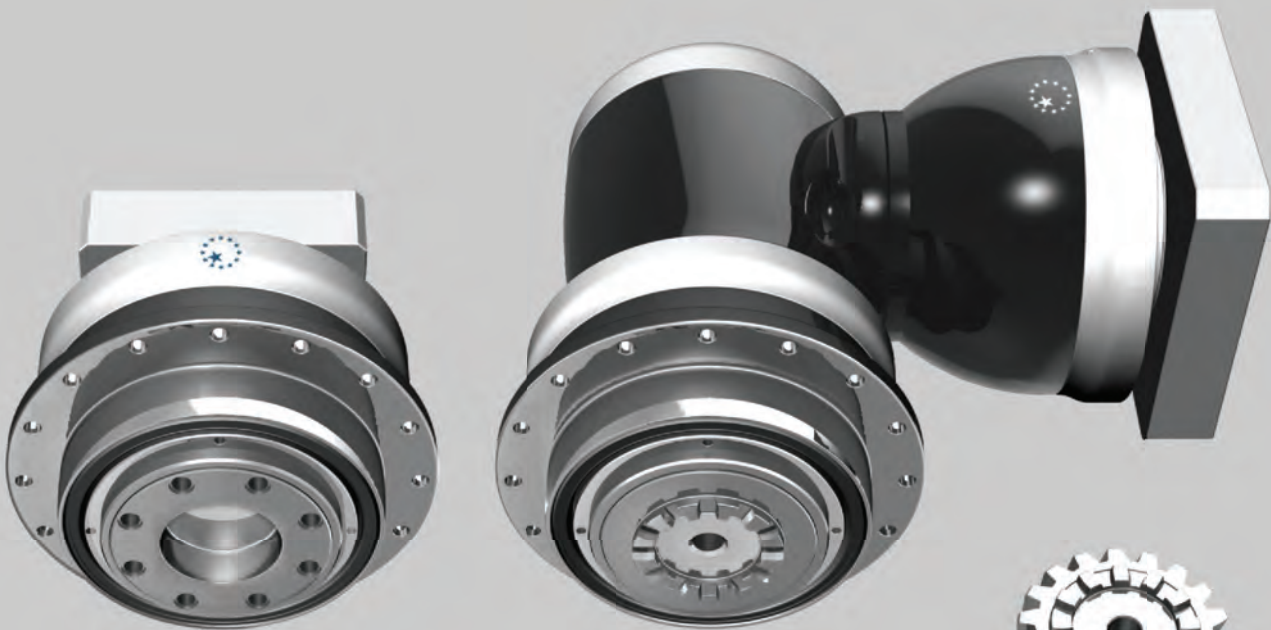




APEX DYNAMICS, INC.

**High Torque
High Precision
Planetary Gearbox**

**AP / APK
APC / APCK - SERIES**



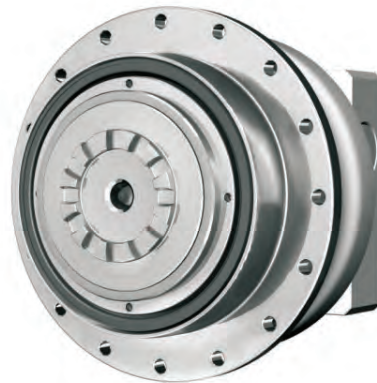
Gearbox Series - AP / APK / APC / APCK

► Features:

- High Torque
- Optimized Output Torque & Inertia Moment
- High Precision
- Long Service Life
- Low Noise
- Limited Temperature Rise
- Support Flange/Curvic Interface
- Suitable for Rack & Pinion Applications



AP



APC



APK



APCK

Order Code

| | | | | |
|---------------|---|----------------------------|---|---------------------|
| API10 | — | 005.5⁽¹⁾ | / | MOTOR |
| APK110 | — | 005.5⁽¹⁾ | / | MOTOR |
| | | | | Motor Type |
| | | | | Ratio |
| | | | | Gearbox Size |

Gearbox Size

| | |
|-------------|--|
| AP | 110 / 140 / 200 / 255 / 285 / 355 / 450 |
| APC | 110 / 140 / 200 / 255 / 285 / 355 / 450 |
| APK | 110 / 140 / 200 / 255 / 285 / 355 / 450 |
| APCK | 110 / 140 / 200 / 255 / 285 / 355 / 450 |

Ratio

| | |
|-----------------|--|
| AP/APC | (1 Stg.) 5.5 |
| AP/APC | (2 Stg.) 22 / 27.5 / 38.5 / 55 |
| AP/APC | (3 Stg.) 88 / 110 / 154 / 220 |
| APK/APCK | (2 Stg.) 5.5 / 11 / 22 / 27.5 / 38.5 / 55 |
| APK/APCK | (3 Stg.) 88 / 110 / 137.5 / 154 / 220 / 385 |
| APK/APCK | (4 Stg.) 440 / 550 / 770 / 1078 / 1540 / 2695 / 3850 / 5500 |

Motor Type : Manufacturer and Model

(1) Ratio ($i = N_{in} / N_{out}$).



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Performance - AP/APC Gearbox

| Model No. | Stage | Ratio ⁽¹⁾ | AP 110 APC 110 | AP 140 APC 140 | AP 200 APC 200 | AP 255 APC 255 | AP 285 APC 285 | AP 355 APC 355 | AP 450 APC 450 | |
|---|----------------------------------|----------------------|-------------------|------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-----------|
| Nominal Output Torque T_{2N} | 1 | 5.5 | 370 | 645 | 1,430 | 2,175 | 4,060 | - | - | |
| | | 22 | 375 | 650 | 1,445 | 2,200 | 4,100 | 6,995 | 13,810 | |
| | 2 | 27.5 | 375 | 655 | 1,445 | 2,200 | 4,105 | 7,000 | 13,825 | |
| | | 38.5 | 375 | 655 | 1,450 | 2,200 | 4,110 | 7,010 | 13,845 | |
| | | 55 | 315 | 655 | 1,450 | 2,205 | 4,110 | 7,020 | 13,855 | |
| | 3 | 88 | 380 | 655 | 1,450 | 2,205 | 4,115 | 7,025 | 13,865 | |
| | | 110 | 380 | 655 | 1,450 | 2,205 | 4,115 | 7,025 | 13,870 | |
| | | 154 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,875 | |
| | | 220 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,875 | |
| | Emergency Stop Torque T_{2NOT} | Nm | 1,2,3 | 5.5~220 | 3 times T_{2N} | | | | | |
| Max. Acceleration Torque T_{2B} | Nm | 1,2,3 | 5.5~220 | 1.5 times T_{2N} | | | | | | |
| No Load Running Torque ⁽²⁾ | Nm | 1 | 5.5 | 2.5 | 7.1 | 14 | 22 | 28 | - | - |
| | | 2 | 22~55 | 1.1 | 3.7 | 8 | 12 | 18 | 17 | 26 |
| | | 3 | 88~220 | 0.7 | 1.6 | 4 | 4.5 | 6.5 | 6 | 12 |
| Backlash ⁽³⁾ | arcmin | 1,2,3 | 5.5~220 | ≤ 1 | | | | | | |
| Torsional Rigidity | Nm/arcmin | 1,2,3 | 5.5~220 | 95 | 205 | 650 | 1,200 | 1,800 | 2,850 | 5,700 |
| Nominal Input Speed n_{1N} | rpm | 1 | 5.5 | 3,600 | 3,000 | 2,700 | 2,400 | 2,100 | - | - |
| | | 2 | 22~55 | 4,600 | 4,000 | 3,700 | 3,400 | 3,100 | 2,500 | 2,000 |
| | | 3 | 88~220 | 5,000 | 4,600 | 4,000 | 3,700 | 3,400 | 3,100 | 2,500 |
| Max. Input Speed n_{1B} | rpm | 1 | 5.5 | 6,000 | 5,000 | 4,500 | 4,000 | 3,500 | - | - |
| | | 2 | 22~55 | 7,000 | 6,000 | 5,500 | 5,000 | 4,500 | 4,000 | 3,500 |
| | | 3 | 88~220 | 7,000 | 7,000 | 6,000 | 5,500 | 5,000 | 4,500 | 4,000 |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 1,2,3 | 5.5~220 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 | 101,500 | 143,700 |
| Max. Tilting Moment M_{2k} ⁽⁴⁾ | Nm | 1,2,3 | 5.5~220 | 480 | 1,310 | 3,530 | 5,920 | 9,230 | 29,100 | 63,300 |
| Service Life ⁽⁵⁾ | hr | 1,2,3 | 5.5~220 | 20,000 | | | | | | |
| Operating Temp. | °C | 1,2,3 | 5.5~220 | -10° C ~ 90° C | | | | | | |
| Degree of Gearbox Protection | | 1,2,3 | 5.5~220 | IP65 | | | | | | |
| Lubrication | | 1,2,3 | 5.5~220 | Synthetic lubrication grease | | | | | | |
| Mounting Position | | 1,2,3 | 5.5~220 | All directions | | | | | | |
| Running Noise ⁽²⁾ | dB(A) | 1 | 5.5 | ≤ 64 | ≤ 66 | ≤ 66 | ≤ 68 | ≤ 68 | - | - |
| | | 2 | 22~55 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 67 | ≤ 67 | ≤ 68 | ≤ 70 |
| | | 3 | 88~220 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 66 | ≤ 67 | ≤ 67 | ≤ 68 |
| Efficiency η | % | 1 | 5.5 | $\geq 97\%$ | | | | | | |
| | | 2 | 22~55 | $\geq 94\%$ | | | | | | |
| | | 3 | 88~220 | $\geq 92\%$ | | | | | | |

(1) Ratio ($i = N_{in} / N_{out}$).

