



APEX DYNAMICS, INC.

**NEW GENERATION
PLANETARY GEARBOX**

MF / MFK Series



Gearbox Series - MF / MFK

► Features:

High Rigidity
High Torque
High Precision
High Efficiency
Persistence of Low Backlash
Long Life-Time



Ordering Code - MF / MFK Series

MF075	—	003	—	SI	/	MOTOR
						Motor Type
						Shaft Type
						Ratio
						Gearbox Size

Gearbox Size

MF 060 / 075 / 100 / 140 / 180 / 210 / 240

MFK 060 / 075 / 100 / 140 / 180 / 210 / 240

Ratio⁽¹⁾

MF (1 Stg.) 3 / 4 / 5 / 7 / 10

(2 Stg.) 16 / 20 / 25 / 28 / 35 / 40 / 50 / 70 / 100

MFK (2 Stg.) 12 / 16 / 20 / 25 / 28 / 35 / 40 / 50 / 70 / 100

MFKA (3 Stg.) 100 / 125 / 140 / 175 / 200 / 250 / 350 / 400 / 500 / 700 / 1,000

MFKB (3 Stg.) 48 / 64 / 84 / 100 / 125 / 140 / 175 / 200 / 250 / 280 / 350 / 400 / 500
700 / 1,000

MFK (4 Stg.) 1,225 / 1,400 / 1,750 / 2,000 / 2,800 / 3,500 / 5,000 / 7,000 / 10,000

MFKC (2 Stg.) 4 / 5 / 7 / 8 / 10

Shaft Type : SI = Smooth Output Shaft
S2 = Output Shaft with Key
S3 = DIN5480 Output Shaft
S4 = Hollow Output Shaft

Motor Type : Manufacturer and Model

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



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Performance - MF Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MF 060	MF 075	MF 100	MF 140	MF 180	MF 210	MF 240
Nominal Output Torque T_{2N} By n_{1N}	Nm	1	3	30	105	200	395	825	1,385	3,110
			4	100	205	380	765	1,415	2,190	4,035
			5	85	185	325	660	1,225	1,905	3,505
			7	60	135	260	515	980	1,530	2,530
			10	24	55	160	315	700	1,070	1,810
		2	16	85	195	385	805	1,485	2,295	4,215
			20	80	190	370	795	1,495	2,310	4,245
			25	90	195	345	700	1,295	2,005	3,685
			28	60	180	345	755	1,510	2,335	4,290
			35	75	195	350	705	1,310	2,030	3,725
			40	40	96	220	615	1,260	2,360	4,280
			50	50	120	275	715	1,325	2,050	3,765
			70	60	135	285	585	1,095	1,670	2,675
			100	24	55	160	345	660	1,005	1,700
Emergency Stop Torque T_{2NOT}	Nm	1,2	3~100	3 times T_{2N}						
Max. Acceleration Torque T_{2B}	Nm	1,2	3~100	1.5 times T_{2N}						
No Load Running Torque ⁽²⁾	Nm	1	3~10	0.3	0.6	1.4	2.5	5	7	11
		2	16~100	0.2	0.3	0.5	1.2	1.7	3	4
Backlash ⁽³⁾	arcmin	1	3~10	≤ 3	≤ 3	≤ 3	≤ 3	≤ 3	≤ 3	≤ 3
		2	16~100	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4
Torsional Rigidity	Nm/arcmin	1,2	3~100	4.6	10	30	55	175	400	550
Nominal Input Speed n_{1N}	rpm	1	3~10	5,000	3,600	3,600	3,000	2,700	2,400	2,100
		2	16~100	5,000	4,600	4,600	4,000	3,700	3,400	3,100
Max. Input Speed n_1	rpm	1	3~10	7,000	6,000	6,000	5,000	4,500	4,000	3,500
		2	16~100	7,000	7,000	7,000	6,000	5,500	5,000	4,500
Max. Radial Load F_{2r} ⁽⁴⁾	N	1,2	3~100	3,000	4,500	6,700	10,000	15,000	22,000	30,000
Max. Axial Load F_{2a} ⁽⁴⁾	N	1,2	3~100	1,500	2,250	3,350	5,000	7,500	11,000	15,000
Max. Tilting Moment M_{2K} ⁽⁴⁾	Nm	1,2	3~100	160	270	550	1,050	1,740	3,350	5,420
Operating Temp.	°C	1,2	3~100	-10° C ~ 90° C						
Degree of Gearbox Protection		1,2	3~100	IP65						
Lubrication		1,2	3~100	Synthetic lubrication grease						
Mounting Position		1,2	3~100	All directions						
Running Noise ⁽⁵⁾	dB(A)	1	3~10	≤ 58	≤ 59	≤ 64	≤ 65	≤ 66	≤ 68	≤ 70
		2	16~100	≤ 58	≤ 59	≤ 60	≤ 63	≤ 66	≤ 68	≤ 70
Efficiency η	%	1	3~10	$\geq 97\%$						
		2	16~100	$\geq 94\%$						

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

(2) These values are measured by gearbox with ratio 10 (1-stage) or ratio 100 (2-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

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

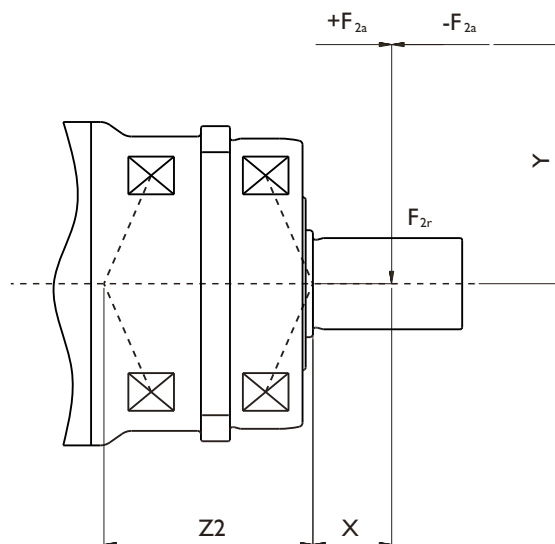
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MF Gearbox

Model No.		MF 060		MF 075		MF 100		MF 140	
(C3) Ø ^(A)	Stage	1	2	1	2	1	2	1	2
8	kg.cm ²	-	0.1	-	-	-	-	-	-
11		0.21	0.16	-	0.17	-	-	-	-
14		0.24	0.2	0.54	0.21	-	0.42	-	-
19		0.64	-	0.79	0.6	2.51	0.66	-	1.83
24		-	-	4.06	-	4.78	3.94	6.85	4.11
28		-	-	-	-	6.15	-	8.38	5.48
32		-	-	-	-	8.03	-	10.41	7.36
35		-	-	-	-	14.72	-	15.56	14.04
38		-	-	-	-	17.38	-	20.43	16.71
42		-	-	-	-	-	-	25.44	-
48		-	-	-	-	-	-	54.66	-
55		-	-	-	-	-	-	-	-
60		-	-	-	-	-	-	-	-

Model No.		MF 180		MF 210		MF 240	
(C3) Ø ^(A)	Stage	1	2	1	2	1	2
8	kg.cm ²	-	-	-	-	-	-
11		-	-	-	-	-	-
14		-	-	-	-	-	-
19		-	-	-	-	-	-
24		-	4.61	-	-	-	-
28		-	6.14	-	-	-	-
32		19.5	8.17	-	10.55	-	-
35		26.71	15.54	39.6	17.75	86.48	20.8
38		29.11	18.19	42.43	20.17	86.48	23.66
42		34.35	23.20	47.65	25.4	92.61	28.88
48		64.13	52.42	77.41	55.18	122.26	58.64
55		97.45	-	111.26	-	156.7	92.48
60		-	-	-	-	180.17	-

(A) Ø = Input shaft diameter.



