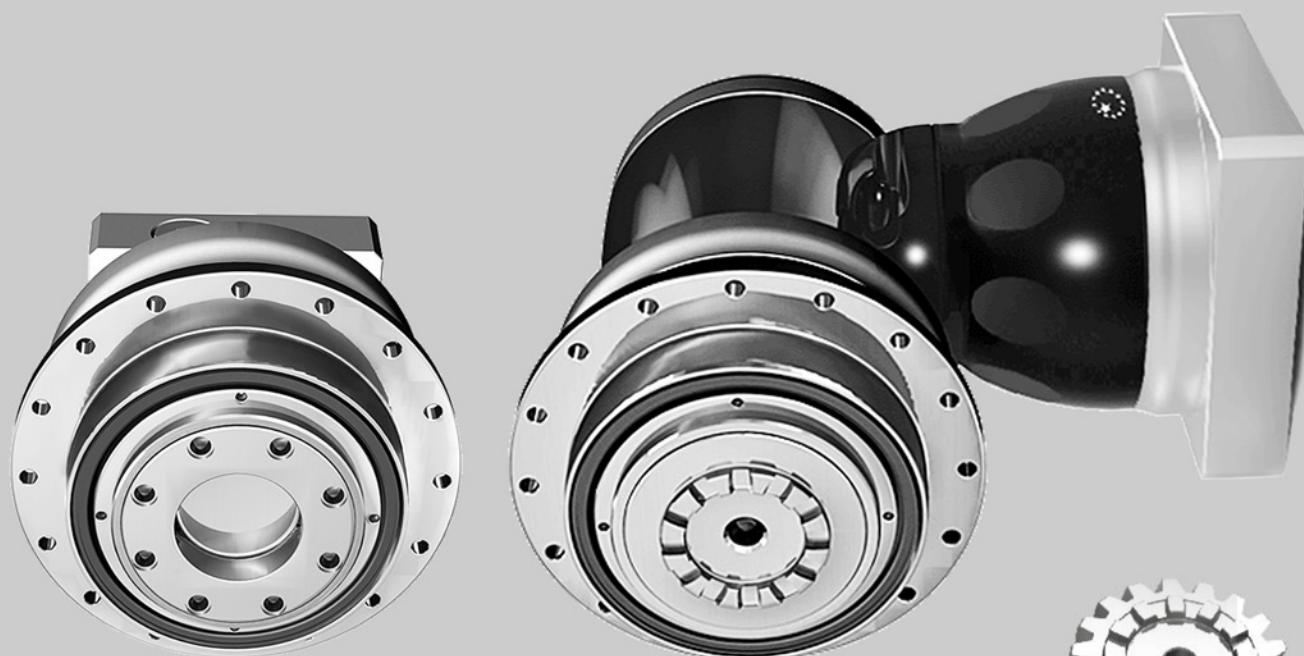




APEX DYNAMICS, INC.

**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

| | | | | |
|---------------|---|----------------------------|---|---------------------|
| AP090 | — | 005.5⁽¹⁾ | / | MOTOR |
| APK090 | — | 005.5⁽¹⁾ | / | MOTOR |
| | | | | Motor Type |
| | | | | Ratio |
| | | | | Gearbox Size |

Gearbox Size

AP 090 / 110 / 140 / 200 / 255 / 285 / 355 / 450

APC 090 / 110 / 140 / 200 / 255 / 285 / 355 / 450

APK 090 / 110 / 140 / 200 / 255 / 285 / 355 / 450

APCK 090 / 110 / 140 / 200 / 255 / 285 / 355 / 450

Ratio

AP/APC (1 Stg.) 4 / 5.5

AP/APC (2 Stg.) 16 / 20 / 22 / 27.5 / 28 / 38.5 / 40 / 55

AP/APC (3 Stg.) 64 / 88 / 100 / 110 / 140 / 154 / 160 / 200 / 220 / 280 / 400

APK/APCK (2 Stg.) 4 / 5.5 / 8 / 11

APK/APCK (2 Stg.) 16 / 20 / 22 / 27.5 / 28 / 38.5 / 40 / 55

APK/APCK (3 Stg.) 64 / 88 / 100 / 110 / 137.5 / 140 / 154 / 160 / 200 / 220 / 280 / 385

**APK/APCK (4 Stg.) 400 / 440 / 500 / 550 / 700 / 770 / 1000 / 1078 / 1400 / 1540 / 1600
2000 / 2695 / 2800 / 3850 / 4000 / 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 090 APC 090 | 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} By n_{1N} | 1 | 4 | 205 | 505 | 790 | 1,885 | 2,920 | 5,380 | - | - | | |
| | | 5.5 | 230 | 435 | 735 | 1,635 | 2,535 | 4,580 | 8,300 | 16,050 | | |
| | | 2 | 16 | 300 | 530 | 895 | 1,980 | 3,055 | 5,615 | - | - | |
| | | | 20 | 300 | 535 | 900 | 1,995 | 3,080 | 5,660 | - | - | |
| | | | 22 | 240 | 460 | 770 | 1,710 | 2,640 | 4,755 | 8,565 | 16,430 | |
| | | | 27.5 | 240 | 460 | 775 | 1,720 | 2,660 | 4,785 | 8,620 | 16,530 | |
| | | | 28 | 250 | 540 | 910 | 2,015 | 3,110 | 5,720 | - | - | |
| | | | 38.5 | 245 | 465 | 785 | 1,740 | 2,690 | 4,830 | 8,700 | 16,680 | |
| | | | 40 | 96 | 225 | 650 | 1,610 | 3,145 | 5,780 | - | - | |
| | | | 55 | 130 | 315 | 795 | 1,740 | 2,715 | 4,875 | 8,775 | 16,830 | |
| | 3 | 64 | 310 | 500 | 930 | 2,060 | 3,180 | 5,840 | - | - | | |
| | | 88 | 250 | 470 | 800 | 1,780 | 2,720 | 4,920 | 8,830 | 16,930 | | |
| | | 100 | 315 | 560 | 945 | 2,085 | 3,215 | 5,910 | - | - | | |
| | | 110 | 250 | 475 | 810 | 1,790 | 2,760 | 4,945 | 8,875 | 17,020 | | |
| | | 140 | 315 | 565 | 950 | 2,105 | 3,245 | 5,965 | - | - | | |
| | | 154 | 250 | 480 | 815 | 1,805 | 2,785 | 4,980 | 8,940 | 17,150 | | |
| | | 160 | 210 | 385 | 915 | 2,110 | 3,255 | 5,985 | - | - | | |
| | | 200 | 265 | 480 | 960 | 2,125 | 3,270 | 6,020 | - | - | | |
| | | 220 | 255 | 480 | 825 | 1,825 | 2,810 | 5,020 | 9,010 | 17,275 | | |
| | | 280 | 250 | 575 | 970 | 2,140 | 3,300 | 6,070 | - | - | | |
| 400 | 100 | 235 | 980 | 2,160 | 3,330 | 6,120 | - | - | | | | |
| Emergency Stop Torque T_{2NOT} | Nm | 1,2,3 | 4~400 | | | | | | | | 3 times T_{2N} | |
| Max. Acceleration Torque T_{2a} | Nm | 1,2,3 | 4~400 | | | | | | | | 1.5 times T_{2N} | |
| No Load Running Torque ⁽²⁾ | Nm | 1 | 4~5.5 | 1.5 | 2.5 | 7.1 | 14 | 22 | 28 | 42 | 75 | |
| | | 2 | 16~55 | 0.6 | 1.1 | 3.7 | 8 | 12 | 18 | 17 | 26 | |
| | | 3 | 64~400 | 0.35 | 0.7 | 1.6 | 4 | 4.5 | 6.5 | 6 | 12 | |
| Backlash ⁽³⁾ | arcmin | 1 | 4~5.5 | | | | | | | | | |
| | | 2,3 | 16~400 | | | | | | | | | |
| Torsional Rigidity | Nm/arcmin | 1,2,3 | 4~400 | 42 | 95 | 205 | 650 | 1,200 | 1,800 | 2,850 | 5,700 | |
| Nominal Input Speed n_{1N} | rpm | 1 | 4~5.5 | 3,600 | 3,600 | 3,000 | 2,700 | 2,400 | 2,100 | 1,500 | 1,000 | |
| | | 2 | 16~55 | 4,600 | 4,600 | 4,000 | 3,700 | 3,400 | 3,100 | 2,500 | 2,000 | |
| | | 3 | 64~400 | 5,000 | 5,000 | 4,600 | 4,000 | 3,700 | 3,400 | 3,100 | 2,500 | |
| Max. Input Speed n_{1B} | rpm | 1 | 4~5.5 | 6,000 | 6,000 | 5,000 | 4,500 | 4,000 | 3,500 | 3,000 | 2,000 | |
| | | 2 | 16~55 | 7,000 | 7,000 | 6,000 | 5,500 | 5,000 | 4,500 | 4,000 | 3,500 | |
| | | 3 | 64~400 | 7,000 | 7,000 | 7,000 | 6,000 | 5,500 | 5,000 | 4,500 | 4,000 | |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 1,2,3 | 4~400 | 2,220 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 | 101,500 | 143,700 | |
| Max. Tilting Moment M_{2K} ⁽⁴⁾ | Nm | 1,2,3 | 4~400 | 280 | 480 | 1,310 | 3,530 | 5,920 | 9,230 | 29,100 | 63,300 | |
| Operating Temp. | °C | 1,2,3 | 4~400 | | | | | | | | | |
| Degree of Gearbox Protection | | 1,2,3 | 4~400 | | | | | | | | | |
| Lubrication | | 1,2,3 | 4~400 | | | | | | | | | |
| Mounting Position | | 1,2,3 | 4~400 | | | | | | | | | |
| Running Noise ⁽²⁾ | dB(A) | 1 | 4~5.5 | ≤ 59 | ≤ 64 | ≤ 66 | ≤ 66 | ≤ 68 | ≤ 68 | ≤ 68 | ≤ 70 | |
| | | 2 | 16~55 | ≤ 60 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 67 | ≤ 67 | ≤ 67 | ≤ 70 | |
| | | 3 | 64~400 | ≤ 60 | ≤ 62 | ≤ 64 | ≤ 66 | ≤ 66 | ≤ 67 | ≤ 67 | ≤ 68 | |
| Efficiency η | % | 1 | 4~5.5 | | | | | | | | | ≥ 97% |
| | | 2 | 16~55 | | | | | | | | | ≥ 94% |
| | | 3 | 64~400 | | | | | | | | | ≥ 92% |

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

(2) The dB values are measured by gearbox with ratio 5.5 (1-stage), 55 (2-stage) or ratio 220 (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.

(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.

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

M_{2K} : [Nm]

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

$X, Y, Z2$: [mm]

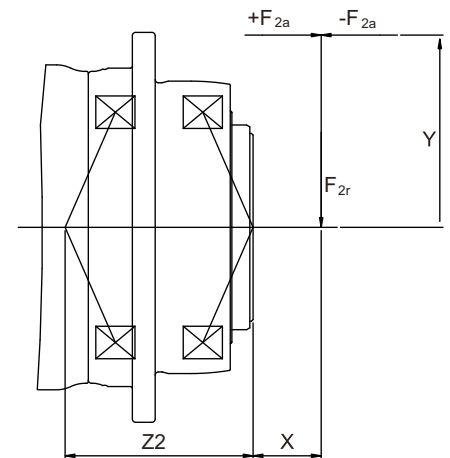


Fig. 1

| AP / APK | 090 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
|----------|------|-------|-----|-------|-------|-------|-------|-------|
| Z2 [mm] | 84.5 | 106.2 | 90 | 122.8 | 133.2 | 175.5 | 220.6 | 275.3 |

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

Max. Inertia - AP / APC Gearbox

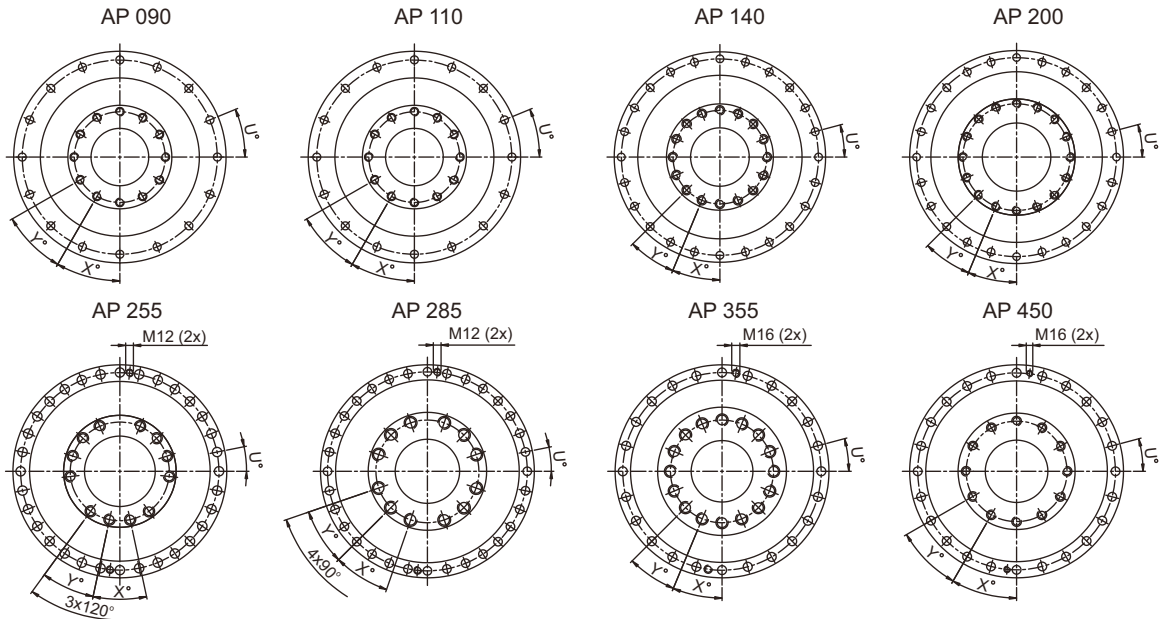
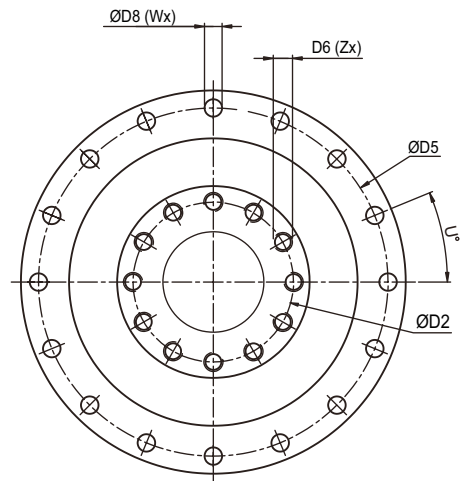
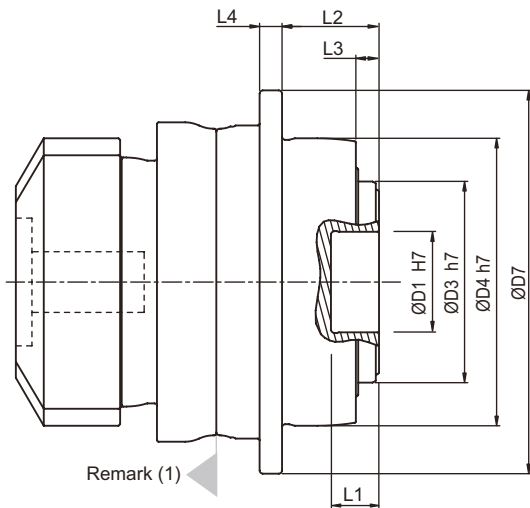
| Model No. | | AP/APC 090 | | | AP/APC 110 | | | AP/APC 140 | | | AP/APC 200 | | | AP/APC 255 | | |
|------------------|--------------------|------------|------|------|------------|------|------|------------|-------|------|------------|-------|-------|------------|-------|-------|
| Ø ^(A) | Stage | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 11 | kg.cm ² | - | - | 0.16 | | | | | | | | | | | | |
| 14 | | 0.42 | 0.21 | 0.19 | - | - | 0.21 | - | - | - | - | - | - | - | - | - |
| 19 | | 0.66 | 0.6 | - | 1.84 | 0.66 | 0.6 | - | - | 0.66 | - | - | - | - | - | - |
| 24 | | 3.94 | - | - | 4.11 | 3.94 | - | 4.61 | 4.11 | 3.94 | - | - | 4.11 | - | - | - |
| 28 | | - | - | - | 5.48 | - | - | 6.14 | 5.48 | - | - | - | 5.48 | - | - | 6.14 |
| 32 | | - | - | - | 7.36 | - | - | 8.17 | 7.36 | - | - | 8.17 | 7.36 | - | - | 8.17 |
| 35 | | - | - | - | 14.04 | - | - | 15.54 | 14.04 | - | 17.75 | 15.54 | 14.04 | - | 17.75 | 15.54 |
| 38 | | - | - | - | 16.71 | - | - | 18.19 | 16.71 | - | 20.17 | 18.19 | 16.71 | - | 20.17 | 18.19 |
| 42 | | - | - | - | - | - | - | 23.2 | - | - | 25.4 | 23.2 | - | 28.88 | 25.4 | - |
| 48 | | - | - | - | - | - | - | 52.42 | - | - | 55.18 | 52.42 | - | 58.64 | 55.18 | - |
| 55 | | - | - | - | - | - | - | - | - | - | 88.51 | - | - | 92.48 | - | - |
| 60 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| Model No. | | AP/APC 285 | | | AP/APC 355 | | | AP/APC 450 | | |
|------------------|--------------------|------------|-------|-------|------------------|--------|-------|------------------|--------|-------|
| Ø ^(A) | Stage | 1 | 2 | 3 | I ^(B) | 2 | 3 | I ^(B) | 2 | 3 |
| 11 | kg.cm ² | | | | | | | | | |
| 14 | | - | - | - | - | - | - | - | - | - |
| 19 | | - | - | - | - | - | - | - | - | - |
| 24 | | - | - | - | - | - | - | - | - | - |
| 28 | | - | - | - | - | - | - | - | - | - |
| 32 | | - | - | - | - | - | - | - | - | - |
| 35 | | - | - | 17.75 | - | - | - | - | - | - |
| 38 | | - | 23.66 | 20.17 | - | - | 20.17 | - | - | 23.66 |
| 42 | | - | 28.88 | 25.4 | - | 28.79 | 25.4 | - | - | 28.95 |
| 48 | | 69.78 | 58.64 | 55.18 | - | 92.76 | 55.18 | - | 106.06 | 58.64 |
| 55 | | 104.22 | 92.48 | - | - | 105.41 | - | - | 118.67 | - |
| 60 | | 127.69 | - | - | - | - | - | - | 127.37 | - |