(2) These values are measured by gearbox with ratio = 5.5 (1-stage), 55 (2-stage) or 220 (3-stage) at 3,000 rpm without load.

(3) Backlash is measured at 2% of Nominal Output Torque T_{2N} .

(4) Applied to the output flange/curvic center at 100 rpm. The calculation formula please refer to Fig. 1.

(5) Continuous operation is not recommended.

$$\text{Max. Tilting Moment } M_{2K} = \frac{F_{2a} * Y + F_{2r} * (X+Z_2)}{1000}$$

M_{2k} : [Nm]
 F_{2a}, F_{2r} : [N]
 X, Y, Z_2 : [mm]

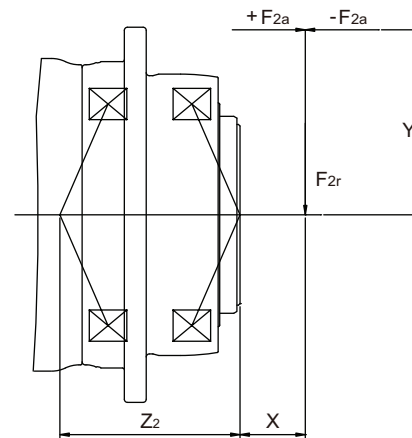


Fig. 1

| AP / APK | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
|----------|-------|-----|-------|-------|-------|-------|-------|
| Z2 [mm] | 106.2 | 90 | 122.8 | 133.2 | 175.5 | 220.6 | 275.3 |

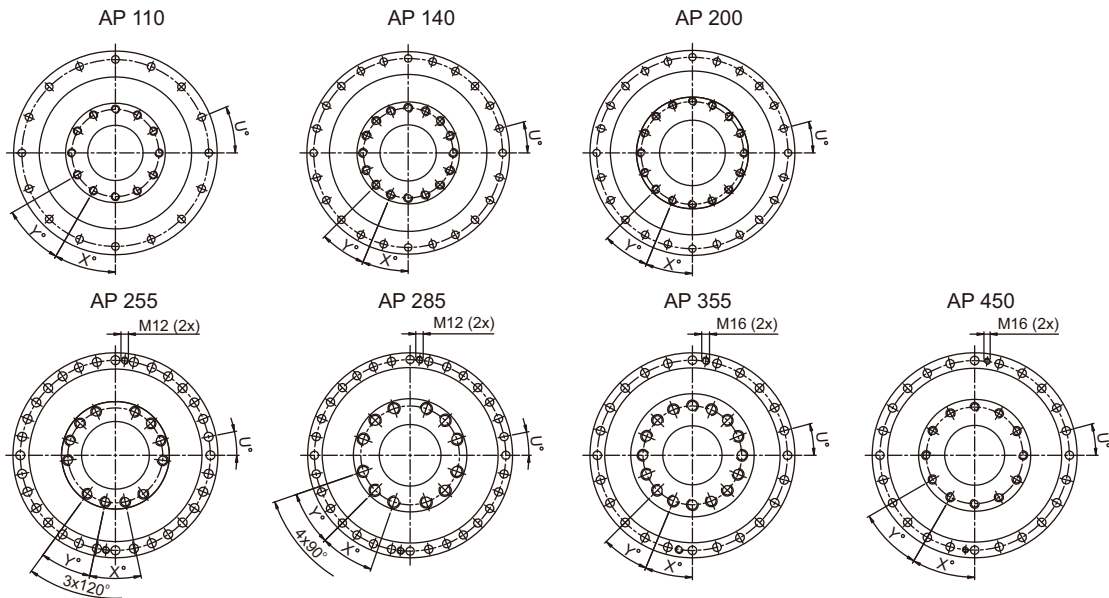
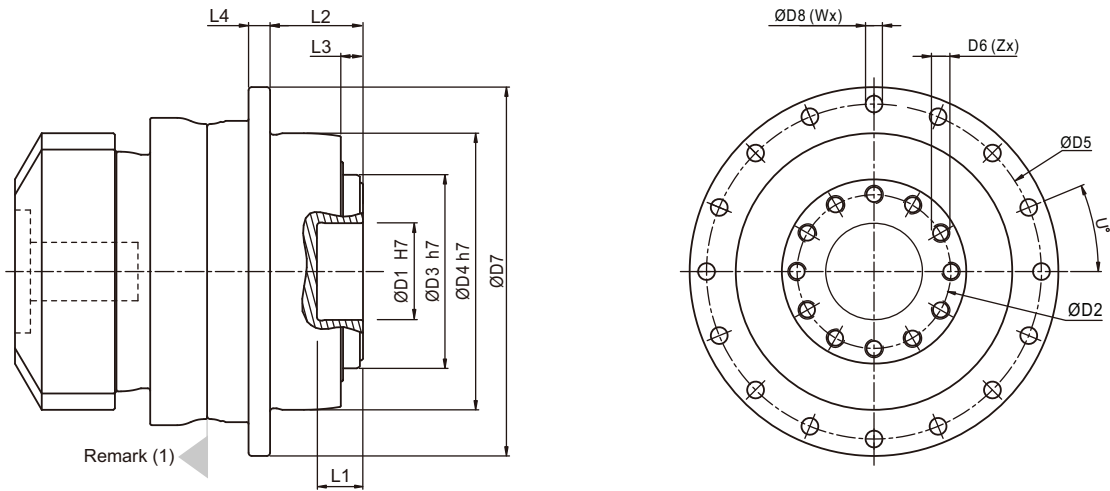
Inertia - AP/APC Gearbox

| Model No. | AP/APC 110 | AP/APC 140 | | | AP/APC 200 | | | AP/APC 255 | | | AP/APC 285 | | | |
|-----------|------------|------------|------|-------|------------|------|-------|------------|-------|-------|------------|-------|-------|-------|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| 14 | - | - | 0.21 | - | - | - | - | - | - | - | - | - | - | - |
| 19 | 1.68 | 0.68 | 0.63 | - | - | 0.68 | - | - | - | - | - | - | - | - |
| 24 | 4.89 | 4.52 | - | 6.83 | 5.04 | 4.52 | - | - | 5.04 | - | - | - | - | - |
| 28 | 6.18 | - | - | 6.69 | 6.33 | - | - | - | 6.33 | - | - | 7.18 | - | - |
| 32 | 8.58 | - | - | 9.6 | 8.73 | - | - | 10.1 | 8.73 | - | - | 10.1 | - | - |
| 35 | 13.89 | - | - | 15.05 | 14.04 | - | 15.79 | 15.54 | 14.04 | - | 17.75 | 15.54 | - | - |
| 38 | 18.91 | - | - | 20.82 | 19.05 | - | 21.3 | 21.32 | 19.05 | - | 23.26 | 21.32 | - | 27.05 |
| 42 | - | - | - | 22.71 | - | - | 23.43 | 23.2 | - | 24.84 | 25.4 | - | - | 28.95 |
| 48 | - | - | - | 55.58 | - | - | 59.06 | 56.07 | - | 60.55 | 61.02 | - | 64.93 | 64.66 |
| 55 | - | - | - | - | - | - | - | - | - | 88.2 | - | - | 92.99 | - |
| 60 | - | - | - | - | - | - | - | - | - | - | - | - | 115.8 | - |

| Model No. | AP/APC 355 | AP/APC 450 | |
|-----------|------------|------------|--------|
| | | 2 | 3 |
| 14 | - | - | - |
| 19 | - | - | - |
| 24 | - | - | - |
| 28 | - | - | - |
| 32 | - | - | - |
| 35 | - | - | - |
| 38 | - | - | 27.05 |
| 42 | 28.79 | 25.4 | 28.95 |
| 48 | 92.76 | 61.02 | 106.06 |
| 55 | 105.41 | - | 118.67 |
| 60 | - | - | 127.37 |

(A) \varnothing = Input shaft diameter.

