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APEX-2017-09-AE/AER Series - 1.0V

Printed in Taiwan



# APEX DYNAMICS, INC.

## HIGH PRECISION PLANETARY GEARBOX

## AE / AER Series



**Stainless**





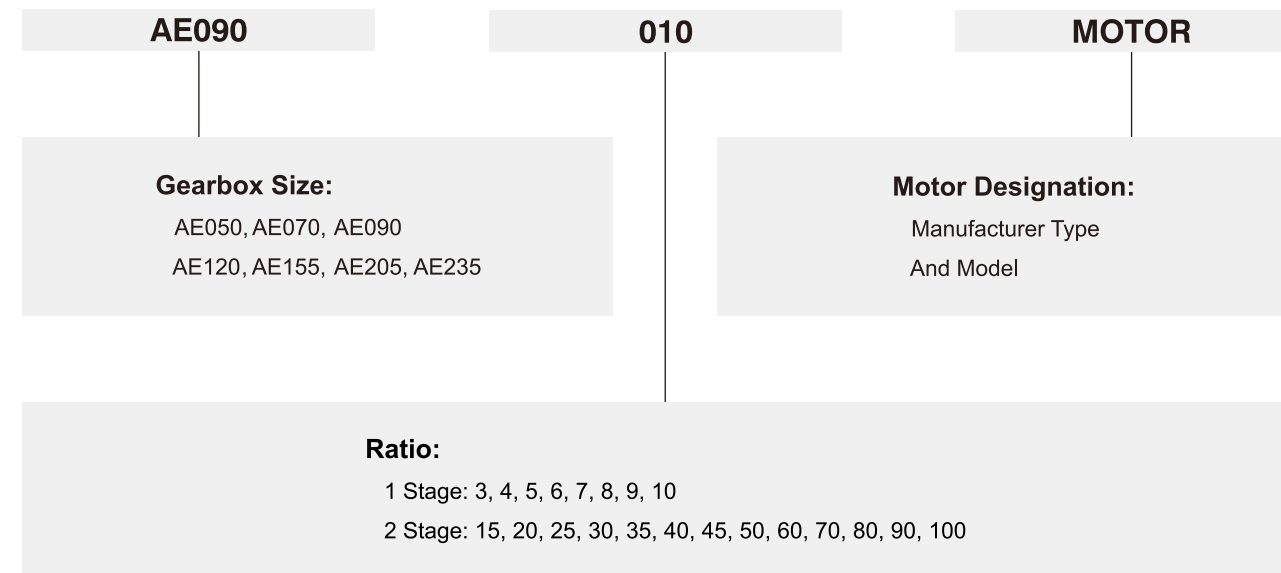
**Apex Dynamics, Inc.** is the world's most productive manufacturer of servomotor drive planetary gearboxes for precision automation machinery. From our 800,000+ square foot ISO 9001:2008 manufacturing facility, based in Taichung, Taiwan, we manufacture to stock using the newest precision machine tools and quality test and inspection equipment. Complete focus on quality and precision allows us to produce our high quality gearheads at precision levels down to less than 1 arc minute (1/60 th of a degree), with consistency and high reliability.

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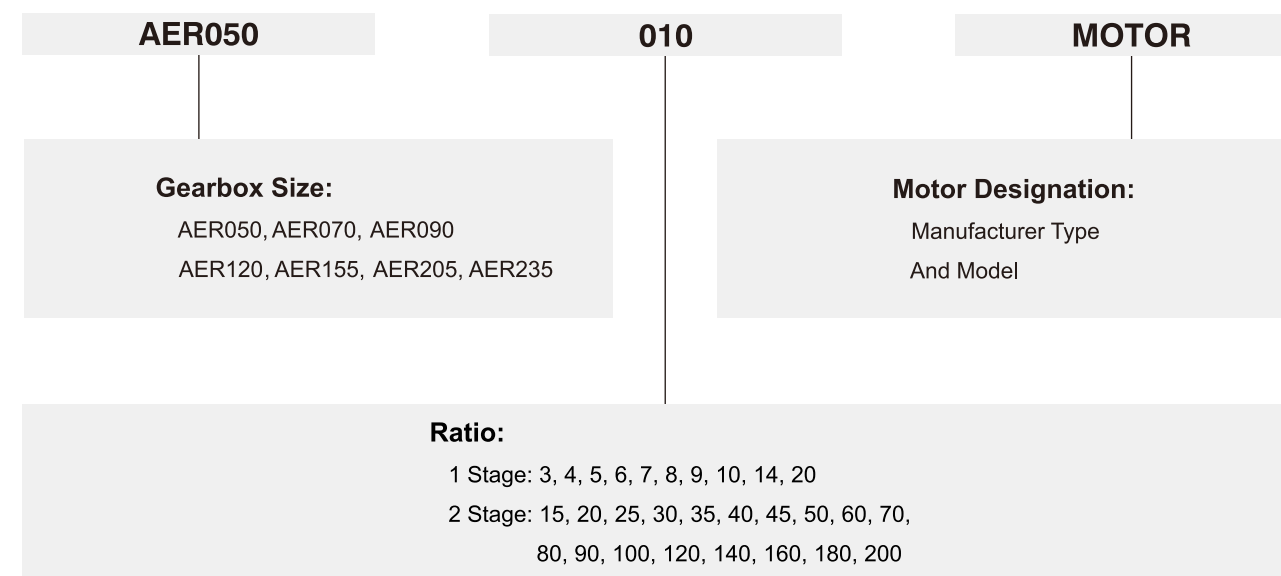


