

# AC Motors Selection flow

## STEP 1: Select the motor size and gear ratio from the torque

● Induction Motors 60 Hz

Unit = N·m (lb-in)

Model Combination Type	Speed r/min	360	300	240	200	144	120	100	72	60	50	36	30	24	20	18	15	12	10	7.2	6	5	
	Gear Ratio	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	250	300	360	
VHI206A2-□U, VHI206C2-□E		0.18 (1.59)	0.22 (1.94)	0.28 (2.4)	0.33 (2.9)	0.46 (4.0)	0.55 (4.8)	0.66 (5.8)	0.92 (8.1)	1.1 (9.7)	1.3 (11.5)	1.8 (15.9)	2.1 (18.5)	2.6 (23)	3.2 (28)	3.5 (30)	4.2 (37)	5.0 (44)	6 (53)	6 (53)	6 (53)	6 (53)	
VHI315A2-□U, VHI315C2-□E		0.47 (4.1)	0.57 (5.0)	0.71 (6.2)	0.85 (7.5)	1.2 (10.6)	1.4 (12.3)	1.7 (15.0)	2.4 (21)	2.7 (23)	3.3 (29)	4.5 (39)	5.4 (47)	6.8 (60)	8.1 (71)	9.0 (79)	10 (88)	10 (88)	10 (88)	10 (88)	10 (88)	10 (88)	
VHI425A2-□U, VHI425A2T-□U VHI425C2-□E, VHI425C2T-□E		0.77 (6.8)	0.92 (8.1)	1.1 (9.7)	1.4 (12.3)	1.9 (16.8)	2.3 (20)	2.8 (24)	3.8 (33)	4.4 (38)	5.3 (46)	7.3 (64)	8.8 (77)	11.0 (97)	13.2 (116)	14.6 (129)	16 (141)	16 (141)	16 (141)	16 (141)	16 (141)	16 (141)	
VHI425S2-□, VHI425S2T-□		0.72 (6.3)	0.86 (7.6)	1.1 (9.7)	1.3 (11.5)	1.8 (15.9)	2.2 (19.4)	2.6 (23)	3.6 (31)	4.1 (36)	5.0 (44)	6.9 (61)	8.3 (73)	10.3 (91)	12.4 (109)	13.8 (122)	16 (141)	16 (141)	16 (141)	16 (141)	16 (141)	16 (141)	
VHI540A2-□U, VHI540A2T-□U VHI540C2-□E, VHI540C2T-□E VHI540S2-□, VHI540S2T-□		1.2 (10.6)	1.4 (12.3)	1.8 (15.9)	2.1 (18.5)	2.9 (25)	3.5 (30)	4.2 (37)	5.6 (49)	6.7 (59)	8.0 (70)	11.2 (99)	13.4 (118)	16.8 (148)	20.1 (177)	22.4 (198)	25.3 (220)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	-
VHI560A2-□U, VHI560A2T-□U VHI560C2-□E, VHI560C2T-□E		1.8 (15.9)	2.2 (19.4)	2.7 (23)	3.3 (29)	4.6 (40)	5.5 (48)	6.6 (58)	8.7 (76)	10.4 (92)	12.5 (110)	17.4 (153)	20.9 (184)	26.1 (230)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	-
VHI560S2-□, VHI560S2T-□		1.7 (15.0)	2.1 (18.5)	2.6 (23)	3.1 (27)	4.3 (38)	5.1 (45)	6.2 (54)	8.2 (72)	9.8 (86)	11.8 (104)	16.3 (144)	19.6 (173)	24.5 (210)	29.4 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	30 (260)	-
VHI590A2-□U, VHI590A2T-□U		2.6 (23)	3.2 (28)	3.9 (34)	4.7 (41)	6.6 (58)	7.9 (69)	9.1 (80)	12.6 (111)	15.1 (133)	18.1 (160)	25.2 (220)	30.2 (260)	35.5 (310)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	-
VHI590C2-□E, VHI590C2T-□E		2.7 (23)	3.3 (29)	4.1 (36)	4.9 (43)	6.8 (60)	8.2 (72)	9.4 (83)	13.0 (115)	15.6 (138)	18.7 (165)	26.0 (230)	31.2 (270)	36.8 (320)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	-
VHI590S2-□, VHI590S2T-□		2.6 (23)	3.1 (27)	3.8 (33)	4.6 (40)	6.4 (56)	7.7 (68)	8.8 (77)	12.3 (108)	14.7 (130)	17.6 (155)	24.5 (210)	29.4 (260)	34.6 (300)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	40 (350)	-