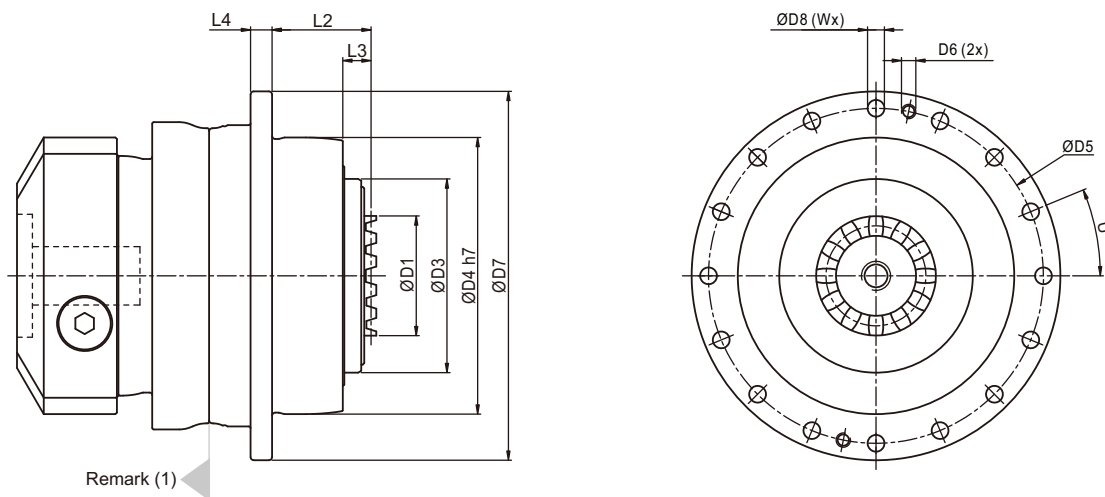
Dimension - AP Gearbox



| Dimension | AP 110 | AP 140 | AP 200 | AP 255 | AP 285 | AP 355 | AP 450 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 h7 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 x Pitch x Deep | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 | M30x3.5Px40 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| L1 | 15 | 15 | 16 | 16 | 16 | 35 | 24 |
| L2 | 29 | 38 | 50 | 66 | 75 | 80 | 85 |
| L3 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 | 20 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| X in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Y in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Z | 12 | 16 | 16 | 12 | 12 | 16 | 12 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

Dimension - APC Gearbox



| Dimension | APC 110 | APC 140 | APC 200 | APC 255 | APC 285 | APC 355 | APC 450 |
|-------------|---------|---------|---------|---------|---------|---------|---------|
| D1 | 46 | 60 | 80 | 90 | 120 | 120 | 132 |
| D3 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 | - | - | - | M12 | M12 | M16 | M16 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| L2 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 | 87.5 |
| L3 | 9.5 | 10 | 11 | 16 | 19 | 22.5 | 22.5 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

Performance - APK / APCK Gearbox

| Model No. | Stage | Ratio ⁽¹⁾ | APK 110 APCK 110 | APK 140 APCK 140 | APK 200 APCK 200 | APK 255 APCK 255 | APK 285 APCK 285 | APK 355 APCK 355 | APK 450 APCK 450 | |
|---|-----------|----------------------|---------------------|------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------|
| Nominal Output Torque T_{2N} | 2 | 22 | 375 | 655 | 1,445 | 2,200 | 4,110 | 7,010 | - | |
| | | 27.5 | 375 | 655 | 1,445 | 2,200 | 4,110 | 7,015 | - | |
| | | 38.5 | 375 | 655 | 1,450 | 2,200 | 4,110 | 7,020 | - | |
| | | 55 | 315 | 655 | 1,450 | 2,205 | 4,115 | 7,025 | - | |
| | 3 | 88 | 380 | 655 | 1,450 | 2,205 | 4,115 | 7,025 | 13,870 | |
| | | 110 | 380 | 655 | 1,450 | 2,205 | 4,115 | 7,025 | 13,870 | |
| | | 137.5 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,875 | |
| | | 154 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,875 | |
| | 4 | 220 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,200 | |
| | | 385 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,880 | |
| | | 440 | 380 | 655 | 1,450 | 2,205 | 4,120 | 7,030 | 13,880 | |
| | | 550 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,030 | 13,880 | |
| | | 770 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,030 | 13,880 | |
| | | 1,078 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,035 | 13,880 | |
| | | 1,540 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,035 | 13,885 | |
| | | 2,695 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,035 | 13,885 | |
| 3,850 | 380 | 655 | 1,450 | 2,210 | 4,120 | 7,035 | 13,885 | | | |
| 5,500 | 315 | 655 | 1,450 | 2,210 | 4,120 | 7,035 | 14,010 | | | |
| Emergency Stop Torque T_{2NOT} | Nm | 2,3,4 | 22~5,500 | | 2 times T_{2N} | | | | | |
| Max. Acceleration Torque T_{2B} | Nm | 2,3,4 | 22~5,500 | | 1.5 times T_{2N} | | | | | |
| No Load Running Torque ⁽²⁾ | Nm | 2 | 22~55 | 2 | 3.1 | 6 | 13 | 16 | 20 | - |
| | | 3 | 88~385 | 1.4 | 2.4 | 4.6 | 7 | 8.5 | 10.5 | 13 |
| | | 4 | 440~5,500 | 0.2 | 0.3 | 0.6 | 0.9 | 1.2 | 1.8 | 2.5 |
| Backlash ⁽³⁾ | arcmin | 2,3,4 | 22~5,500 | ≤ 1.2 | | | | | | |
| Torsional Rigidity | Nm/arcmin | 2 | 22~55 | 56 | 112 | 389 | 642 | 1,275 | 2,500 | - |
| | | 3 | 88~385 | 56 | 112 | 389 | 642 | 1,275 | 2,500 | 5,100 |
| | | 4 | 440~5,500 | 45 | 85 | 310 | 535 | 1,050 | 1,700 | 2,700 |
| Nominal Input Speed n_{1N} | rpm | 2 | 22~55 | 2,800 | 2,700 | 2,200 | 2,100 | 2,000 | 1,600 | - |
| | | 3 | 88~385 | 3,000 | 2,800 | 2,700 | 2,200 | 2,100 | 2,100 | 2,000 |
| | | 4 | 440~5,500 | 5,500 | 4,600 | 4,600 | 4,000 | 3,700 | 3,700 | 3,400 |
| Max. Input Speed n_{1B} | rpm | 2 | 22~55 | 6,000 | 4,500 | 4,500 | 4,000 | 3,000 | 2,500 | - |
| | | 3 | 88~385 | 6,000 | 6,000 | 4,500 | 4,500 | 4,000 | 4,000 | 3,000 |
| | | 4 | 440~5,500 | 7,000 | 7,000 | 7,000 | 6,000 | 5,500 | 5,500 | 5,000 |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 2,3,4 | 22~5,500 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 | 101,500 | 143,700 |
| Max. Tilting Moment M_{2k} ⁽⁴⁾ | Nm | 2,3,4 | 22~5,500 | 480 | 1,310 | 3,530 | 5,920 | 9,230 | 29,100 | 63,300 |
| Service Life ⁽⁵⁾ | hr | 2,3,4 | 22~5,500 | 20,000 | | | | | | |
| Operating Temp. | °C | 2,3,4 | 22~5,500 | -10° C ~ 90° C | | | | | | |
| Degree of Gearbox Protection | | 2,3,4 | 22~5,500 | IP65 | | | | | | |
| Lubrication | | 2,3,4 | 22~5,500 | Synthetic lubrication grease | | | | | | |
| Mounting Position | | 2,3,4 | 22~5,500 | All directions | | | | | | |
| Running Noise ⁽²⁾ | dB(A) | 2,3,4 | 22~5,500 | ≤ 68 | ≤ 68 | ≤ 70 | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 76 |
| Efficiency η | % | 2 | 22~5,500 | ≥ 94% | | | | | | |
| | | 3 | 88~385 | ≥ 92% | | | | | | |
| | | 4 | 440~5,500 | ≥ 90% | | | | | | |

(1) Ratio ($i = N_{in} / N_{out}$).

(2) These values are measured by gearbox with ratio = 55 (2-stage), 385 (3-stage) or 5,500 (4-stage) at 3,000 rpm without load.

(3) Backlash is measured at 2% of Nominal Output Torque T_{2N} .

(4) Applied to the output flange/curvic center at 100 rpm. The calculation formula please refer to page (3)

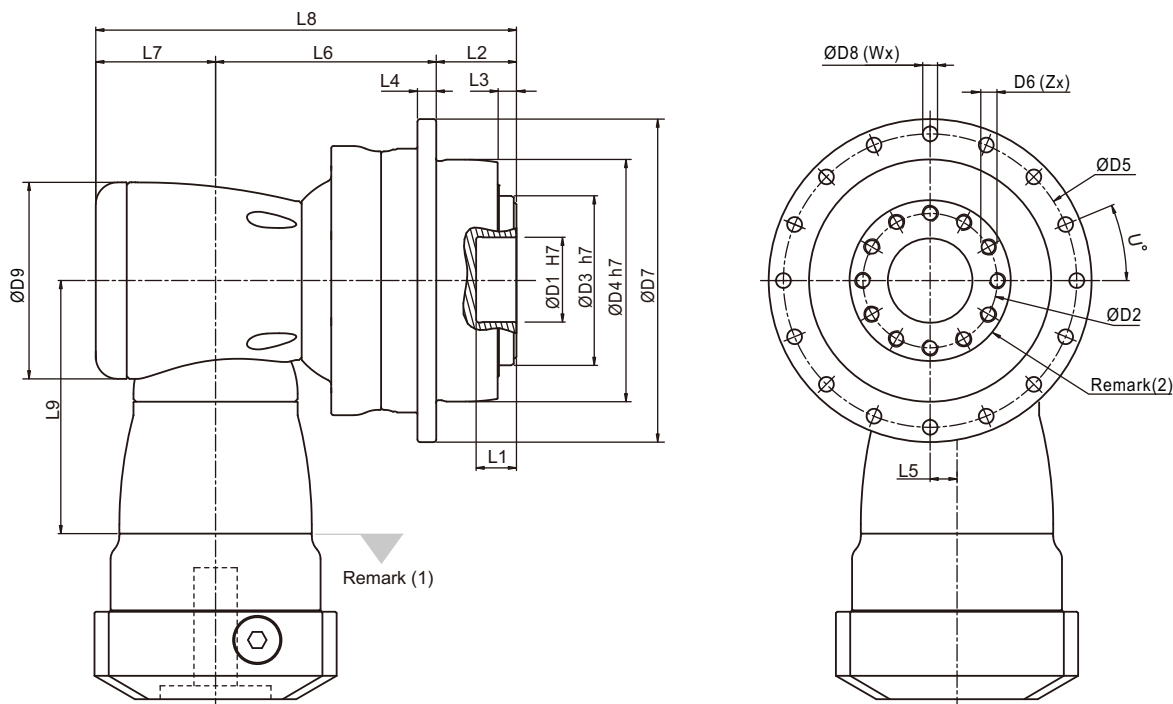
(5) Continuous operation is not recommended.