(A) Ø = Input shaft diameter.

(B) For Istage of AP/APC355/450 please contact APEX for details.

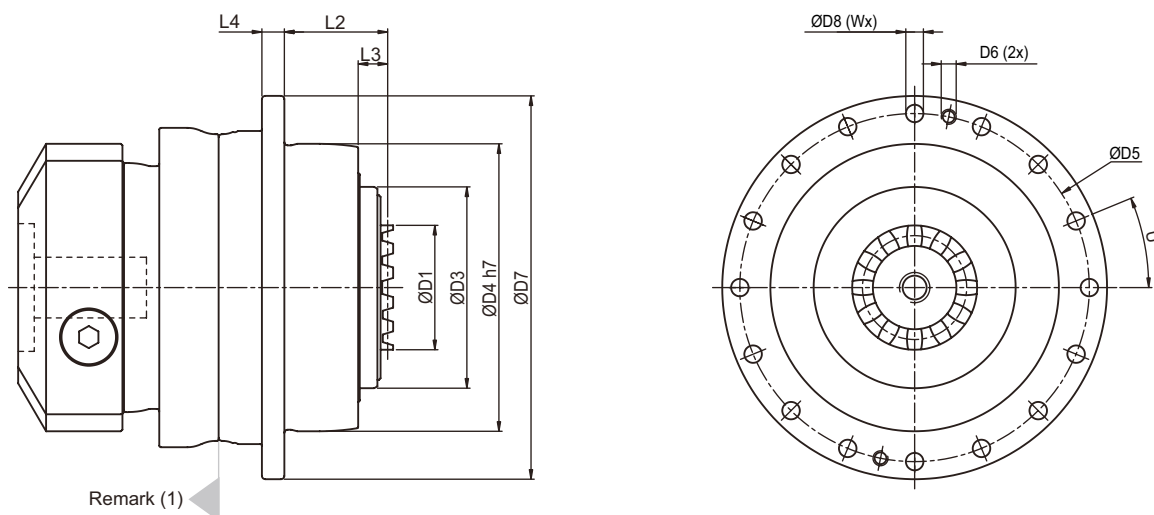
Dimension - AP Gearbox



| Dimension | | AP 090 | AP 110 | AP 140 | AP 200 | AP 255 | AP 285 | AP 355 | AP 450 |
|-------------------|----|----------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 | H7 | 31.5 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | | 50 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 | h7 | 63 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 | h7 | 90 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | | 109 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 x Pitch x Deep | | M6x1Px11 | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 | M30x3.5Px40 |
| D7 | | 120 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| L1 | | 15 | 15 | 15 | 16 | 16 | 16 | 35 | 24 |
| L2 | | 30 | 29 | 38 | 50 | 66 | 75 | 80 | 85 |
| L3 | | 7 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 | 20 |
| L4 | | 7 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| X in Degree | | 30 | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Y in Degree | | 30 | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 | 30 |
| Z | | 12 | 12 | 16 | 16 | 12 | 12 | 16 | 12 |
| U in Degree | | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | | 16 | 16 | 24 | 24 | 32 | 32 | 24 | 24 |

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

Dimension - APC Gearbox



| Dimension | APC 090 | APC 110 | APC 140 | APC 200 | APC 255 | APC 285 | APC 355 | APC 450 |
|-------------|---------|---------|---------|---------|---------|---------|---------|---------|
| D1 | 36 | 46 | 60 | 80 | 90 | 120 | 120 | 132 |
| D3 | 63 | 80 | 100 | 160 | 180 | 200 | 250 | 315 |
| D4 h7 | 90 | 110 | 140 | 200 | 255 | 285 | 355 | 450 |
| D5 | 109 | 135 | 168 | 233 | 280 | 310 | 385 | 490 |
| D6 | - | - | - | - | M12 | M12 | M16 | M16 |
| D7 | 120 | 147 | 180 | 249.5 | 302 | 332 | 415 | 530 |
| D8 | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 | 22 |
| L2 | 32.5 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 | 87.5 |
| L3 | 9.5 | 9.5 | 10 | 11 | 16 | 19 | 22.5 | 22.5 |
| L4 | 7 | 8 | 10 | 12 | 18 | 20 | 45 | 60 |
| U in Degree | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 | 15 |
| W | 16 | 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 090 APCK 090 | 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} By n_{1N} | 2 | 16 | 255 | 528 | 848 | 1,800 | 2,015 | 3,935 | - | - | |
| | | 20 | 255 | 528 | 848 | 1,800 | 2,015 | 3,935 | - | - | |
| | | 22 | 245 | 465 | 780 | 1,740 | 2,685 | 4,815 | 8,670 | - | |
| | | 27.5 | 245 | 465 | 785 | 1,750 | 2,700 | 4,840 | 8,720 | - | |
| | | 28 | 240 | 480 | 848 | 1,800 | 1,872 | 3,600 | - | - | |
| | | 38.5 | 245 | 470 | 795 | 1,770 | 2,574 | 4,885 | 8,795 | - | |
| | | 40 | 192 | 408 | 816 | 1,725 | 1,728 | 2,880 | - | - | |
| | 55 | 250 | 475 | 805 | 1,785 | 2,376 | 3,790 | 7,260 | - | | |
| | 3 | 64 | - | 565 | 845 | 2,080 | 3,220 | 5,815 | - | - | |
| | | 88 | - | 480 | 815 | 1,800 | 2,185 | 4,970 | 8,910 | 17,020 | |
| | | 100 | - | 565 | 845 | 2,105 | 3,260 | 5,815 | - | - | |
| | | 110 | - | 480 | 820 | 1,810 | 2,800 | 4,990 | 8,950 | 17,105 | |
| | | 137.5 | - | 480 | 825 | 1,820 | 2,815 | 5,020 | 8,995 | 17,190 | |
| | | 140 | - | 565 | 840 | 2,125 | 3,285 | 5,815 | - | - | |
| | | 154 | - | 485 | 825 | 1,825 | 2,820 | 5,035 | 8,580 | 16,500 | |
| | | 160 | - | 565 | 845 | 2,130 | 3,295 | 5,760 | - | - | |
| | | 200 | - | 565 | 845 | 2,145 | 3,315 | 5,815 | - | - | |
| | | 220 | - | 490 | 835 | 1,840 | 2,850 | 5,070 | 7,920 | 13,200 | |
| | | 280 | - | 540 | 845 | 2,160 | 3,345 | 5,815 | - | - | |
| | 4 | 385 | - | 495 | 850 | 1,845 | 2,890 | 5,130 | 9,195 | 17,565 | |
| | | 400 | - | 565 | 845 | 2,155 | 3,320 | 5,815 | - | - | |
| | | 440 | - | 450 | 835 | 1,840 | 2,840 | 5,060 | 9,070 | 17,335 | |
| | | 500 | - | 565 | 845 | 2,165 | 3,340 | 5,815 | - | - | |
| | | 550 | - | 490 | 845 | 1,860 | 2,870 | 5,110 | 9,155 | 17,485 | |
| | | 700 | - | 590 | 995 | 2,185 | 3,370 | 6,195 | - | - | |
| | | 770 | - | 495 | 850 | 1,870 | 2,895 | 5,150 | 9,225 | 17,600 | |
| | | 1,000 | - | 565 | 810 | 2,205 | 3,400 | 5,815 | - | - | |
| | | 1,078 | - | 500 | 860 | 1,890 | 2,920 | 5,180 | 8,580 | 16,500 | |
| | | 1,400 | - | 540 | 845 | 2,220 | 3,430 | 5,815 | - | - | |
| | | 1,540 | - | 500 | 870 | 1,910 | 2,945 | 5,220 | 7,920 | 13,200 | |
| | 1,600 | - | 565 | 845 | 2,225 | 3,435 | 5,760 | - | - | | |
| | 2,000 | - | 565 | 810 | 2,240 | 3,455 | 5,815 | - | - | | |
| | 2,695 | - | 510 | 880 | 1,935 | 2,980 | 5,275 | 9,440 | 18,015 | | |
| 2,800 | - | 540 | 845 | 2,225 | 3,480 | 5,815 | - | - | | | |
| 3,850 | - | 510 | 980 | 1,610 | 2,995 | 5,365 | 9,585 | 18,245 | | | |
| 4,000 | - | 225 | 650 | 1,840 | 3,515 | 5,815 | - | - | | | |
| 5,500 | - | 315 | 895 | 1,980 | 3,110 | 5,515 | 9,825 | 18,715 | | | |
| Emergency Stop Torque T_{2NOT} | Nm | 2,3,4 | 16~5,500 | | | | | | | | 2 times T_{2N} |
| Max. Acceleration Torque T_{2B} | Nm | 2,3,4 | 16~5,500 | | | | | | | | 1.5 times T_{2N} |
| No Load Running Torque ⁽²⁾ | Nm | 2 | 16~55 | 1.3 | 2 | 3.1 | 6 | 13 | 16 | 20 | - |
| | | 3 | 64~385 | - | 1.4 | 2.4 | 4.6 | 7 | 8.5 | 10.5 | 13 |
| | | 4 | 400~5,500 | - | 0.2 | 0.3 | 0.6 | 0.9 | 1.2 | 1.8 | 2.5 |
| Backlash ⁽³⁾ | arcmin | 2,3,4 | 16~5,500 | | | | | | | | ≤ 2 |
| Torsional Rigidity | Nm/arcmin | 2 | 16~55 | 27 | 56 | 112 | 389 | 642 | 1,275 | 2,500 | - |
| | | 3 | 64~385 | - | 56 | 112 | 389 | 642 | 1,275 | 2,500 | 5,100 |
| | | 4 | 400~5,500 | - | 45 | 85 | 310 | 535 | 1,050 | 1,700 | 2,700 |
| Nominal Input Speed n_{1N} | rpm | 2 | 16~55 | 3,000 | 2,800 | 2,700 | 2,200 | 2,100 | 2,000 | 1,600 | - |
| | | 3 | 64~385 | - | 3,000 | 2,800 | 2,700 | 2,200 | 2,100 | 2,100 | 2,000 |
| | | 4 | 400~5,500 | - | 5,500 | 4,600 | 4,600 | 4,000 | 3,700 | 3,700 | 3,400 |
| Max. Input Speed n_{1B} | rpm | 2 | 16~55 | 6,000 | 6,000 | 4,500 | 4,500 | 4,000 | 3,000 | 2,500 | - |
| | | 3 | 64~385 | - | 6,000 | 6,000 | 4,500 | 4,500 | 4,000 | 4,000 | 3,000 |
| | | 4 | 400~5,500 | - | 7,000 | 7,000 | 7,000 | 6,000 | 5,500 | 5,500 | 5,000 |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 2,3,4 | 16~5,500 | 2,220 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 | 101,500 | 143,700 |
| Max. Tilting Moment M_{2k} ⁽⁴⁾ | Nm | 2,3,4 | 16~5,500 | 280 | 480 | 1,310 | 3,530 | 5,920 | 9,230 | 29,100 | 63,300 |
| Operating Temp. | °C | 2,3,4 | 16~5,500 | | | | | | | | -10° C~ 90° C |
| Degree of Gearbox Protection Lubrication | | 2,3,4 | 16~5,500 | | | | | | | | IP65 |
| | | 2,3,4 | 16~5,500 | | | | | | | | Synthetic lubrication grease |
| Mounting Position | | 2,3,4 | 16~5,500 | | | | | | | | All directions |
| Running Noise ⁽²⁾ | dB(A) | 2,3,4 | 16~5,500 | ≤ 68 | ≤ 68 | ≤ 68 | ≤ 70 | ≤ 70 | ≤ 72 | ≤ 74 | ≤ 76 |
| Efficiency η | % | 2 | 16~55 | ≥ 94% | | | | | | | |
| | | 3 | 64~385 | ≥ 92% | | | | | | | |
| | | 4 | 400~5,500 | ≥ 90% | | | | | | | |

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

(2) The dB values are measured by gearbox with ratio 55 (2-stage), 385 (3-stage) or ratio 5,500 (4-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.

(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.