## STEP 2: Confirm the permissible inertia $J_G$ of the motor selected is greater than load inertia $J_L$

Frame Size		□42 mm □1.65 in	□60 mm □2.36 in	□70 mm □2.76 in	□80 mm □3.15 in	□90 mm □3.54 in	□90 mm □3.54 in	□104mm □4.09 in
Output Power	(Watts)	1, 3	6	15	25	40	60, 90	200
	(HP)	1/750, 1/250	1/125	1/50	1/30	1/19	1/12, 1/8	1/4
Permissible Inertia at the Motor $J_M$	( $\times 10^{-4}$ Kgm <sup>2</sup> )	0.016	0.062	0.14	0.31	0.75	1.1	2.0
	(Oz-in <sup>2</sup> )	0.088	0.34	0.77	1.70	4.1	6.0	10.9

Gear ratio 3:1 to 50:1,  $J_G = J_M \times i^2$   
 Gear ratio 60:1 or higher,  $J_G = J_M \times 2500$

$J_G$ : Permissible load inertia at the gearhead output shaft  
 $J_M$ : Permissible load inertia at the motor shaft  
 i: Gear ratio (Ex. If the gear ratio is 3:1,  $i=3$ )

$$J_G > J_L$$

# Brushless DC Motor Selection Flow

## STEP 1: Select the motor size and gear ratio from the torque table

### ● Combination Type – Hollow Shaft Flat Gearhead

Unit = N·m (lb-in)

Model	Motor Speed [r/min]	Gear Ratio							
		5	10	15	20	30	50	100	200
		80 r/min	3000 r/min	4000 r/min	80~3000 r/min	4000 r/min	80~3000 r/min	4000 r/min	80~3000 r/min
BLF230 □-□FR	80~3000 r/min	0.4 (3.5)	0.85 (7.5)	1.3 (11.5)	1.7 (15.0)	2.6 (23)	4.3 (38)	8.5 (75)	17 (150)
	4000 r/min	0.3 (2.6)	0.64 (5.6)	0.96 (8.4)	1.3 (11.5)	1.9 (16.8)	3.2 (28)	6.4 (56)	12.8 (113)
BLF460 □-□FR	80~3000 r/min	0.85 (7.5)	1.7 (15.0)	2.6 (23)	3.4 (30)	5.1 (45)	8.5 (75)	17 (150)	34 (300)
	4000 r/min	0.64 (5.6)	1.3 (11.5)	1.9 (16.8)	2.6 (23)	3.8 (33)	6.4 (56)	12.8 (113)	25.5 (220)
BLF5120 □-□FR	80~3000 r/min	1.7 (15.0)	3.4 (30)	5.1 (45)	6.8 (60)	10.2 (90)	17 (150)	34 (300)	68 (600)
	4000 r/min	1.3 (11.5)	2.6 (23)	3.8 (33)	5.1 (45)	7.7 (68)	12.8 (113)	25.5 (220)	51 (450)
BLF6200 □-□FR	80~3000 r/min	–	5.5 (48)	8.3 (73)	11.1 (98)	16.6 (146)	27.6 (240)	55.3 (480)	–
	4000 r/min	–	3.8 (33)	5.7 (50)	7.7 (68)	11.5 (101)	19.1 (169)	38.3 (330)	–
BLF6400S □FR	80~3000 r/min	5.5 (48)	11.1 (98)	16.6 (146)	22.1 (195)	33.2 (290)	55.3 (480)	110 (970)	–
	4000 r/min	4.0 (35)	8.1 (71)	12.1 (107)	16.2 (143)	24.2 (210)	40.4 (350)	80.8 (710)	–