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

M_{2K} : [Nm]

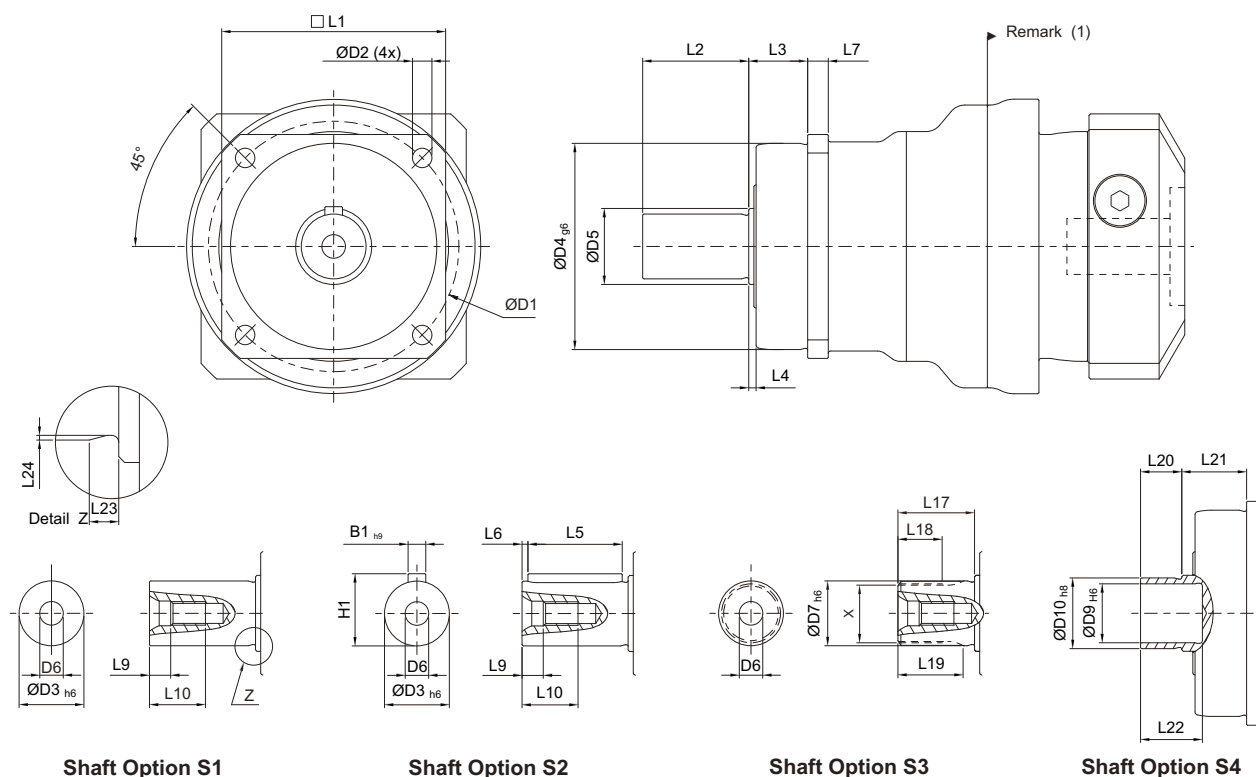
F_{2a}, F_{2r} : [N]

$X, Y, Z2$: [mm]

MF / MFK	060	075	100	140	180	210	240
Z2 [mm]	41.3	50.1	58.9	72.7	93.7	98.5	112.2

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

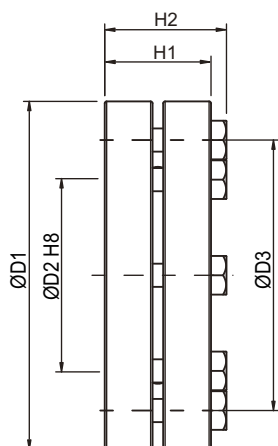
Dimension - MF Gearbox



Dimension	MF 060	MF 075	MF 100	MF 140	MF 180	MF 210	MF 240
D1	68	85	120	165	215	250	290
D2	5.5	7	9	11	13.5	17	17
D3 h6	16	22	32	40	55	75	85
D4 g6	60	70	90	130	160	180	200
D5	18.5	25.8	36.8	55.2	69.2	82.2	92.2
D6	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P	M20 x 2.5P
D7 h6	16	22	32	40	55	75	85
D9 H6	15	20	30	40	55	-	-
D10 h8	18	24	36	50	68	-	-
L1	62	76	101	141	182	215	245
L2	28	36	58	82	82	105	130
L3	20	20	30	30	30	38	40
L4	2	2.5	3	3	3	3	3
L5	25	32	50	63	70	90	125
L6	2	2	4	5	6	7	3
L7	6	7	10	12	15	17	22
L9	4.8	7.2	10	12	15	15	15
L10	12.5	19	28	36	42	42	42
L17	26	26	26	40	41.5	52	60
L18	15	15	15	20	21.5	28	36
L19	21	22.5	23	33.5	33.5	45	53
L20	12	14	18	22	23	-	-
L21	22	22	32	33	32	-	-
L22	19	21	25	30	30	-	-
L23	2	2.5	2.5	2.5	2.5	2.5	4
L24	0.3	0.4	0.4	0.4	0.4	0.4	0.5
B1 h9	5	6	10	12	16	20	22
H1	18	24.5	35	43	59	79.5	90
X DIN5480	W16 x 0.8 x 30 x 18 x 6m	W22x 1.25 x 30 x 16 x 6m	W32 x 1.25 x 30 x 24 x 6m	W40 x 2 x 30 x 18 x 6m	W55 x 2 x 30 x 26 x 6m	W70 x 2 x 30 x 34 x 6m	W80 x 2 x 30 x 38 x 6m

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

Shrink Disc Power Lock



SHRINK DISC POWER LOCK

Diameter	Tolerance
≤ 30	H6 / j6
$> 30 \sim 50$	H6 / h6
$> 50 \sim 80$	H6 / g6

* For surface roughness $Ra \leq 3.2 \mu m$

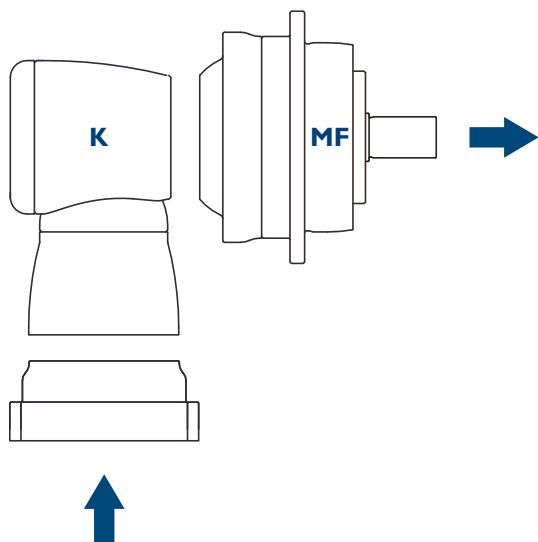
Model No.	D1	D2	D3	H1	H2	Screw ⁽¹⁾	TA ⁽²⁾	J	Order code
MF / MFK						No x type	[Nm]	[Kg.cm] ²	
060	44	18	30	15	18.5	5 x M5	4	0.4	SSD-18
075	50	24	36	19.5	23	6 x M5	4	0.8	SSD-24
100	72	36	52	23.5	27.5	5 x M6	12	3.9	SSD-36
140	90	50	70	27.5	31.5	8 x M6	12	11.2	SSD-50
180	115	68	86	30.5	34.5	10 x M6	12	30.9	SSD-68

