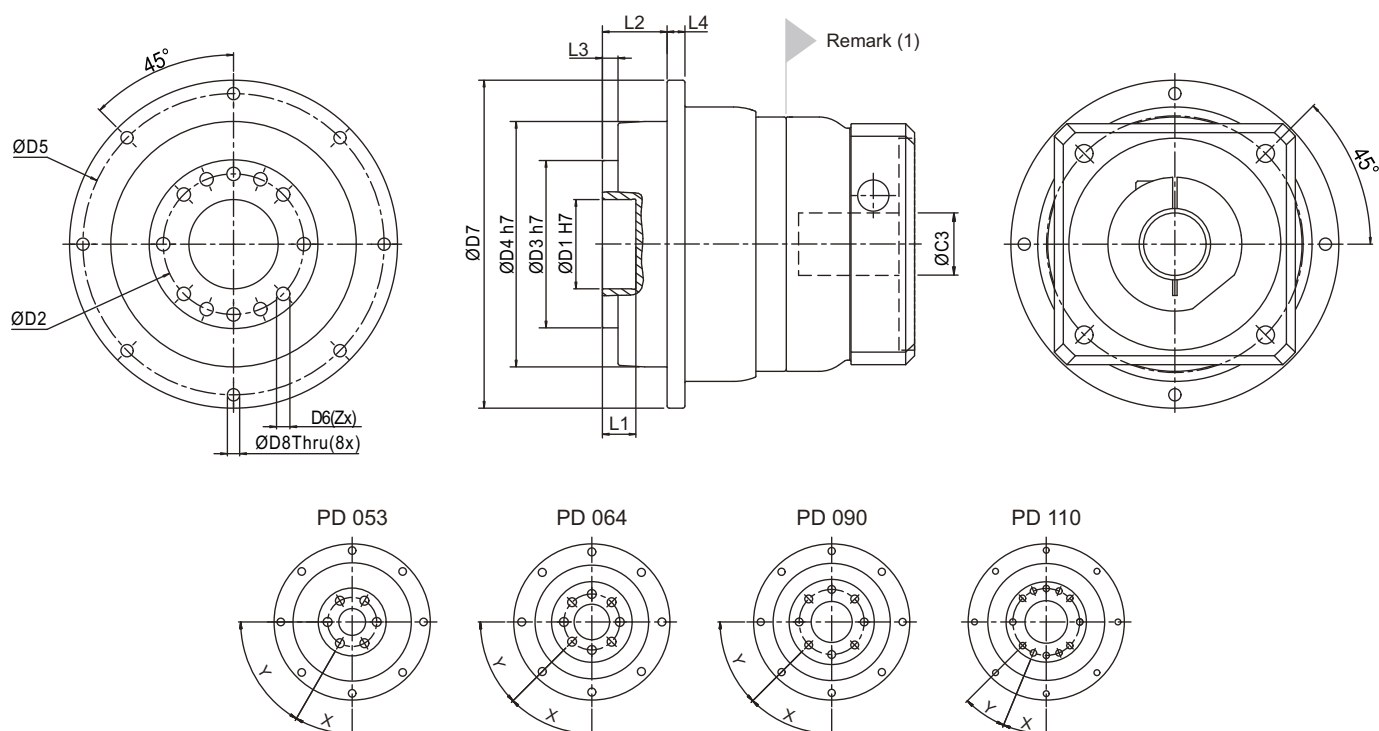
$X, Y, Z2$: [mm]



| PD / PDR | 053 | 064 | 090 | 110 |
|----------|------|------|------|------|
| Z2 [mm] | 23.8 | 21.5 | 30.1 | 42.1 |

Note : Applied to the output flange center at 100 rpm.