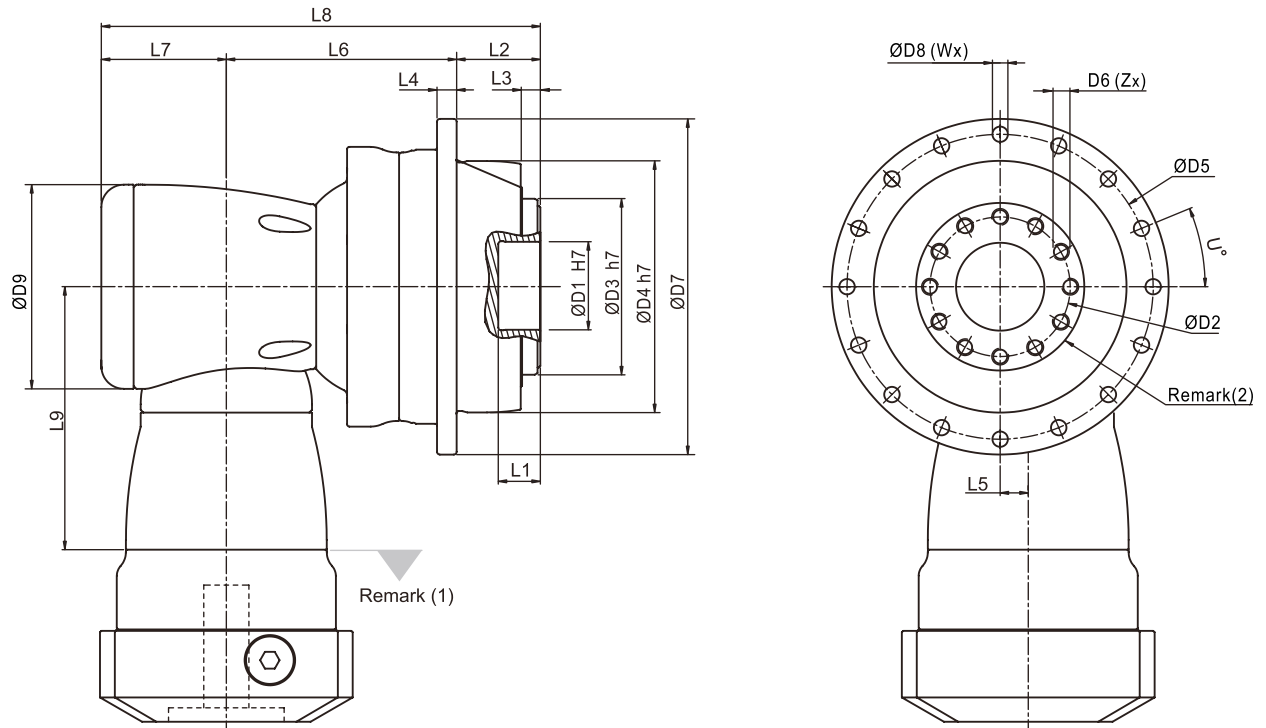
Max. Inertia - APK / APCK Gearbox

| Model No. | | APK/APCK 090 | | | APK/APCK 110 | | | APK/APCK 140 | | | APK/APCK 200 | | | APK/APCK 255 | | | APK/APCK 285 | | | | |
|------------------|--------------------|--------------|------|------|--------------|-------|------|--------------|---|-------|--------------|---|------|--------------|-------|-------|--------------|---|-------|-------|-------|
| Ø ^(A) | Stage | 2 | 3 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | | |
| 8 | kg.cm ² | - | - | 0.17 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 11 | | - | - | 0.17 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 14 | | 0.37 | - | 0.37 | - | - | 0.42 | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 19 | | 0.6 | 1.61 | 0.6 | - | - | 1.61 | 0.66 | - | - | 1.83 | - | - | - | - | - | - | - | - | | |
| 24 | | - | 3.9 | - | - | 4.01 | 3.9 | 3.94 | - | 4.01 | 4.11 | - | - | 4.61 | - | - | - | - | - | | |
| 28 | | - | - | - | - | 5.53 | 5.15 | - | - | 5.53 | - | - | 5.61 | 6.14 | - | - | - | - | - | | |
| 32 | | - | - | - | - | 7.57 | - | - | - | 8.11 | 7.57 | - | - | 8.11 | 8.17 | - | - | - | - | | |
| 35 | | - | - | - | - | 14.95 | - | - | - | 15.32 | 14.95 | - | - | 15.32 | 15.32 | 15.54 | - | - | 15.32 | 15.54 | |
| 38 | | - | - | - | - | 17.58 | - | - | - | 17.72 | 17.58 | - | - | 17.72 | 17.72 | 18.19 | - | - | 18.52 | 17.72 | 18.19 |
| 42 | | - | - | - | - | - | - | - | - | 22.95 | - | - | - | 22.95 | - | - | - | - | 23.74 | 22.95 | 23.2 |
| 48 | | - | - | - | - | - | - | - | - | 52.74 | - | - | - | 52.74 | - | - | - | - | 53.49 | 52.74 | 52.42 |
| 55 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 87.34 | - | - |

| Model No. | | APK/APCK 355 | | | APK/APCK 450 | |
|------------------|--------------------|--------------|-------|-------|--------------|-------|
| Ø ^(A) | Stage | 2 | 3 | 4 | 3 | 4 |
| 8 | kg.cm ² | - | - | - | - | - |
| 11 | | - | - | - | - | - |
| 14 | | - | - | - | - | - |
| 19 | | - | - | - | - | - |
| 24 | | - | - | - | - | - |
| 28 | | - | - | - | - | - |
| 32 | | - | - | - | - | - |
| 35 | | - | - | 15.54 | - | 17.76 |
| 38 | | - | 17.72 | 18.19 | 18.52 | 20.17 |
| 42 | | 25.5 | 22.95 | 23.2 | 23.74 | 25.4 |
| 48 | 55.14 | 52.74 | 52.42 | 53.49 | 55.18 | |
| 55 | 89.59 | - | - | - | - | |

(A) Ø = Input shaft diameter.

Dimension - APK (2 Stage) Gearbox (Ratio $i = 16 \sim 55$)

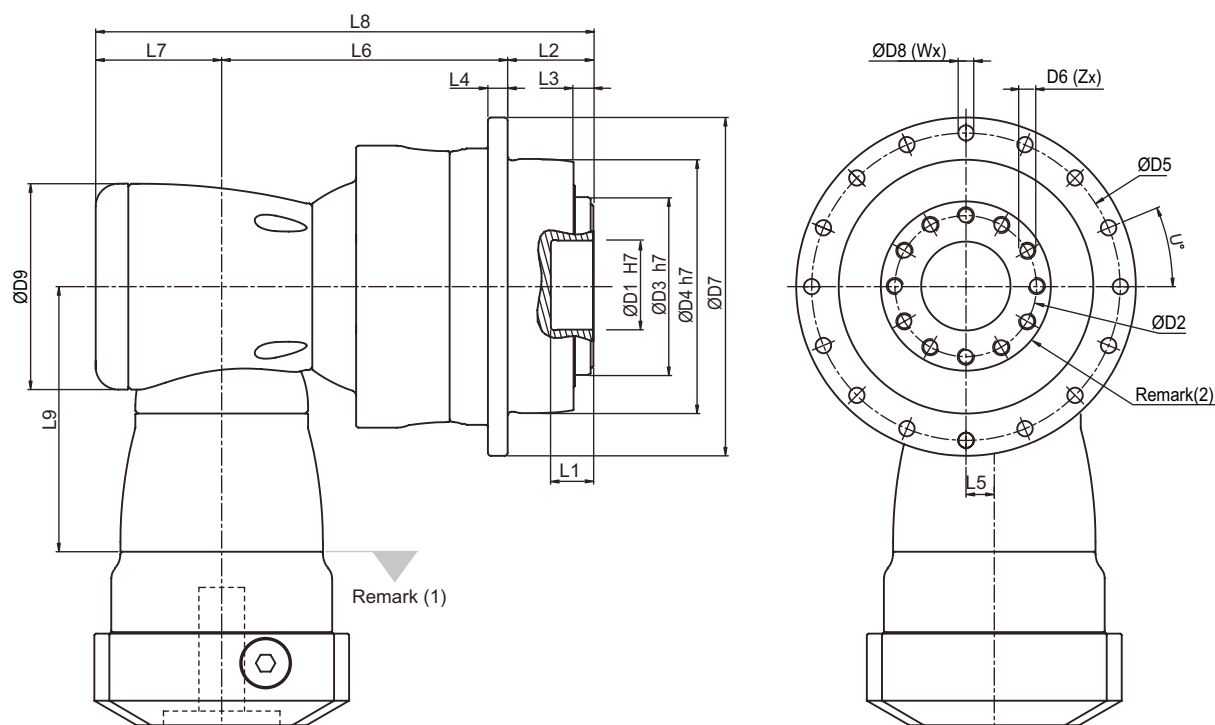


| Dimension | APK 090 | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 |
|-------------------|----------|-------------|-------------|-------------|-----------|-----------|-----------|
| D1 H7 | 31.5 | 40 | 50 | 80 | 100 | 100 | 120 |
| D2 | 50 | 63 | 80 | 125 | 140 | 160 | 200 |
| D3 h7 | 63 | 80 | 100 | 160 | 180 | 200 | 250 |
| D4 h7 | 90 | 110 | 140 | 200 | 255 | 285 | 355 |
| D5 | 109 | 135 | 168 | 233 | 280 | 310 | 385 |
| D6 x Pitch x Deep | M6x1Px11 | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 | M24x3Px32 |
| D7 | 120 | 147 | 180 | 249.5 | 302 | 332 | 415 |
| D8 | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 |
| D9 | 94 | 116 | 163 | 210 | 210 | 255 | 300 |
| L1 | 15 | 15 | 15 | 16 | 16 | 16 | 35 |
| L2 | 30 | 29 | 38 | 50 | 66 | 75 | 80 |
| L3 | 7 | 7 | 7.5 | 8.5 | 13.5 | 16.5 | 20 |
| L4 | 7 | 8 | 10 | 12 | 18 | 20 | 45 |
| L5 | 13 | 17 | 25 | 31 | 31 | 36 | 43 |
| L6 | 90.5 | 114 | 147.5 | 175 | 191.5 | 249.5 | 290 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 131 | 165 |
| L8 | 173.5 | 211.3 | 274.5 | 340 | 372.5 | 455.5 | 535 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 265.5 | 294.5 |
| X in Degree | 30 | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 |
| Y in Degree | 30 | 30 | 22.5 | 22.5 | 24 | 26 | 22.5 |
| Z | 12 | 12 | 16 | 16 | 12 | 12 | 16 |
| U in Degree | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 |
| W | 16 | 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 $i = 64 \sim 385$)

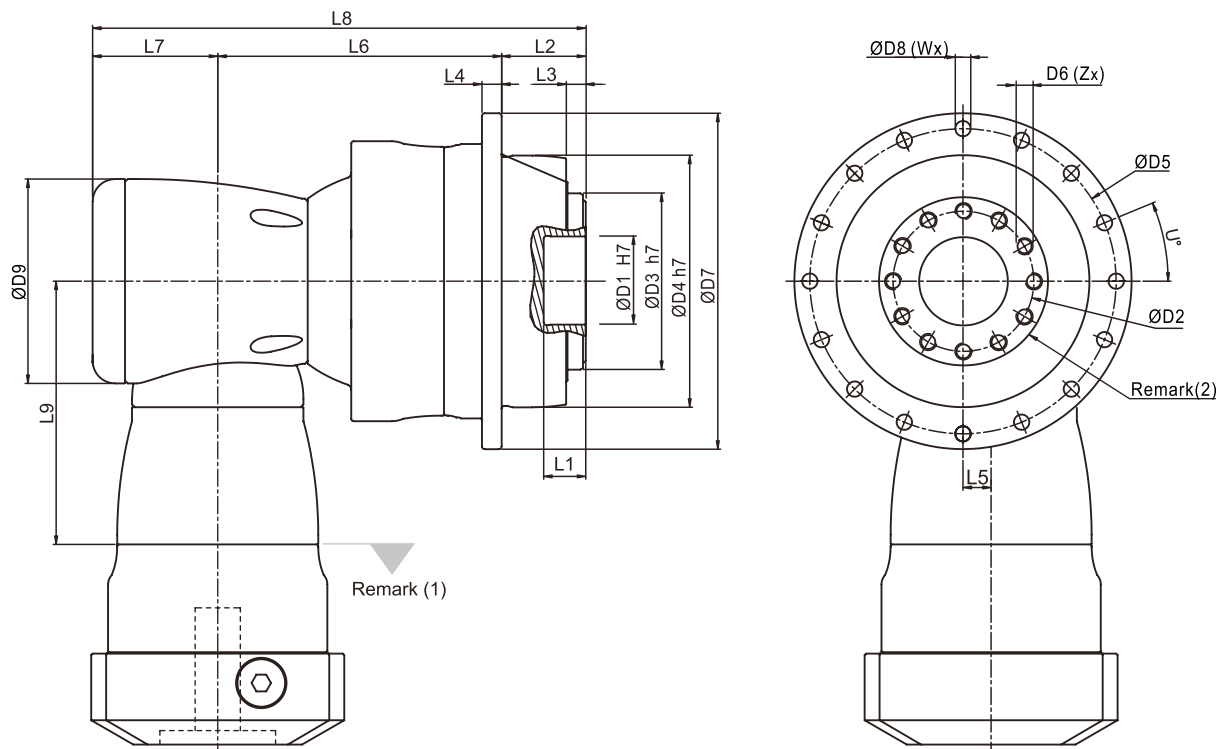


| Dimension | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 | APK 450 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 h7 | 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 = 400 ~ 5,500)

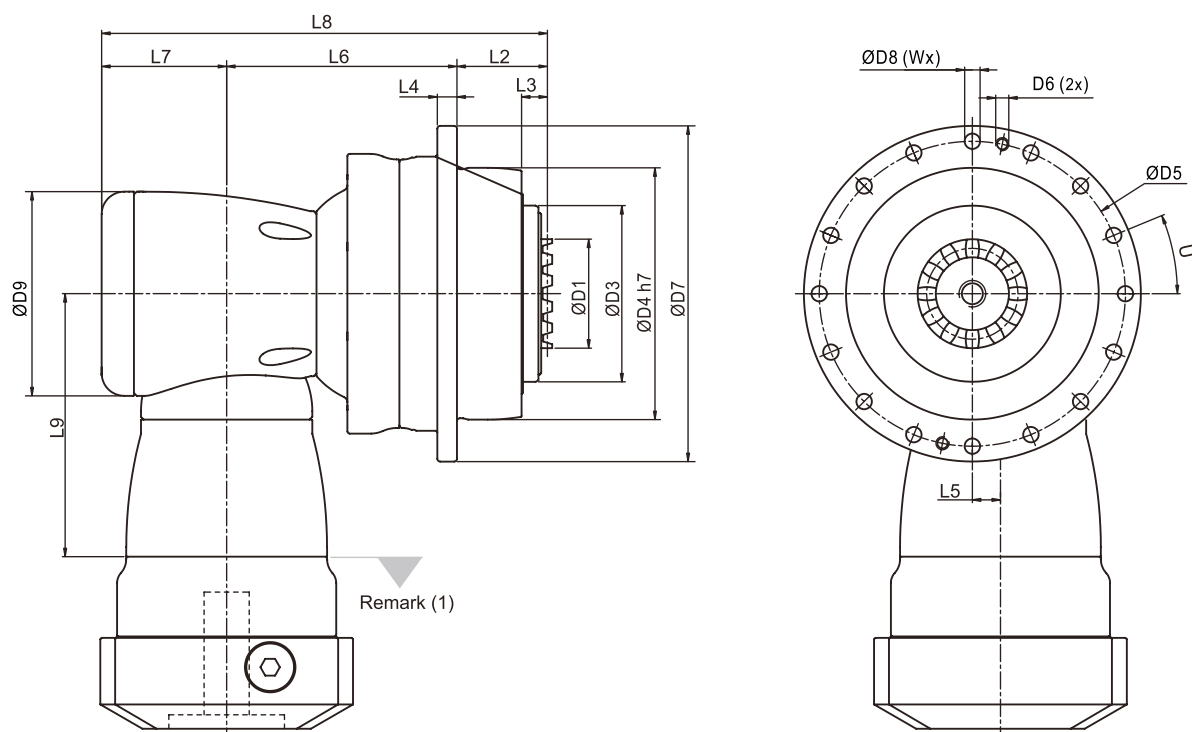


| Dimension | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 | APK 355 | APK 450 |
|-------------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|
| D1 H7 | 40 | 50 | 80 | 100 | 100 | 120 | 155 |
| D2 | 63 | 80 | 125 | 140 | 160 | 200 | 250 |
| D3 h7 | 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).