## STEP 2: Confirm the permissible inertia is greater than the calculated Load inertia

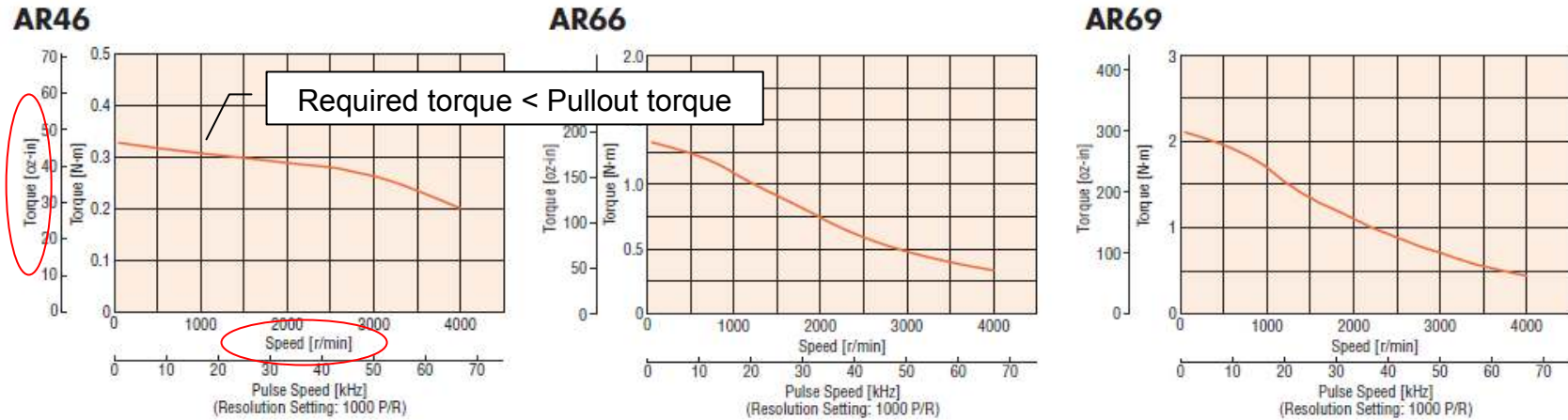
### ● Combination Type – Hollow Shaft Flat Gearhead

Unit =  $\times 10^{-4}$  kg·m<sup>2</sup> (oz-in<sup>2</sup>)

Model	Gear Ratio	5	10	15	20	30	50	100	200
		(66)	(270)	(600)	(1090)	(2000)	(5000)	(13700)	(27000)
BLF230 □-□FR		12	50	110	200	370	920	2500	5000
	When instantaneous stop or instantaneous bi-directional operation is performed	1.55 (8.5)	6.2 (34)	14.0 (77)	24.8 (136)	55.8 (310)	155 (850)	155 (850)	155 (850)
BLF460 □-□FR		22	95	220	350	800	2200	6200	12000
	When instantaneous stop or instantaneous bi-directional operation is performed	5.5 (30)	22 (120)	49.5 (270)	88 (480)	198 (1080)	550 (3000)	550 (3000)	550 (3000)
BLF5120 □-□FR		45	190	420	700	1600	4500	12000	25000
	When instantaneous stop or instantaneous bi-directional operation is performed	25 (137)	100 (550)	225 (1230)	400 (2200)	900 (4900)	2500 (13700)	2500 (13700)	2500 (13700)
BLF6200 □-□FR		–	460 (2500)	1000 (5500)	1700 (9300)	3900 (21000)	9300 (51000)	18000 (98000)	–
	When instantaneous stop or instantaneous bi-directional operation is performed	–	150 (820)	338 (1850)	600 (3300)	1350 (7400)	3750 (21000)	3750 (21000)	–
BLF6400S □FR		100 (550)	460 (2500)	1000 (5500)	1700 (9300)	3900 (21000)	9300 (51000)	18000 (98000)	–
	When instantaneous stop or instantaneous bi-directional operation is performed	37.5 (210)	150 (820)	338 (1850)	600 (3300)	1350 (7400)	3750 (21000)	3750 (21000)	–