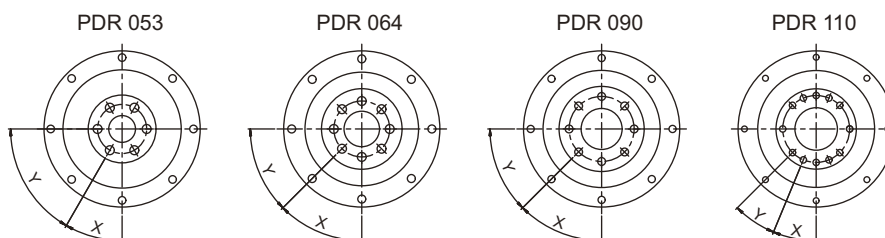
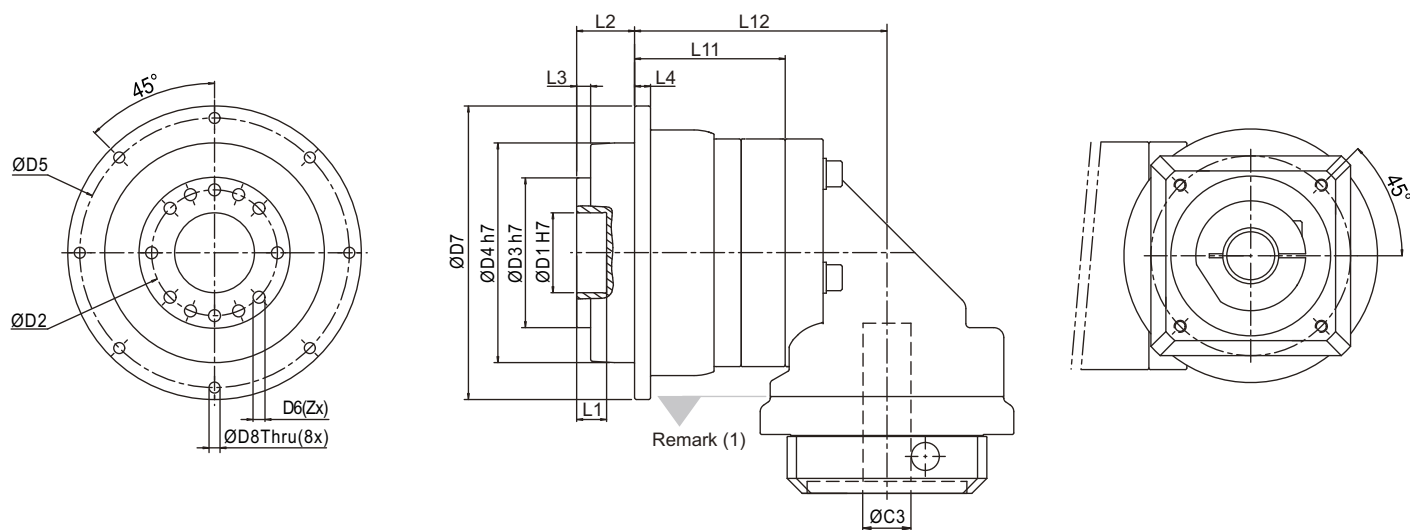
PD Series Dimension



| 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 | | 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 |
| 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} | 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⁾ | 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⁾ | 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 |
| 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 |
| Max. belt tension | N | 1,2 | 3~100 | All | 560 | 950 | 1200 |
| Max. bending moment based on the gearbox input flange M_b ⁽⁵⁾ | Nm | 2 | 12~100 | PL | 19 | 38 | 45 |
| | | 2 | | PLR | 10 | 17 | 14 |
| Efficiency η | % | 1 | 3~10 | PL | $\geq 97\%$ | | |
| | | | | PLR | $\geq 93\%$ | | |
| | | 2 | 12~100 | PL | $\geq 94\%$ | | |
| | | | | PLR | $\geq 90\%$ | | |

(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) The dB values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

(5) Max. motor weight* (kg) = $\frac{0.1 \times M_b}{\text{motor length (m)}}$

*with symmetrically distributed motor weight

*with horizontal and stationary mounting

(6) 5 years warranty.

