



ELECTRICAL ENGINEERING Co.

- **RESEARCH AND DEVELOPMENT**
- **MANUFACTURING**
- **INTERNATIONAL BUSINESS**

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QUALITY-ENVIRONMENT INTEGRATE SYSTEM



BSM Series Brushless Servo Motor Manual

Use of Motors

Servo motors are intended to drive machinery. As such, they must be part of a controlled system that includes a transistorized electronic amplifier. They are not intended for direct connection to the power supply or for use with thyristor drives. Instructions in the amplifier and control system manuals must be observed; this document does not replace those instructions.

Unless specified otherwise, servo motors are intended for use in a normal industrial environment without exposure to excessive or corrosive moisture or abnormal ambient temperatures. The exact operating conditions may be established by referring to the data for the motor. The mating of motors to machinery is a skilled operation; disassembly or repair must not be attempted. In the event that a motor fails to operate correctly, contact the place of purchase for return instructions.

Safety Notes

There are some possible hazards associated with the use of motors. The following precautions should be observed. Specific Warnings and Cautions are listed inside the back cover.

Installation and Maintenance: Installation and maintenance or replacement must be carried out by suitably qualified service personnel, paying particular attention to possible electrical and mechanical hazards.

Flying leads: Ensure that flying or loose leads are suitably restrained, to prevent snagging or entanglement, before carrying motors with such leads.

Generation: If the motor is driven mechanically, it may generate hazardous voltages at its power input terminals. The power connector must be suitably guarded to prevent a possible shock hazard.

Loose motors: When running an unmounted motor, ensure that the rotating shaft is adequately guarded and the motor is physically restrained to prevent it from moving. Remove the key which otherwise could fly out when the motor is running.

Damaged cables: Damage to cables or connectors may cause an electrical hazard. Ensure there is no damage before energizing the system.

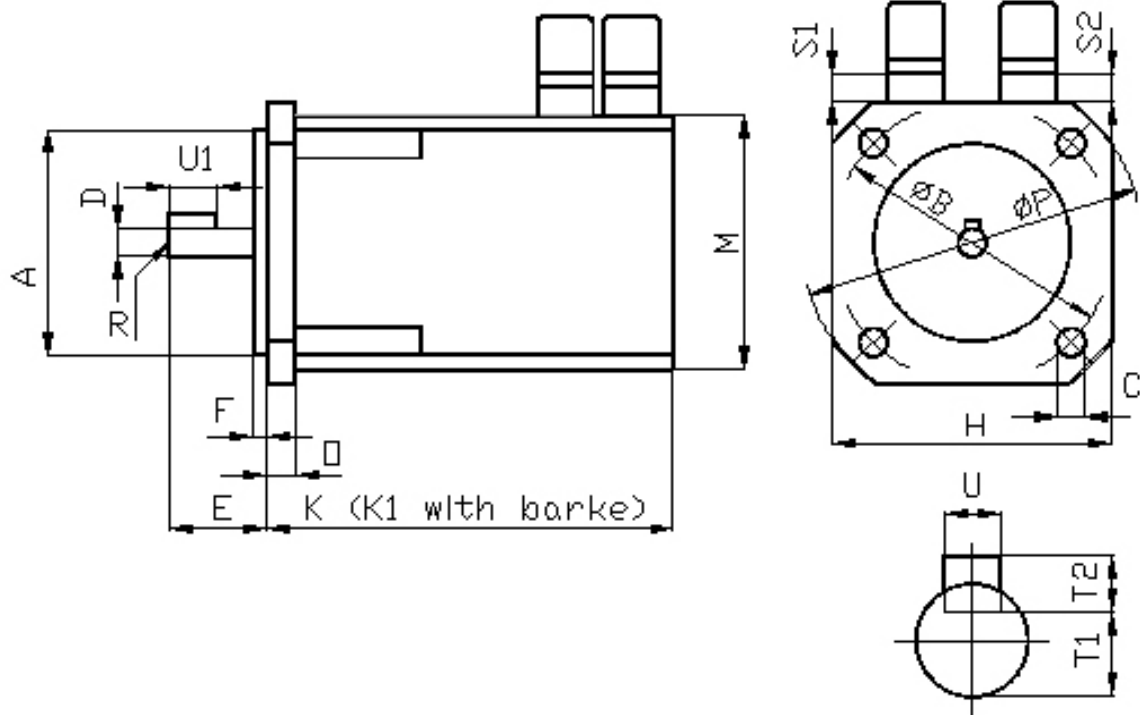
Supply: Servo motors must not be directly connected to a power supply; they require an electronic drive system. Consult the instructions for the drive system before energizing or using the motor.