## AE Series



**Ordering Example: AE090-010 / SIEMENS 1FT6 041-4AF71**

## AER Series



**Ordering Example: AER050-010 / SIEMENS 1FT5 034-OAK71**

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# Specifications / AE Series

# Dimensions (1-stage, Ratio i=3~10) / AE Series

## Gearbox Performance

Model No.	Stage	Ratio <sup>A</sup>	AE050	AE070	AE090	AE120	AE155	AE205	AE235	
Nominal output torque $T_{2N}$	1	3	20	55	130	208	342	588	1,140	
		4	19	50	140	290	542	1,050	1,700	
		5	22	60	160	330	650	1,200	2,000	
		6	20	55	150	310	600	1,100	1,900	
		7	19	50	140	300	550	1,100	1,800	
		8	17	45	120	260	500	1,000	1,600	
		9	14	40	100	230	450	900	1,500	
		10	14	40	100	230	450	900	1,500	
		2	15	20	55	130	208	342	588	1,140
			20	19	50	140	290	542	1,050	1,700
	25		22	60	160	330	650	1,200	2,000	
	30		20	55	150	310	600	1,100	1,900	
	35		19	50	140	300	550	1,100	1,800	
	40		17	45	120	260	500	1,000	1,600	
	45		14	40	100	230	450	900	1,500	
	50		22	60	160	330	650	1,200	2,000	
	60		20	55	150	310	600	1,100	1,900	
	70		19	50	140	300	550	1,100	1,800	
	80	17	45	120	260	500	1,000	1,600		
	90	14	40	100	230	450	900	1,500		
100	14	40	100	230	450	900	1,500			
Emergency Stop Torque $T_{2NOT}^B$	Nm	1,2	3 times of nominal output torque							
Nominal input speed $n_{1N}$	rpm	1,2	3~100	5,000	5,000	4,000	4,000	3,000	3,000	2,000
Max. input speed $n_{1B}$	rpm	1,2	3~100	10,000	10,000	8,000	8,000	6,000	6,000	4,000
Backlash	arcmin	1	3~10	≤8	≤8	≤8	≤8	≤8	≤8	≤8
		2	15~100	≤12	≤12	≤12	≤12	≤12	≤12	≤12
Torsional rigidity	Nm/arcmin	1,2	3~100	3	7	14	25	50	145	225
Max. Radial Load $F_{2B}^C$	N	1,2	3~100	702	1,377	2,985	6,100	8,460	13,050	8,700
Max. Axial Load $F_{2AB}^C$	N	1,2	3~100	390	765	1,625	3,350	4,700	7,250	5,400
Service Life <sup>D</sup>	hr	1,2	3~100	20,000						
Efficiency $\eta$	%	1	3~10	≥97%						
		2	15~100	≥94%						
Weight	kg	1	3~10	0.6	1.4	3.3	6.9	13	31	53
		2	15~100	0.9	1.6	4.7	8.7	17	35	66
Operating temp	°C	1,2	3~100	-10°C~90°C						
Lubrication				Synthetic lubrication oils						
Degree of gearbox protection		1,2	3~100	IP65						
Mounting position		1,2	3~100	all directions						
Noise ( $n_1=3000$ rpm, $i=10$ , No load) <sup>E</sup>	dB(A)	1,2	3~100	≤56	≤58	≤60	≤63	≤65	≤67	≤70

## Gearbox Inertia

Model No.	Stage	Ratio <sup>A</sup>	AE050	AE070	AE090	AE120	AE155	AE205	AE235	
Mass moments of inertia $J_1$	1	3	0.03	0.16	0.61	3.25	9.21	28.98	69.61	
		4	0.03	0.14	0.48	2.74	7.54	23.67	54.37	
		5	0.03	0.13	0.47	2.71	7.42	23.29	53.27	
		6	0.03	0.13	0.45	2.65	7.25	22.75	51.72	
		7	0.03	0.13	0.45	2.62	7.14	22.48	50.97	
		8	0.03	0.13	0.44	2.58	7.07	22.59	50.84	
		9	0.03	0.13	0.44	2.57	7.04	22.53	50.63	
		10	0.03	0.13	0.44	2.57	7.03	22.51	50.56	
		2	15	0.03	0.03	0.13	0.47	2.71	7.42	23.29
			20	0.03	0.03	0.13	0.47	2.71	7.42	23.29
	25		0.03	0.03	0.13	0.47	2.71	7.42	23.29	
	30		0.03	0.03	0.13	0.47	2.71	7.42	23.29	
	35		0.03	0.03	0.13	0.47	2.71	7.42	23.29	
	40		0.03	0.03	0.13	0.47	2.71	7.42	23.29	
	45		0.03	0.03	0.13	0.47	2.71	7.42	23.29	
	50		0.03	0.03	0.13	0.44	2.57	7.03	22.51	
	60		0.03	0.03	0.13	0.44	2.57	7.03	22.51	
	70		0.03	0.03	0.13	0.44	2.57	7.03	22.51	
	80	0.03	0.03	0.13	0.44	2.57	7.03	22.51		
	90	0.03	0.03	0.13	0.44	2.57	7.03	22.51		
100	0.03	0.03	0.13	0.44	2.57	7.03	22.51			