# Stepping Motor Selection Flow

## STEP 1: Select motor size from the Torque-Speed chart



## STEP 2: Confirm the rotor inertia $J_o$ and the load inertia $J_L$ ratio



Model	Standard (Single shaft)	AR46A-3	AR66A-3	AR69A-3	AR98A-3	AR911A-3
	Standard (Double shaft)*1	AR46B-3	AR66B-3	AR69B-3	AR98B-3	AR911B-3
	Electromagnetic Brake	AR46M-3	AR66M-3	AR69M-3	AR98M-3	-
Maximum Holding Torque	N-m (oz-in)	0.3 (42)	1.2 (170)	2 (280)	4 (560)	
Holding Torque at Motor Standstill	Power ON	0.15 (21)	0.6 (85)	1 (142)	2 (280)	
	Electromagnetic Brake	0.15 (21)	0.6 (85)	1 (142)	-	
Rotor Inertia	J: kg-m <sup>2</sup> (oz-in <sup>2</sup> )	58×10 <sup>-7</sup> (0.32) [73×10 <sup>-7</sup> (0.4)]*2	380×10 <sup>-7</sup> (2.1) [500×10 <sup>-7</sup> (2.7)]*2	750×10 <sup>-7</sup> (4.1) [870×10 <sup>-7</sup> (4.8)]*2	1100×10 <sup>-7</sup> (6) [1220×10 <sup>-7</sup> (6.7)]*2	2200×10 <sup>-7</sup> (12)
Resolution		0.36°/Pulse				

$$\text{Inertia Ratio} \geq \frac{J_L}{J_o \times i^2}$$

Where  $J_L$ : load inertia,  $J_o$ : rotor inertia,  $i$ : gear ratio

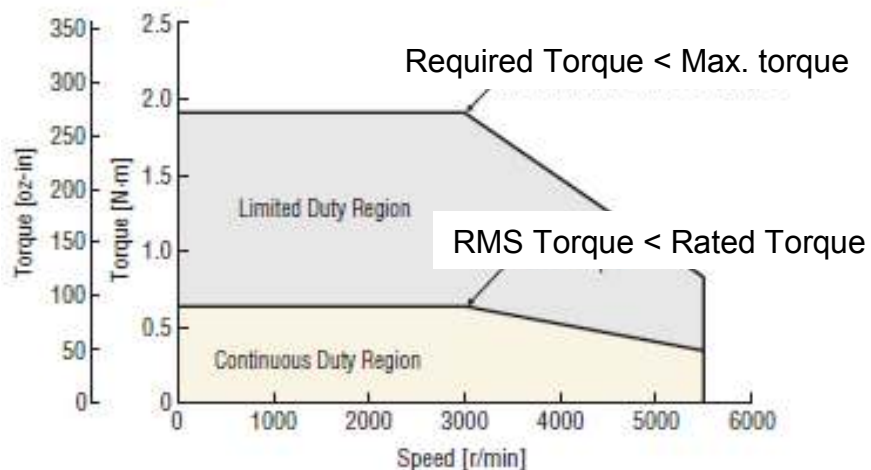
### Inertia Ratio (Reference values)

Product	Motor Frame Size	Inertia Ratio
<b>αSTEP</b>	28, 42, 60, 85	30 Max.
Stepping Motor and Driver Package	20, 28	5 Max.
	42, 60, 85	10 Max.

# Servo Motor Selection Flow

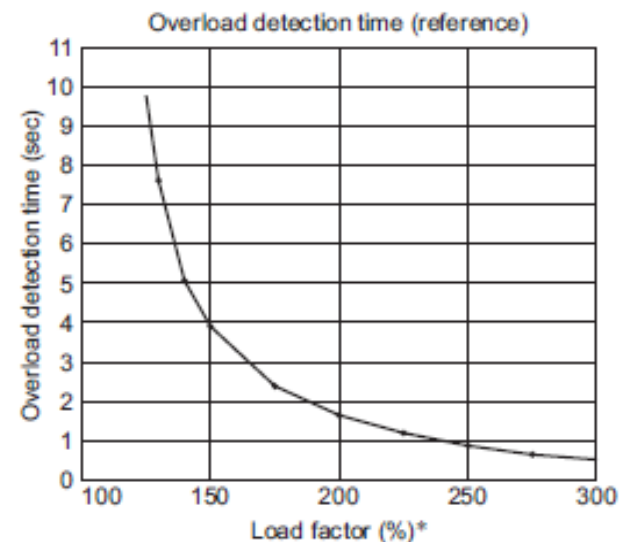
**STEP 1: Select motor size from the Torque-Speed chart using the Required torque and the RMS torque**