Inertia - APK/APCK Gearbox

| Model No. | APK/APCK 110 | APK/APCK 140 | APK/APCK 200 | APK/APCK 255 | APK/APCK 285 | APK/APCK 355 | APK/APCK 450 |
|------------------------|--------------|----------------|---------------|-------------------|------------------|-------------------|--------------|
| Ø ^(A) Stage | 2 3 4 | 2 3 4 | 2 3 4 | 2 3 4 | 2 3 4 | 2 3 4 | 3 4 |
| 8 | - - 0.17 | - - - | - - - | - - - | - - - | - - - | - - |
| 11 | - - 0.17 | - - - | - - - | - - - | - - - | - - - | - - |
| 14 | - 0.47 - | - - 0.53 | - - - | - - - | - - - | - - - | - - |
| 19 | 1.64 0.63 - | - 1.64 0.68 | - - 1.83 | - - - | - - - | - - - | - - |
| 24 | 4.74 - - | 5.05 4.74 4.52 | - 5.05 5.04 | - - 5.63 | - - - | - - - | - - |
| 28 | - - - | 6.55 5.96 - | - 6.55 - | - 6.98 7.18 | - - - | - - - | - - |
| 32 | - - - | 9.47 - - | 10.18 9.47 - | - 10.18 10.1 | - - - | - - - | - - |
| 35 | - - - | 14.91 - - | 15.21 14.91 - | 15.21 15.21 15.54 | - 15.21 15.54 | - - 15.54 | - 17.75 |
| 38 | - - - | 20.69 - - | 20.7 20.69 - | 20.7 20.7 21.32 | 21.69 20.7 21.32 | - 20.7 21.32 | 21.69 23.26 |
| 42 | - - - | - - - | 22.83 - - | 22.83 - - | 23.59 22.83 23.2 | 25.28 22.83 23.2 | 23.59 25.4 |
| 48 | - - - | - - - | 58.45 - - | 58.45 - - | 59.3 58.45 56.07 | 61.61 58.45 56.07 | 59.3 61.02 |
| 55 | - - - | - - - | - - - | - - - | - - - | 89.67 - - | - - |

(A) Ø = Input shaft diameter.

Dimension - APK (2 Stage) Gearbox (Ratio i = 22 ~ 55)

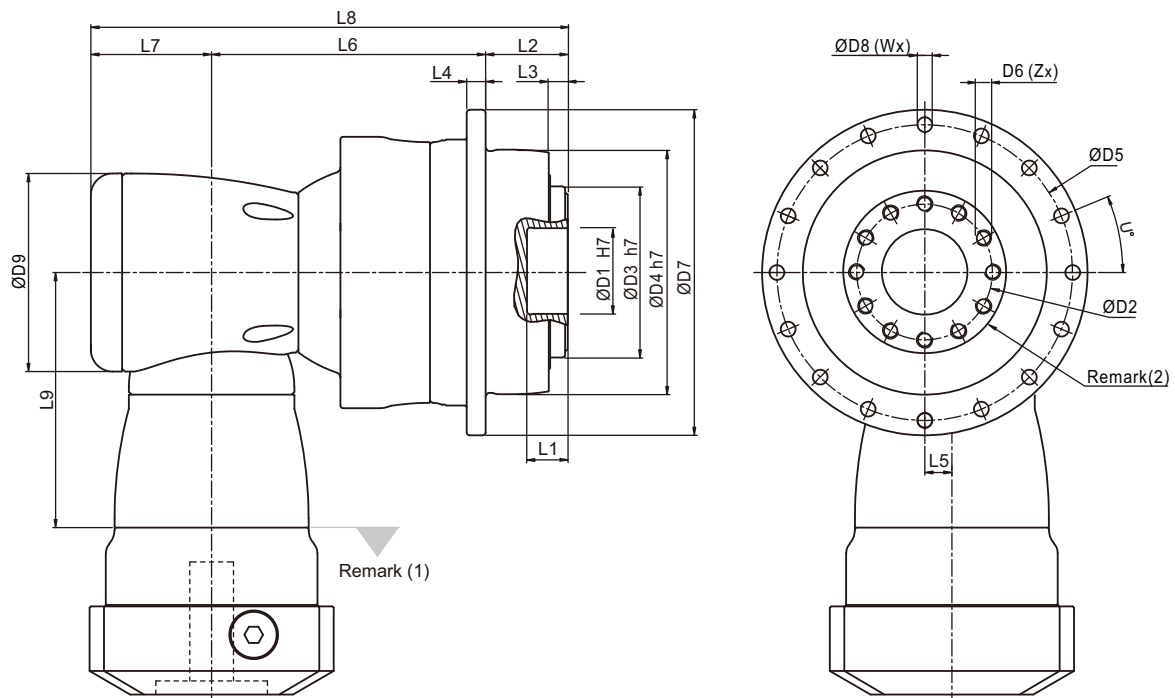


| Dimension | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 |
| D3 h7 | 80 | 100 | 160 | 180 | 200 | 250 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 |
| D6 x Pitch x Deep | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 |
| D9 | 116 | 163 | 210 | 210 | 255 | 300 |
| L1 | 15 | 15 | 16 | 16 | 16 | 35 |
| L2 | 29 | 38 | 50 | 66 | 75 | 80 |
| L3 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 |
| L5 | 17 | 25 | 31 | 31 | 36 | 43 |
| L6 | 114 | 147.5 | 175 | 191.5 | 249.5 | 290 |
| L7 | 68.3 | 89 | 115 | 115 | 131 | 165 |
| L8 | 211.3 | 274.5 | 340 | 372.5 | 455.5 | 535 |
| L9 | 129 | 173.5 | 228 | 228 | 265.5 | 294.5 |
| X in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 |
| Y in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 |
| Z | 12 | 16 | 16 | 12 | 12 | 16 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 |

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

(2) Flange Interface, please refer to page (5).

Dimension - APK (3 Stage) Gearbox (Ratio $i = 88 \sim 385$)