Brakes: The brakes that are included on motors are holding brakes only and are not to be used as a mechanical restraining device for safety purposes.

Safety requirements: The safe incorporation of this product into a machine system is the responsibility of the machine designer, who should comply with the local safety requirements at the place where the machine is to be used. In Europe this is likely to be the Machinery Directive.

Mechanical connection: Motors must be connected to the machine with a torsionally rigid coupler or a reinforced timing belt. Couplers which are not rigid will cause difficulty in achieving an acceptable response from the control system. Couplings and pulleys must be tight as the high dynamic performance of a servo motor can easily cause couplings to slip, and thereby damage the shaft and cause instability. Care must be taken in aligning couplings and tightening belts so that the motor is not subjected to significant bearing loads, or premature bearing wear will occur. Once connected to a load, tuning will be affected. A system tuned without a load will probably require retuning once a load is applied.

Connectors: Motor power connectors are for assembly purposes only. They should not be connected or disconnected while power is applied.

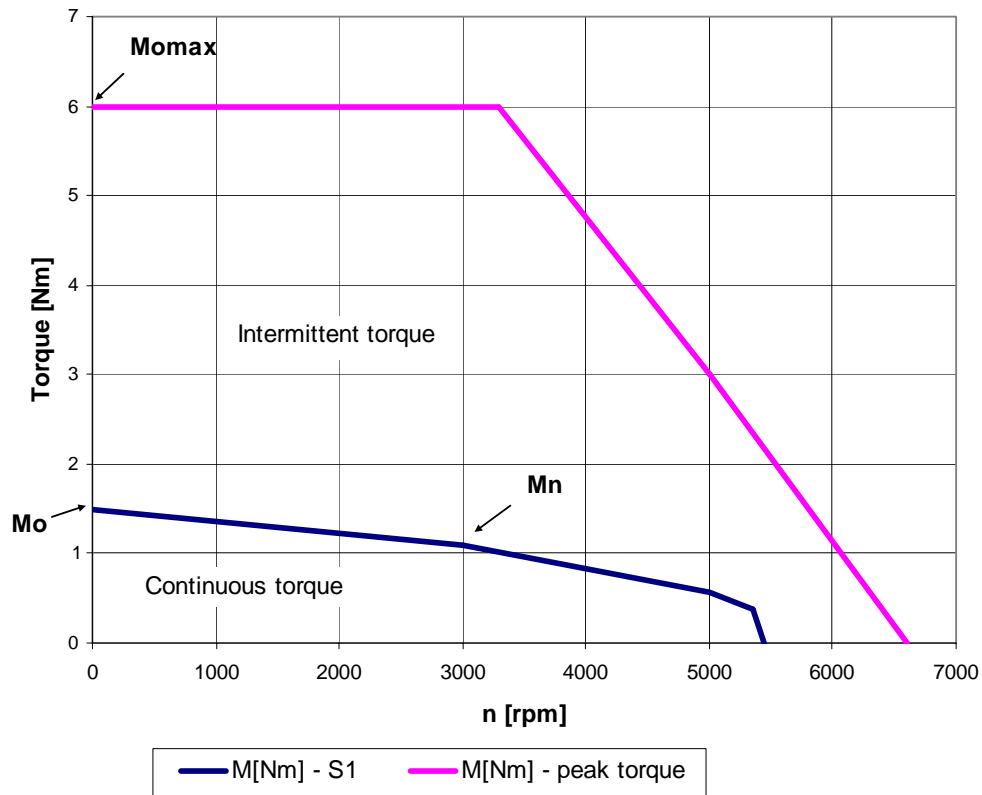


size	A J6	B	C	D k6	E	F	H	K	K1	M	O	P	R	S1	S2	T1	T2 h9	U h9	U1
0.1	40	63	5,8	9	24	2,5	55	118	151	55	8	74	M3.10	39	39	7,2	3	3	14
0.2	40	63	5,8	9	24	2,5	55	143	176	55	8	74	M3.10	39	39	7,2	3	3	14
0.3	40	63	5,8	9	24	2,5	55	163	196	55	8	74	M3.10	39	39	7,2	3	3	14
0.4	40	63	5,8	9	24	2,5	55	183	216	55	8	74	M3.10	39	39	7,2	3	3	14
0.5	40	63	5,8	9	24	2,5	55	254	287	55	8	74	M3.10	39	39	7,2	3	3	14
1.1	80	100	7	14	30	3	88	132	173	82	10	115	M4.12	36	36	11,1	5	5	20
1.2	80	100	7	14	30	3	88	152	193	82	10	115	M4.12	36	36	11,1	5	5	20
1.3	80	100	7	14	30	3	88	172	213	82	10	115	M4.12	36	36	11,1	5	5	20
1.4	80	100	7	14	30	3	88	192	233	82	10	115	M4.12	36	36	11,1	5	5	20
1.5	80	100	7	14	40	3	88	222	263	82	10	115	M4.12	36	36	11,1	5	5	20
2.1	95	115	9	19	40	3	105	198	238	105	12	135	M6.15	39	39	15,5	6	6	30
2.2	95	115	9	19	40	3	105	228	268	105	12	135	M6.15	39	39	15,5	6	6	30
2.3	95	115	9	19	40	3	105	248	288	105	12	135	M6.15	39	39	15,5	6	6	30
2.4	95	115	9	19	40	3	105	293	333	105	12	135	M6.15	39	39	15,5	6	6	30
3.1	130	165	11	24	50	3,5	145	280	323	145	12	188	M8.25	39	39	19,9	8	8	40
