1326AB Servomotor Performance Data

The following section contains 1326AB performance data. Included is a Selection List detailing the performance parameters of selected amplifier/ motor combinations, followed by typical speed-torque curves.

1389 Servo System Selection List [1, 2]

Continuous Stall Torque (lb.-in./N-m)	Peak Stall Torque (lb.-in./N-m)	1391B Rated Speed (rpm)	Motor Catalog Number	Servo Amplifier Catalog Number	Amperes at Continuous Torque	Rotor Inertia (lb.-in.-s ^{2}/kg-m ^{2})	Rated Output (kW)
16/1.8	32/3.6	5000	1326AB-A1G	1389-AA045	4.5	0.004/0.0005	0.7
32/3.6	64/7.23	3000	1326AB-A2E	1389-AA09	5.2	0.007/0.0008	0.8
48/5.4	96/10.84	3000	1326AB-A3E	1389-AA09	7.8	0.010/0.001	1.2
102/11.5	204/23.0	3000	1326AB-B2E	1389-AA17	16.4	0.05/0.006	2.5

1391B Servo System Selection List [1, 2]

Continuous Stall Torque (lb.-in./N-m)	Peak Stall Torque (lb.-in./N-m)	1391B Rated Speed (rpm)	Motor Catalog Number	Servo Amplifier Catalog Number	Amperes at Continuous Torque	Rotor Inertia (lb.-in.-s ^{2}/kg-m ^{2})	Rated Output (kW)
16/1.8	48/5.4	5000	1326AB-A1G	1391B-AA15	4.5	0.004/0.0005	0.9
32/3.6	96/10.84	3000	1326AB-A2E	1391B-AA15	5.2	0.007/0.0008	1.1
48/5.4	96/10.84	3000	1326AB-A3E	1391B-AA15	7.8	0.010/0.001	1.2
93.3/10.53	186.6/21.0	3000	1326AB-B2E	1391B-AA15	15.0	0.05/0.006	2.28
102/11.5	204/23.0	3000	1326AB-B2E	1391B-AA22	16.4	0.05/0.006	2.5
140/15.8	280/31.6	3000	1326AB-B3E	1391B-AA22	22.5	0.08/0.009	3.5
153/17.3	306/34.6	3000	1326AB-B3E	1391B-AA45	24.6	0.08/0.009	3.8
210/23.7	420/47.5	3000	1326AB-C2E	1391B-AA45	33.2	0.14/0.015	5.2
310/35.0	568/64.1	3000	1326AB-C3E	1391B-AA45	49.1	0.22/0.024	7.5
420/47.4	811/91.7	2000	1326AB-C4C	1391B-AA45	46.6	0.29/0.032	7.0
420/47.4	840/94.8	1600	1326AB-C4B	1391B-AA45	38.2	0.29/0.032	5.6

1391B-ES/1391-DES Servo System Selection List [1, 2]

Continuous Stall Torque (lb.-in./N-m)	Peak Stall Torque (lb.-in./N-m)	1391B Rated Speed (rpm)	Motor Catalog Number	Servo Amplifier Catalog Number [4]	Amperes at Continuous Torque	Rotor Inertia (lb.-in.-s ^{2}/kg-m ^{2})	Rated Output (kW)
16/1.8	48/5.4	6000	1326AB-A1G	1391B-ESAA15	4.5	0.004/0.0005	0.9
32/3.6	96/10.84	4000	1326AB-A2E	1391B-ESAA15	5.2	0.007/0.0008	1.1
48/5.4	144/16.3	4000	1326AB-A3E	1391B-ESAA15	7.8	0.010/0.001	1.6
93.3/10.53	170.7/19.3	4000	1326AB-B2E	1391B-ESAA15	15.0	0.05/0.006	3.0
102/11.5	279/31.5	4000	1326AB-B2E	1391B-ESAA22	16.4	0.05/0.006	3.3
140/15.8	280/31.6	4000	1326AB-B3E	1391B-ESAA22	22.5	0.08/0.009	4.7
153/17.3	459/51.9	4000	1326AB-B3E	1391B-ESAA45	24.6	0.08/0.009	5.1
210/23.7	569/64.3	4000	1326AB-C2E	1391B-ESAA45	33.2	0.14/0.015	6.9
310/35.0	568/64.1	4000	1326AB-C3E	1391B-ESAA45	49.1	0.22/0.024	10.0
420/47.4	811/91.7	3000	1326AB-C4C	1391B-ESAA45	46.6	0.29/0.032	9.3[3]
420/47.4	989/111.8	2000	1326AB-C4B	1391B-ESAA45	38.2	0.29/0.032	7.5