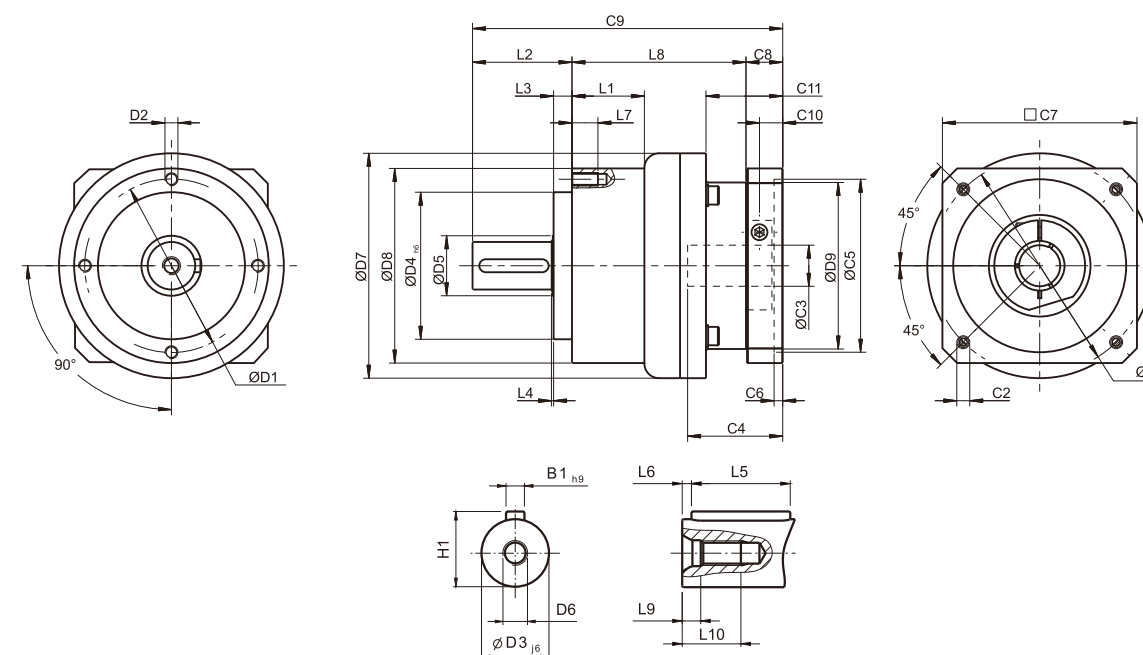
A. Ratio ( $i=N_n/N_{out}$ )

B. Max. acceleration torque  $T_{2B} = 60\%$  of  $T_{2NOT}$

C. Applied to the output shaft center at 100 rpm

D. For continuous operation, the service life time is less than 10,000 hrs

E. These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm no loading  
By less smaller than 10, the noise value would be 3~5 dB higher



[unit: mm]

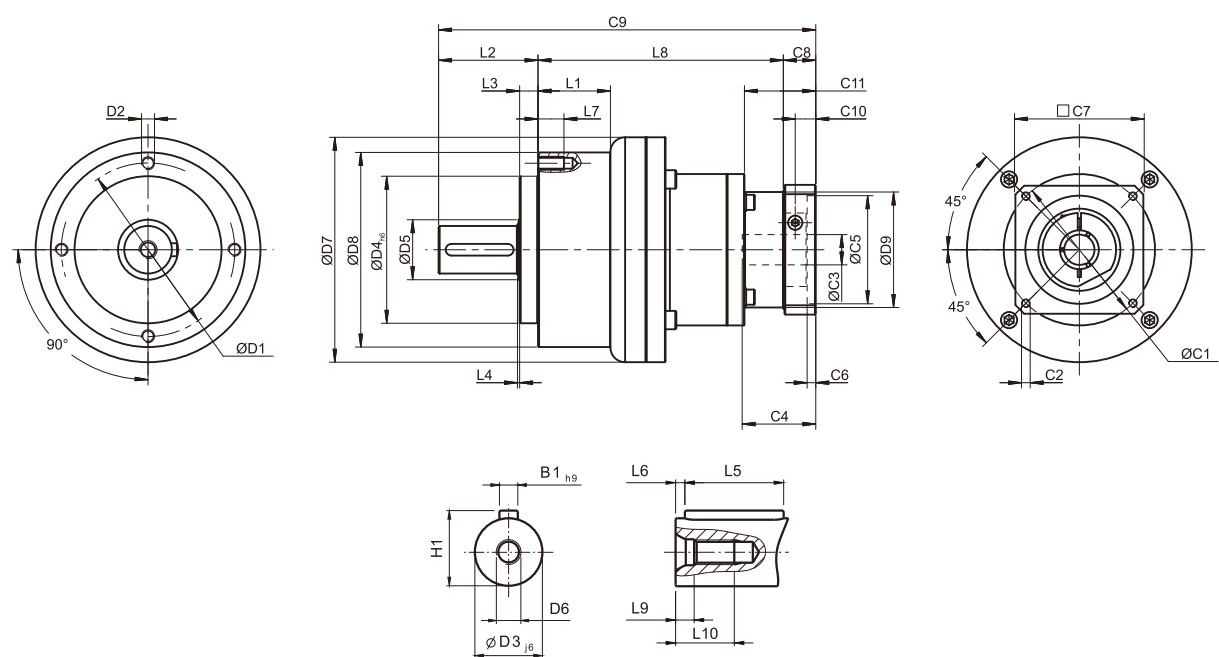
Dimension	AE050	AE070	AE090	AE120	AE155	AE205	AE235
D1	44	62	80	108	140	184	210
D2	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M16 x 2P
D3 <sub>j6</sub>	12	16	22	32	40	55	75
D4 <sub>h6</sub>	35	52	68	90	120	160	180
D5	22	22	30	40	75	95	115
D6	M4 x 0.7P	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P
D7	53	70	104	130	162	205	260
D8	50	70	90	120	155	205	235
D9	45.5	53.4	77	102	125	160	205
L1	--	--	33.5	38	50	--	70
L2	24.5	36	46	70	97	100	126
L3	4	6.5	8.5	17.5	15	15	18
L4	1	1	1	1.5	3	3	3
L5	14	25	32	40	63	70	90
L6	2	2	3	5	5	6	7
L7	8	10	12	16	20	22	28
L8	47	62	80.5	97	119.5	159	175.5
L9	4.5	4.8	7.2	10	12	15	15
L10	10	12.5	19	28	36	42	42
C1 <sup>1</sup>	46	70	100	130	165	215	235
C2 <sup>1</sup>	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M12 x 1.75P
C3 <sup>1</sup>	≤11 / ≤12 <sup>2</sup>	≤14 / ≤16 <sup>2</sup>	≤19 / ≤24	≤32	≤38	≤48	≤55
C4 <sup>1</sup>	30	34	40	50	60	85	116
C5 <sup>1</sup>	30	50	80	110	130	180	200
C6 <sup>1</sup>	3.5	8	4	5	6	6	6
C7 <sup>1</sup>	48	60	90	115	142	190	220
C8 <sup>1</sup>	19.5	19	17	19.5	22.5	29	63
C9 <sup>1</sup>	91	117	143.5	186.5	239	288	364.5
C10 <sup>1</sup>	13.25	13.5	10.75	13	15	20.75	53.5
C11 <sup>1</sup>	19.5	37	35.5	46	53.5	79.5	106.5
B1 <sub>h9</sub>	4	5	6	10	12	16	20
H1	14	18	24.5	35	43	59	79.5