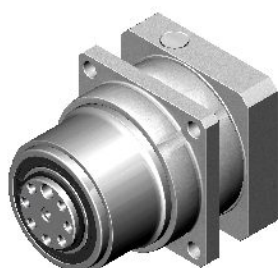
PL Gearbox Inertia

| Model No. | PL 070 | | PL 090 | | PL 120 | |
|--------------------------|---------|---------|---------|---------|---------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 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 | |
|--------------------------|---------|---------|---------|---------|---------|---------|
| $\varnothing^{(A)}$ (C3) | 1-stage | 2-stage | 1-stage | 2-stage | 1-stage | 2-stage |
| 8 | 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) \varnothing = Input shaft diameter.



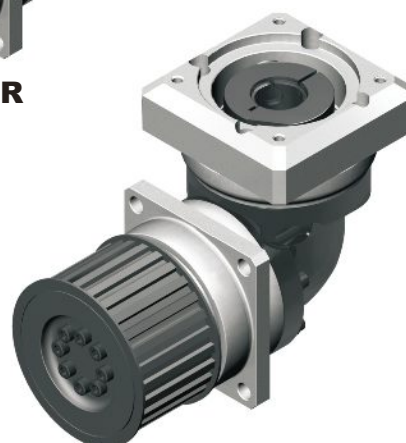
PL



PLR

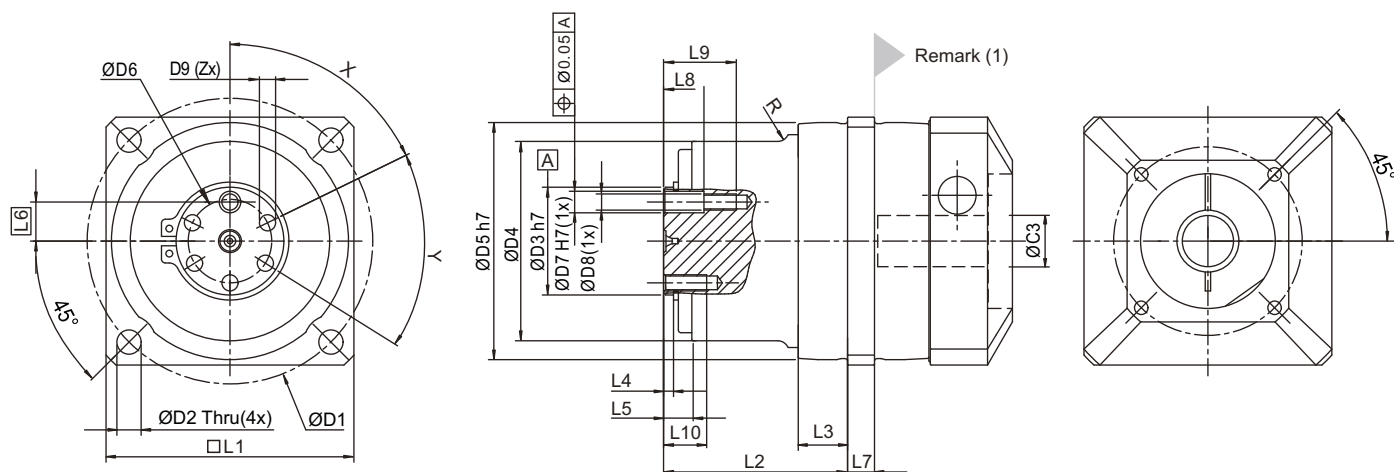


PL+Pulley



PLR+Pulley

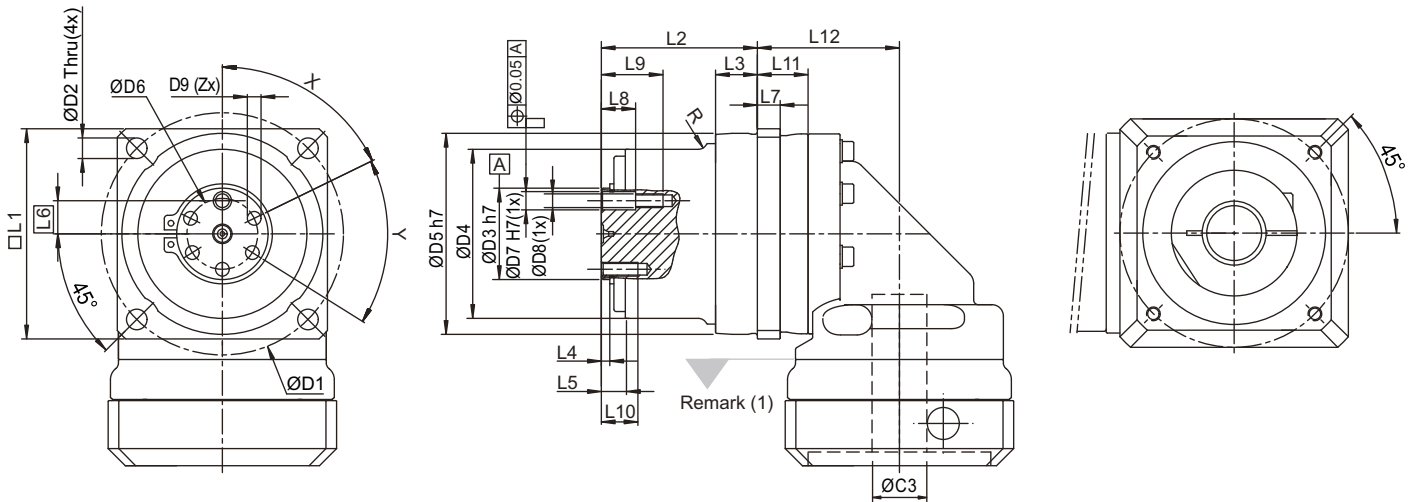
PL Series Dimension



| 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.