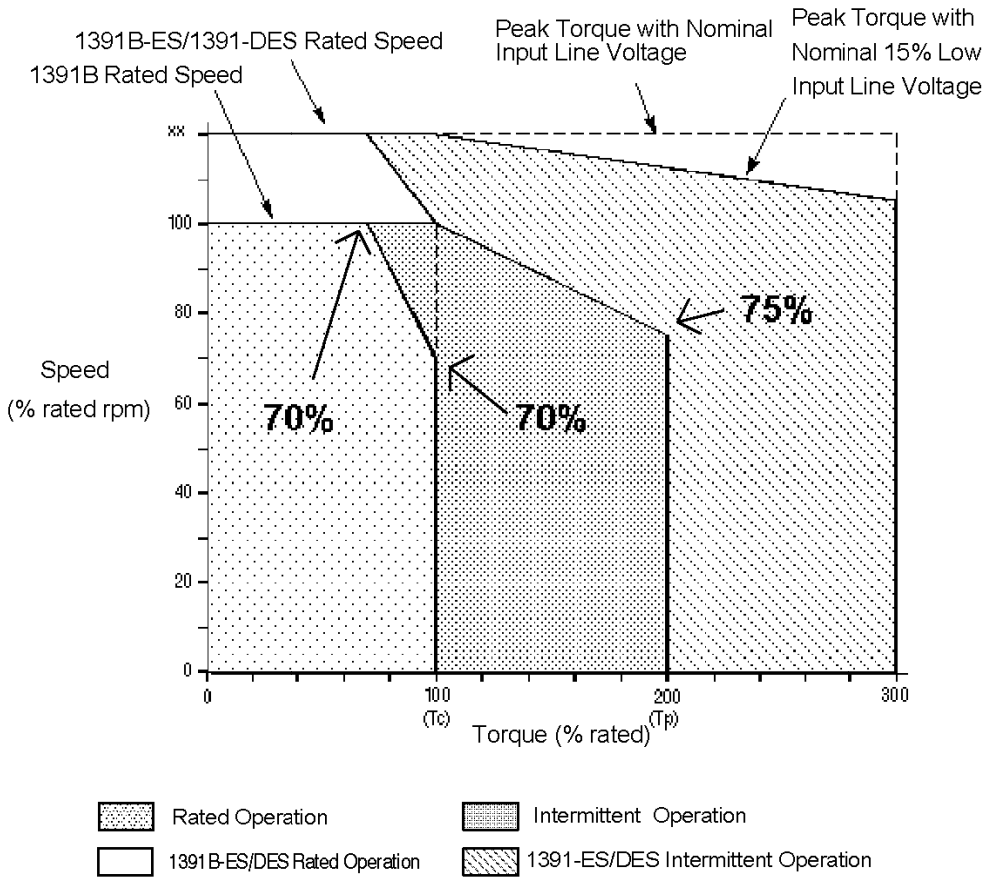
1 All ratings are for 40° C motor ambient, 110° C case and 60° C amplifier ambient. For extended ratings at lower ambients contact Allen-Bradley.

2 The motor contains two thermal switches wired in series that will open on an overtemperature condition. They are set to open at 150° C (typical) and close at 90-100° C (typical). Contacts are rated for 1A at 115V AC, 1A at 24V DC.

3 -10% line voltage maximum.

4 Use either 1391B-ES or 1391-DES drives.

Figure 1 Typical 1326AB Speed-Torque Curve



Speed-Torque Curves

Typical speed-torque curves for the standard 1326AB servomotors are contained on the following pages. Definitions of the terms used are provided below.