1. C1~C11 are motor specific dimensions (metric std shown). Refer to [www.apexdyna.com](http://www.apexdyna.com) and Design Tool to view your specific motor mounting system.

2. AF050 ratio 5, 10 offers C3 ≤ 12 option; AF070 ratio 5, 10 offers C3 ≤ 16 option.

# Dimensions (2-stage, Ratio i=15~100) / AE Series

# Specifications / AER Series



[unit: mm]

Dimension	AE050	AE070	AE090	AE120	AE155	AE205	AE235
D1	44	62	80	108	140	184	210
D2	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M16 x 2P
D3 <sub>js</sub>	12	16	22	32	40	55	75
D4 <sub>h6</sub>	35	52	68	90	120	160	180
D5	22	22	30	40	75	95	115
D6	M4 x 0.7P	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P
D7	53	70	104	130	162	205	260
D8	50	70	90	120	155	205	235
D9	45.5	45.5	53.4	77	102	125	160
L1	--	--	33.5	38	50	--	70
L2	24.5	36	46	70	97	100	126
L3	4	6.5	8.5	17.5	15	15	18
L4	1	1	1	1.5	3	3	3
L5	14	25	32	40	63	70	90
L6	2	2	3	5	5	6	7
L7	8	10	12	16	20	22	28
L8	74	87.5	113.5	138.5	176	214.5	260
L9	4.5	4.8	7.2	10	12	15	15
L10	10	12.5	19	28	36	42	42
C1 <sup>3</sup>	46	46	70	100	130	165	215
C2 <sup>3</sup>	M4 x 0.7P	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P
C3 <sup>3</sup>	≤11 / ≤12	≤11 / ≤12	≤14 / ≤15.875 / ≤16	≤19 / ≤24	≤32	≤38	≤48
C4 <sup>3</sup>	30	30	34	40	50	60	85
C5 <sup>3</sup>	30	30	50	80	110	130	180
C6 <sup>3</sup>	3.5	3.5	8	4	5	6	6
C7 <sup>3</sup>	48	48	60	90	115	142	190
C8 <sup>3</sup>	19.5	19.5	19	17	19.5	22.5	29
C9 <sup>3</sup>	118	143	178.5	225.5	292.5	337	415
C10 <sup>3</sup>	13.25	13.25	13.5	10.75	13	15	20.75
C11 <sup>3</sup>	19.5	19.5	37	35.5	46	53.5	79.5
B1 <sub>h9</sub>	4	5	6	10	12	16	20
H1	14	18	24.5	35	43	59	79.5

3. C1~C11 are motor specific dimensions (metric std shown). Refer to www.apexdyna.com and Design Tool to view your specific motor mounting system.