3.2	130	165	11	24	50	3,5	145	320	363	145	12	188	M8.25	39	39	19,9	8	8	40
3.3	130	165	11	24	50	3,5	145	440	483	145	12	188	M8.25	39	39	19,9	8	8	40

Size	Dim.	P _N (kW)	M _N (Nm)	Mo[Nm]	Mom[Nm]	In[A]	Io[A]	J [kgcm ²]	m[kg]	m+BR[kg]	R[Ohm]	L[mH]	k _E [V]	k _T [Nm/A]
BSM 55 - 0020 - 3	0.1	0.04	0.13	0.2	0.8	0.3	0.4	0.05	0.83	1.2	122	66.5	30	0.50
BSM 55 - 0050 - 3	0.2	0.13	0.35	0.5	1	0.9	1.2	0.1	1.3	1.6	18,3	13	26	0.43
BSM 55 - 0070 - 3	0.3	0.19	0.5	0.7	2.8	1.2	1.6	0.15	1.6	1.8	11.9	14.3	28	0.46
BSM 55 - 0070 - 6	0.3	0.19	0.5	0.7	2.8	0.7	0.9	0.15	1.6	1.8	32	28	47	0.78
BSM 55 - 0085 - 3	0.4	0.29	0.74	0.85	3.4	1.7	1.9	0.2	1.9	2.2	8.9	9.3	28	0.46
BSM 55 - 0085 - 6	0.4	0.29	0.74	0.85	3.4	0.9	1.1	0.2	1.9	2.2	28	23	50	0.83
BSM 55 - 0150 - 3	0.5	0.54	1.35	1.5	6	3.1	3.4	0.33	2.8	3.1	3.8	4.6	28	0.46
BSM 55 - 0150 - 6	0.5	0.54	1.35	1.5	6	1.7	1.9	0.33	2.8	3.1	13.7	13.9	51	0.84
BSM 88 - 0100 - 3	1.1	0.23	0.66	1	4	1.6	2.4	0.3	2	2.8	6.3	14.3	26	0.43
BSM 88 - 0100 - 6	1.1	0.23	0.66	1	4	1.0	1.4	0.3	2	2.8	18.4	39	44	0.73
BSM 88 - 0170 - 3	1.2	0.38	1.1	1.7	6.2	2.3	3.6	0.68	2.9	3.7	3.3	9.2	30	0.50
BSM 88 - 0170 - 6	1.2	0.38	1.1	1.7	6.2	1.4	2.2	0.68	2.9	3.7	7.7	24	50	0.83
BSM 88 - 0260 - 3	1.3	0.63	1.8	2.6	10.4	3.8	5.5	1	3.7	4.5	1.7	6	30	0.50
BSM 88 - 0260 - 6	1.3	0.63	1.8	2.6	10.4	1.9	2.8	1	3.7	4.5	5.2	16.7	59	0.98
BSM 88 - 0350 - 3	1.4	0.92	2.5	3.5	14	4.8	6.6	1.4	4.3	5.5	1.1	4.3	33.5	0.55
BSM 88 - 0350 - 6	1.4	0.92	2.5	3.5	14	3.1	4.3	1.4	4.3	5.5	2.8	10.8	52	0.86
BSM 88 - 0420 - 3	1.5	1.21	3.2	4.2	16.8	6.2	8.1	1.8	5.4	6.7	0.8	3.2	33	0.55
BSM 88 - 0420 - 6	1.5	1.21	3.2	4.2	16.8	3.7	4.8	1.8	5.4	6.7	2.4	9.3	55	0.91
BSM 105 - 0450 - 3	2.1	1.34	3.5	4.5	18	6.4	8.2	2.4	6	6.9	1	5.5	35	0.58
BSM 105 - 0450 - 6	2.1	1.34	3.5	4.5	18	3.7	4.8	2.4	6	6.9	2.8	13.6	60	0.99
BSM 105 - 0650 - 3	2.2	2.01	5.2	6.5	26	11.1	13.8	3.2	7.6	9.5	0.4	2.3	30	0.50
BSM 105 - 0650 - 6	2.2	2.01	5.2	6.5	26	4.9	6.1	3.2	7.6	9.5	2	11.3	68	1.12
BSM 105 - 0750 - 3	2.3	2.72	6.8	7.5	30	13.0	14.4	3.6	8.5	11.4	0.47	1.9	33	0.55
BSM 105 - 0750 - 6	2.3	2.72	6.8	7.5	30	7.1	7.9	3.6	8.5	11.4	1.5	8.4	60	0.99
BSM 105 - 1000 - 6	2.4	3.48	8.7	10	40	10.3	11.8	4.5	16	19	0.8	4.4	54	0.89
BSM 145 - 1500 - 6	3.1	4.02	11	15	30	12.0	16.4	5.3	19.5	24	0.6	6.1	58	0.96
BSM 145 - 2000 - 6	3.2	5.03	15	20	40	18.5	26.5	6.7	22	28	0.3	3.2	48	0.79
BSM 145 - 3000 - 6	3.3	8.38	22	30	60	22.0	29.3	11.2	30	34	0.3	3.8	65	1.08