Tc - rated torque of motor with windings at rated temperature and an ambient of 40° C. The controller is operating in a rated ambient of 60° C.

Tp - the peak torque that can be produced by the motor/controller combination with both at rated temperature and the motor in a 40° C ambient and the controller in a 60° C ambient. Since 200% current torque peaks are common in many applications for optimal controller usage, the following curves show typical system performance. Higher peak torques are permissible where RMS torque is less than or equal to the rated torque (Tc). 1391B-ES/1391-DES operation is shown in the outer envelope and will show higher speed and 300% torque capability.

Rated Speed - the operating speed of the controller and motor combination at which a minimum of 70% of continuous rated torque (Tc) can be developed. This point is defined with the motor at 25° C and controller operating in a 60° C ambient.

Rated Operation Area - boundary of speed-torque curve where the motor and controller combination may operate on a servo basis without exceeding the RMS rating of either. See page NO TAG for formula details.

$$\text{RMS Torque} = \sqrt{\frac{Tpa^2 \times t_1 + Tss^2 \times t_2 + Tpd^2 \times t_3 + Tr^2 \times t_4}{t_1 + t_2 + t_3 + t_4}}$$

Intermittent Operation Area - Boundary of speed-torque curve where the motor and controller combination may operate in acceleration-deceleration mode without exceeding peak rating of either, provided that the duty cycle RMS continuous torque limit is not exceeded.

Continuous Current - Rated current of motor with windings at rated temperature and an ambient of 40° C. The controller is operating in a rated ambient of 60° C.

Peak Current - The amount of current which can be applied to the motor without causing damage to the motor.

Mechanical Time Constant - Time taken by the motor to reach 63% of final speed when a step voltage is applied.

Electrical Time Constant - The time required for the motor to reach 63% of rated current.

Max. Ambient Temperature - Maximum environmental temperature in which the motor can be operated at rated loads without exceeding its insulation type temperature rise limits.

Insulation Class - Designation of operating temperature limits of the motor insulation materials.

Thermal Time Constant - Time for motor windings to reach 63% of continuous temperature rise with constant watts loss.

Torque Constant - At the stated motor temperature the amount of torque developed for one ampere of motor current.

Voltage Constant - Value of the generated voltage at a specified speed when the rotor is moved mechanically in the magnetic field.

Terminal Resistance - Winding resistance.

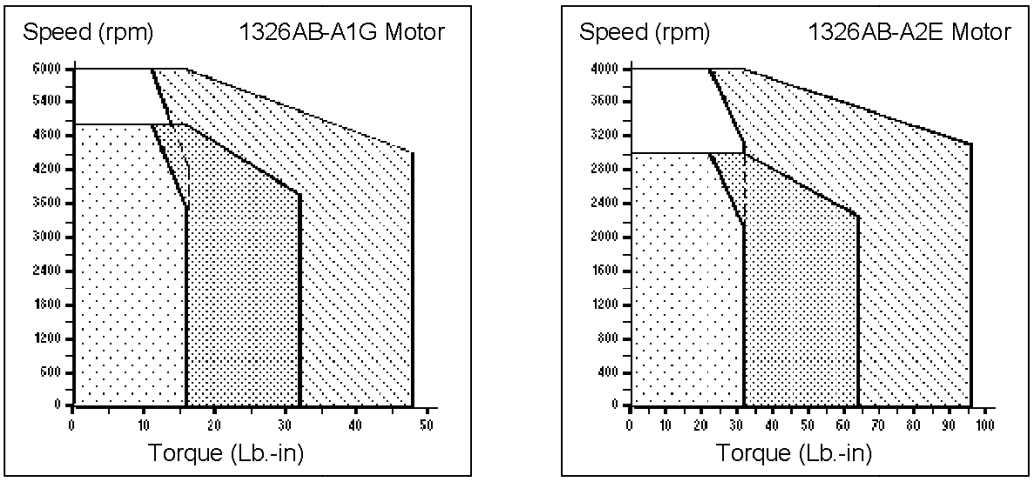
Inductance - Winding inductance measured by a step input of zero impedance voltage applied to the locked rotor.