## Gearbox Performance

Model No.	Stage	Ratio <sup>A</sup>	AER050	AER070	AER090	AER120	AER155	AER205	AER235			
Nominal output torque T <sub>2N</sub>	1	3	9	36	90	195	342	588	1,140			
		4	12	48	120	260	520	1,040	1,680			
		5	15	60	150	325	650	1,200	2,000			
		6	18	55	150	310	600	1,100	1,900			
		7	19	50	140	300	550	1,100	1,800			
		8	17	45	120	260	500	1,000	1,600			
		9	14	40	100	230	450	900	1,500			
		10	14	60	150	325	650	1,200	2,000			
		14	-	42	140	300	550	1,100	1,800			
		20	-	40	100	230	450	900	1,500			
	2	15	14	-	-	-	-	-	-			
		20	14	-	-	-	-	-	-			
		25	15	60	150	325	650	1,200	2,000			
		30	20	55	150	310	600	1,100	1,900			
		35	19	50	140	300	550	1,100	1,800			
		40	17	45	120	260	500	1,000	1,600			
		45	14	40	100	230	450	900	1,500			
		50	14	60	100	230	650	1,200	2,000			
		60	20	55	150	310	600	1,100	1,900			
		70	19	50	140	300	550	1,100	1,800			
80	17	45	120	260	500	1,000	1,600					
90	14	40	100	230	450	900	1,500					
100	14	40	100	230	450	900	1,500					
120	-	-	150	310	600	1,100	1,900					
140	-	-	140	300	550	1,100	1,800					
160	-	-	120	260	550	1,000	1,600					
180	-	-	100	230	450	900	1,500					
200	-	-	100	230	450	900	1,500					
Emergency Stop Torque T <sub>2NOT</sub> <sup>B</sup>	Nm	1,2	3~200							3 times of nominal output torque		
Nominal Input Speed n <sub>1N</sub>	rpm	1,2	3~200	5,000	5,000	4,000	4,000	3,000	3,000	2,000		
Max. Input Speed n <sub>1B</sub>	rpm	1,2	3~200	10,000	10,000	8,000	8,000	6,000	6,000	4,000		
Backlash	arcmin	1	3~20	≤10	≤10	≤10	≤10	≤10	≤10	≤10		
		2	25~200	≤14	≤14	≤14	≤14	≤14	≤14	≤14		
Torsional Rigidity	Nm/arcmin	1,2	3~200	3	7	14	25	50	145	225		
Max. Radial Load F <sub>2rB</sub> <sup>C</sup>	N	1,2	3~200	702	1,377	2,985	6,100	8,460	13,050	8,700		
Max. Axial Load F <sub>2aB</sub> <sup>C</sup>	N	1,2	3~200	390	765	1,625	3,350	4,700	7,250	5,400		
Service Life <sup>D</sup>	hr	1,2	3~200	20,000*								
Efficiency η	%	1	3~20	≥95%								
		2	25~200	≥92%								
Weight	kg	1	3~20	1.0	2.1	5.8	11.2	22.4	46.8	78.0		
		2	25~200	1.3	2.0	4.6	11.1	21.8	43.7	81.9		
Operating temp	°C	1,2	3~200	-10°C~90°C								
Lubrication				Synthetic lubrication oils								
Degree of gearbox protection		1,2	3~200	IP65								
Mounting position		1,2	3~200	all directions								
Noise(n <sub>1</sub> =3000rpm,i=10,No-load) <sup>E</sup>	dB(A)	1,2	3~200	≤61	≤63	≤65	≤68	≤70	≤72	≤74		

## Gearbox Inertia

Model No.	Stage	Ratio <sup>A</sup>	AER050	AER070	AER090	AER120	AER155	AER205	AER235
Mass Moments of Inertia J <sub>1</sub>	1	3~10	0.09	0.35	2.25	6.84	23.4	68.9	135.4
		14	-	0.07	1.87	6.25	21.8	65.6	119.8
		20	-	0.07	1.87	6.25	21.8	65.6	119.8
	2	15	0.09	-	-	-	-	-	-
		20	0.09	-	-	-	-	-	-
		25~100	0.09	0.09	0.35	2.25	6.84	23.4	68.9
		120~200	-	-	0.31	1.87	6.25	21.8	65.6