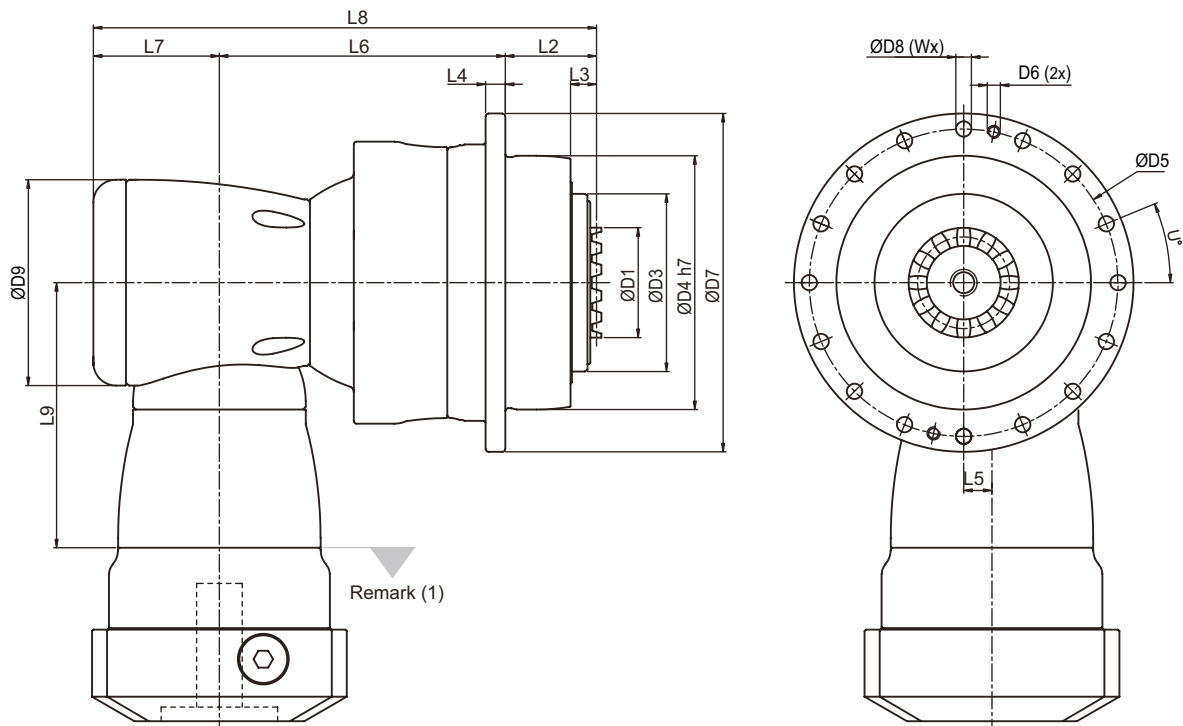
Dimension - APCK (2 Stage) Gearbox (Ratio $i = 16 \sim 55$)



| Dimension | APCK 090 | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 | APCK 355 |
|-------------|----------|----------|----------|----------|----------|----------|----------|
| D1 | 36 | 46 | 60 | 80 | 90 | 120 | 120 |
| D3 | 63 | 80 | 100 | 160 | 180 | 200 | 250 |
| D4 h7 | 90 | 110 | 140 | 200 | 255 | 285 | 355 |
| D5 | 109 | 135 | 168 | 233 | 280 | 310 | 385 |
| D6 | - | - | - | - | M12 | M12 | M16 |
| D7 | 120 | 147 | 180 | 249.5 | 302 | 332 | 415 |
| D8 | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 | 17.5 |
| D9 | 94 | 116 | 163 | 210 | 210 | 255 | 300 |
| L2 | 32.5 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 | 82.5 |
| L3 | 9.5 | 9.5 | 10 | 11 | 16 | 19 | 22.5 |
| L4 | 7 | 8 | 10 | 12 | 18 | 20 | 45 |
| L5 | 13 | 17 | 25 | 31 | 31 | 36 | 43 |
| L6 | 90.5 | 114 | 147.5 | 175 | 191.5 | 249.5 | 290 |
| L7 | 53 | 68.3 | 89 | 115 | 115 | 131 | 165 |
| L8 | 176 | 213.8 | 277 | 342.5 | 375 | 458 | 537.5 |
| L9 | 114.5 | 129 | 173.5 | 228 | 228 | 265.5 | 294.5 |
| U in Degree | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 | 15 |
| W | 16 | 16 | 24 | 24 | 32 | 32 | 24 |

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

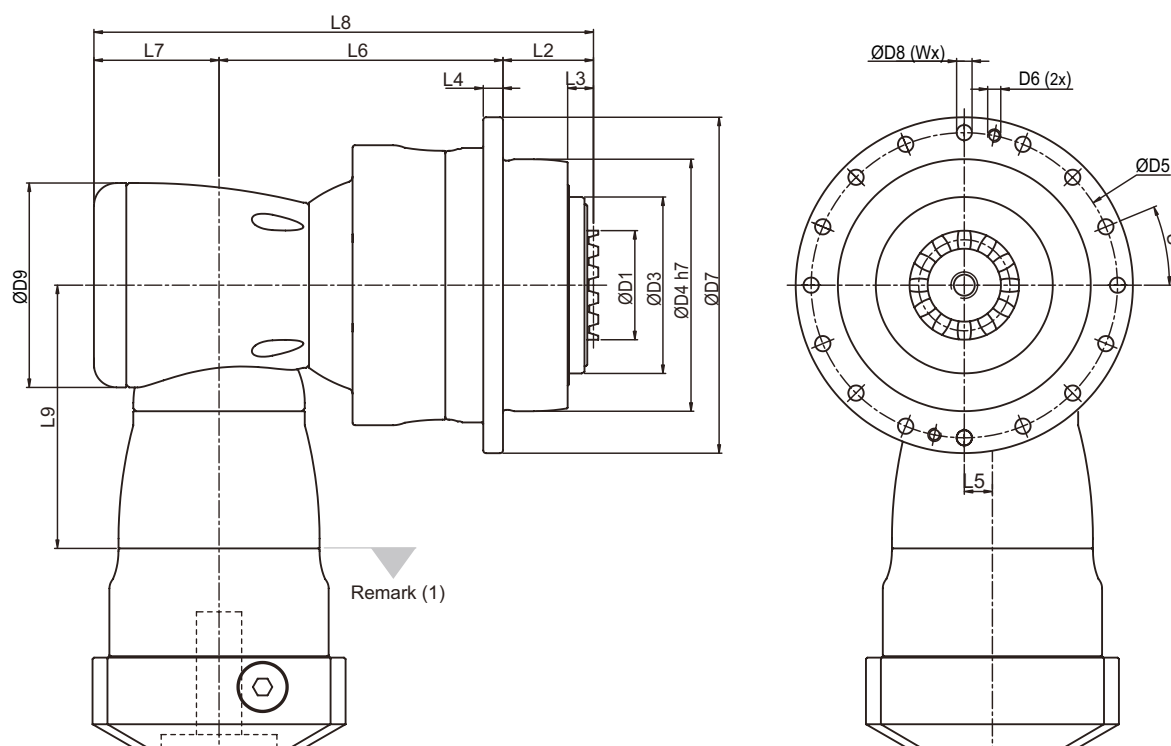
Dimension - APCK (3 Stage) Gearbox (Ratio i = 64 ~ 385)



| Dimension | APCK 110 | APCK140 | 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 $i = 400 \sim 5,500$)



| Dimension | APCK 110 | APCK140 | 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 = 4~11)

| Model No. | | Stage | Ratio ⁽¹⁾ | APK 090 APCK 090 | 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} By n_{1N} | Nm | 2 | 4 | 75 | 510 | 845 | 1,728 | 2,805 | 5,545 |
| | | | 5.5 | 105 | 440 | 745 | 1,665 | 2,590 | 4,700 |
| | | | 8 | 150 | 525 | 845 | 1,584 | 2,610 | 5,680 |
| | | | 11 | 210 | 455 | 765 | 1,710 | 2,655 | 4,800 |
| Emergency Stop Torque T_{2NOT} | Nm | 2 | 4~11 | 2 times T_{2N} | | | | | |
| Max. Acceleration Torque T_{2B} | Nm | 2 | 4~11 | 1.5 times T_{2N} | | | | | |
| No Load Running Torque ⁽²⁾ | Nm | 2 | 4~11 | 2.5 | 5.8 | 12 | 25 | 48 | 95 |
| Backlash ⁽³⁾ | arcmin | 2 | 4~11 | ≤ 2 | | | | | |
| Torsional Rigidity | Nm/arcmin | 2 | 4~11 | 27 | 56 | 112 | 389 | 642 | 1,275 |
| Nominal Input Speed n_{1N} | rpm | 2 | 4~11 | 3,600 | 3,000 | 2,300 | 1,800 | 1,500 | 1,100 |
| Max. Input Speed n_{1B} | rpm | 2 | 4~11 | 6,000 | 5,500 | 4,500 | 3,500 | 3,000 | 2,200 |
| Max. Axial Load F_{2a} ⁽⁴⁾ | N | 2 | 4~11 | 2,220 | 4,070 | 8,530 | 17,000 | 26,900 | 39,200 |
| Max. Tilting Moment M_{2K} ⁽⁴⁾ | Nm | 2 | 4~11 | 280 | 480 | 1,310 | 3,530 | 5,920 | 9,230 |
| Operating Temp. | °C | 2 | 4~11 | -10° C ~ 90° C | | | | | |
| Degree of Gearbox Protection | | 2 | 4~11 | IP65 | | | | | |
| Lubrication | | 2 | 4~11 | Synthetic lubrication grease | | | | | |
| Mounting Position | | 2 | 4~11 | All directions | | | | | |
| Running Noise ⁽²⁾ | dB(A) | 2 | 4~11 | ≤ 68 | ≤ 68 | ≤ 70 | ≤ 70 | ≤ 72 | ≤ 74 |
| Efficiency η | % | 2 | 4~11 | ≥ 95% | | | | | |

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

(2) The dB values are measured by gearbox with ratio 11 (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.

(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).

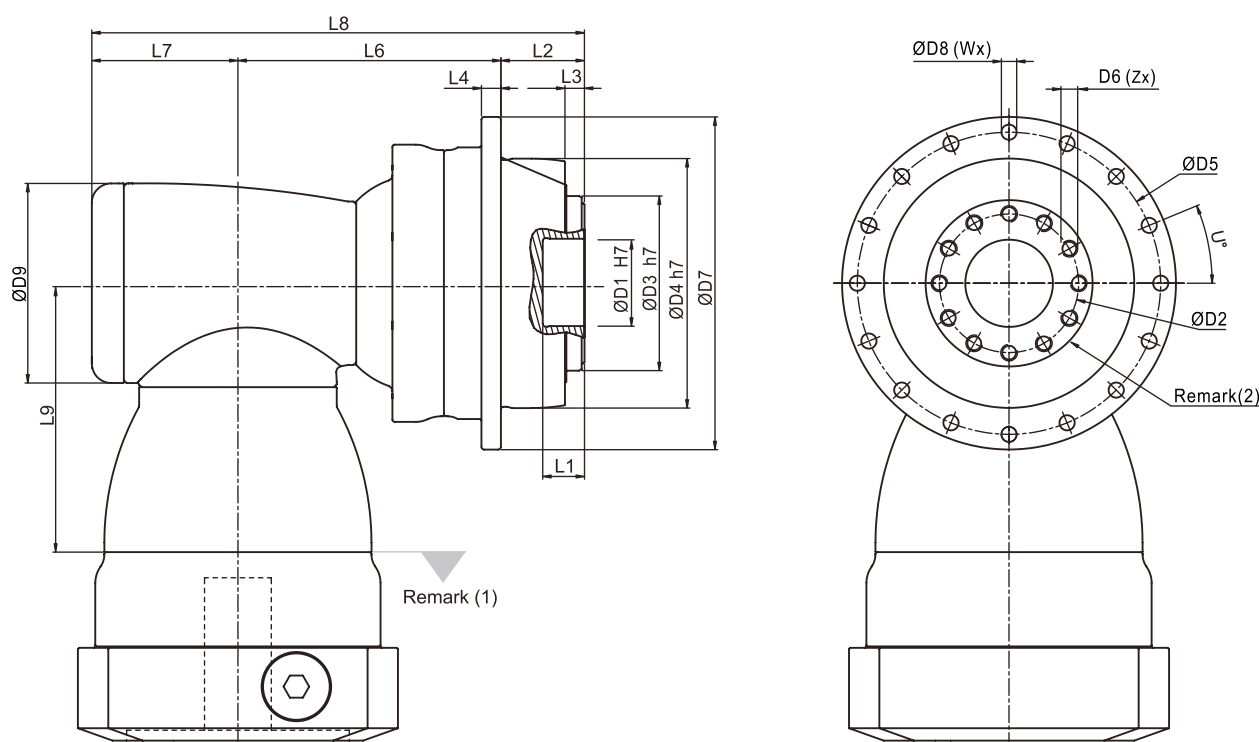
(5) Continuous operation is not recommended.

Max. Inertia - APK / APCK (2 Stage) Gearbox (Ratio i = 4~11)

| Model No. | | APK/APCK 090 | APK/APCK 110 | APK/APCK 140 | APK/APCK 200 | APK/APCK 255 | APK/APCK 285 |
|---------------------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| $\varnothing^{(A)}$ | Stage | 2st | 2st | 2st | 2st | 2st | 2st |
| 11 | kg.cm ² | 0.41 | - | - | - | - | - |
| 14 | | 0.41 | - | - | - | - | - |
| 19 | | 1.61 | 1.61 | - | - | - | - |
| 24 | | 3.9 | 4.01 | 5.61 | - | - | - |
| 28 | | - | 5.53 | 5.61 | - | - | - |
| 32 | | - | 7.57 | 8.11 | - | - | - |
| 35 | | - | 14.95 | 15.32 | 15.32 | - | - |
| 38 | | - | 17.58 | 17.72 | 17.72 | - | - |
| 42 | | - | - | 22.95 | 22.95 | 23.74 | - |
| 48 | | - | - | 52.74 | 52.74 | 53.49 | 55.14 |
| 55 | | - | - | - | - | 87.34 | 89.59 |
| 60 | | - | - | - | - | - | 113.06 |

(A) \varnothing = Input shaft diameter.