Rotor Polar Moment of Inertia - Moment of inertia about the axis of rotation.

Motor Weight - Weight of the complete motor (including brake, if supplied) less the weight of options.

Balance - Compensation of rotor weight distribution to reduce vibrational resonance. Motors are factory balanced under running speeds.

Figure 2 1326AB-A1G and A2E Motor Performance Curves



Speed-torque curves show the rated performance of the servomotor in a 40 degree C ambient. Motor is at full rated temperature. Motor windings are at 150 degrees C with a 110 degree C rise over ambient. Motor case temperature is at approximately 100 degrees C.

Important: Curves and performance data shown are for motor and amplifier combinations where amplifier rating is equal to or greater than Ic of motor

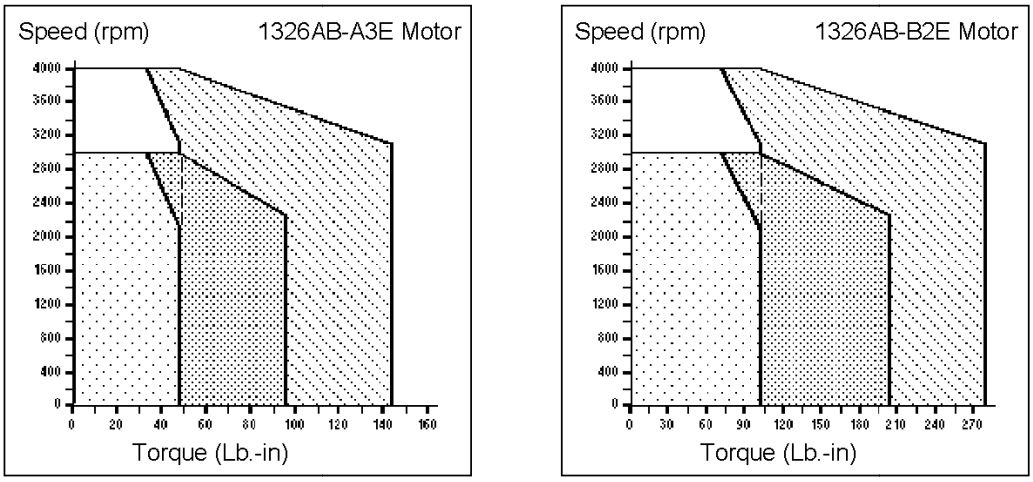
Category	Parameter		Units	1326AB-A1G	1326AB-A2E
General	Continuous Stall Torque at 40° C Ambient		lb.-in. (N-m)	16.0 (1.8)	32.0 (3.6)
	Rated Output/1391B-ES, DES Rated Output		kW	0.7/0.9	0.8/1.1
	Peak Stall Torque/1391B-ES, DES Peak Stall Torque [3]		lb.-in. (N-m)	32.0 (3.6)/48.0 (5.4)	64.0 (7.2)/96.0 (10.8)
	Continuous Stall Current [3]		amperes	4.5	5.2
	Peak Stall Current/1391B-ES, DES Peak Stall Current [3]		amperes	9.0/13.5	10.4/15.6
	Mechanical Time Constant [3]		milliseconds	10.0	9.2
	Electrical Time Constant [3]		milliseconds	3.4	3.4
	Rated Speed/1391B-ES, DES Rated Speed [3]		rpm	5000/6000	3000/4000
Thermal	Maximum Ambient Temperature (without derating)		degrees C	40.0	40.0
	Insulation Class			H	H
	Thermal Time Constant		minutes	23	33
Winding	Torque Constant	at 25° C	lb.-in. (N-m)/A	4.18 (0.47)	7.23 (0.82)
	Voltage Constant	RMS (L-L) at 25° C	volts/1000 rpm	28.5	49.5
	Terminal Resistance	ohms (L-L) at 25° C	ohms	1.9	2.89
	Inductance	mH (L-L) at 25° C	millihenry	8.4	12.7
Mechanical	Rotor Polar Moment of Inertia		lb.-in.-s^2 (kg-m^2)	0.004 (0.0005)	0.007 (0.0008)
	Motor Weight		lbs. (kg)	22 (10.0)	28 (12.7)
	Balance [1]		in. (mm) [2]	0.0005 (0.0127)	0.0005 (0.0127)