(1) 10.9 Class, DIN 931 (2) Tightening Torque

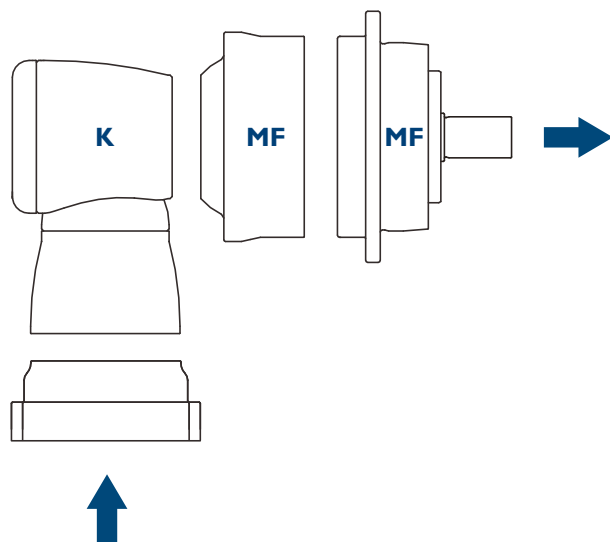
MFK Gearbox Structure

MFK Structure

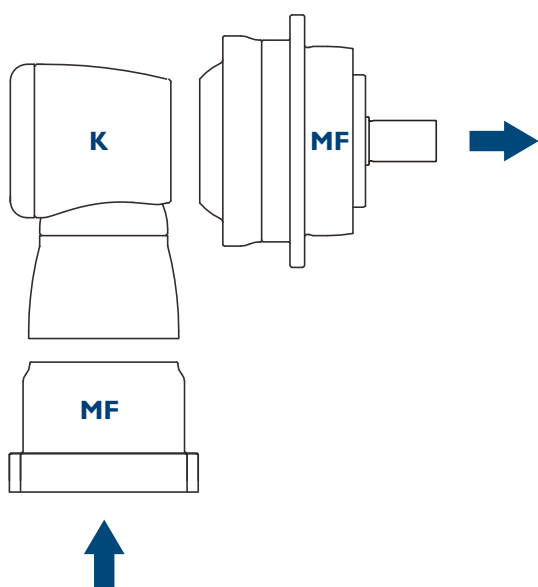
(I) MFK-2 Stage



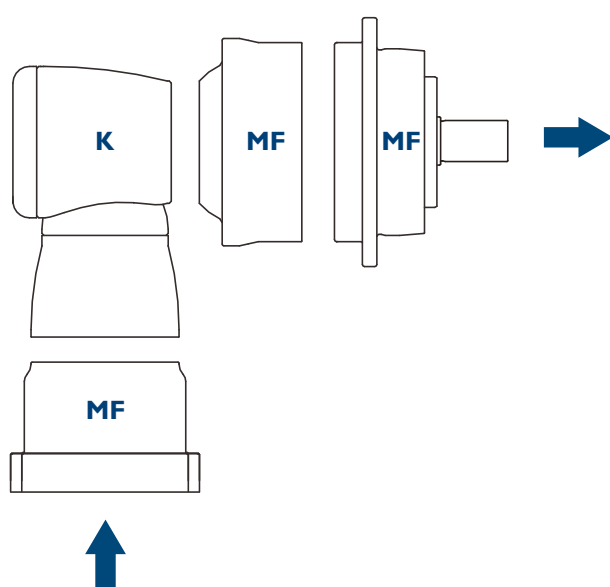
(II) MFK-3 Stage



(III) MFK-3 Stage



(IV) MFK-4 Stage



Performance - MFK (2-Stage) Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MFK 060	MFK 075	MFK 100	MFK 140	MFK 180	MFK 210	MFK 240
Nominal Output Torque T _{2N} By n _{1N}	Nm	2	12	80	195	365	805	1,495	1,680	3,280
			16	80	185	350	775	1,510	1,680	3,280
			20	75	180	335	750	1,520	1,780	3,710
			25	80	195	350	710	1,320	1,775	3,735
			28	75	170	320	720	1,465	1,560	3,000
			35	80	190	355	715	1,330	1,950	3,750
			40	72	160	305	680	1,405	1,440	2,400
			50	85	185	345	725	1,345	1,800	3,000
			70	63	135	295	600	1,130	1,710	2,730
			100	24	57	160	350	605	915	1,590
Emergency Stop Torque T _{2NOT}	Nm	2	12~100	2 times T _{2N}						
Max. Acceleration Torque T _{2B}	Nm	2	12~100	1.5 times T _{2N}						
No Load Running Torque ⁽²⁾	Nm	2	12~100	1	1.3	2	3.1	6	13	16
Backlash ⁽³⁾	arcmin	2	12~100	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4
Torsional Rigidity	Nm/arcmin	2	12~100	4.6	10	30	55	175	300	510
Nominal Input Speed n _{1N}	rpm	2	12~100	3,000	3,000	2,800	2,700	2,200	2,100	2,000
Max. Input Speed n _{1B}	rpm	2	12~100	6,000	6,000	6,000	4,500	4,500	4,000	3,000
Max. Radial Load F _{2r} ⁽⁴⁾	N	2	12~100	3,000	4,500	6,700	10,000	15,000	22,000	30,000
Max. Axial Load F _{2a} ⁽⁴⁾	N	2	12~100	1,500	2,250	3,350	5,000	7,500	11,000	15,000
Max. Tilting Moment M _{2K} ⁽⁴⁾	Nm	2	12~100	160	270	550	1,050	1,740	3,350	5,420
Operating Temp.	° C	2	12~100	-10° C~ 90° C						
Degree of Gearbox Protection		2	12~100	IP65						
Lubrication		2	12~100	Synthetic lubrication grease						
Mounting Position		2	12~100	All directions						
Running Noise ⁽⁵⁾	dB(A)	2	12~100	≤ 64	≤ 66	≤ 68	≤ 68	≤ 70	≤ 70	≤ 72
Efficiency η	%	2	12~100	≥ 94%						

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

(2) These values are measured by gearbox with ratio 100 (2-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

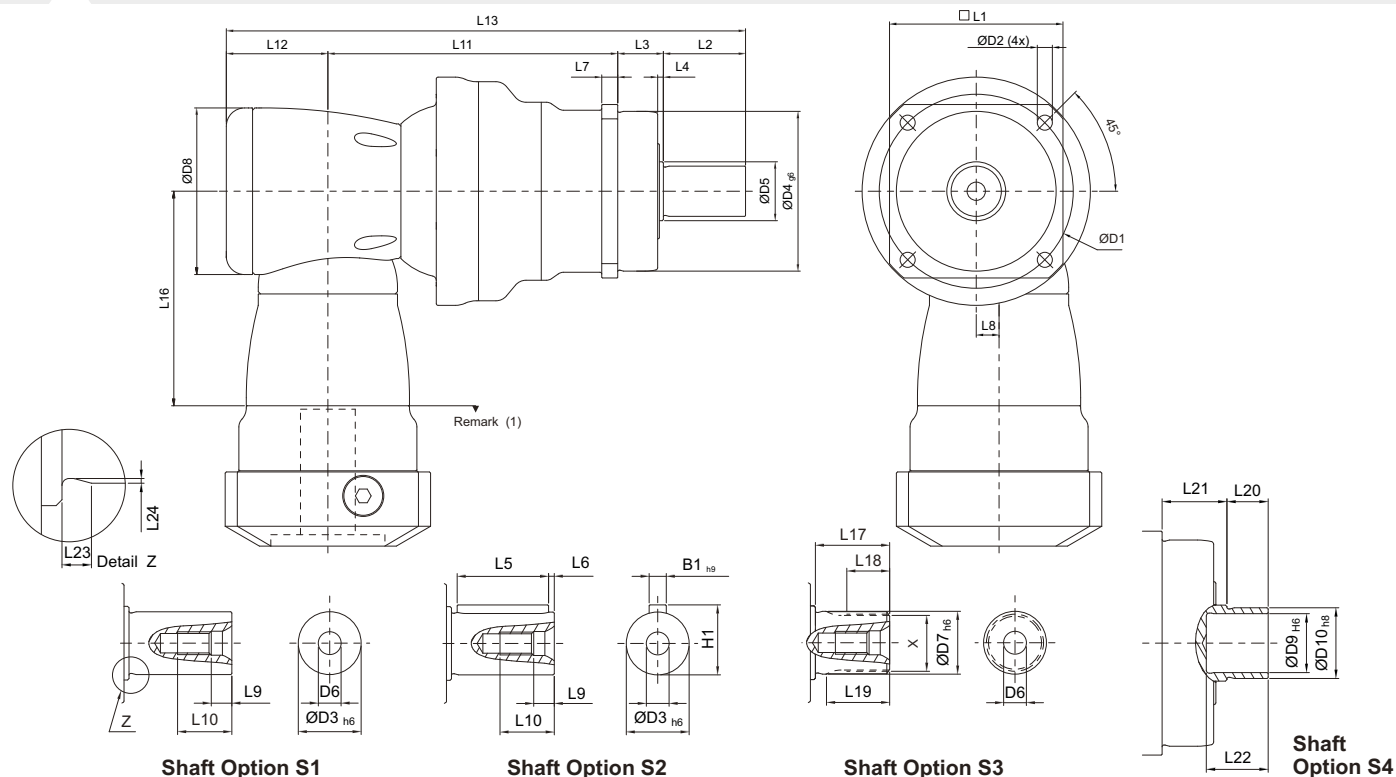
(5) The dB values are measured by gearbox with 100 (2-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MFK (2-Stage) Gearbox