A. Ratio (i=N<sub>r</sub>/N<sub>out</sub>)

B. Max. acceleration torque T<sub>2B</sub> = 60% of T<sub>2NOT</sub>

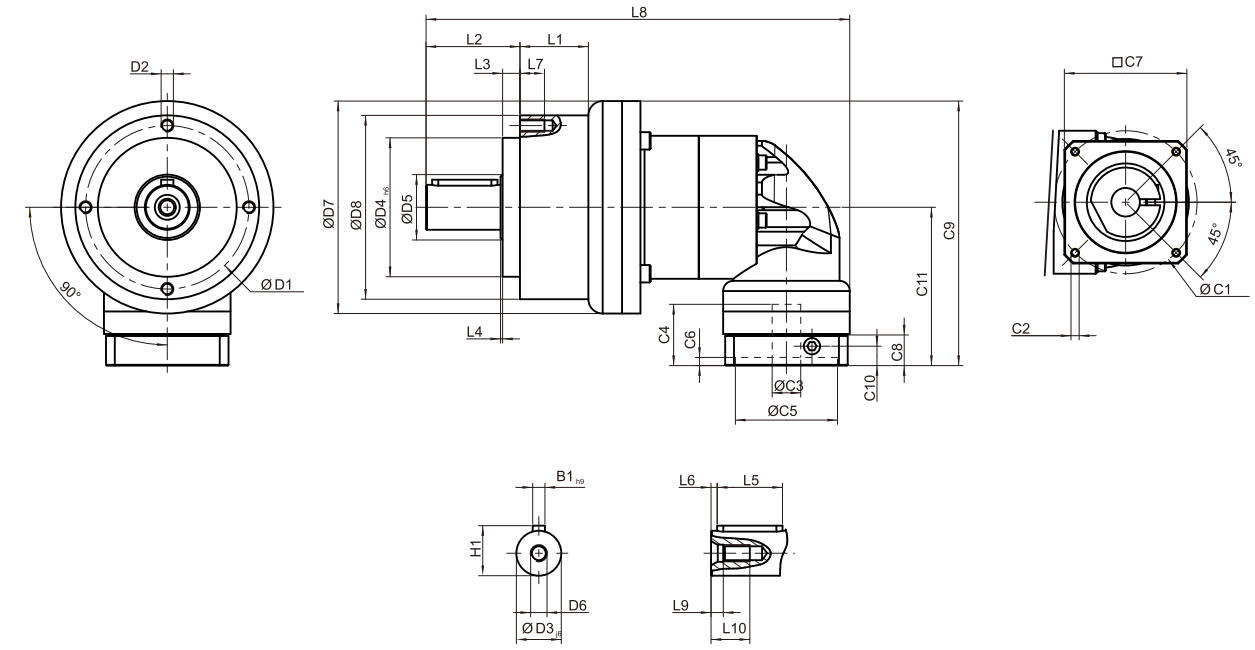
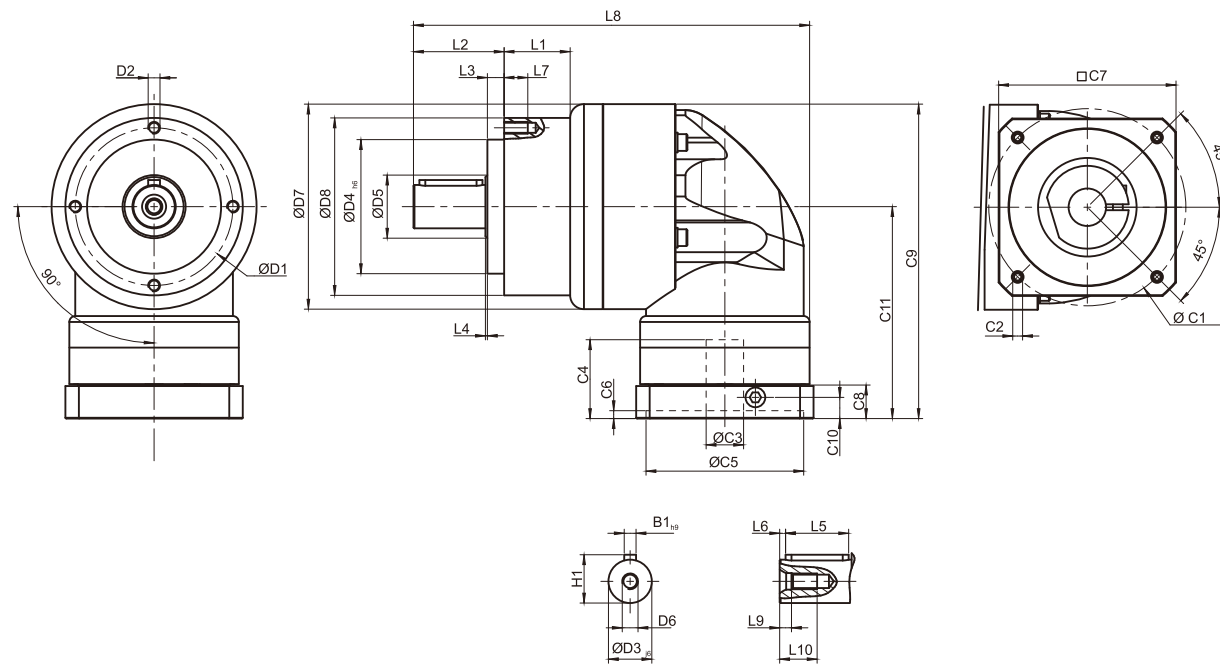
C. Applied to the output shaft center at 100 rpm

D. For continuous operation, the service life time is less than 10,000 hrs

E. These values are measured by gearbox with ratio = 10 (1-stage) or ratio = 100 (2-stage) at 3,000 rpm no loading  
By less smaller than 10, the noise value would be 3~5 dB higher

# Dimensions (1-stage, Ratio i=3~20) / AER Series

# Dimensions (2-stage, Ratio i=15~200) / AER Series



[unit: mm]

[unit: mm]