[1] To obtain vibration velocity in inches (mm)/second use the following formula: $V_V = (D_{p\text{-}p} \times rpm) / 27.01$
where: $D_{p\text{-}p}$ = peak-peak displacement in in. (mm)
V_V = Vibration velocity in in. (mm)/second
rpm = motor speed

[2] peak-peak displacement

[3] at 40° C

Figure 3 1326AB-A3E and B2E Motor Performance Curves



1391B Rated Operation

1391B Intermittent Operation

1391B-ES/1391-DES Rated Operation

1391B-ES/1391-DES Intermittent Operation

Speed-torque curves show the rated performance of the servomotor in a 40 degree C ambient. Motor is at full rated temperature. Motor windings are at 150 degrees C with a 110 degree C rise over ambient. Motor case temperature is at approximately 100 degrees C.

Important: Curves and performance data shown are for motor and amplifier combinations where amplifier rating is equal to or greater than Ic of motor

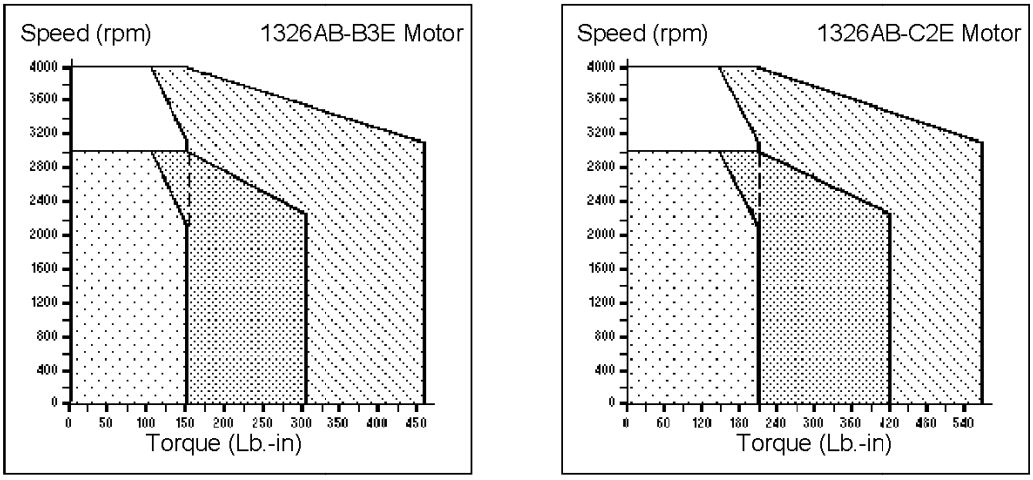
Category	Parameter		Units	1326AB-A3E	1326AB-B2E
General	Continuous Stall Torque at 40° C Ambient		lb.-in. (N-m)	48.0 (5.4)	102.0 (11.5)
	Rated Output/1391B-ES, DES Rated Output		kW	1.2/1.6	2.5/3.3
	Peak Stall Torque/1391B-ES, DES Peak Stall Torque [3]		lb.-in. (N-m)	96.0 (10.84)/144.0 (16.3)	204 (23.0)/279 (31.5)
	Continuous Stall Current [3]		amperes	7.8	16.4
	Peak Stall Current/1391B-ES, DES Peak Stall Current [3]		amperes	15.6/23.4	32.8/44.9
	Mechanical Time Constant [3]		milliseconds	8.6	7.8
	Electrical Time Constant [3]		milliseconds	3.4	7.7
	Rated Speed/1391B-ES, DES Rated Speed [3]		rpm	3000/4000	3000/4000
Thermal	Maximum Ambient Temperature (without derating)		degrees C	40.0	40.0
	Insulation Class			H	H
	Thermal Time Constant		minutes	38	56
Winding	Torque Constant	at 25° C	lb.-in. (N-m)/A	7.24 (0.82)	7.31 (0.83)
	Voltage Constant	RMS (L-L) at 25° C	volts/1000 rpm	49.5	49.9
	Terminal Resistance	ohms (L-L) at 25° C	ohms	1.9	0.35
	Inductance	mH (L-L) at 25° C	millihenry	8.4	3.52
Mechanical	Rotor Polar Moment of Inertia		lb.-in.-s^2 (kg-m^2)	0.010 (0.001)	0.050 (0.006)
	Motor Weight		lbs. (kg)	37 (16.8)	61 (27.7)
	Balance [1]		in. (mm) [2]	0.0005 (0.0127)	0.0005 (0.0127)