Model No.	MFK 060	MFK 075	MFK 100	MFK 140	MFK 180	MFK 210	MFK 240
(C3) $\emptyset^{(A)}$							
8	0.1	-	-	-	-	-	-
11	0.16	0.17	-	-	-	-	-
14	0.2	0.37	0.41	-	-	-	-
19	-	0.6	1.61	1.61	-	-	-
24	-	-	3.9	4.01	5.62	-	-
28	-	-	-	5.53	5.62	-	-
32	-	-	-	7.57	8.11	8.11	-
35	-	-	-	14.95	15.32	15.32	15.68
38	-	-	-	17.58	17.72	17.72	18.52
42	-	-	-	-	22.95	22.95	23.74
48	-	-	-	-	52.74	52.74	53.49
55	-	-	-	-	-	-	87.34

(A) $\emptyset$ = Input shaft diameter.

Dimension - MFK (2-Stage) Gearbox (Ratio $i = 12 \sim 100$)



Dimension	MFK 060	MFK 075	MFK 100	MFK 140	MFK 180	MFK 210	MFK 240
D1	68	85	120	165	215	250	290
D2	5.5	7	9	11	13.5	17	17
D3 h6	16	22	32	40	55	75	85
D4 g6	60	70	90	130	160	180	200
D5	18.5	25.8	36.8	55.2	69.2	82.2	92.2
D6	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P	M20 x 2.5P
D7 h6	16	22	32	40	55	75	85
D8	73	94	116	163	210	210	255
D9 H6	15	20	30	40	55	-	-
D10 h8	18	24	36	50	68	-	-
L1	62	76	101	141	182	215	245
L2	28	36	58	82	82	105	130
L3	20	20	30	30	30	38	40
L4	2	2.5	3	3	3	3	3
L5	25	32	50	63	70	90	125
L6	2	2	4	5	6	7	3
L7	6	7	10	12	15	17	22
L8	10	13	17	25	31	31	36
L9	4.8	7.2	10	12	15	15	15
L10	12.5	19	28	36	42	42	42
L11	118.5	135.5	152.5	191	248	270	336
L12	44.5	53	68.3	89	115	115	131
L13	211	244.5	308.8	392	475	528	637
L16	94	114.5	129	173.5	228	228	265.5
L17	26	26	26	40	41.5	52	60
L18	15	15	15	20	21.5	28	36
L19	21	22.5	23	33.5	33.5	45	53
L20	12	14	18	22	23	-	-
L21	22	22	32	33	32	-	-
L22	19	21	25	30	30	-	-
L23	2	2.5	2.5	2.5	2.5	2.5	4
L24	0.3	0.4	0.4	0.4	0.4	0.4	0.5
B1 h9	5	6	10	12	16	20	22
H1	18	24.5	35	43	59	79.5	90
X DIN5480	W16 x 0.8 x 30 x 18 x 6m	W22 x 1.25 x 30 x 16 x 6m	W32 x 1.25 x 30 x 24 x 6m	W40 x 2 x 30 x 18 x 6m	W55 x 2 x 30 x 26 x 6m	W70 x 2 x 30 x 34 x 6m	W80 x 2 x 30 x 38 x 6m

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

Performance - MFKA (3-Stage) Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MFKA 240
Nominal Output Torque T_{2N} By n_{1N}	Nm	3	100	4,240
			125	3,900
			140	4,110
			175	3,930
			200	4,270
			250	3,970
			350	4,000
			500	4,035
			700	3,090
			1,000	1,770
Emergency Stop Torque T_{2NOT}	Nm	3	100~1,000	2 times T_{2N}
Max. Acceleration Torque T_{2B}	Nm	3	100~1,000	1.5 times T_{2N}
No Load Running Torque ⁽²⁾	Nm	3	100~1,000	6
Backlash ⁽³⁾	arcmin	3	100~1,000	≤ 4
Torsional Rigidity	Nm/arcmin	3	100~1,000	510
Nominal Input Speed n_{1N}	rpm	3	100~1,000	2,100
Max. Input Speed n_{1B}	rpm	3	100~1,000	4,000
Max. Radial Load F_{2r} ⁽⁴⁾	N	3	100~1,000	30,000
Max. Axial Load F_{2a} ⁽⁴⁾	N	3	100~1,000	15,000
Max. Tilting Moment M_{2K} ⁽⁴⁾	Nm	3	100~1,000	5,420
Operating Temp.	°C	3	100~1,000	-10° C ~ 90° C
Degree of Gearbox Protection		3	100~1,000	IP65
Lubrication		3	100~1,000	Synthetic lubrication grease
Mounting Position		3	100~1,000	All directions
Running Noise ⁽⁵⁾	dB(A)	3	100~1,000	≤ 72
Efficiency η	%	3	100~1,000	$\geq 92\%$

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

(2) These values are measured by gearbox with ratio 1,000 (3-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