Dimension - APK (2 Stage) Gearbox (Ratio i = 4 ~ 11)

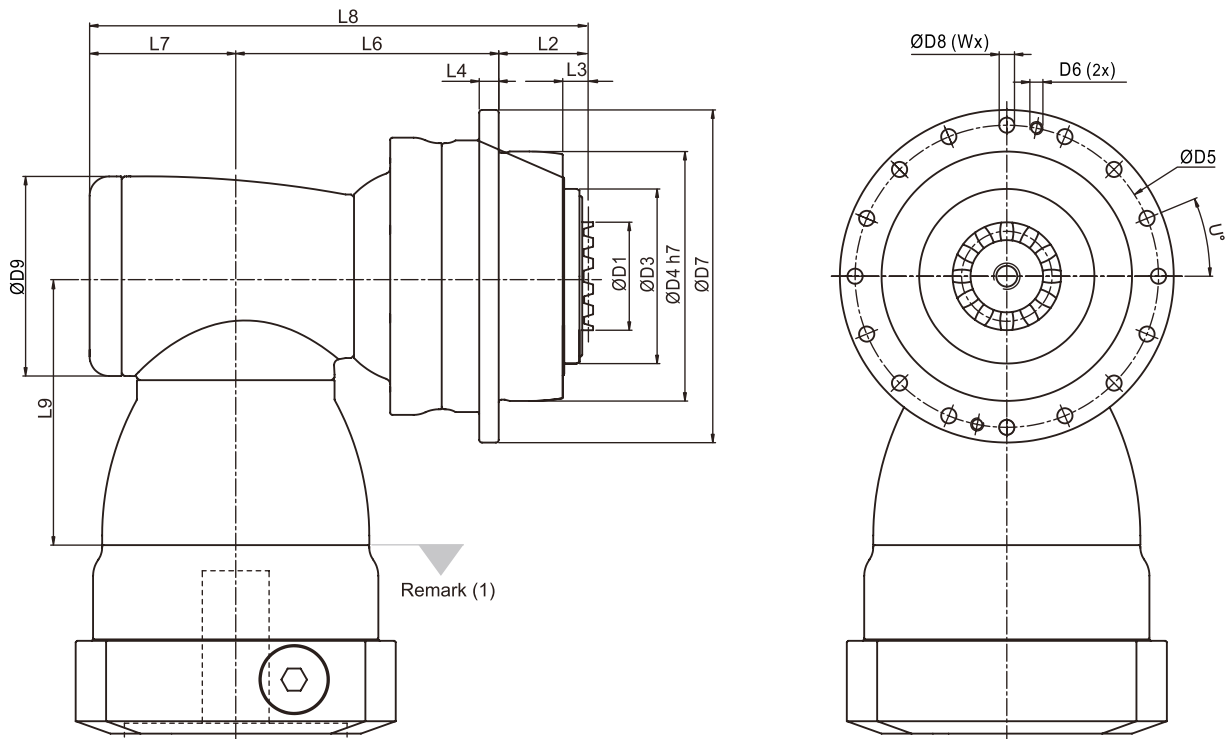


| Dimension | APK 090 | APK 110 | APK 140 | APK 200 | APK 255 | APK 285 |
|-------------------|----------|-------------|-------------|-------------|-----------|-----------|
| D1 H7 | 31.5 | 40 | 50 | 80 | 100 | 100 |
| D2 | 50 | 63 | 80 | 125 | 140 | 160 |
| D3 h7 | 63 | 80 | 100 | 160 | 180 | 200 |
| D4 h7 | 90 | 110 | 140 | 200 | 255 | 285 |
| D5 | 109 | 135 | 168 | 233 | 280 | 310 |
| D6 x Pitch x Deep | M6x1Px11 | M8x1.25Px12 | M8x1.25Px15 | M10x1.5Px20 | M16x2Px25 | M24x3Px37 |
| D7 | 120 | 147 | 180 | 249.5 | 302 | 332 |
| D8 | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 |
| D9 | 92 | 116 | 156 | 156 | 195 | 240 |
| L1 | 15 | 15 | 15 | 16 | 16 | 16 |
| L2 | 30 | 29 | 38 | 50 | 66 | 75 |
| L3 | 7 | 7 | 7.5 | 8.5 | 13.5 | 16.5 |
| L4 | 7 | 8 | 10 | 12 | 18 | 20 |
| L6 | 100.5 | 124.5 | 175.5 | 185 | 199 | 265.5 |
| L7 | 61.5 | 76 | 97.5 | 97.5 | 105.5 | 141 |
| L8 | 192 | 229.5 | 311 | 332.5 | 370.5 | 481.5 |
| L9 | 113.5 | 147.5 | 196.5 | 196.5 | 229 | 260 |
| X in Degree | 30 | 30 | 22.5 | 22.5 | 24 | 26 |
| Y in Degree | 30 | 30 | 22.5 | 22.5 | 24 | 26 |
| Z | 12 | 12 | 16 | 16 | 12 | 12 |
| U in Degree | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 |
| W | 16 | 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 = 4 ~ 11)



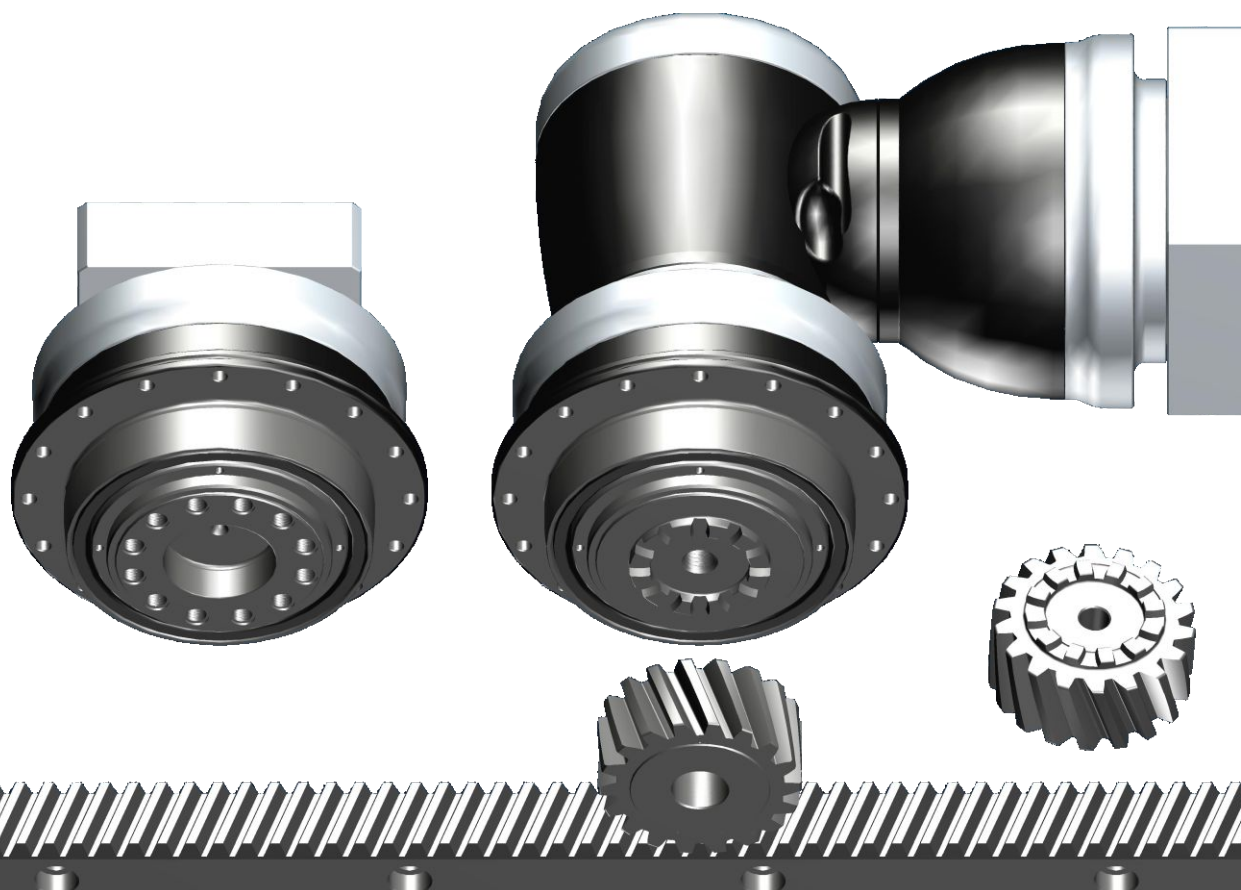
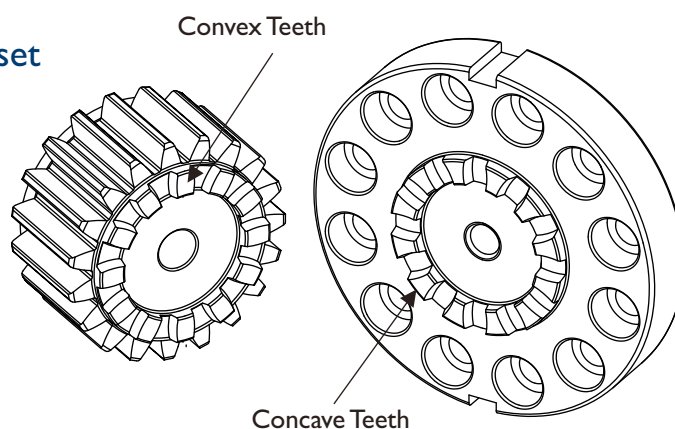
| Dimension | APCK 090 | APCK 110 | APCK 140 | APCK 200 | APCK 255 | APCK 285 |
|-------------|----------|----------|----------|----------|----------|----------|
| D1 | 36 | 46 | 60 | 80 | 90 | 120 |
| D3 | 63 | 80 | 100 | 160 | 180 | 200 |
| D4 h7 | 90 | 110 | 140 | 200 | 255 | 285 |
| D5 | 109 | 135 | 168 | 233 | 280 | 310 |
| D6 | - | - | - | - | M12 | M12 |
| D7 | 120 | 147 | 180 | 249.5 | 302 | 332 |
| D8 | 5.5 | 5.5 | 6.6 | 9 | 13.5 | 13.5 |
| D9 | 92 | 116 | 156 | 156 | 195 | 240 |
| L2 | 32.5 | 31.5 | 40.5 | 52.5 | 68.5 | 77.5 |
| L3 | 9.5 | 9.5 | 10 | 11 | 16 | 19 |
| L4 | 7 | 8 | 10 | 12 | 18 | 20 |
| L6 | 100.5 | 124.5 | 175.5 | 185 | 199 | 265.5 |
| L7 | 61.5 | 76 | 97.5 | 97.5 | 105.5 | 141 |
| L8 | 194.5 | 232 | 313.5 | 335 | 373 | 484 |
| L9 | 113.5 | 147.5 | 196.5 | 196.5 | 229 | 260 |
| U in Degree | 22.5 | 22.5 | 15 | 15 | 11.25 | 11.25 |
| W | 16 | 16 | 24 | 24 | 32 | 32 |

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

Rack and Pinion for AP series

Advantages of Curvic Coupling

- All-Teeth-Coupling between pinion and gearbox
- Zero backlash
- Automatic concentricity
- High torque transmission
- The Round-Out of the gearbox-pinion-set can be adjusted by switching the curvic positions.
- Quick assembly and disassembly or replacement
- More suitable pinion teeth-no. can be chosen, without interference with screwing.



Rack with Helical Teeth

Quality 5

Module : 2~3 Alloy Steel / 4~10 Carbon Steel

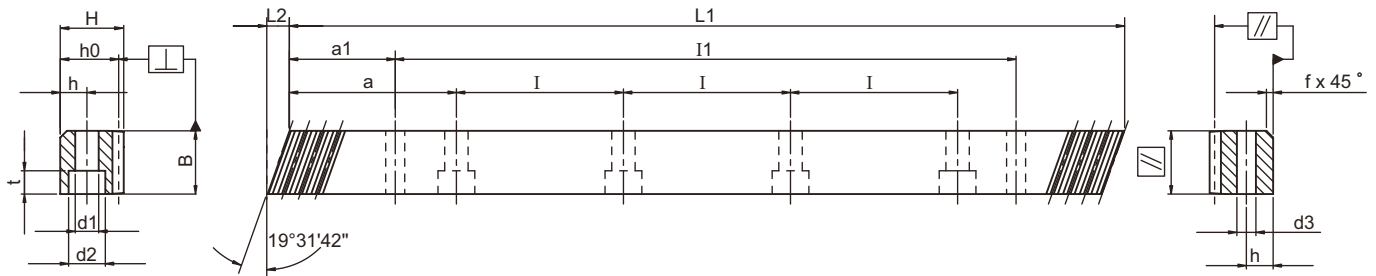
Tooth Thickness Tolerance : -15 ~ 0 μm

Right - Hand Helical

Helical Angle $\beta = 19^\circ 31'42'' (19.5283^\circ)$ Pressure Angle $\alpha = 20^\circ$