**NX620□-3**



**STEP 3**

**Confirm the acceleration time is within the Overload detection time for limited duty region operation.**



\* The load factor is 100% when the rated torque is output.

**STEP 2: Confirm the load inertia is within the permissible inertia**

Model	Standard Electromagnetic Brake Type	NX45A□-3	NX410A□-3	NX620A□-3	NX640AS-3	NX975AS-3
		NX45M□-3	NX410M□-3	NX620M□-3	NX640MS-3	NX975MS-3
Rated Output Power	W (HP)	50 (1/15)	100 (1/8)	200 (1/4)	400 (1/2)	750 (1)
Rated Speed	r/min	3000				
Maximum Speed	r/min	5500				
Rated Torque	N·m (oz-in)	0.159 (22)	0.318 (45)	0.637 (90)	1.27 (180)	2.39 (330)
Maximum Instantaneous Torque	N·m (oz-in)	0.478 (67)	0.955 (135)	1.91 (270)	3.82 (540)	7.16 (1010)
Rotor Inertia	J: kg·m <sup>2</sup> (oz-in <sup>2</sup> )	0.0174×10 <sup>-4</sup> (0.095) [0.0217×10 <sup>-4</sup> (0.119)]*1	0.0290×10 <sup>-4</sup> (0.159) [0.0334×10 <sup>-4</sup> (0.183)]*1	0.162×10 <sup>-4</sup> (0.89) [0.185×10 <sup>-4</sup> (1.01)]*1	0.291×10 <sup>-4</sup> (1.59) [0.314×10 <sup>-4</sup> (1.72)]*1	0.948×10 <sup>-4</sup> (5.2) [1.03×10 <sup>-4</sup> (5.6)]*1
Permissible Load Inertia*2	J: kg·m <sup>2</sup> (oz-in <sup>2</sup> )	1.74×10 <sup>-4</sup> (9.5)	2.90×10 <sup>-4</sup> (15.9)	16.2×10 <sup>-4</sup> (89)	29.1×10 <sup>-4</sup> (159)	94.8×10 <sup>-4</sup> (520)
Resolution	P/R	100 to 100000 (Factory setting 1000)				

## Other Considerations

### 1. Over run and Duty cycle of AC and BL motors

Products	Induction motors	Reversible motors	Electromagnetic brake motors	Brake Pack	Clutch brake motors	Brushless DC Motors
Overrun (Revs)	30-40	5-6	2-3	1-1.5	1 or less	2-3
Duty Cycle	Continuous	30 min	30 min	---	Continuous	Continuous

### 2. Stopping accuracy and Duty cycle of Stepping motors and Servo motors

Products	0.36 deg Closed-Loop AR series	0.72 deg RK series	0.36 / 0.72 deg CRK series	0.9 / 1.8 deg UMK, RBK, CMK series PK motors	NX Servo motor
Stopping Accuracy	AR46: +/- 4 arc min. (0.067 deg) AR6[], AR9[]: +/- 3 arc min. (0.05 deg)	+/- 3 arc min (0.05 deg)	0.36 deg motor: +/- 2 arc min (0.03 deg) 0.72 deg motor: +/- 3 arc min (0.05 deg)	+/- 3 arc min (0.05 deg)	+/- 1 pulse of resolution
Duty Cycle	Continuous	Limited	Limited	Limited	Continuous

### 3. Gearhead backlash

Gearhead types	Harmonic HG	Planetary PN, PJ, PS	Taper hobbled TH	Spur SG
Backlash (Lost motion )	0 arc min. (1.5 arc min.)	PN, PJ: 2-3 arc min. PS: 15-25 arc min.	10-45 arc min.	45-90 arc min.