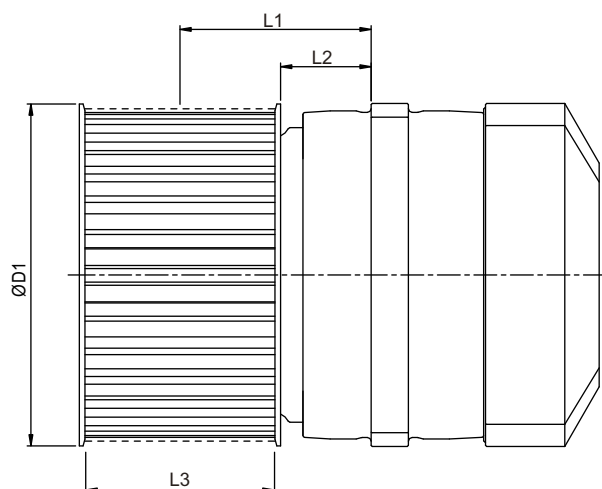
PLR Series Dimension



| 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**

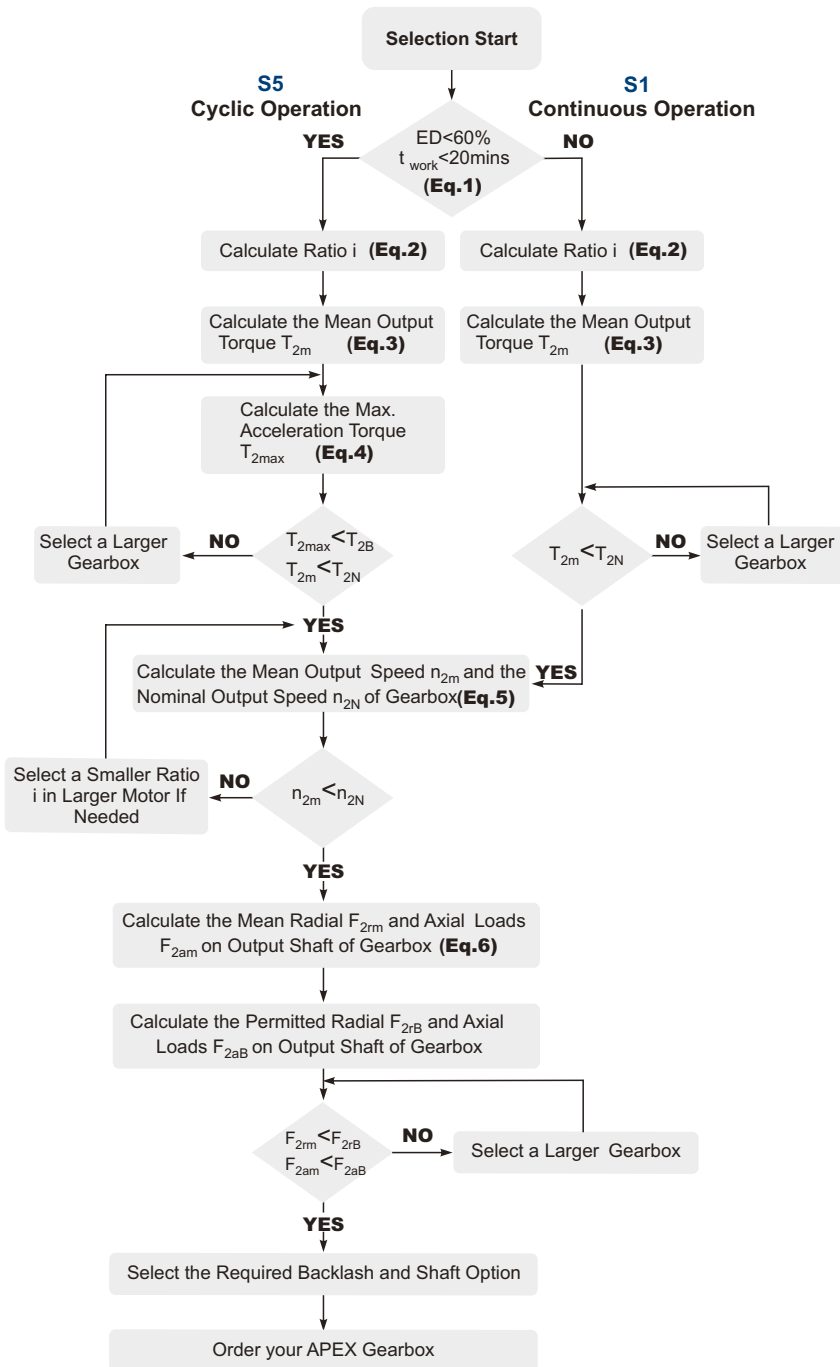
(1) Pulley size.

(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

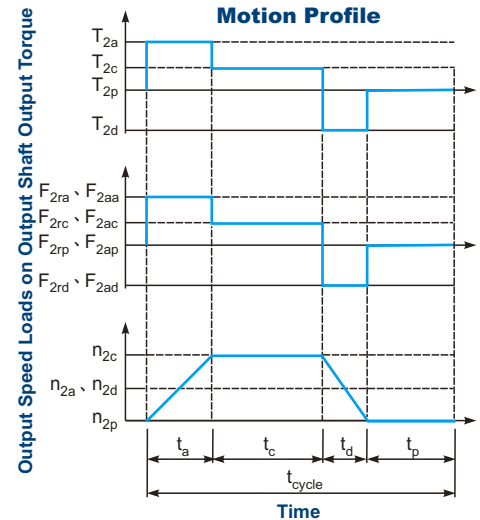
$$\frac{J_L}{i^2} \leq 4 \times J_m$$

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)

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

(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 Efficiency 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)

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

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

(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 | <p>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'.</p> |
| Torsional Rigidity | Nm/arcmin | <p>Torsional Rigidity is the quotient ($\Delta T / \Delta \theta$) 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.</p> <p>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.</p> |
| Radial Load And Axial Load | N | <p>The permitted radial and axial loads on output shaft of the gearbox depend on the design of the gearbox supporting bearings.</p> |
| 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 J_1 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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APEX DYNAMICS, INC.

No10. Keyuan 3rd RD.Situn District, Taichung City 40763, Taiwan (R.O.C)
Tel:886-4-24650219 | Fax:886-4-24650118
sales@apexdyna.com | <http://www.apexdyna.com>

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UK & Ireland Distributor



11-15 Francis Avenue, Bournemouth,
Dorset, UK, BH11 8NX
Tel.: +44 (0)1202 599922
enquiries@motioncontrolproducts.com
www.motioncontrolproducts.com