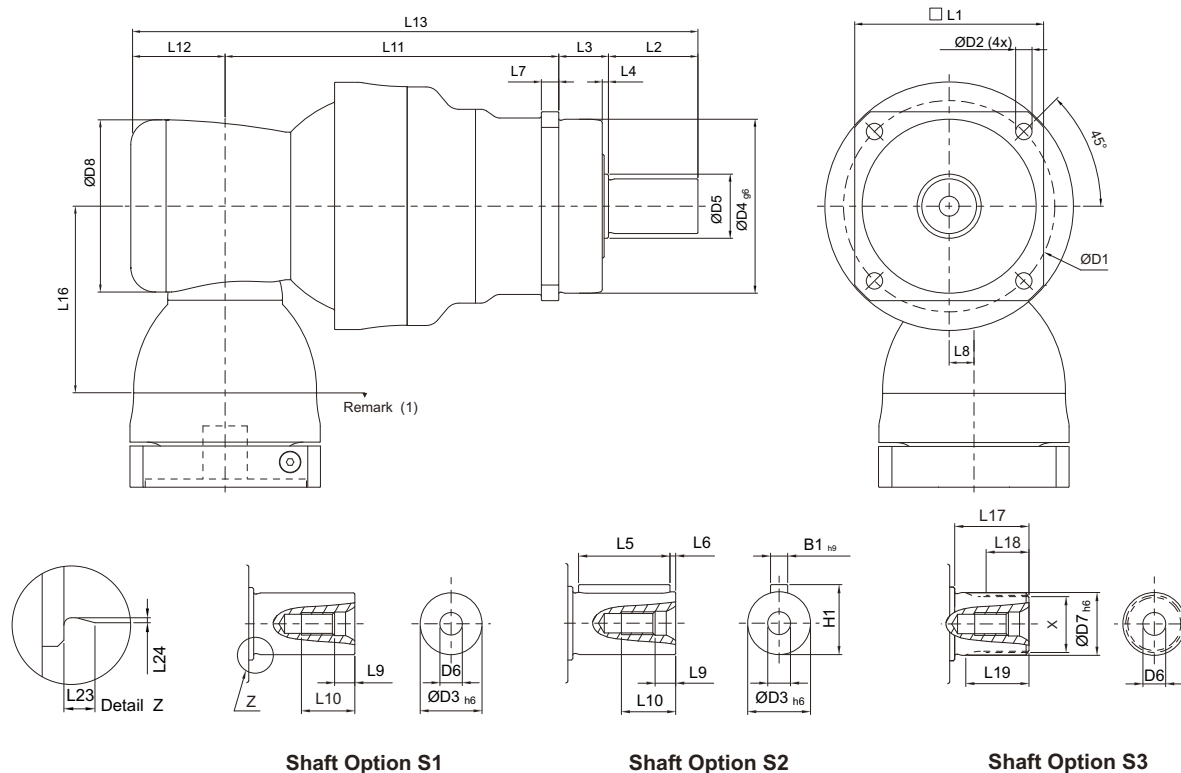
(5) The dB values are measured by gearbox with 1,000 (3-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MFKA (3-Stage) Gearbox

Model No.	MFKA 240
(C3) $\emptyset$ ^(A)	
32	8.11
35	15.32
38	17.72
42	22.95
48	52.74

(A) $\emptyset$ = Input shaft diameter.

Dimension - MFKA (3-Stage) Gearbox (Ratio $i = 100 \sim 1,000$)



Dimension	MFKA 240
D1	290
D2	17
D3 h6	85
D4 g6	200
D5	92.2
D6	M20 × 2.5P
D7 h6	85
D8	210
L1	245
L2	130
L3	40
L4	3
L5	125
L6	3
L7	22
L8	31
L9	15
L10	42
L11	378
L12	115
L13	663
L16	228
L17	60
L18	36
L19	53
L23	4
L24	0.5
B1 h9	22
H1	90
X DIN5480	W80 × 2 × 30 × 38 × 6m

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

Performance - MFKB (3-Stage) Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MFKB 075	MFKB 100	MFKB 140	MFKB 180	MFKB 210	MFKB 240
Nominal Output Torque T _{2N} By n _{1N}	Nm	3	48	-	-	-	-	-	3,280
			64	165	310	690	1,425	1,680	3,280
			84	165	300	670	1,380	1,680	-
			100	165	290	655	1,355	2,085	3,830
			125	190	330	730	1,355	2,095	3,850
			140	170	285	630	1,310	2,100	3,860
			175	190	325	705	1,370	2,115	3,885
			200	175	290	605	1,265	2,100	3,900
			250	195	335	680	1,380	2,135	3,920
			280	180	300	610	1,230	1,560	3,000
			350	200	345	705	1,395	1,950	3,750
			400	160	330	670	1,330	1,440	2,400
			500	200	380	760	1,405	1,800	3,000
			700	135	325	670	1,240	1,875	3,005
1,000	55	160	380	660	1,065	1,725			
Emergency Stop Torque T _{2NOT}	Nm	3	48~1,000	2 times T _{2N}					
Max. Acceleration Torque T _{2B}	Nm	3	48~1,000	1.5 times T _{2N}					
No Load Running Torque ⁽²⁾	Nm	3	48~1,000	0.2	0.2	0.3	0.4	1	1.2
Backlash ⁽³⁾	arcmin	3	48~1,000	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4
Torsional Rigidity	Nm/arcmin	3	48~1,000	10	30	55	175	300	510
Nominal Input Speed n _{1N}	rpm	3	48~1,000	5,500	4,600	4,600	4,000	3,700	3,400
Max. Input Speed n _{1B}	rpm	3	48~1,000	7,000	7,000	7,000	6,000	5,500	5,000
Max. Radial Load F _{2r} ⁽⁴⁾	N	3	48~1,000	4,500	6,700	10,000	15,000	22,000	30,000
Max. Axial Load F _{2a} ⁽⁴⁾	N	3	48~1,000	2,250	3,350	5,000	7,500	11,000	15,000
Max. Tilting Moment M _{2K} ⁽⁴⁾	Nm	3	48~1,000	270	550	1,050	1,740	3,350	5,420
Operating Temp.	° C	3	48~1,000	-10° C~ 90° C					
Degree of Gearbox Protection		3	48~1,000	IP65					
Lubrication		3	48~1,000	Synthetic lubrication grease					
Mounting Position		3	48~1,000	All directions					
Running Noise ⁽⁵⁾	dB(A)	3	48~1,000	≤ 66	≤ 68	≤ 68	≤ 70	≤ 70	≤ 72
Efficiency η	%	3	48~1,000	≥ 92%					

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

(2) These values are measured by gearbox with ratio 1,000 (3-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

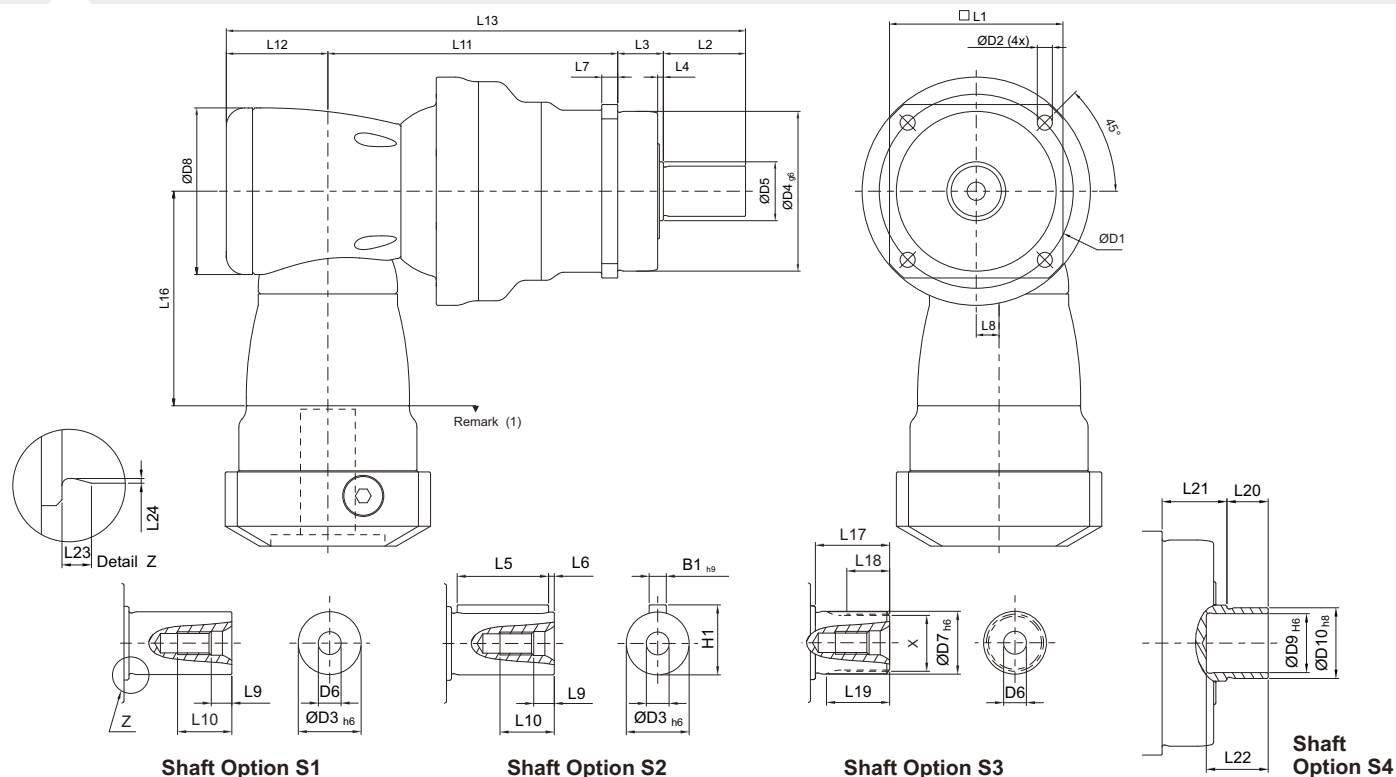
(5) The dB values are measured by gearbox with 1,000 (3-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MFKB (3-Stage) Gearbox