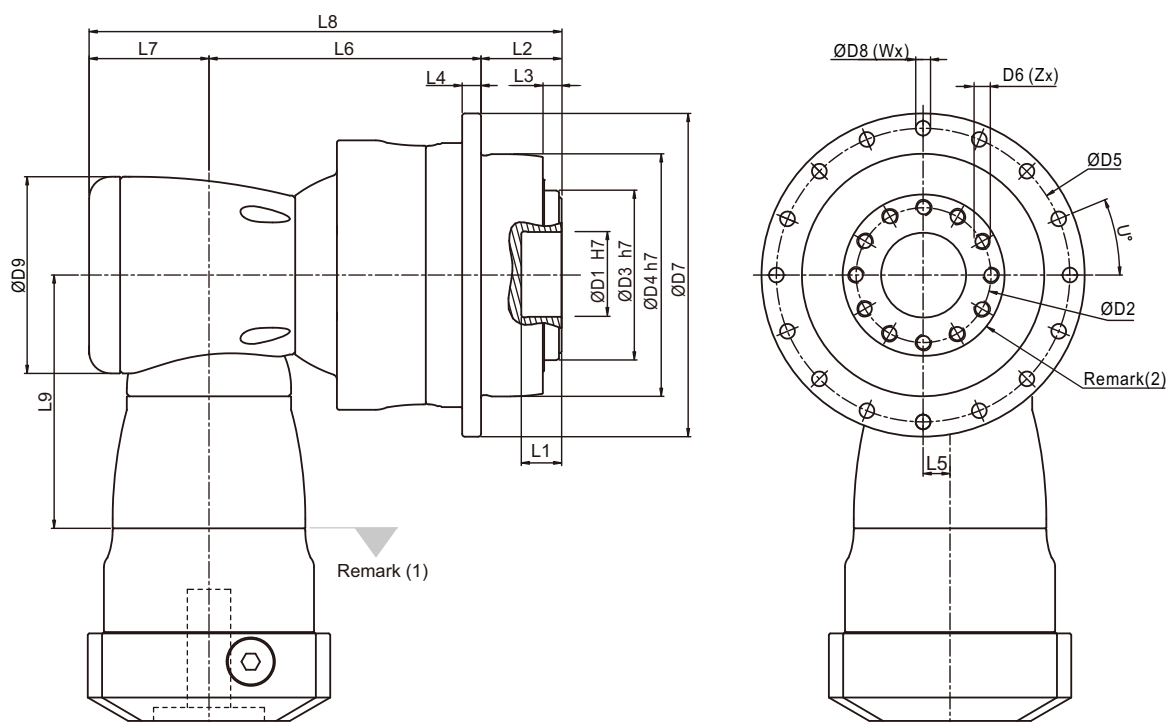


| Dimension | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 | APK 450 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 h7 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 x Pitch x Deep | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 | M30x3.5Px40 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| D9 | 94 | 116 | 163 | 210 | 210 | 210 | 255 |
| L1 | 15 | 15 | 16 | 16 | 16 | 35 | 24 |
| L2 | 29 | 38 | 50 | 66 | 75 | 80 | 85 |
| L3 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 | 20 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| L5 | 13 | 17 | 25 | 31 | 31 | 31 | 36 |
| L6 | 132 | 164 | 216.5 | 254.5 | 300 | 332 | 447.5 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 115 | 131 |
| L8 | 214 | 270.3 | 355.5 | 435.5 | 490 | 527 | 663.5 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 228 | 265.5 |
| X in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Y in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Z | 12 | 16 | 16 | 12 | 12 | 16 | 12 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

(2) Flange Interface, please refer to page (5).

Dimension - APK (4 Stage) Gearbox (Ratio $i = 440 \sim 5,500$)

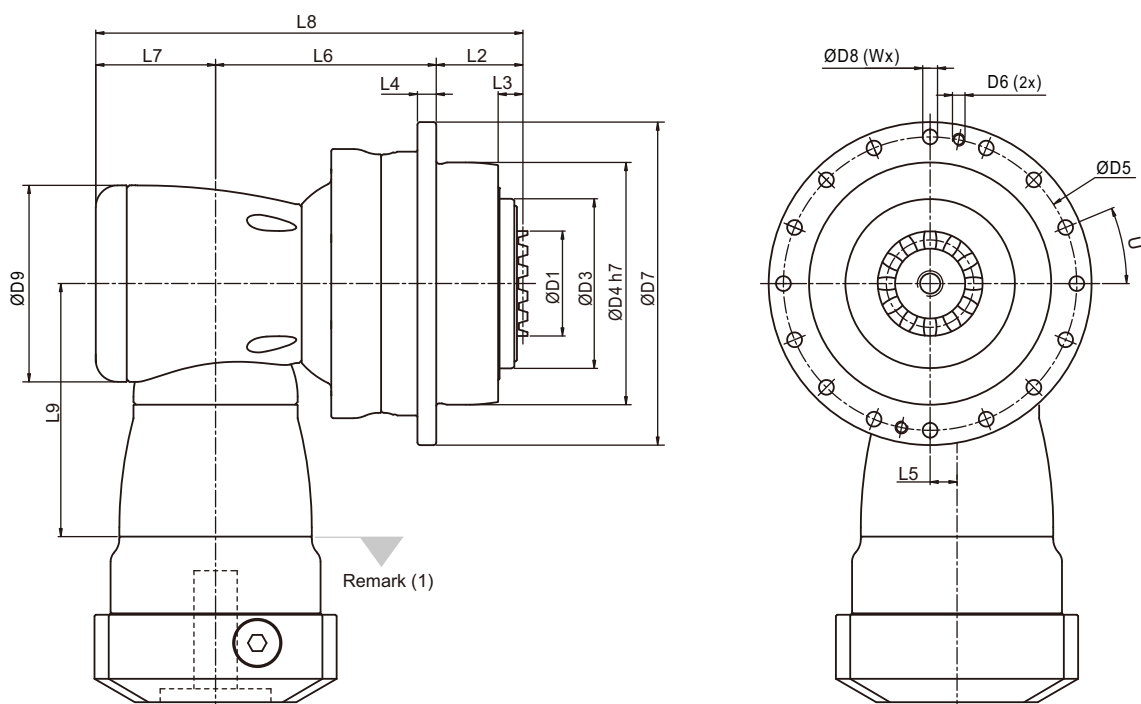


| Dimension | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 | APK 450 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 h7 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 x Pitch x Deep | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 | M30x3.5Px40 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| D9 | 94 | 116 | 163 | 210 | 210 | 210 | 255 |
| L1 | 15 | 15 | 16 | 16 | 16 | 35 | 24 |
| L2 | 29 | 38 | 50 | 66 | 75 | 80 | 85 |
| L3 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 | 20 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| L5 | 13 | 17 | 25 | 31 | 31 | 31 | 36 |
| L6 | 132 | 164 | 216.5 | 254.5 | 300 | 332 | 447.5 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 115 | 131 |
| L8 | 214 | 270.3 | 355.5 | 435.5 | 490 | 527 | 663.5 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 228 | 265.5 |
| X in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Y in Degree | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Z | 12 | 16 | 16 | 12 | 12 | 16 | 12 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

(2) Flange Interface, please refer to page (5).

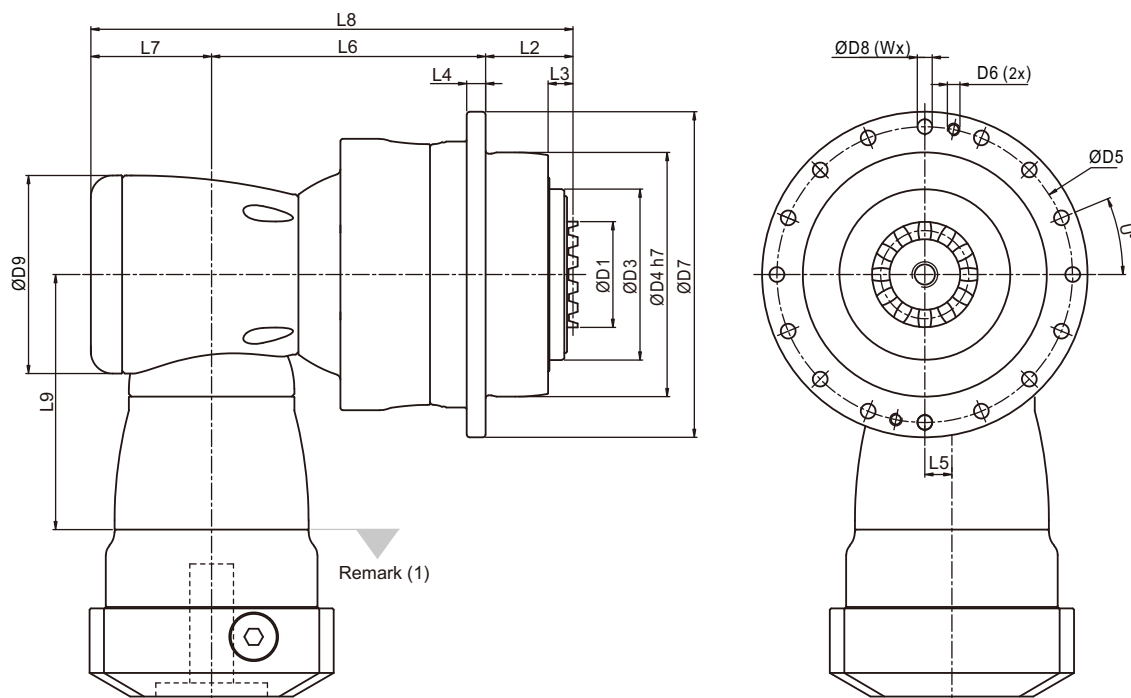
Dimension - APCK (2 Stage) Gearbox (Ratio $i = 22 \sim 55$)



| Dimension | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 | APCK 355 |
|-------------|----------|----------|----------|----------|----------|----------|
| D1 | 46 | 60 | 80 | 90 | 120 | 120 |
| D3 | 80 | 100 | 160 | 180 | 200 | 250 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 |
| D6 | - | - | - | M12 | M12 | M16 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 |
| D9 | 116 | 163 | 210 | 210 | 255 | 300 |
| L2 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 |
| L3 | 9.5 | 10 | 11 | 16 | 19 | 22.5 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 |
| L5 | 17 | 25 | 31 | 31 | 36 | 43 |
| L6 | 114 | 147.5 | 175 | 191.5 | 249.5 | 290 |
| L7 | 68.3 | 89 | 115 | 115 | 131 | 165 |
| L8 | 213.8 | 277 | 342.5 | 375 | 458 | 537.5 |
| L9 | 129 | 173.5 | 228 | 228 | 265.5 | 294.5 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 |