Induction Hardened

Teeth Ground and All Sides Ground



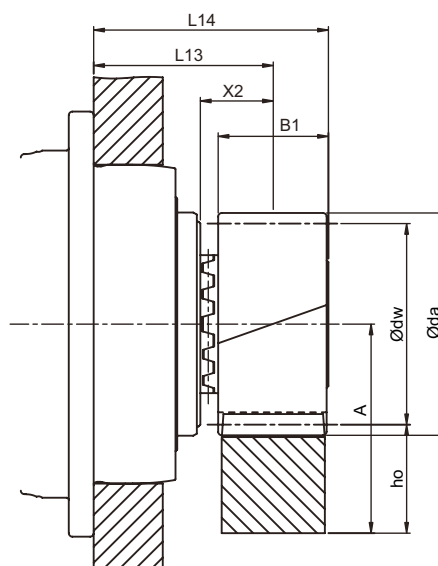
| Mn | Pt ⁽¹⁾ | L1 | L2 | Teeth No. | B | H | ho | f | a | l | Holes No. | h | d1 | d2 | t | a1 | l1 | d3 | fp ⁽²⁾ | Fp ⁽³⁾ | Order Code |
|----|-------------------|----------|------|-----------|----|----|----|---|------|-----|-----------|----|----|----|----|------|---------|------|-------------------|-------------------|-------------|
| 2 | 6.66668 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 436 | 5.7 | 0.0055 | 0.021 | 0205R050M10 |
| 2 | 6.66668 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 936.6 | 5.7 | 0.006 | 0.024 | 0205R100M10 |
| 2 | 6.66668 | 1246.67 | 8.5 | 187 | 24 | 24 | 22 | 2 | 62.5 | 125 | 10 | 8 | 7 | 11 | 7 | 31.7 | 1183.3 | 5.7 | 0.006 | 0.024 | 0205R125M10 |
| 2 | 6.66668 | 1500 | 8.5 | 225 | 24 | 24 | 22 | 2 | 62.5 | 125 | 12 | 8 | 7 | 11 | 7 | 31.7 | 1436.6 | 5.7 | 0.006 | 0.024 | 0205R150M10 |
| 2 | 6.66668 | 1746.67 | 8.5 | 262 | 24 | 24 | 22 | 2 | 62.5 | 125 | 14 | 8 | 7 | 11 | 7 | 31.7 | 1683.3 | 5.7 | 0.006 | 0.024 | 0205R175M10 |
| 2 | 6.66668 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | 62.5 | 125 | 16 | 8 | 7 | 11 | 7 | 31.7 | 1936.6 | 5.7 | 0.007 | 0.027 | 0205R200M10 |
| 3 | 10.00002 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 430 | 7.7 | 0.006 | 0.023 | 0305R050M10 |
| 3 | 10.00002 | 1,000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 930 | 7.7 | 0.006 | 0.026 | 0305R100M10 |
| 3 | 10.00002 | 1,250 | 10.3 | 125 | 29 | 29 | 26 | 2 | 62.5 | 125 | 10 | 9 | 10 | 15 | 9 | 35 | 1,180 | 7.7 | 0.006 | 0.026 | 0305R125M10 |
| 3 | 10.00002 | 1,500 | 10.3 | 150 | 29 | 29 | 26 | 2 | 62.5 | 125 | 12 | 9 | 10 | 15 | 9 | 35 | 1,430 | 7.7 | 0.006 | 0.026 | 0305R150M10 |
| 3 | 10.00002 | 1,750 | 10.3 | 175 | 29 | 29 | 26 | 2 | 62.5 | 125 | 14 | 9 | 10 | 15 | 9 | 35 | 1,680 | 7.7 | 0.006 | 0.026 | 0305R175M10 |
| 3 | 10.00002 | 2,000 | 10.3 | 200 | 29 | 29 | 26 | 2 | 62.5 | 125 | 16 | 9 | 10 | 15 | 9 | 35 | 1,930 | 7.7 | 0.007 | 0.03 | 0305R200M10 |
| 4 | 13.33335 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 433 | 7.7 | 0.007 | 0.025 | 0405R050C10 |
| 4 | 13.33335 | 1,000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 933.4 | 7.7 | 0.007 | 0.028 | 0405R100C10 |
| 4 | 13.33335 | 1,000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 33.3 | 933.4 | 11.7 | 0.007 | 0.028 | 0405R100CS0 |
| 4 | 13.33335 | 1,253.34 | 13.8 | 94 | 39 | 39 | 35 | 3 | 62.5 | 125 | 10 | 12 | 10 | 15 | 9 | 33.3 | 1,186.7 | 7.7 | 0.007 | 0.028 | 0405R125C10 |
| 4 | 13.33335 | 1,506.67 | 13.8 | 113 | 39 | 39 | 35 | 3 | 62.5 | 125 | 12 | 12 | 10 | 15 | 9 | 33.3 | 1,433.4 | 7.7 | 0.007 | 0.028 | 0405R150C10 |
| 4 | 13.33335 | 1,506.67 | 13.8 | 113 | 39 | 39 | 35 | 3 | 62.5 | 125 | 12 | 12 | 14 | 20 | 13 | 33.3 | 1,433.4 | 11.7 | 0.007 | 0.028 | 0405R150CS0 |
| 4 | 13.33335 | 1,760 | 13.8 | 132 | 39 | 39 | 35 | 3 | 62.5 | 125 | 14 | 12 | 10 | 15 | 9 | 33.3 | 1,693.4 | 7.7 | 0.007 | 0.028 | 0405R175C10 |
| 4 | 13.33335 | 2,000 | 13.8 | 150 | 39 | 39 | 35 | 3 | 62.5 | 125 | 16 | 12 | 10 | 15 | 9 | 33.3 | 1,933.4 | 7.7 | 0.008 | 0.032 | 0405R200C10 |
| 4 | 13.33335 | 2,000 | 13.8 | 150 | 39 | 39 | 35 | 3 | 62.5 | 125 | 16 | 12 | 14 | 20 | 13 | 33.3 | 1,933.4 | 11.7 | 0.008 | 0.032 | 0405R200CS0 |
| 5 | 16.66669 | 1,000 | 17.4 | 60 | 49 | 39 | 34 | 3 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 925 | 11.7 | 0.007 | 0.028 | 0505R100C10 |
| 6 | 20.00003 | 1,000 | 20.9 | 50 | 59 | 49 | 43 | 3 | 62.5 | 125 | 8 | 16 | 18 | 26 | 17 | 37.5 | 925 | 15.7 | 0.007 | 0.028 | 0605R100C10 |
| 8 | 26.66671 | 960 | 28 | 36 | 79 | 79 | 71 | 3 | 60 | 120 | 8 | 25 | 22 | 33 | 21 | 120 | 720 | 19.7 | 0.008 | 0.031 | 0805R100C10 |
| 10 | 33.33339 | 1,000 | 35.1 | 30 | 99 | 99 | 89 | 3 | 62.5 | 125 | 8 | 32 | 33 | 48 | 32 | 125 | 750 | 19.7 | 0.008 | 0.031 | 1005R100C10 |

(1) Teeth Pitch Pt = Module $\times \pi / \cos \beta$ (2) fp = Single Pitch Error (3) Fp = Total Pitch Error

● Please refer to APEX Rack & Pinion catalog for other models

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⁾ | DI ⁽⁷⁾ | Order Code |
|---------------|----|------------------|------------------|-------------------|------------------|-------------------|-----|------|-------|-----|------------------|-------------------|------------|
| APC/APCK 090 | 3 | 17 | 0.441 | 62.76 | 54.113 | 56.76 | 31 | 20.5 | 50.5 | 66 | 170 | 36 | A03L17 |
| APC/APCK 110 | 3 | 20 | 0.3897 | 72 | 63.662 | 66 | 31 | 20.5 | 49.5 | 65 | 200 | 46 | A03L20 |
| APC/APCK 140 | 4 | 19 | 0.4102 | 91.92 | 80.639 | 83.92 | 41 | 25.5 | 63.5 | 84 | 253.335 | 60 | A04L19 |
| APC/APCK 200 | 5 | 19 | 0.4002 | 114.8 | 100.798 | 104.8 | 51 | 30.5 | 80.5 | 106 | 316.666 | 80 | A05L19 |
| APC/APCK 255 | 6 | 19 | 0.4035 | 137.8 | 120.958 | 125.8 | 61 | 35.5 | 101.5 | 132 | 380 | 90 | A06L19 |
| APC/APCK 285 | 8 | 19 | 0.4108 | 183.85 | 161.277 | 167.85 | 81 | 45.5 | 120.5 | 161 | 506.667 | 120 | A08L19 |
| APC/APCK 355 | 8 | 19 | 0.4108 | 183.85 | 161.277 | 167.85 | 81 | 45.5 | 125.5 | 166 | 506.667 | 120 | A08L19 |
| APC/APCK 450 | 10 | 18 | 0.4257 | 219.5 | 190.986 | 199.5 | 101 | 55.5 | 140.5 | 191 | 600 | 132 | 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 $L = \pi \times d$ (7) Curvic specification

Pinion material carburized 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 090 | | 3 | 17 | 56.76 | 18,110 | 390 | 0.7 |
| 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

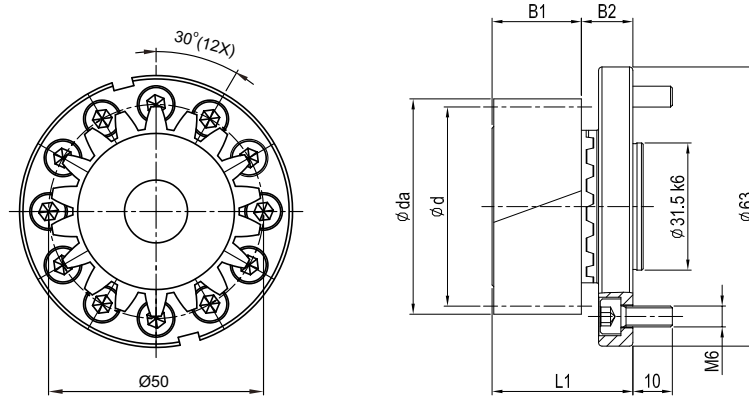
- In Table I, the max. permissible torque of the curvic plate pinion and the rack is calculated under the basis of speed 3 m/s. This condition is under providing good lubrication (using the automatic lubrication system or applied grease manually every day), the tooth root strength factor $SF \geq 1.4$, 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.

Pinion with Helical Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

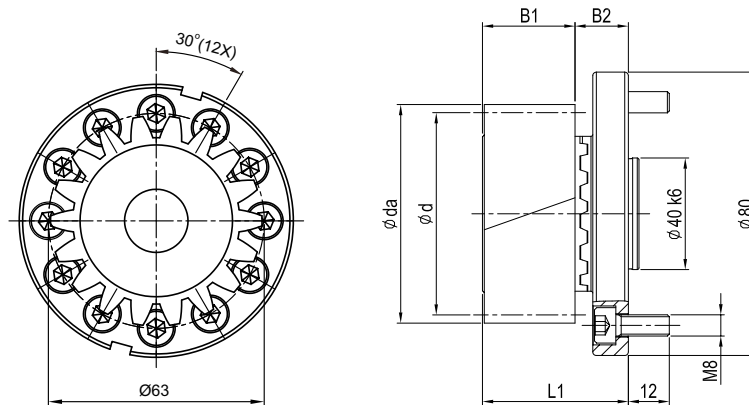
Tooth Thickness Tolerance : e24
 Left - Hand Helical Teeth
 Helical Angle $\beta = 19^\circ 31'42'' (19.5283^\circ)$
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

AP / APK 090



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 2 | 20 | 0.390 | 48 | 42.441 | 44 | 26 | 15 | 41 | 133.334 | 36 | M10 | A02L20P050 | A02L20 |
| 3 | 17 | 0.441 | 62.76 | 54.113 | 56.76 | 31 | 15 | 46 | 170 | 36 | M10 | A03L17P050 | A03L17 |

AP / APK 110



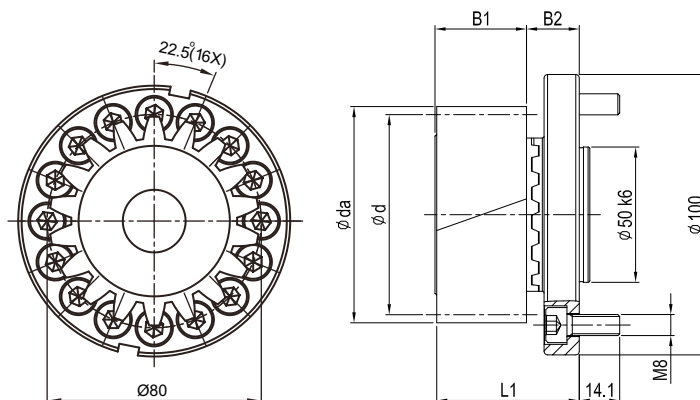
| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|------|------|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 2 | 20 | 0.390 | 48 | 42.441 | 44 | 26 | 19.5 | 45.5 | 133.334 | 36 | M10 | A02L20C063 | A02L20 |
| 3 | 20 | 0.390 | 72 | 63.662 | 66 | 31 | 19.5 | 50.5 | 200 | 46 | M12 | A03L20C063 | A03L20 |

Pinion with Helical Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

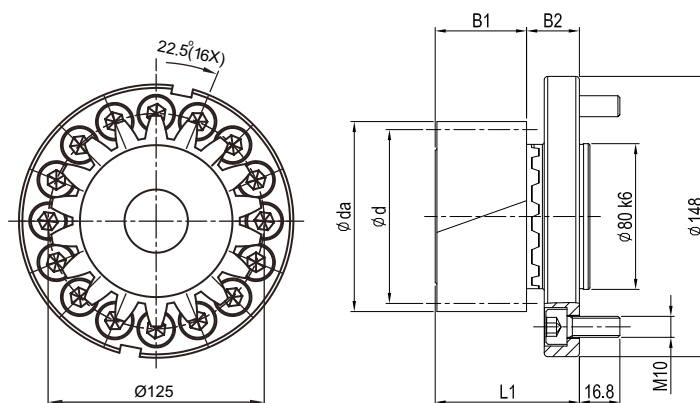
Tooth Thickness Tolerance : e24
 Left - Hand Helical Teeth
 Helical Angle $\beta = 19^\circ 31'42'' (19.5283^\circ)$
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

AP / APK 140



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|------|------|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 3 | 18 | 0.118 | 64 | 57.296 | 58 | 31 | 21.5 | 52.5 | 180 | 46 | M12 | A03L18P080 | A03L18 |
| | 20 | 0.390 | 72 | 63.662 | 66 | 31 | 21.5 | 52.5 | 200 | 46 | M12 | A03L20P080 | A03L20 |
| 4 | 19 | 0.410 | 91.92 | 80.639 | 83.92 | 41 | 21.5 | 62.5 | 253.335 | 60 | M16 | A04L19P080 | A04L19 |

AP / APK 200



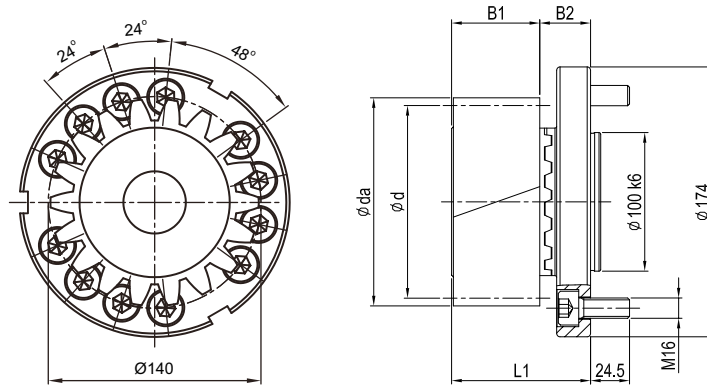
| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 4 | 18 | 0.638 | 89.5 | 76.394 | 81.5 | 41 | 29 | 70 | 240 | 68 | M16 | A04L18P125 | A04L18 |
| | 20 | 0.190 | 94.4 | 84.883 | 86.4 | 41 | 29 | 70 | 266.667 | 68 | M16 | A04L20P125 | A04L20 |
| 5 | 19 | 0.400 | 114.8 | 100.798 | 104.8 | 51 | 29 | 80 | 316.666 | 80 | M20 | A05L19P125 | A05L19 |

Pinion with Helical Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

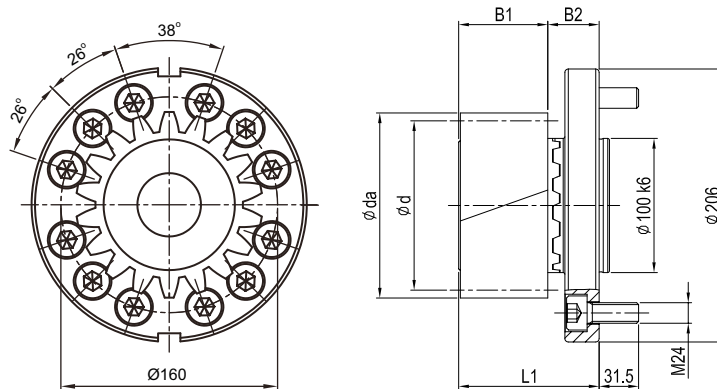
Tooth Thickness Tolerance : e24
 Left - Hand Helical Teeth
 Helical Angle $\beta = 19^\circ 31'42'' (19.5283^\circ)$
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

AP / APK 255



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 5 | 18 | 0.251 | 108 | 95.493 | 98 | 51 | 38 | 89 | 300 | 80 | M20 | A05L18A140 | A05L18 |
| | 19 | 0.400 | 114.8 | 100.798 | 104.8 | 51 | 38 | 89 | 316.667 | 80 | M20 | A05L19A140 | A05L19 |
| 6 | 19 | 0.404 | 137.8 | 120.958 | 125.8 | 61 | 38 | 99 | 380 | 90 | M24 | A06L19A140 | A06L19 |

AP / APK 285

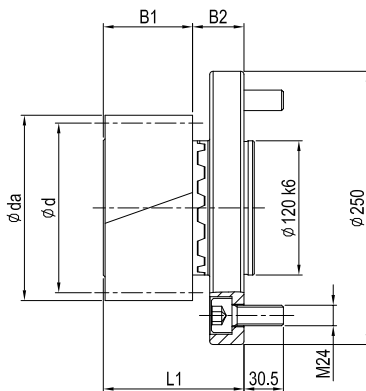
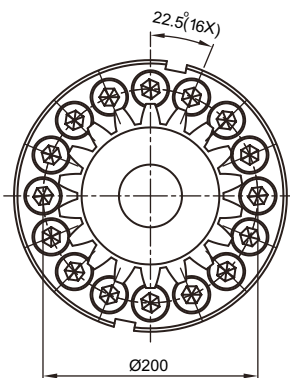


| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 6 | 18 | 0.201 | 129 | 114.592 | 117 | 61 | 49 | 110 | 360 | 90 | M24 | A06L18P160 | A06L18 |
| | 19 | 0.404 | 137.8 | 120.958 | 125.8 | 61 | 49 | 110 | 380 | 90 | M24 | A06L19P160 | A06L19 |
| 8 | 19 | 0.411 | 183.85 | 161.277 | 167.85 | 81 | 49 | 130 | 506.667 | 120 | M30 | A08L19P160 | A08L19 |