Model No.	MFKB 075	MFKB 100	MFKB 140	MFKB 180	MFKB 210	MFKB 240
(C3) $\varnothing^{(A)}$						
8	0.17	-	-	-	-	-
11	0.17	0.42	-	-	-	-
14	0.21	0.42	1.83	-	-	-
19	-	0.66	1.83	4.61	-	-
24	-	-	4.11	4.61	4.61	-
28	-	-	-	6.14	6.14	-
32	-	-	-	8.17	8.17	10.55
35	-	-	-	15.56	15.56	17.76
38	-	-	-	18.19	18.19	20.17
42	-	-	-	-	23.2	25.4
48	-	-	-	-	52.42	55.18

(A) $\varnothing$ = Input shaft diameter.

Dimension - MFKB (3-Stage) Gearbox (Ratio i = 48~1,000)



Dimension	MFKB 075	MFKB 100	MFKB 140	MFKB 180	MFKB 210	MFKB 240
D1	85	120	165	215	250	290
D2	7	9	11	13.5	17	17
D3 h6	22	32	40	55	75	85
D4 g6	70	90	130	160	180	200
D5	25.8	36.8	55.2	69.2	82.2	92.2
D6	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P	M20 x 2.5P
D7 h6	22	32	40	55	75	85
D8	94	116	163	210	210	255
D9 H6	20	30	40	55	-	-
D10 h8	24	36	50	68	-	-
L1	76	101	141	182	215	245
L2	36	58	82	82	105	130
L3	20	30	30	30	38	40
L4	2.5	3	3	3	3	3
L5	32	50	63	70	90	125
L6	2	4	5	6	7	3
L7	7	10	12	15	17	22
L8	13	17	25	31	31	36
L9	7.2	10	12	15	15	15
L10	19	28	36	42	42	42
L11	135.5	152.5	191	248	270	336
L12	53	68.3	89	115	115	131
L13	244.5	308.8	392	475	528	637
L16	114.5	129	173.5	228	228	265.5
L17	26	26	40	41.5	52	60
L18	15	15	20	21.5	28	36
L19	22.5	23	33.5	33.5	45	53
L20	14	18	22	23	-	-
L21	22	32	33	32	-	-
L22	21	25	30	30	-	-
L23	2.5	2.5	2.5	2.5	2.5	4
L24	0.4	0.4	0.4	0.4	0.4	0.5
B1 h9	6	10	12	16	20	22
H1	24.5	35	43	59	79.5	90
X DIN5480	W22 x 1.25 x 30 x 16 x 6m	W32 x 1.25 x 30 x 24 x 6m	W40 x 2 x 30 x 18 x 6m	W55 x 2 x 30 x 26 x 6m	W70 x 2 x 30 x 34 x 6m	W80 x 2 x 30 x 38 x 6m

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

Performance - MFK (4-Stage) Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MFK 240
Nominal Output Torque T_{2N} By n_{1N}	Nm	4	1,225	4,070
			1,400	4,725
			1,750	4,100
			2,000	4,765
			2,800	4,165
			3,500	4,180
			5,000	4,285
			7,000	3,445
			10,000	2,240
Emergency Stop Torque T_{2NOT}	Nm	4	1,225~10,000	2 times T_{2N}
Max. Acceleration Torque T_{2B}	Nm	4	1,225~10,000	1.5 times T_{2N}
No Load Running Torque ⁽²⁾	Nm	4	1,225~10,000	0.4
Backlash ⁽³⁾	arcmin	4	1,225~10,000	≤ 4
Torsional Rigidity	Nm/arcmin	4	1,225~10,000	510
Nominal Input Speed n_{1N}	rpm	4	1,225~10,000	3,700
Max. Input Speed n_{1B}	rpm	4	1,225~10,000	5,500
Max. Radial Load F_{2r} ⁽⁴⁾	N	4	1,225~10,000	30,000
Max. Axial Load F_{2a} ⁽⁴⁾	N	4	1,225~10,000	15,000
Max. Tilting Moment M_{2K} ⁽⁴⁾	Nm	4	1,225~10,000	5,420
Operating Temp.	°C	4	1,225~10,000	-10° C ~ 90° C
Degree of Gearbox Protection		4	1,225~10,000	IP65
Lubrication		4	1,225~10,000	Synthetic lubrication grease
Mounting Position		4	1,225~10,000	All directions
Running Noise ⁽⁵⁾	dB(A)	4	1,225~10,000	≤ 72
Efficiency η	%	4	1,225~10,000	$\geq 90\%$

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

(2) These values are measured by gearbox with ratio 10,000 (4-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

(5) The dB values are measured by gearbox with 10,000 (4-stage), no loading at 3,000 RPM or at the respective Nominal Input Speed by bigger model size.

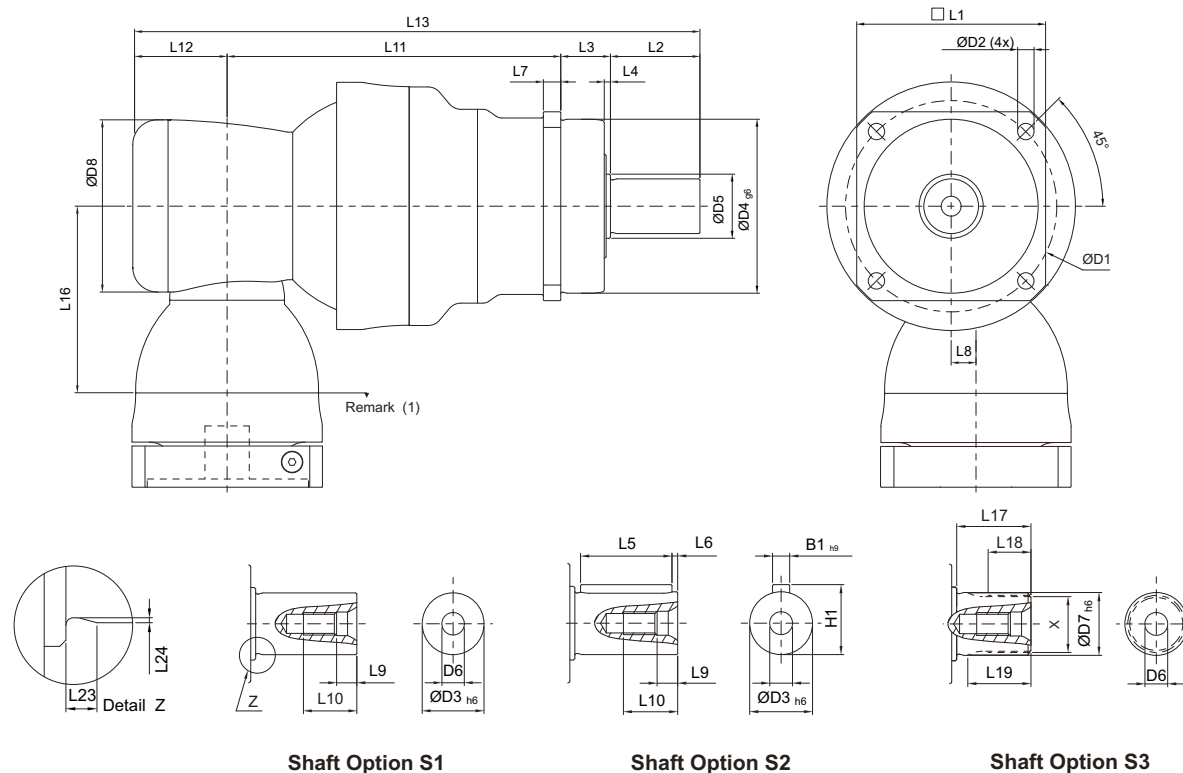
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MFK (4-Stage) Gearbox

Model No.		MFK 240
(C3) $\varnothing^{(A)}$		
24	kg.cm ²	4.61
28		6.14
32		8.17
35		15.56
38		18.19

(A) $\varnothing$ = Input shaft diameter.