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

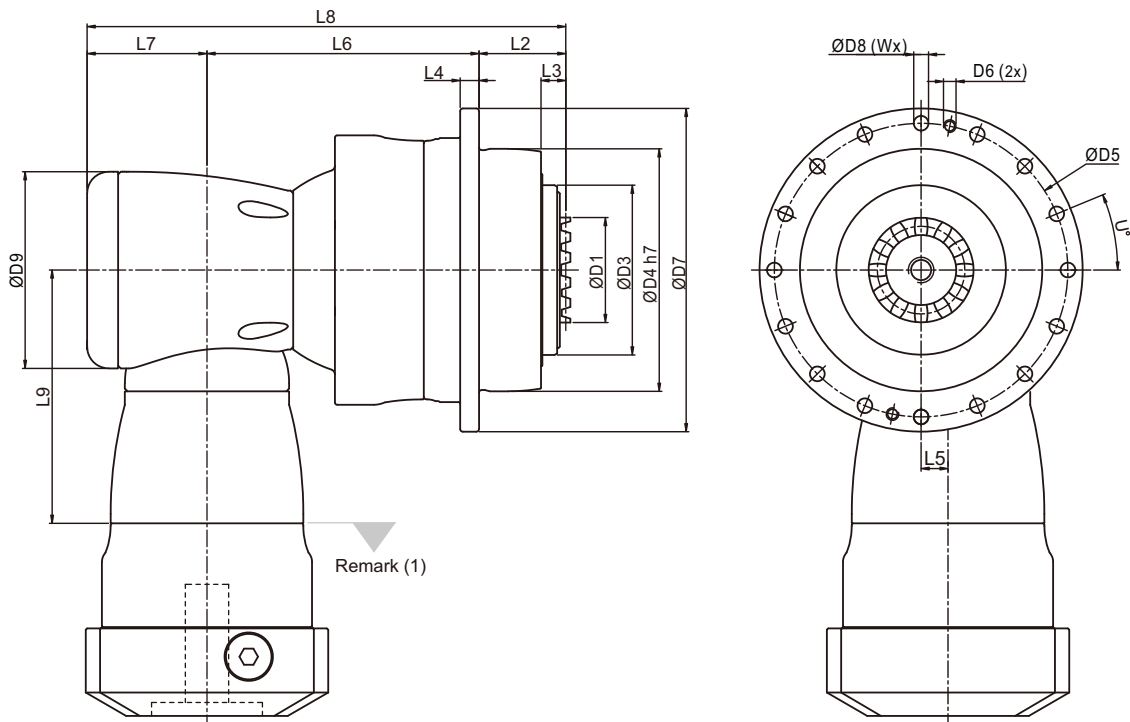
Dimension - APCK (3 Stage) Gearbox (Ratio i = 88 ~ 385)



| Dimension | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 | APCK 355 | APCK 450 |
|-------------|----------|----------|----------|----------|----------|----------|----------|
| D1 | 46 | 60 | 80 | 90 | 120 | 120 | 132 |
| D3 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 | - | - | - | M12 | M12 | M16 | M16 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| D9 | 94 | 116 | 163 | 210 | 210 | 210 | 255 |
| L2 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 | 87.5 |
| L3 | 9.5 | 10 | 11 | 16 | 19 | 22.5 | 22.5 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| L5 | 13 | 17 | 25 | 31 | 31 | 31 | 36 |
| L6 | 132 | 164 | 216.5 | 254.5 | 300 | 332 | 447.5 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 115 | 131 |
| L8 | 216.5 | 272.8 | 358 | 438 | 492.5 | 529.5 | 666 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 228 | 265.5 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

Dimension - APCK (4 Stage) Gearbox (Ratio $i = 440 \sim 5,500$)



| Dimension | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 | APCK 355 | APCK 450 |
|-------------|----------|----------|----------|----------|----------|----------|----------|
| D1 | 46 | 60 | 80 | 90 | 120 | 120 | 132 |
| D3 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 | - | - | - | M12 | M12 | M16 | M16 |
| D7 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| D9 | 94 | 116 | 163 | 210 | 210 | 210 | 255 |
| L2 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 | 87.5 |
| L3 | 9.5 | 10 | 11 | 16 | 19 | 22.5 | 22.5 |
| L4 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| L5 | 13 | 17 | 25 | 31 | 31 | 31 | 36 |
| L6 | 132 | 164 | 216.5 | 254.5 | 300 | 332 | 447.5 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 115 | 131 |
| L8 | 216.5 | 272.8 | 358 | 438 | 492.5 | 529.5 | 666 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 228 | 265.5 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

Performance - APK / APCK (2 Stage) Gearbox (Ratio i = 5.5~11)

| Model No. | | Stage | Ratio ⁽¹⁾ | APK 110 APCK 110 | APK 140 APCK 140 | APK 200 APCK 200 | APK 255 APCK 255 | APK 285 APCK 285 |
|---|-----------|-------|----------------------|------------------------------|---------------------|---------------------|---------------------|---------------------|
| Nominal Output Torque T_{2N} | Nm | 2 | 5.5 | 370 | 645 | 1,435 | 2,180 | 4,080 |
| | | | 11 | 375 | 650 | 1,440 | 2,195 | 4,100 |
| Emergency Stop Torque T_{2NOT} | Nm | 2 | 5.5~11 | 2 times T_{2N} | | | | |
| Max. Acceleration Torque T_{2B} | Nm | 2 | 5.5~11 | 1.5 times T_{2N} | | | | |
| No Load Running Torque ⁽²⁾ | Nm | 2 | 5.5~11 | 5.8 | 12 | 25 | 48 | 95 |
| Backlash ⁽³⁾ | arcmin | 2 | 5.5~11 | ≤ 1.3 | | | | |
| Torsional Rigidity | Nm/arcmin | 2 | 5.5~11 | 56 | 112 | 389 | 642 | 1,275 |
| Nominal Input Speed n_{1N} | rpm | 2 | 5.5~11 | 3,000 | 2,300 | 1,800 | 1,500 | 1,100 |
| Max. Input Speed n_{1B} | rpm | 2 | 5.5~11 | 5,500 | 4,500 | 3,500 | 3,000 | 2,200 |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 2 | 5.5~11 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 |
| Max. Tilting Moment M_{2k} ⁽⁴⁾ | Nm | 2 | 5.5~11 | 480 | 1,310 | 3,530 | 5,920 | 9,230 |
| Service Life ⁽⁵⁾ | hr | 2 | 5.5~11 | 20,000 | | | | |
| Operating Temp. | °C | 2 | 5.5~11 | -10° C ~ 90° C | | | | |
| Degree of Gearbox Protection | | 2 | 5.5~11 | IP65 | | | | |
| Lubrication | | 2 | 5.5~11 | Synthetic lubrication grease | | | | |
| Mounting Position | | 2 | 5.5~11 | All directions | | | | |
| Running Noise ⁽²⁾ | dB(A) | 2 | 5.5~11 | ≤ 68 | ≤ 70 | ≤ 70 | ≤ 72 | ≤ 74 |
| Efficiency η | % | 2 | 5.5~11 | $\geq 95\%$ | | | | |

(1) Ratio ($i = N_{in} / N_{out}$).

(2) These values are measured by gearbox with ratio = 11 (2-stage) at 3,000 rpm without load.

(3) Backlash is measured at 2% of Nominal Output Torque T_{2N} .

(4) Applied to the output flange/curvic center at 100 rpm. The calculation formula please refer to page (3).

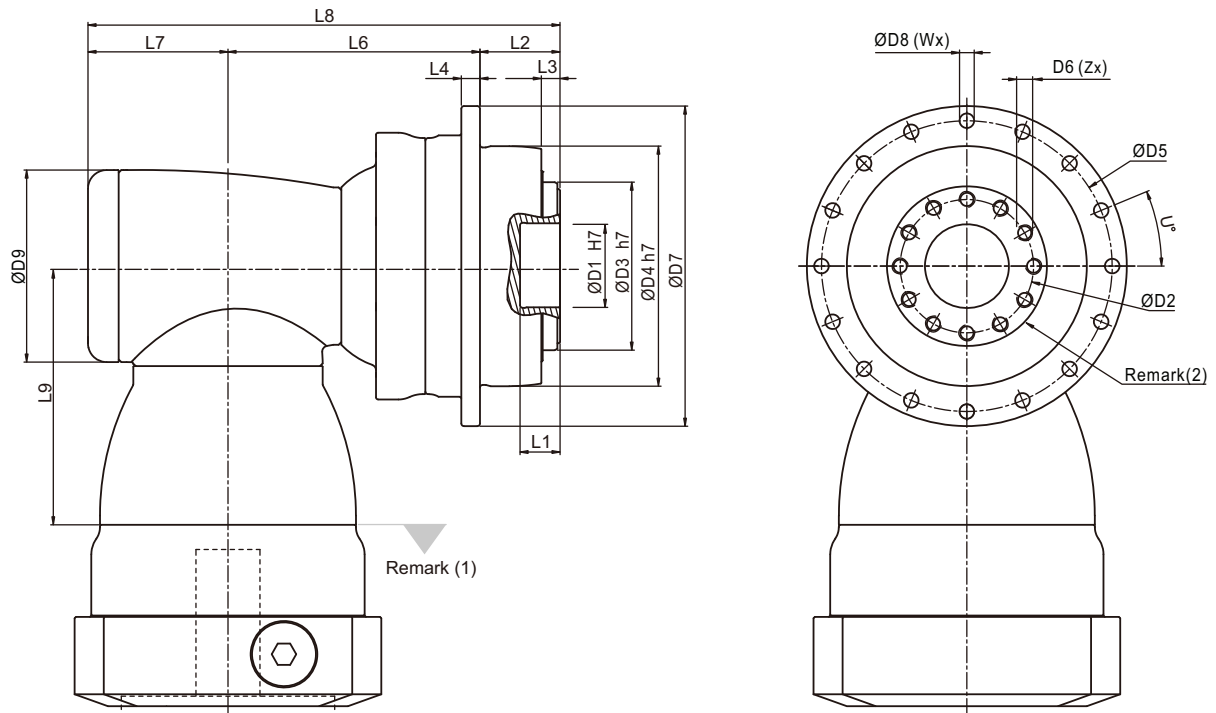
(5) Continuous operation is not recommended.