Pinion with Helical Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

AP / APK 355

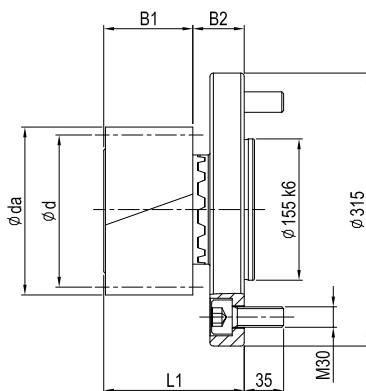
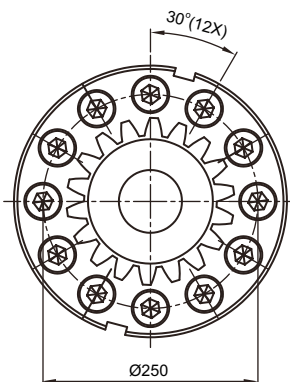
Quality DIN4 / Alloy Steel



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

| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 8 | 15 | 0.355 | 149 | 127.324 | 133 | 81 | 50 | 131 | 400 | 108 | M30 | A08L15A200 | A08L15 |
| | 19 | 0.411 | 183.85 | 161.277 | 167.85 | 81 | 50 | 131 | 506.667 | 120 | | A08L19A200 | A08L19 |

AP / APK 450



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|-----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 10 | 14 | 0.523 | 179 | 148.545 | 159 | 101 | 62 | 163 | 466.667 | 132 | M36 | A10L14A250 | A10L14 |
| | 18 | 0.426 | 219.5 | 190.986 | 199.5 | 101 | 62 | 163 | 600 | 132 | | A10L18A250 | 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 $L = \pi * d$ (7) Curvic specification

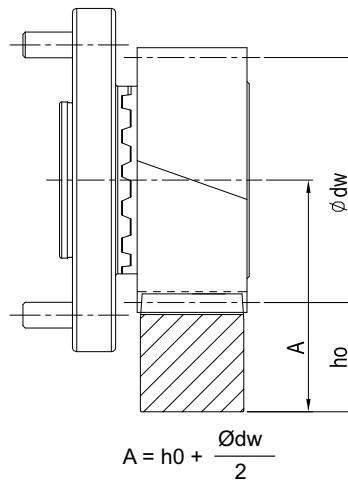
- Pinion material carburized, surface hardness reached 60 HRC.
- Teeth surface ground to reduce noise and improve wear resistance.
- Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)
- The strength of screws is limits the max. transmission torque. Please refer to the table below :

| PCD of Flange | Bolt / Screw Size | Max. Torque (Nm) |
|---------------|-------------------|------------------|
| Ø50 | M6 x 12 PCS | 265 |
| Ø63 | M8 x 12 PCS | 640 |
| Ø80 | M8 x 16 PCS | 1,160 |
| Ø125 | M10 x 16 PCS | 2,960 |
| Ø140 | M16 x 12 PCS | 6,620 |
| Ø160 | M24 x 12 PCS | 18,160 |
| Ø200 | M24 x 16 PCS | 29,170 |
| Ø250 | M30 x 12 PCS | 44,320 |

- Tightening torque recommended for bolt.

| Screws | Screws tightening torque(Nm) |
|-------------|------------------------------|
| M5 x 0.8P | 9.8 |
| M6 x 1P | 17 |
| M8 x 1.25P | 41 |
| M10 x 1.5P | 80 |
| M12 x 1.75P | 139 |
| M16 x 2P | 343 |
| M20 x 2.5P | 692 |
| M24 x 3P | 1,190 |
| M30 x 3.5P | 2,380 |
| M36 x 4P | 4,136 |

- The maximum permissible torque of the rack



- In Table 2, the maximum permissible torque of the pinion Curvic Plate and the rack is calculated on the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $SF \geq 1.4$, tooth surface strength coefficient $SH \geq 1$, the safety factor $SB \geq 1$, 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.
- Backlash changes by different center height. Please contact APEX under (WWW.APEXDYNA.COM).

■ Table 2. The max. permitted torque and feed-force of pinion Curvic Plate.

| Mn | Z ⁽¹⁾ | dw ⁽²⁾ | Fz ⁽³⁾ | TzB ⁽⁴⁾ |
|------|------------------|-------------------|-------------------|--------------------|
| [mm] | [] | [mm] | [N] | [Nm] |
| 2 | 17 | 37.84 | 8,870 | 160 |
| | 20 | 44 | 9,896 | 210 |
| 3 | 17 | 56.76 | 18,110 | 390 |
| | 18 | 58 | 20,420 | 585 |
| | 20 | 66 | 18,535 | 590 |
| 4 | 18 | 81.5 | 30,761 | 1,175 |
| | 19 | 83.92 | 32,247 | 1,300 |
| | 20 | 86.4 | 29,452 | 1,250 |
| 5 | 18 | 98 | 56,339 | 2,690 |
| | 19 | 104.8 | 56,649 | 2,855 |
| 6 | 18 | 117 | 77,580 | 4,445 |
| | 19 | 125.8 | 73,662 | 4,455 |
| 8 | 15 | 133 | 135,717 | 8,640 |
| | 19 | 167.85 | 131,761 | 10,625 |
| 10 | 14 | 159 | 189,707 | 14,090 |
| | 18 | 199.5 | 204,308 | 19,510 |

(1) Number of teeth (2) Working Pitch Circle Diameter (in mm) (3) Maximum Feed-Force (4) Maximum Driving Torque

Rack with Straight Teeth

Quality 5

Module : 2~3 Alloy Steel / 4~10 Carbon Steel

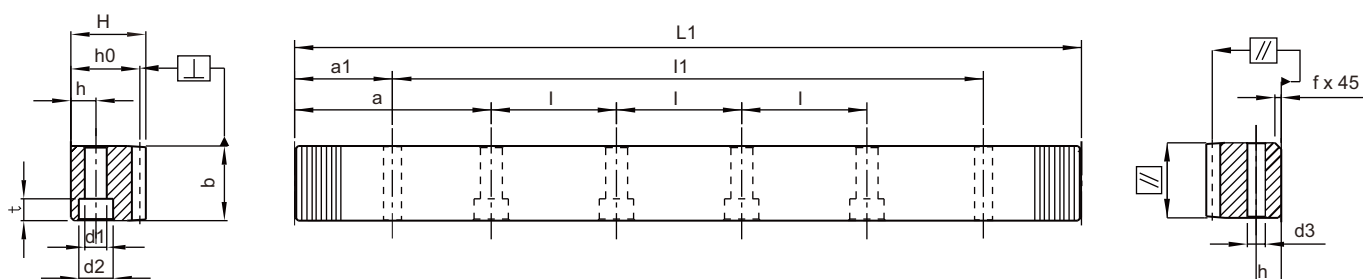
Tooth Thickness Tolerance : -15 ~ 0 μm

Straight teeth

Pressure Angle $\alpha = 20^\circ$

Induction Hardened

Teeth Ground and All Sides Ground



| Mn | P ⁽¹⁾ | L1 | No. Teeth | B | H | h ₀ | f | a | l | No. Holes | h | d1 | d2 | t | a1 | l1 | d3 | fp ⁽²⁾ | Fp ⁽³⁾ | Order Code |
|----|------------------|---------|-----------|----|----|----------------|---|-------|--------|-----------|----|----|----|----|--------|---------|------|-------------------|-------------------|-------------|
| 2 | 6.28319 | 251.33 | 40 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 2 | 8 | 7 | 11 | 7 | 31.3 | 188.73 | 5.7 | 0.005 | 0.018 | 02051025M10 |
| 2 | 6.28319 | 502.66 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 440.06 | 5.7 | 0.0055 | 0.021 | 02051050M10 |
| 2 | 6.28319 | 1005.31 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 942.71 | 5.7 | 0.006 | 0.024 | 02051100M10 |
| 3 | 9.42478 | 254.47 | 27 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 2 | 9 | 10 | 15 | 9 | 34.4 | 185.67 | 7.7 | 0.0055 | 0.019 | 03051025M10 |
| 3 | 9.42478 | 508.94 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 440.14 | 7.7 | 0.006 | 0.023 | 03051050M10 |
| 3 | 9.42478 | 1017.88 | 108 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 949.05 | 7.7 | 0.006 | 0.026 | 03051100M10 |
| 4 | 12.56637 | 251.33 | 20 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 2 | 12 | 10 | 15 | 9 | 37.5 | 176.33 | 7.7 | 0.006 | 0.021 | 04051025C10 |
| 4 | 12.56637 | 502.66 | 40 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 427.66 | 7.7 | 0.007 | 0.026 | 04051050C10 |
| 4 | 12.56637 | 1005.31 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 930.31 | 7.7 | 0.007 | 0.028 | 04051100C10 |
| 4 | 12.56637 | 1005.31 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 37.5 | 930.31 | 11.7 | 0.007 | 0.028 | 04051100CS0 |
| 4 | 12.56637 | 1256.64 | 100 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 10 | 12 | 10 | 15 | 9 | 37.5 | 1181.64 | 7.7 | 0.007 | 0.028 | 04051125C10 |
| 4 | 12.56637 | 1507.96 | 120 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 12 | 12 | 10 | 15 | 9 | 37.5 | 1432.96 | 7.7 | 0.007 | 0.028 | 04051150C10 |
| 4 | 12.56637 | 1507.96 | 120 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 12 | 12 | 14 | 20 | 13 | 37.5 | 1432.96 | 11.7 | 0.007 | 0.028 | 04051150CS0 |
| 4 | 12.56637 | 1759.29 | 140 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 14 | 12 | 10 | 15 | 9 | 37.5 | 1684.29 | 7.7 | 0.007 | 0.028 | 04051175C10 |
| 4 | 12.56637 | 2010.62 | 160 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 1935.62 | 7.7 | 0.008 | 0.032 | 04051200C10 |
| 4 | 12.56637 | 2010.62 | 160 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 37.5 | 1935.62 | 11.7 | 0.008 | 0.032 | 04051200CS0 |
| 5 | 15.70796 | 1005.31 | 64 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.1 | 945.11 | 11.7 | 0.007 | 0.028 | 05051100C10 |
| 6 | 18.84956 | 1017.88 | 54 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 955.08 | 15.7 | 0.007 | 0.028 | 06051100C10 |
| 8 | 25.13274 | 1005.31 | 40 | 79 | 79 | 71 | 3 | 62.83 | 125.66 | 8 | 25 | 22 | 33 | 21 | 26.6 | 952.11 | 19.7 | 0.008 | 0.031 | 08051100C10 |
| 10 | 31.41593 | 1005.31 | 32 | 99 | 99 | 89 | 3 | 62.83 | 125.66 | 8 | 32 | 33 | 48 | 32 | 125.66 | 753.99 | 19.7 | 0.008 | 0.031 | 10051100C10 |

(1) Teeth Pitch $P_t = \text{Module} \times \pi / \cos \beta$ (2) $f_p = \text{Single Pitch Error}$ (3) $F_p = \text{Total Pitch Error}$

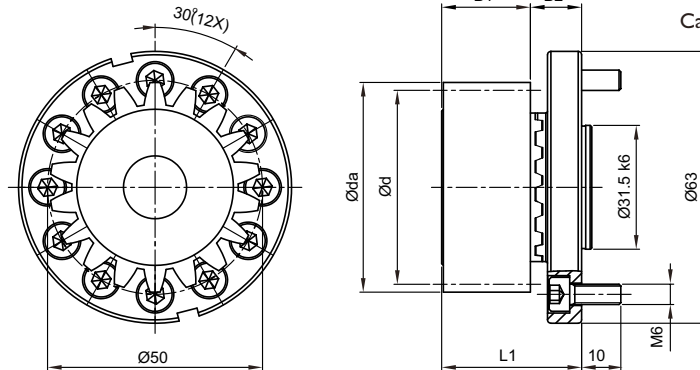
- Material Carburized.
- Induction hardened after carburized and ground.
- All sides ground.

Pinion with Straight Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

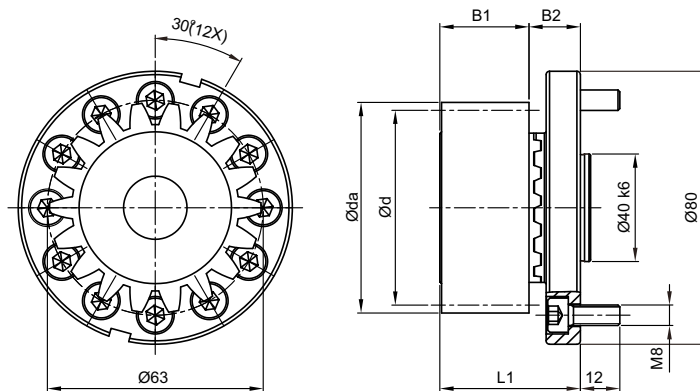
Tooth Thickness Tolerance : e24
 Straight Teeth
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

AP / APK 090



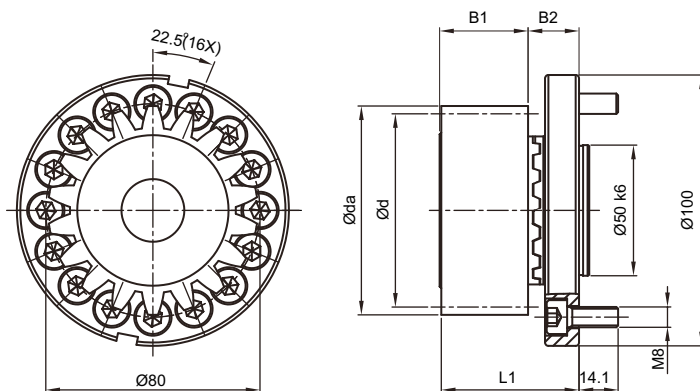
| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 2 | 21 | 0.5 | 48 | 42 | 44 | 26 | 15 | 41 | 131.947 | 36 | M10 | A02121P050 | A02121 |

AP / APK 110



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|------|------|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 2 | 21 | 0.5 | 48 | 42 | 44 | 26 | 19.5 | 45.5 | 131.947 | 36 | M10 | A02121C063 | A02121 |

AP / APK 140



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|------|------|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 3 | 19 | 0.1667 | 64 | 57 | 58 | 31 | 21.5 | 52.5 | 179.071 | 46 | M12 | A03119P080 | A03119 |