[1] To obtain vibration velocity in inches (mm)/second use the following formula: $V_V = (D_{p-p} \times rpm) / 27.01$
where: D_{p-p} = peak-peak displacement in in. (mm)
V_V = Vibration velocity in in. (mm)/second
rpm = motor speed

[2] peak-peak displacement

[3] at 40° C

Figure 4 1326AB-B3E and C2E Motor Performance Curves



1391B Rated Operation

1391B Intermittent Operation

1391B-ES/1391-DES Rated Operation

1391B-ES/1391-DES Intermittent Operation

Speed-torque curves show the rated performance of the servomotor in a 40 degree C ambient. Motor is at full rated temperature. Motor windings are at 150 degrees C with a 110 degree C rise over ambient. Motor case temperature is at approximately 100 degrees C.

Important: Curves and performance data shown are for motor and amplifier combinations where amplifier rating is equal to or greater than Ic of motor

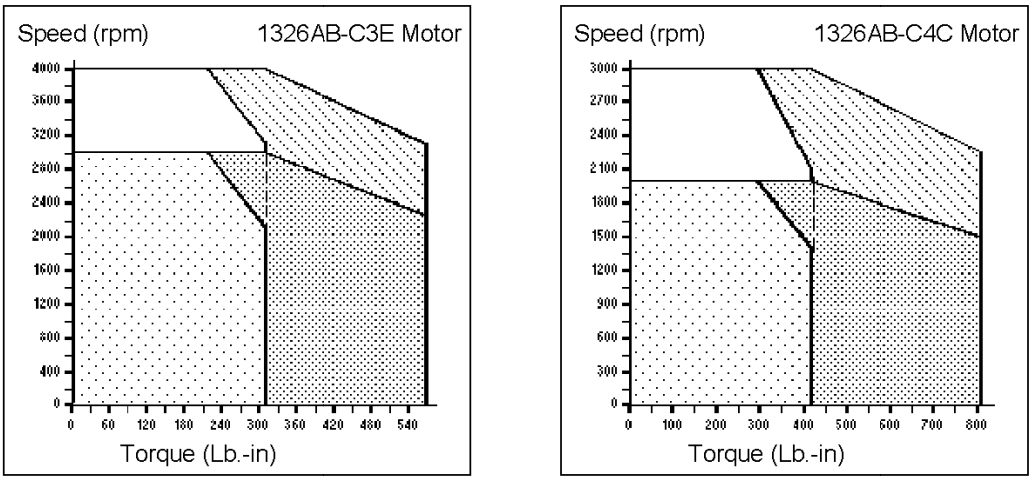
Category	Parameter		Units	1326AB-B3E	1326AB-C2E
General	Continuous Stall Torque at 40° C Ambient		lb.-in. (N-m)	153.0 (17.3)	210.0 (23.7)
	Rated Output/1391B-ES, DES Rated Output		kW	3.8/5.1	5.2/6.9
	Peak Stall Torque/1391B-ES, DES Peak Stall Torque [3]		lb.-in. (N-m)	306.0 (34.6)/459.0 (51.9)	420.0 (47.4)/569.0 (64.3)
	Continuous Stall Current [3]		amperes	24.6	33.2
	Peak Stall Current/1391B-ES, DES Peak Stall Current [3]		amperes	49.2/73.8	66.4/90
	Mechanical Time Constant [3]		milliseconds	8.6	5.3
	Electrical Time Constant [3]		milliseconds	7.4	13.1
	Rated Speed/1391B-ES, DES Rated Speed [3]		rpm	3000/4000	3000/4000
Thermal	Maximum Ambient Temperature (without derating)		degrees C	40.0	40.0
	Insulation Class			H	H
	Thermal Time Constant		minutes	66	71
Winding	Torque Constant	at 25° C	lb.-in. (N-m)/A	7.3 (0.82)	7.44 (0.84)
	Voltage Constant	RMS (L-L) at 25° C	volts/1000 rpm	49.9	50.5
	Terminal Resistance	ohms (L-L) at 25° C	ohms	0.234	0.088
	Inductance	mH (L-L) at 25° C	millihenry	2.35	1.5
Mechanical	Rotor Polar Moment of Inertia		lb.-in.-s^2 (kg-m^2)	0.080 (0.009)	0.140 (0.015)
	Motor Weight		lbs. (kg)	76 (34.5)	102 (46.3)
	Balance [1]		in. (mm) [2]	0.0005 (0.0127)	0.0005 (0.0127)