Inertia - APK / APCK (2 Stage) Gearbox (Ratio i = 5.5~11)

| Model No. | | APK/APCK 110 | APK/APCK 140 | APK/APCK 200 | APK/APCK 255 | APK/APCK 285 |
|---------------------|--------------------|--------------|--------------|--------------|--------------|--------------|
| $\varnothing^{(A)}$ | Stage | 2 | 2 | 2 | 2 | 2 |
| 19 | kg·cm ² | 1.71 | - | - | - | - |
| 24 | | 5.05 | 6.92 | - | - | - |
| 28 | | 6.55 | 6.98 | - | - | - |
| 32 | | 9.47 | 10.18 | - | - | - |
| 35 | | 14.91 | 15.21 | 15.21 | - | - |
| 38 | | 20.69 | 20.7 | 20.7 | - | - |
| 42 | | - | 22.83 | 22.83 | 23.59 | - |
| 48 | | - | 58.45 | 58.45 | 59.3 | 61.61 |
| 55 | | - | - | - | 86.95 | 89.67 |
| 60 | | - | - | - | - | 112.49 |

(A) \varnothing = Input shaft diameter.

Dimension - APK (2 Stage) Gearbox (Ratio $i = 5.5 \sim 11$)

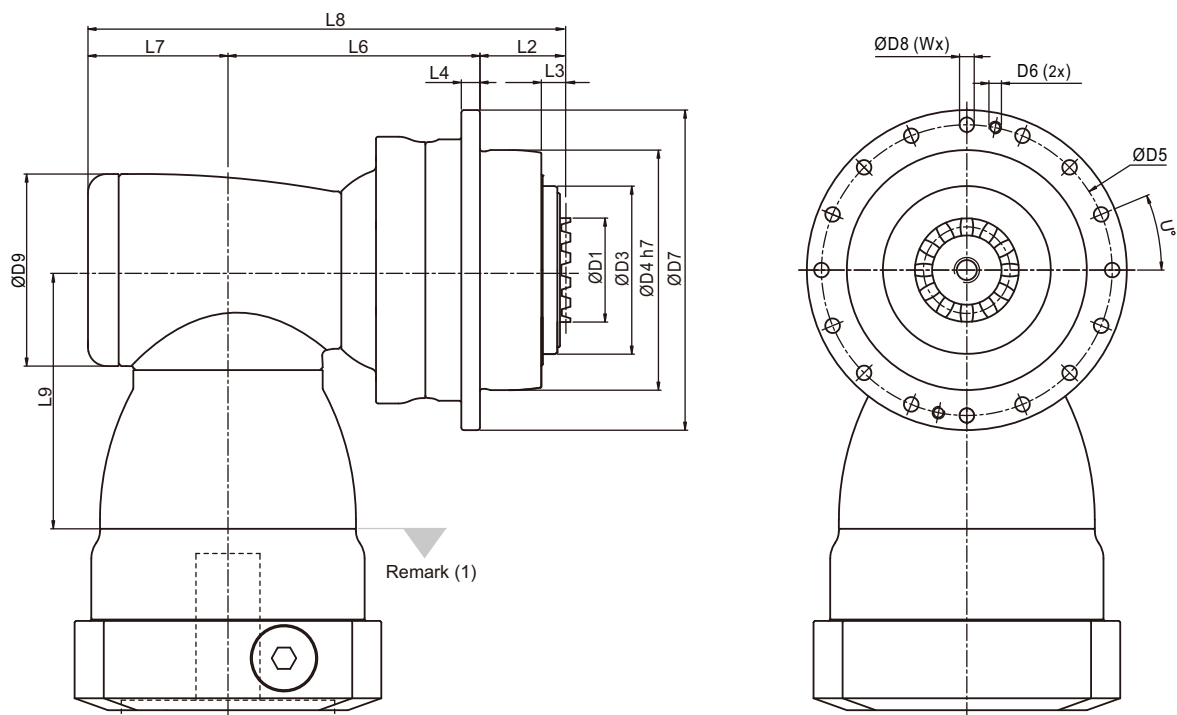


| Dimension | | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 |
|-------------------|----|-------------|-------------|-------------|-----------|-----------|
| D1 | H7 | 40 | 50 | 80 | 100 | 100 |
| D2 | | 63 | 80 | 125 | 140 | 160 |
| D3 | h7 | 80 | 100 | 160 | 180 | 200 |
| D4 | h7 | 110 | 140 | 200 | 255 | 285 |
| D5 | | 135 | 168 | 233 | 280 | 310 |
| D6 x Pitch x Deep | | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 |
| D7 | | 147 | 180 | 249.5 | 302 | 332 |
| D8 | | 5.5 | 6.6 | 9 | 13.5 | 13.5 |
| D9 | | 116 | 156 | 156 | 195 | 240 |
| L1 | | 15 | 15 | 16 | 16 | 16 |
| L2 | | 29 | 38 | 50 | 66 | 75 |
| L3 | | 7 | 7.5 | 8.5 | 13.5 | 16.5 |
| L4 | | 8 | 10 | 12 | 18 | 20 |
| L6 | | 124.5 | 175.5 | 185 | 199 | 265.5 |
| L7 | | 76 | 97.5 | 97.5 | 105.5 | 141 |
| L8 | | 229.5 | 311 | 332.5 | 370.5 | 481.5 |
| L9 | | 147.5 | 196.5 | 196.5 | 229 | 260 |
| X in Degree | | 30 | 22.5 | 22.5 | 24 | 26 |
| Y in Degree | | 30 | 22.5 | 22.5 | 24 | 26 |
| Z | | 12 | 16 | 16 | 12 | 12 |
| U in Degree | | 22.5 | 15 | 15 | 11.25 | 11.25 |
| W | | 16 | 24 | 24 | 32 | 32 |

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

(2) Flange Interface, please refer to page (5).

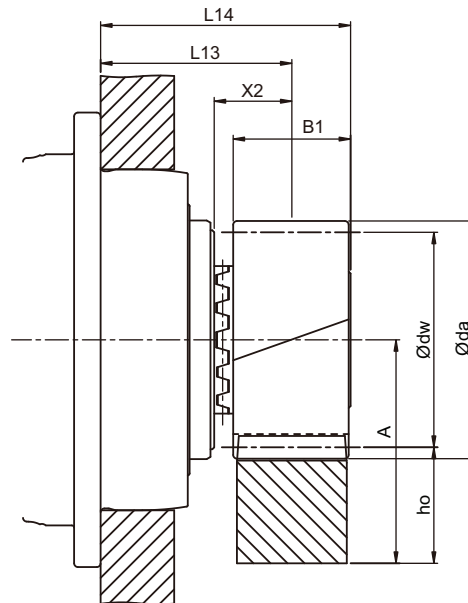
Dimension - APCK (2 Stage) Gearbox (Ratio i = 5.5 ~ 11)



| Dimension | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 |
|-------------|----------|----------|----------|----------|----------|
| D1 | 46 | 60 | 80 | 90 | 120 |
| D3 | 80 | 100 | 160 | 180 | 200 |
| D4 h7 | 110 | 140 | 200 | 255 | 285 |
| D5 | 135 | 168 | 233 | 280 | 310 |
| D6 | - | - | - | M12 | M12 |
| D7 | 147 | 180 | 249.5 | 302 | 332 |
| D8 | 5.5 | 6.6 | 9 | 13.5 | 13.5 |
| D9 | 116 | 156 | 156 | 195 | 240 |
| L2 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 |
| L3 | 9.5 | 10 | 11 | 16 | 19 |
| L4 | 8 | 10 | 12 | 18 | 20 |
| L6 | 124.5 | 175.5 | 185 | 199 | 265.5 |
| L7 | 76 | 97.5 | 97.5 | 105.5 | 141 |
| L8 | 232 | 313.5 | 335 | 373 | 484 |
| L9 | 147.5 | 196.5 | 196.5 | 229 | 260 |
| U in Degree | 22.5 | 15 | 15 | 11.25 | 11.25 |
| W | 16 | 24 | 24 | 32 | 32 |