Pinion with Straight Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

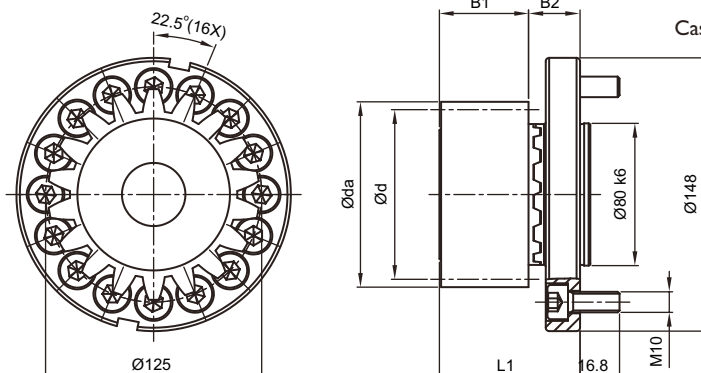
Tooth Thickness Tolerance : e24

Straight Teeth

Pressure Angle $\alpha = 20^\circ$

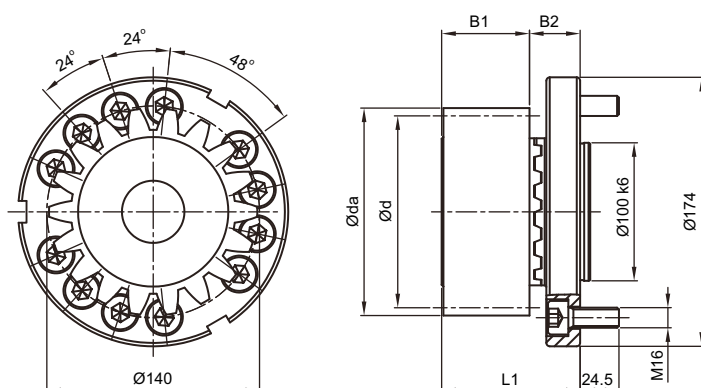
Case - Hardened and Teeth Ground

AP / APK 200



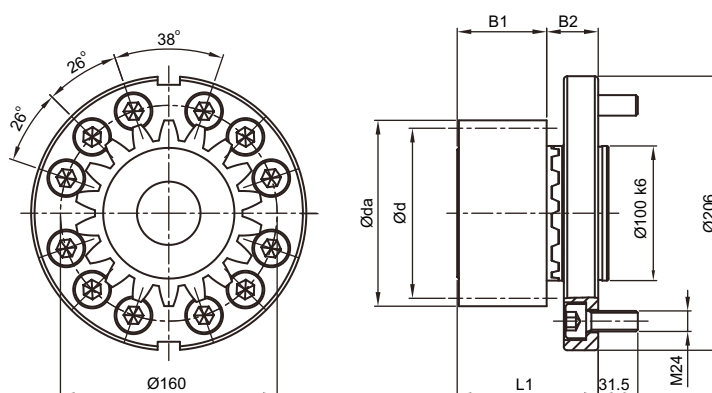
| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 4 | 19 | 0.6875 | 89.5 | 76 | 81.5 | 41 | 29 | 70 | 238.761 | 68 | M16 | A04119P125 | A04119 |

AP / APK 255



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 5 | 19 | 0.3 | 108 | 95 | 98 | 51 | 38 | 89 | 298.451 | 80 | M20 | A05119A140 | A05119 |

AP / APK 285

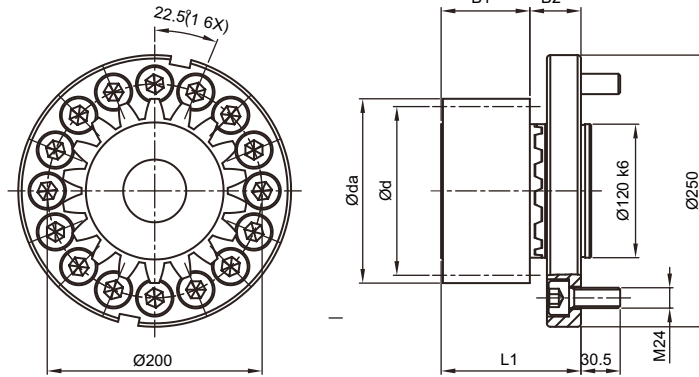


| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | D1 ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 6 | 19 | 0.25 | 129 | 114 | 117 | 61 | 49 | 110 | 358.142 | 90 | M24 | A06119P160 | A06119 |

Pinion with Straight Teeth (Interface : Curvic Plate / EN ISO 9409-I-A)

Quality DIN4 / Alloy Steel

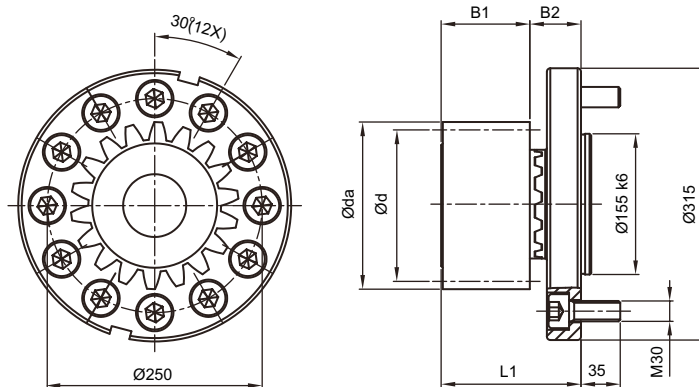
AP / APK 355



Tooth Thickness Tolerance : e24
 Straight Teeth
 Pressure Angle $\alpha = 20^\circ$
 Case - Hardened and Teeth Ground

| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 8 | 16 | 0.3125 | 0.3125 | 128 | 133 | 81 | 50 | 131 | 402.124 | 108 | M30 | A08116A200 | A08116 |

AP / APK 450



| Mn | Z ⁽¹⁾ | X ⁽²⁾ | da ⁽³⁾ | d ⁽⁴⁾ | dw ⁽⁵⁾ | B1 | B2 | L1 | L ⁽⁶⁾ | DI ⁽⁷⁾ | Locking screws for pinion | Order Code | |
|----|------------------|------------------|-------------------|------------------|-------------------|-----|----|-----|------------------|-------------------|---------------------------|------------|-------------|
| | | | | | | | | | | | | Set | Pinion only |
| 10 | 15 | 0.45 | 179 | 150 | 159 | 101 | 62 | 163 | 471.239 | 132 | M36 | A10115A250 | A10115 |

(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 $L = \pi * d$ (7) Curvic specification

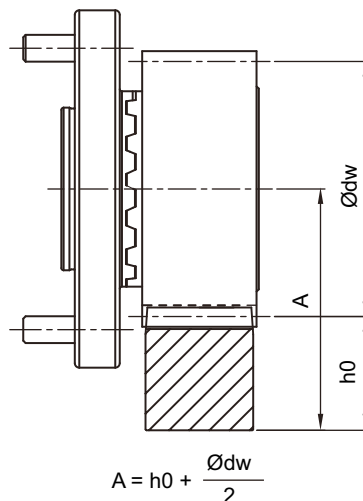
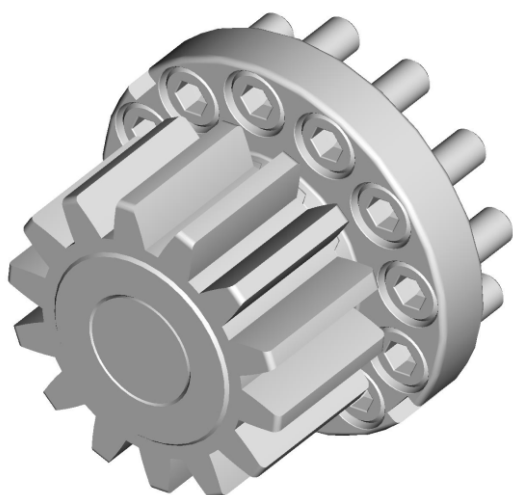
- Pinion material carburized, surface hardness reached 60 HRC.
- Teeth surface ground to reduce noise and improve wear resistance.
- Accessories include hexagon socket head cap screws (Strength 12.9 , DIN 912)
- The strength of screws is limits the max. transmission torque. Please refer to the table below :

| PCD of Flange | Bolt / Screw Size | Max. Torque (Nm) |
|---------------|-------------------|------------------|
| Ø50 | M6 x 12 PCS | 265 |
| Ø63 | M8 x 12 PCS | 640 |
| Ø80 | M8 x 16 PCS | 1,160 |
| Ø125 | M10 x 16 PCS | 2,960 |
| Ø140 | M16 x 12 PCS | 6,620 |
| Ø160 | M24 x 12 PCS | 18,160 |
| Ø200 | M24 x 16 PCS | 29,170 |
| Ø250 | M30 x 12 PCS | 44,320 |

- Tightening torque recommended for bolt.

| Screws | Screws tightening torque(Nm) |
|-------------|------------------------------|
| M5 x 0.8P | 9.8 |
| M6 x 1P | 17 |
| M8 x 1.25P | 41 |
| M10 x 1.5P | 80 |
| M12 x 1.75P | 139 |
| M16 x 2P | 343 |
| M20 x 2.5P | 692 |
| M24 x 3P | 1,190 |
| M30 x 3.5P | 2,380 |
| M36 x 4P | 4,136 |

- The maximum permissible torque of the rack



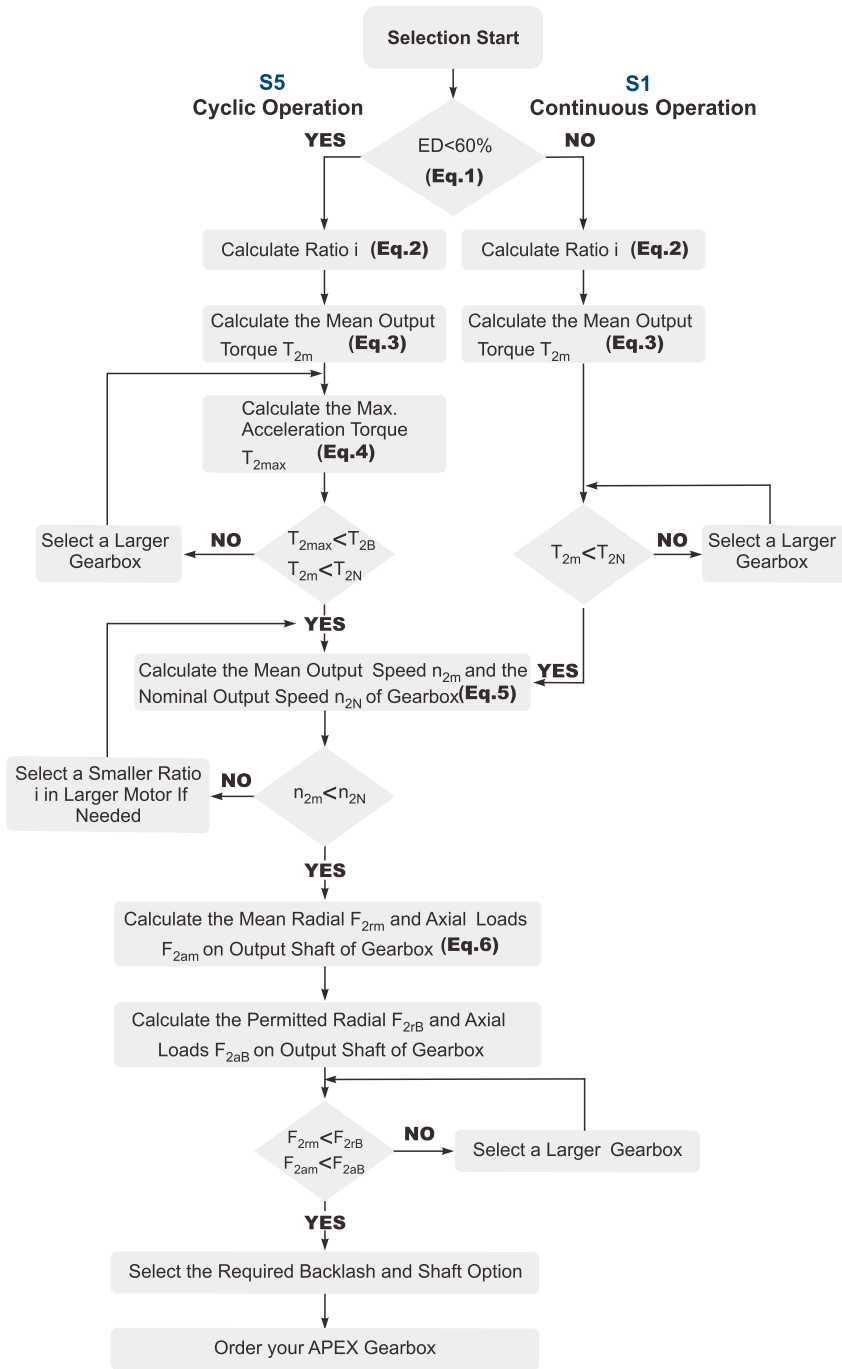
- In Table 2, the maximum permissible torque of the pinion Curvic Plate and the rack is calculated of the basis of a speed of 1.5 m/s and providing good lubrication (using an automatic lubrication system or manually applied grease every day), the tooth root strength factor $SF \geq 1.4$, tooth surface strength coefficient $SH \geq 1$, the safety factor $SB \approx 1$, 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.
- Backlash changes by different center height. Please contact APEX under (WWW.APEXDYNA.COM).

■ Table 2. The max. permitted torque and feed-force of pinion Curvic Plate.

| Mn [mm] | Z ⁽¹⁾ [] | dw ⁽²⁾ [mm] | F _{2r} ⁽³⁾ [N] | T _{2B} ⁽⁴⁾ [Nm] |
|------------|-------------------------|---------------------------|---------------------------------------|--|
| 2 | 21 | 44 | 7,857 | 165 |
| 3 | 19 | 58 | 14,211 | 405 |
| 4 | 19 | 81.5 | 26,974 | 1,025 |
| 5 | 19 | 98 | 44,316 | 2,105 |
| 6 | 19 | 117 | 63,246 | 3,605 |
| 8 | 16 | 133 | 93,125 | 5,960 |
| 10 | 15 | 159 | 144,000 | 10,800 |

(1) Number of teeth (2) Working Pitch Circle Diameter (in mm) (3) Maximum Feed-Force

Selection of the optimum gearbox



Recommended (for S5 Cycle Operation)

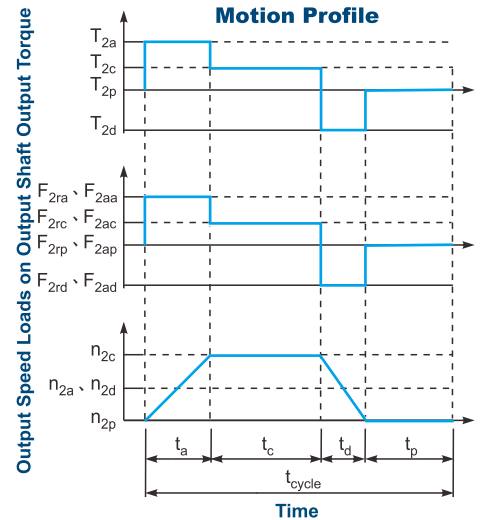
The general design is given for

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

The optimal design is given for

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

J_L Load Inertia
 J_m Motor Inertia



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

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)

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

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

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

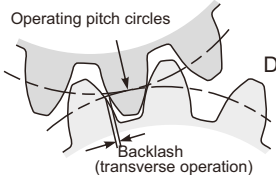
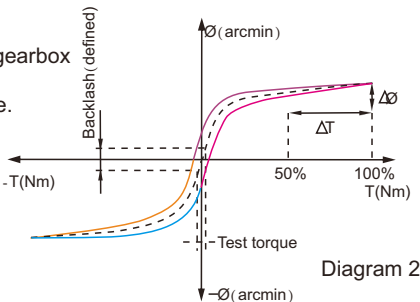
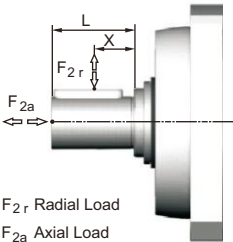
(Eq.5)

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

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

(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>  <p style="text-align: right;">Diagram 1</p> |
| Torsional Rigidity | Nm/arcmin | <p>Torsional Rigidity is the quotient ($\Delta T / \Delta \varnothing$) 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.

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