Dimension - MFK (4-Stage) Gearbox (Ratio $i = 1,225 \sim 10,000$)



Dimension	MFK 240
D1	290
D2	17
D3 h6	85
D4 g6	200
D5	92.2
D6	M20 × 2.5P
D7 h6	85
D8	210
L1	245
L2	130
L3	40
L4	3
L5	125
L6	3
L7	22
L8	31
L9	15
L10	42
L11	378
L12	115
L13	663
L16	228
L17	60
L18	36
L19	53
L23	4
L24	0.5
B1 h9	22
H1	90
X DIN5480	W80 × 2 × 30 × 38 × 6m

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

Performance - MFKC Gearbox

Model No.		Stage	Ratio ⁽¹⁾	MFKC 060	MFKC 075	MFKC 100	MFKC 140	MFKC 180	MFKC 210	MFKC 240
Nominal Output Torque T_{2N} By n_{1N}	Nm	2	4	100	205	380	775	1,440	2,240	4,160
			5	85	185	330	670	1,250	1,930	3,610
			7	60	135	260	525	1,000	1,565	2,535
			8	96	205	395	800	1,320	2,300	4,260
			10	90	190	340	690	1,290	2,000	3,700
Emergency Stop Torque T_{2NOT}	Nm	2	4~10	2 times T_{2N}						
Max. Acceleration Torque T_{2B}	Nm	2	4~10	1.5 times T_{2N}						
No Load Running Torque ⁽²⁾	Nm	2	4~10	2	2.5	5.8	12	25	48	95
Backlash ⁽³⁾	arcmin	2	4~10	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4
Torsional Rigidity	Nm/arcmin	2	4~10	4.6	10	30	55	175	300	510
Nominal Input Speed n_{1N}	rpm	2	4~10	5,000	3,600	3,000	2,300	1,800	1,500	1,100
Max. Input Speed n_{1B}	rpm	2	4~10	7,000	6,000	5,500	4,500	3,500	3,000	2,200
Max. Radial Load F_{2r} ⁽⁴⁾	N	2	4~10	3,000	4,500	6,700	10,000	15,000	22,000	30,000
Max. Axial Load F_{2a} ⁽⁴⁾	N	2	4~10	1,500	2,250	3,350	5,000	7,500	11,000	15,000
Max. Tilting Moment M_{2K} ⁽⁴⁾	Nm	2	4~10	160	270	550	1,050	1,740	3,350	5,420
Operating Temp.	°C	2	4~10	-10° C ~ 90° C						
Degree of Gearbox Protection		2	4~10	IP65						
Lubrication		2	4~10	Synthetic lubrication grease						
Mounting Position		2	4~10	All directions						
Running Noise ⁽⁵⁾	dB(A)	2	4~10	≤ 68	≤ 68	≤ 68	≤ 70	≤ 70	≤ 72	≤ 74
Efficiency η	%	2	4~10	$\geq 95\%$						

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

(2) These values are measured by gearbox with ratio 10 (2-stage) at 3,000 rpm no loading.

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

(4) Applied to the output shaft center at 100 rpm.

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

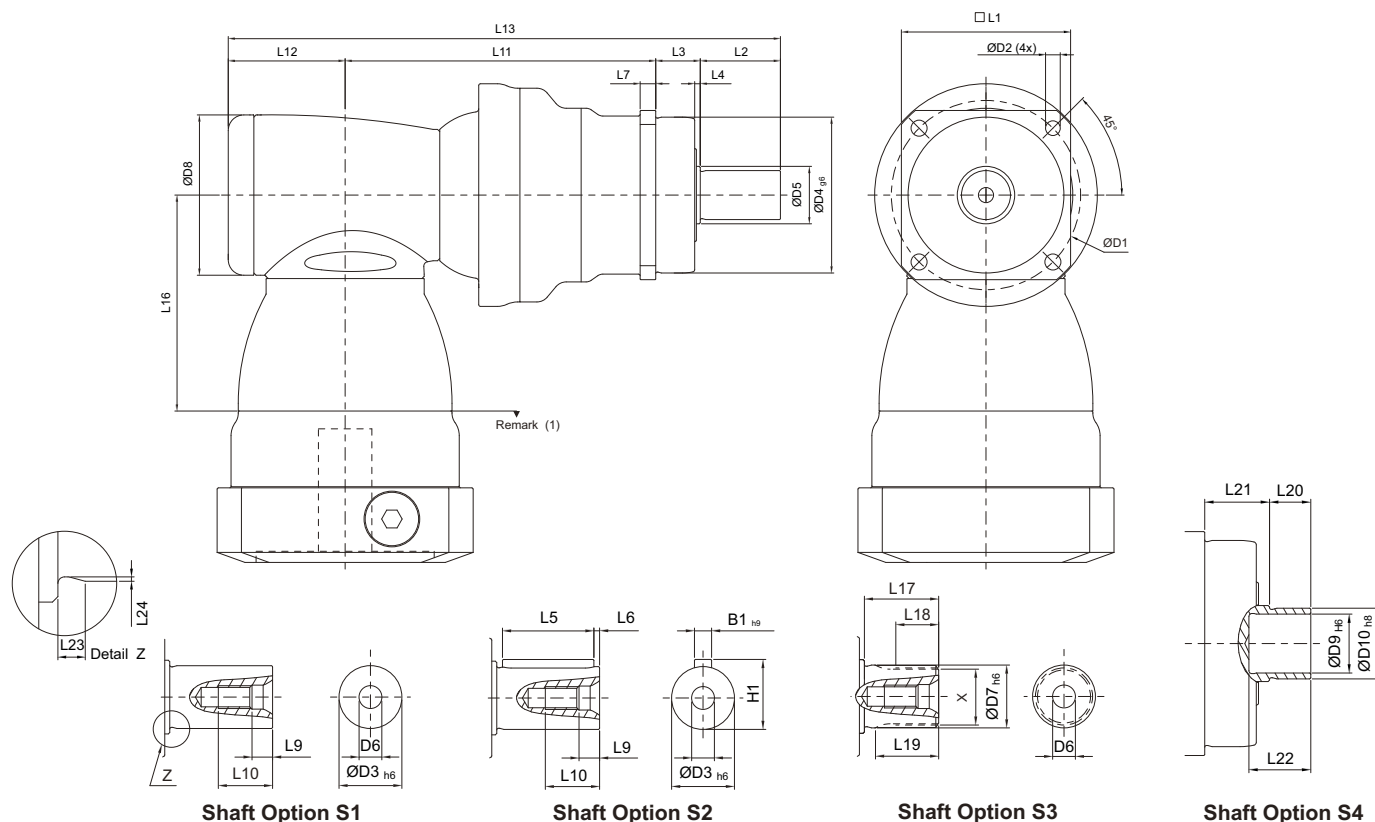
By lower ratio and/or higher RPM, the noise level could be 3 to 5 dB higher.