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

Pinion with Curvic Coupling



Quality DIN4 / Alloy Steel

Tooth Thickness Tolerance : e24
 Left - Hand Helical
 Helical Angle $\beta = 19^\circ 31' 42'' (19.5283^\circ)$
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

$$A = h_o + \frac{\text{Ø}dw}{2}$$

| Gearbox Model | Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | X2 | L13 | L14 | L ⁽⁶⁾ | Order Code |
|---------------|----|------------------|------------------|-------------------|------------------|-------------------|-----|------|-------|-----|------------------|------------|
| APC/APCK 110 | 3 | 20 | 0.3897 | 72 | 63.662 | 66 | 31 | 20.5 | 49.5 | 65 | 200 | A03L20 |
| APC/APCK 140 | 4 | 19 | 0.4102 | 91.92 | 80.639 | 83.92 | 41 | 25.5 | 63.5 | 84 | 253.335 | A04L19 |
| APC/APCK 200 | 5 | 19 | 0.4002 | 114.8 | 100.798 | 104.8 | 51 | 30.5 | 80.5 | 106 | 316.666 | A05L19 |
| APC/APCK 255 | 6 | 19 | 0.4035 | 137.8 | 120.958 | 125.8 | 61 | 35.5 | 101.5 | 132 | 380 | A06L19 |
| APC/APCK 285 | 8 | 19 | 0.4108 | 183.85 | 161.277 | 167.85 | 81 | 45.5 | 120.5 | 161 | 506.667 | A08L19 |
| APC/APCK 355 | 8 | 19 | 0.4108 | 183.85 | 161.277 | 167.85 | 81 | 45.5 | 125.5 | 166 | 506.667 | A08L19 |
| APC/APCK 450 | 10 | 18 | 0.4257 | 219.5 | 190.986 | 199.5 | 101 | 55.5 | 140.5 | 191 | 600 | A10L18 |

(1) Number of teeth (2) Profile modification factor (3) Diameter of addendum circle (4) Pitch circle diameter (5) Working pitch circle diameter

(6) Pitch circle length $L = \pi \times d$

Pinion material carburized and quenched, surface hardness reached 60 HRc.

Teeth surface ground to reduce noise and improve wear resistance.

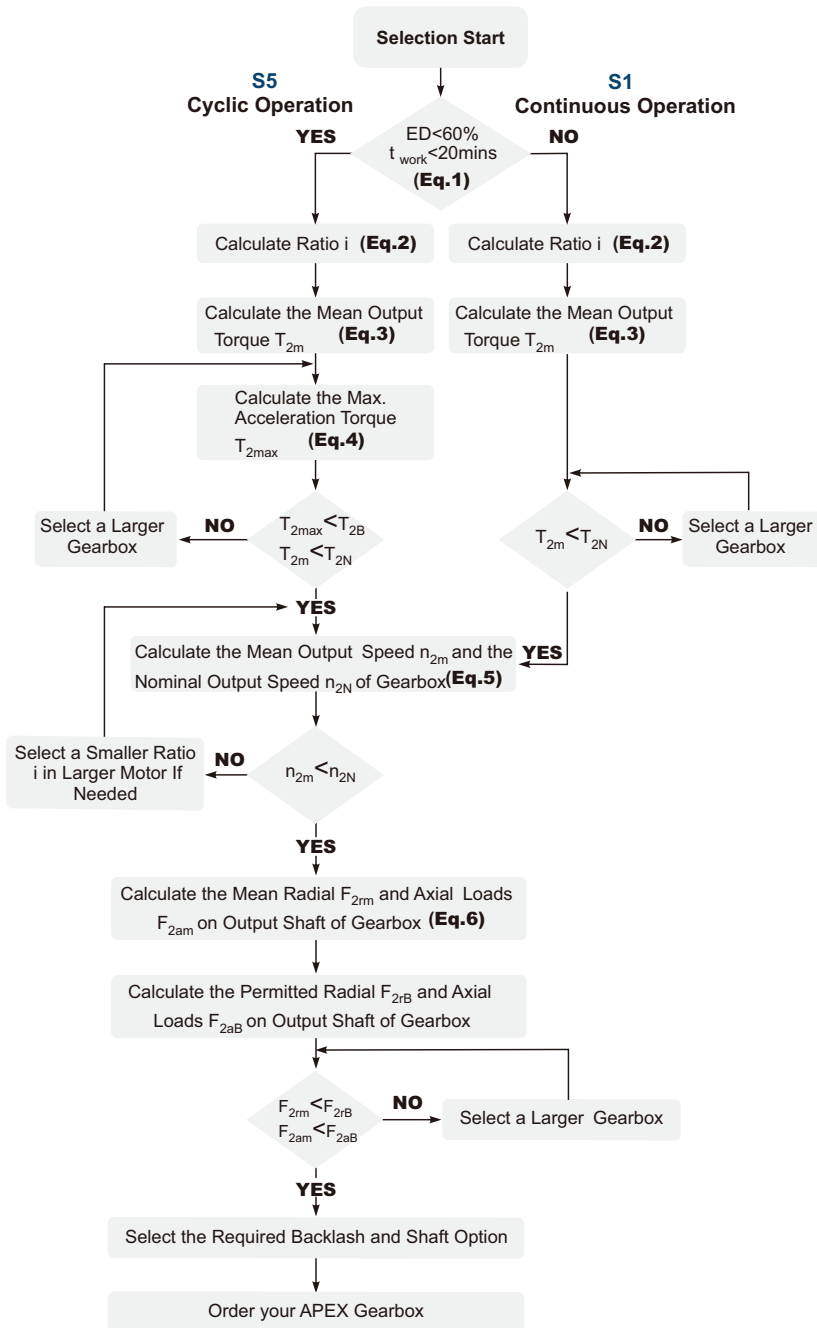
■ Table I. The max permitted torque and feed-force of rack and pinion.

| Gearbox Model | Unit | Mn | Z ⁽¹⁾ | dw ⁽²⁾ | F _{2T} ⁽³⁾ | T _{2B} ⁽⁴⁾ | M |
|-----------------------------|------|------|------------------|-------------------|--------------------------------|--------------------------------|-------|
| | | [mm] | | [mm] | [N] | [Nm] | [kg] |
| APC/APCK 110 | | 3 | 20 | 66 | 18,535 | 590 | 0.92 |
| APC/APCK 140 | | 4 | 19 | 83.92 | 31,003 | 1,250 | 1.98 |
| APC/APCK 200 | | 5 | 19 | 104.8 | 48,612 | 2,450 | 3.81 |
| APC/APCK 255 | | 6 | 19 | 125.8 | 63,907 | 3,865 | 6.61 |
| APC/APCK 285 | | 8 | 19 | 167.85 | 131,265 | 10,585 | 15.49 |
| APC/APCK 355 ⁽⁵⁾ | | 8 | 19 | 167.85 | 131,761 | 10,625 | 15.49 |
| APC/APCK 450 ⁽⁵⁾ | | 10 | 18 | 199.5 | 204,308 | 19,510 | 28.13 |

(1) Number of teeth (2) Working pitch circle diameter (3) Maximal Feed-Force (4) Maximal Driving Torque (5) Calculated under the basis of speed 1.5 m/s

- In Table I, the max. permissible torque of the curvic plate pinion and the rack is calculated under the basis of speed 3 m/s. This condition is under providing good lubrication (using the automatic lubrication system or applied grease manually every day), the tooth root strength factor $SF \geq 1.4$, teeth surface strength coefficient $SH \geq 1$, the safety factor $SB = 1$ and the required service life of 20,000 hours. By higher speed, the max. permissible torque reduced. The user needs to increase the safety factor for the application. Please visit APEX website (www.apexdyna.com/) for the backlash value by different center height.

Selection of the optimum gearbox



Recommended (for S5 Cycle Operation)

The general design is given for

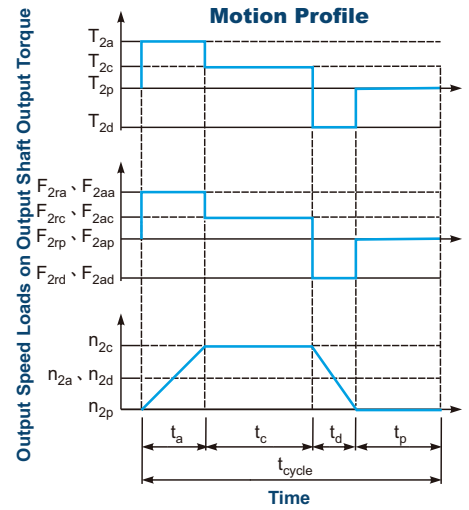
$$\frac{J_L}{i^2} \leq 4 \times J_m$$

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)

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

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

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

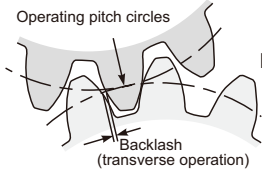
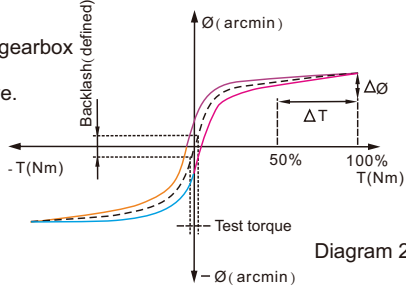
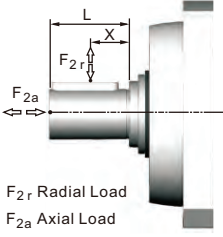
(Eq.5)

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

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

(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>  <p style="text-align: right;">Diagram 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>  <p style="text-align: right;">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> <p>For more information, please refer to APEX website.</p>  <p style="text-align: right;">F_{2r} Radial Load F_{2a} Axial Load</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 lower than 3,000 rpm, this value is measured by that specific Nominal Input Speed.

Note



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