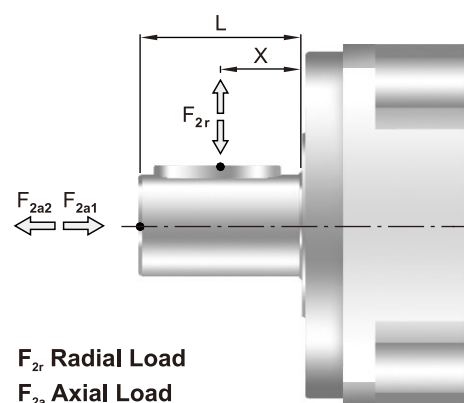
Dimension	AER050	AER070	AER090	AER120	AER155	AER205	AER235
D1	44	62	80	108	140	184	210
D2	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M16 x 2P
D3 <sub>js</sub>	12	16	22	32	40	55	75
D4 <sub>h6</sub>	35	52	68	90	120	160	180
D5	22	22	30	40	75	95	115
D6	M4 x 0.7P	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P
D7	53	70	104	130	162	205	260
D8	50	70	90	120	155	205	235
L1	--	--	33.5	38	50	--	70
L2	24.5	36	46	70	97	100	126
L3	4	6.5	8.5	17.5	15	15	18
L4	1	1	1	1.5	3	3	3
L5	14	25	32	40	63	70	90
L6	2	2	3	5	5	6	7
L7	8	10	12	16	20	22	28
L8	115.5	146	201	252	324.5	379.5	461.5
L9	4.5	4.8	7.2	10	12	15	15
L10	10	12.5	19	28	36	42	42
C1 <sup>1</sup>	46	70	100	130	165	215	235
C2 <sup>1</sup>	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M12 x 1.75P
C3 <sup>1</sup>	≦11 / ≦12	≦14 / ≦16	≦19 / ≦24	≦32	≦38	≦48	≦55
C4 <sup>1</sup>	30	34	40	50	60	85	116
C5 <sup>1</sup>	30	50	80	110	130	180	200
C6 <sup>1</sup>	3.5	8	4	5	6	6	6
C7 <sup>1</sup>	48	60	90	115	142	190	220
C8 <sup>1</sup>	19.5	19	17	19.5	22.5	29	63
C9 <sup>1</sup>	100.5	116.5	159.5	199	245.5	316	398.5
C10 <sup>1</sup>	13.25	13.5	10.75	13	15	20.75	53.5
C11 <sup>1</sup>	74	81.5	107.5	134	164.5	213.5	268.5
B1 <sub>h9</sub>	4	5	6	10	12	16	20
H1	14	18	24.5	35	43	59	79.5

1. C1~C11 are motor specific dimensions (metric std shown). Refer to [www.apexdyna.com](http://www.apexdyna.com) and Design Tool to view your specific motor mounting system.

Dimension	AER050	AER070	AER090	AER120	AER155	AER205	AER235
D1	44	62	80	108	140	184	210
D2	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P	M16 x 2P
D3 <sub>js</sub>	12	16	22	32	40	55	75
D4 <sub>h6</sub>	35	52	68	90	120	160	180
D5	22	22	30	40	75	95	115
D6	M4 x 0.7P	M5 x 0.8P	M8 x 1.25P	M12 x 1.75P	M16 x 2P	M20 x 2.5P	M20 x 2.5P
D7	53	70	104	130	162	205	260
D8	50	70	90	120	155	205	235
L1	--	--	33.5	38	50	--	70
L2	24.5	36	46	70	97	100	126
L3	4	6.5	8.5	17.5	15	15	18
L4	1	1	1	1.5	3	3	3
L5	14	25	32	40	63	70	90
L6	2	2	3	5	5	6	7
L7	8	10	12	16	20	22	28
L8	142.5	167.5	207.5	283	358	422.5	506.5
L9	4.5	4.8	7.2	10	12	15	15
L10	10	12.5	19	28	36	42	42
C1 <sup>2</sup>	46	46	70	100	130	165	215
C2 <sup>2</sup>	M4 x 0.7P	M4 x 0.7P	M5 x 0.8P	M6 x 1P	M8 x 1.25P	M10 x 1.5P	M12 x 1.75P
C3 <sup>2</sup>	≦11 / ≦12	≦11 / ≦12	≦14 / ≦15.875 / ≦16	≦19 / ≦24	≦32	≦38	≦48
C4 <sup>2</sup>	30	30	34	40	50	60	85
C5 <sup>2</sup>	30	30	50	80	110	130	180
C6 <sup>2</sup>	3.5	3.5	8	4	5	6	6
C7 <sup>2</sup>	48	48	60	90	115	142	190
C8 <sup>2</sup>	19.5	19.5	19	17	19.5	22.5	29
C9 <sup>2</sup>	100.5	109	133.5	172.5	215	267	343.5
C10 <sup>2</sup>	13.25	13.25	13.5	10.75	13	15	20.75
C11 <sup>2</sup>	74	74	81.5	107.5	134	164.5	213.5
B1 <sub>h9</sub>	4	5	6	10	12	16	20
H1	14	18	24.5	35	43	59	79.5