Inertia - MFKC Gearbox

Model No.		MFKC 060	MFKC 075	MFKC 100	MFKC 140	MFKC 180	MFKC 210	MFKC 240
(C3) $\varnothing$ ^(A)								
8	kg·cm ²	0.1	-	-	-	-	-	-
11		0.16	0.41	-	-	-	-	-
14		0.20	0.41	-	-	-	-	-
19		0.58	1.61	1.61	-	-	-	-
24		-	3.9	4.01	5.62	-	-	-
28		-	-	5.53	5.62	-	-	-
32		-	-	7.57	8.11	8.11	-	-
35		-	-	14.95	15.32	15.32	15.68	19.37
38		-	-	17.58	17.72	17.72	18.52	19.37
42		-	-	-	22.95	22.95	23.74	25.5
48		-	-	-	52.74	52.74	53.49	55.14
55		-	-	-	-	-	87.34	89.59
60		-	-	-	-	-	-	113.06

(A) $\varnothing$ = Input shaft diameter.

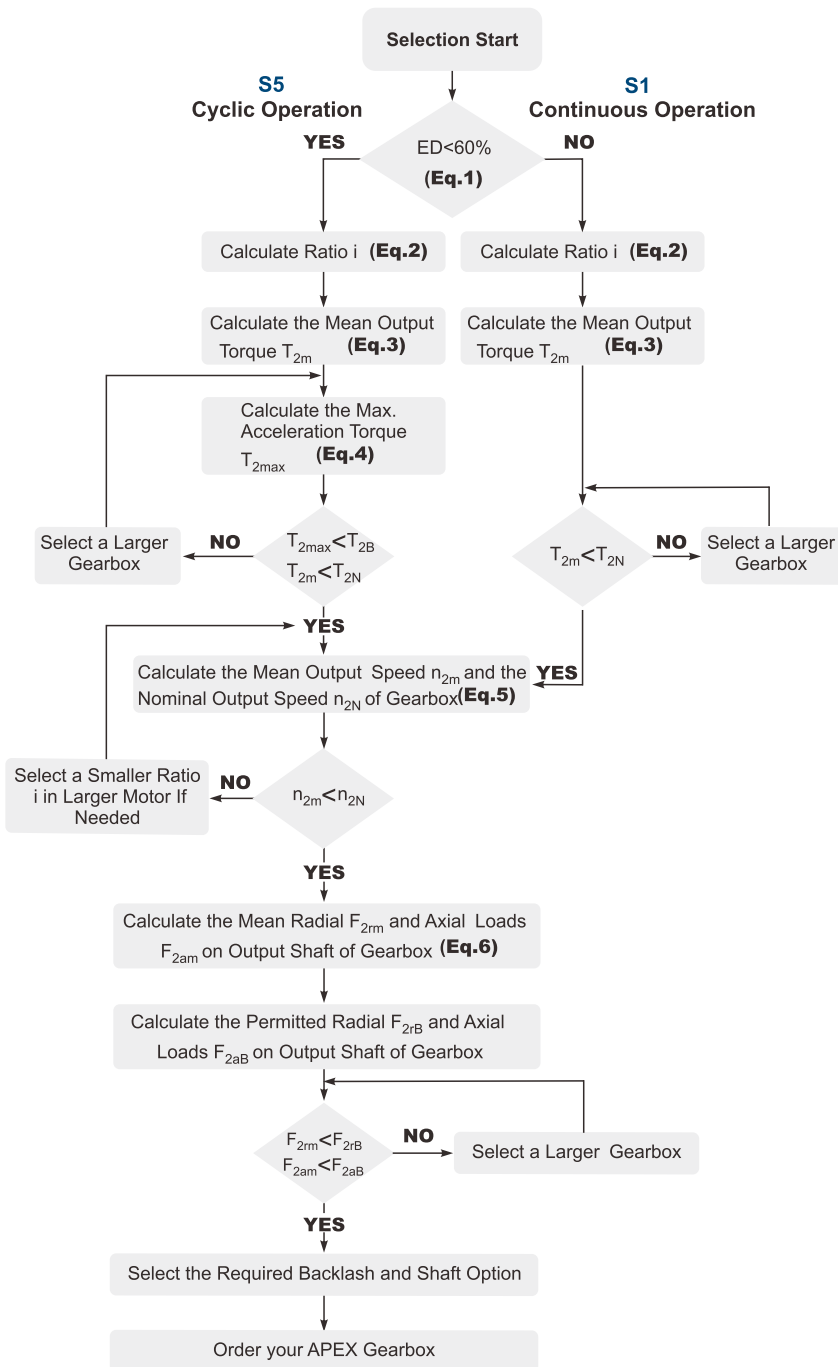
Dimension - MFKC Gearbox (Ratio i = 4~10)



Dimension	MFKC 060	MFKC 075	MFKC 100	MFKC 140	MFKC 180	MFKC 210	MFKC 240
D1	68	85	120	165	215	250	290
D2	5.5	7	9	11	13.5	17	17
D3 h6	16	22	32	40	55	75	85
D4 g6	60	70	90	130	160	180	200
D5	18.5	25.8	36.8	55.2	69.2	82.2	92.2
D6	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P	M20 x 2.5P
D7 h6	16	22	32	40	55	75	85
D8	64	92	116	156	156	195	240
D9 H6	15	20	30	40	55	-	-
D10 h8	18	24	36	50	68	-	-
L1	62	76	101	141	182	215	245
L2	28	36	58	82	82	105	130
L3	20	20	30	30	30	38	40
L4	2	2.5	3	3	3	3	3
L5	25	32	50	63	70	90	125
L6	2	2	4	5	6	7	3
L7	6	7	10	12	15	17	22
L9	4.8	7.2	10	12	15	15	15
L10	12.5	19	28	36	42	42	42
L11	121.5	145.5	163	219	258	277.5	352
L12	46.5	61.5	76	97.5	97.5	105.5	141
L13	216	263	327	428.5	467.5	526	663
L16	81.5	113.5	147.5	196.5	196.5	229	260
L17	26	26	26	40	41.5	52	60
L18	15	15	15	20	21.5	28	36
L19	21	22.5	23	33.5	33.5	45	53
L20	12	14	18	22	23	-	-
L21	22	22	32	33	32	-	-
L22	19	21	25	30	30	-	-
L23	2	2.5	2.5	2.5	2.5	2.5	4
L24	0.3	0.4	0.4	0.4	0.4	0.4	0.5
B1 h9	5	6	10	12	16	20	22
H1	18	24.5	35	43	59	79.5	90
X DIN5480	W16 x 0.8 x 30 x 18 x 6m	W22 x 1.25 x 30 x 16 x 6m	W32 x 1.25 x 30 x 24 x 6m	W40 x 2 x 30 x 18 x 6m	W55 x 2 x 30 x 26 x 6m	W70 x 2 x 30 x 34 x 6m	W80 x 2 x 30 x 38 x 6m

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

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

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

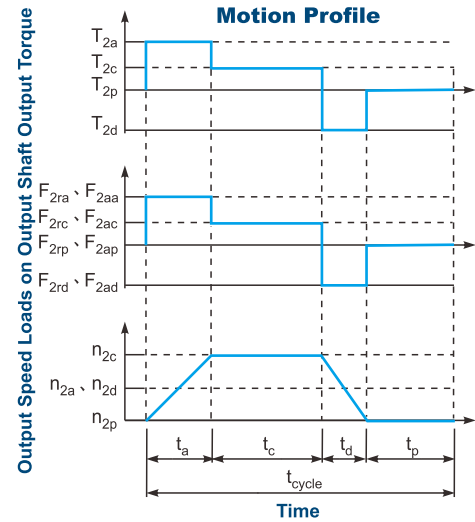
J_L Load Inertia

J_m Motor Inertia

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

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)