[1] To obtain vibration velocity in inches (mm)/second use the following formula: $V_V = (D_{p-p} \times rpm) / 27.01$
where: D_{p-p} = peak-peak displacement in in. (mm)
V_V = Vibration velocity in in. (mm)/second
rpm = motor speed

[2] peak-peak displacement

[3] at 40° C

Figure 5 1326AB-C3E and C4C Motor Performance Curves



Speed-torque curves show the rated performance of the servomotor in a 40 degree C ambient. Motor is at full rated temperature. Motor windings are at 150 degrees C with a 110 degree C rise over ambient. Motor case temperature is at approximately 100 degrees C.

Important: Curves and performance data shown are for motor and amplifier combinations where amplifier rating is equal to or greater than Ic of motor

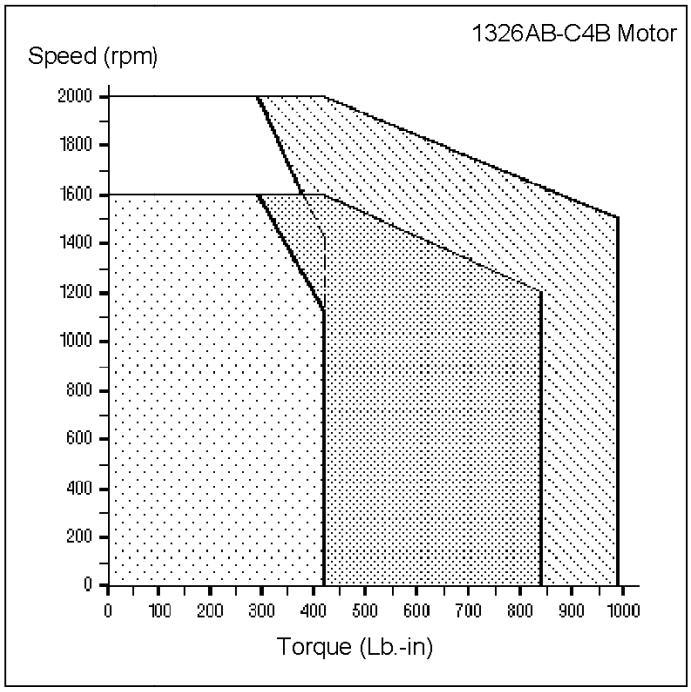
Category	Parameter		Units	1326AB-C3E	1326AB-C4C
General	Continuous Stall Torque at 40° C Ambient		lb.-in. (N-m)	310.0 (35.0)	420.0 (47.5)
	Rated Output/1391B-ES, DES Rated Output		kW	7.5/10.0	7.0/9.3
	Peak Stall Torque/1391B-ES, DES Peak Stall Torque [3]		lb.-in. (N-m)	568.0 (64.1)/568.0 (64.1)	811.0 (91.7)/811.0 (91.7)
	Continuous Stall Current [3]		amperes	49.1	46.6
	Peak Stall Current/1391B-ES, DES Peak Stall Current [3]		amperes	90.0/90.0	90.0/90.0
	Mechanical Time Constant [3]		milliseconds	6.0	5.6
	Electrical Time Constant [3]		milliseconds	13.0	13.1
	Rated Speed/1391B-ES, DES Rated Speed [3]		rpm	3000/4000	2000/3000
Thermal	Maximum Ambient Temperature (without derating)		degrees C	40.0	40.0
	Insulation Class			H	H
	Thermal Time Constant		minutes	86.0	95.0
Winding	Torque Constant	at 25° C	lb.-in. (N-m)/A	7.44 (0.84)	10.6 (1.20)
	Voltage Constant	RMS (L-L) at 25° C	volts/1000 rpm	50.5	72.4
	Terminal Resistance	ohms (L-L) at 25° C	ohms	0.059	0.09
	Inductance	mH (L-L) at 25° C	millihenry	1.0	1.54
Mechanical	Rotor Polar Moment of Inertia		lb.-in.-s^2 (kg-m^2)	0.220 (0.024)	0.290 (0.032)
	Motor Weight		lbs. (kg)	138 (62.6)	170 (77.1)
	Balance [1]		in. (mm) [2]	0.0005 (0.0127)	0.0005 (0.0127)