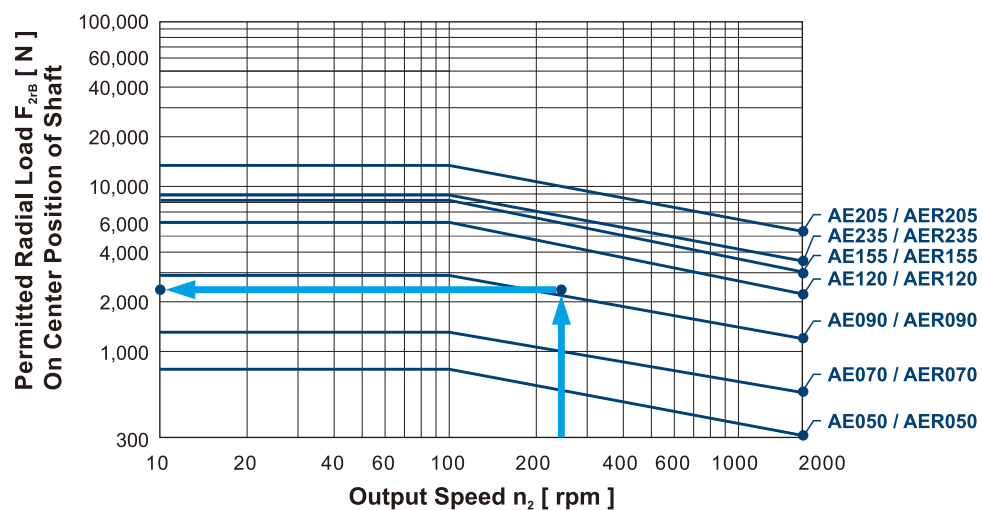
2. C1~C11 are motor specific dimensions (metric std shown). Refer to [www.apexdyna.com](http://www.apexdyna.com) and Design Tool to view your specific motor mounting system.

# Permitted Radial and Axial Loads

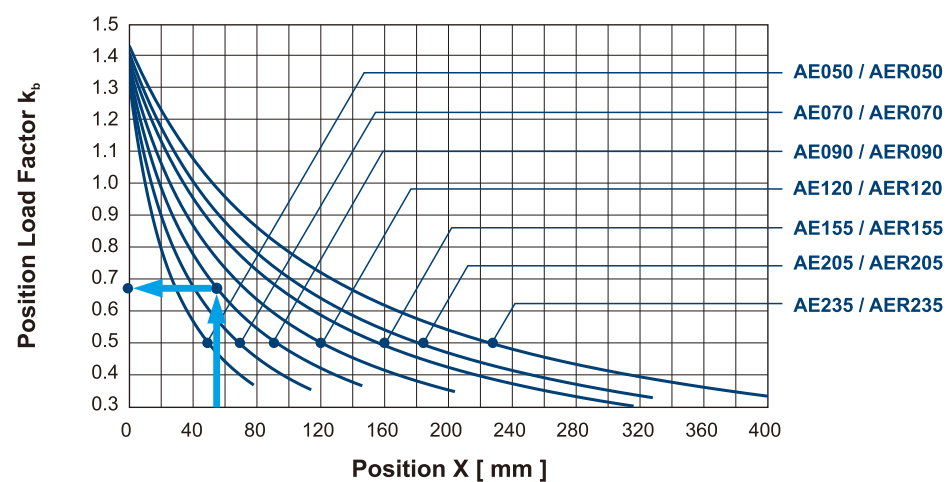


The permitted radial and axial loads on output shaft of the gearbox depend on the design of the gearbox supporting bearings. APEX use the extension straddle oversized ball bearing design. It can take heavy load from both axes.

**F<sub>2r</sub> Radial Load**  
**F<sub>2a</sub> Axial Load**



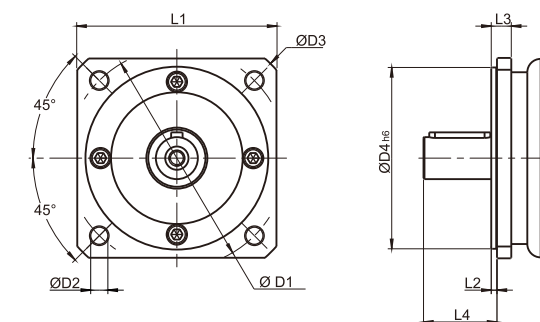
If radial force  $F_{2r}$  exert on the center of the output shaft  $X=1/2 \times L$ . Under various operating condition the lifetime is over 20,000 hours\*. The permitted radial load is given on left diagram.



If radial force  $F_{2r}$  not exert on the center of the output shaft  $X < 1/2 \times L$  or  $X > 1/2 \times L$ . The permitted radial and axial load can be calculated by the position load factor  $k_b$  on the left diagram.

\* S1 service life 10,000 hrs

# Front Plate Option



[unit: mm]

Dimension	D1	D2	D3	D4 <sup>h8</sup>	L1	L2	L3	L4
AE050(AER050)-NEMA 23	66.675	6	77	38.1	57.2	2	8	18.5
AE050(AER050)-PX60	70	5.6	80.5	50	60	2.5	8.5	18.5
AE070(AER070)-Metric	90	6.6	106	50	80	3	11	28
AE070(AER070)-NEMA 34	98.425	5.5	115	73.025	86	2.5	8	30.5
AE070(AER070)-DT90 / PX90	100	6.6	120	80	90	3	8	31
AE090(AER090)-IEC 63D5 B5	115	9	140	95	105	3	10.5	38.5
AE090(AER090)-NEMA 34	98.425	5.5	120	73.025	92	2.5	12.5	36
AE090(AER090)-DT90 / PX90	100	6.5	120	80	92	2.5	12.5	36
AE090(AER090)-NEMA 42	125.73	7	144	55.58	107	4	14.5	35.5
AE120(AER120)-NEMA 42	125.73	7.1	170	55.499	127	1.5	21.5	50
AE120(AER120)-NEMA 56	149.225	6.6	170	114.3	127	3	17.5	55.5
AE155(AER155)-B5	175	11	196	130	160	5	20	82
AE205(AER205)-B5	230	13	277	180	210	5	23	82
AE235(AER235)-B5	275	17	317	235	240	5	23	108