[1] To obtain vibration velocity in inches (mm)/second use the following formula: $V_V = (D_{p-p} \times rpm) / 27.01$
where: D_{p-p} = peak-peak displacement in in. (mm)
V_V = Vibration velocity in in. (mm)/second
rpm = motor speed

[2] peak-peak displacement

[3] at 40° C

Figure 6 1326AB-C4B Motor Performance Curves



1391B Rated Operation | 1391B Intermittent Operation | 1391B-ES/1391-DES Rated Operation | 1391B-ES/1391-DES Intermittent Operation

Speed-torque curves show the rated performance of the servomotor in a 40 degree C ambient. Motor is at full rated temperature. Motor windings are at 150 degrees C with a 110 degree C rise over ambient. Motor case temperature is at approximately 100 degrees C.

Important: Curves and performance data shown are for motor and amplifier combinations where amplifier rating is equal to or greater than Ic of motor

Category	Parameter		Units	1326AB-C4B
General	Continuous Stall Torque at 40° C Ambient		lb.-in. (N-m)	420.0 (47.5)
	Rated Output/1391B-ES, DES Rated Output		kW	5.6/7.5
	Peak Stall Torque/1391B-ES, DES Peak Stall Torque [3]		lb.-in. (N-m)	840.0 (94.8)/989.0 (111.8)
	Continuous Stall Current [3]		amperes	38.2
	Peak Stall Current/1391B-ES, DES Peak Stall Current [3]		amperes	76.4/90
	Mechanical Time Constant [3]		milliseconds	5.4
	Electrical Time Constant [3]		milliseconds	13.25
	Rated Speed/1391B-ES, DES Rated Speed [3]		rpm	1600/2000
Thermal	Maximum Ambient Temperature (without derating)		degrees C	40.0
	Insulation Class			H
	Thermal Time Constant		minutes	95.0
Winding	Torque Constant	at 25° C	lb.-in. (N-m)/A	13.0 (1.47)
	Voltage Constant	RMS (L-L) at 25° C	volts/1000 rpm	89.5
	Terminal Resistance	ohms (L-L) at 25° C	ohms	0.133
	Inductance	mH (L-L) at 25° C	millihenry	2.212
Mechanical	Rotor Polar Moment of Inertia		lb.-in.-s^2 (kg-m^2)	0.29 (0.032)
	Motor Weight		lbs. (kg)	170 (77.1)
	Balance [1]		in. (mm) [2]	0.0005 (0.0127)

[1] To obtain vibration velocity in inches (mm)/second use the following formula: $V_V = (D_{p-p} \times rpm) / 27.01$
where: D_{p-p} = peak-peak displacement in in. (mm)
V_V = Vibration velocity in in. (mm)/second
rpm = motor speed

[2] peak-peak displacement

[3] at 40° C