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Torque v. speed



n_N - Nominal speed

P_N - Nominal power

M_N - Nominal torque

M_o - Static torque - continuous standstill torque

M_{omax} - Maximum static torque - maximum intermittent static torque

I_N - Nominal current ($\pm 10\%$)

I_o - Static current ($\pm 10\%$)

J - Moment of inertia including resolver (without brake)

m - Weight of the motor (weight of the motor with brake)

R - Line to line motor resistance (25°C) ($\pm 10\%$)

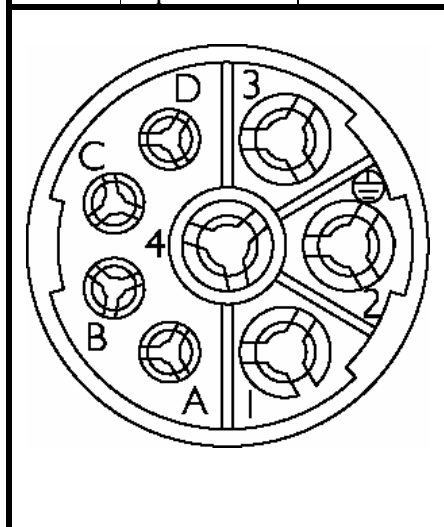
L - Line to line motor inductivity ($\pm 20\%$)

k_E - Electromotive force [V] at 1000 rpm ($\pm 10\%$)

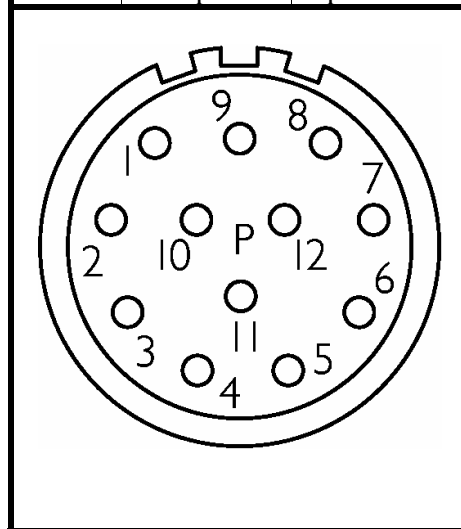
k_T - Torque constant ($\pm 10\%$)

Connectors Data

	Power Connector	Power Cable
Pin	Signal	
1	PHASE R	1
2	GROUND	SHIELD +GROUND
3	PHASE S	2
4	PHASE T	3
A	Brake (+24V)	Red
B	Brake (0V)	Blue
C	Open	
D	Open	



	Resolver Connector	Resolver Cable
Pin	Signal	
1	Sin +	WHITE
2	Sin -	BROWN
3	Cos +	GREEN
4	Cos -	YELLOW
5	PTC	RED
6	PTC	BLUE
7	Carrier -	PINK
8	Carrier +	GREY
9	Open	Open
10	Open	Open
11	Open	Open
12	Open	Open

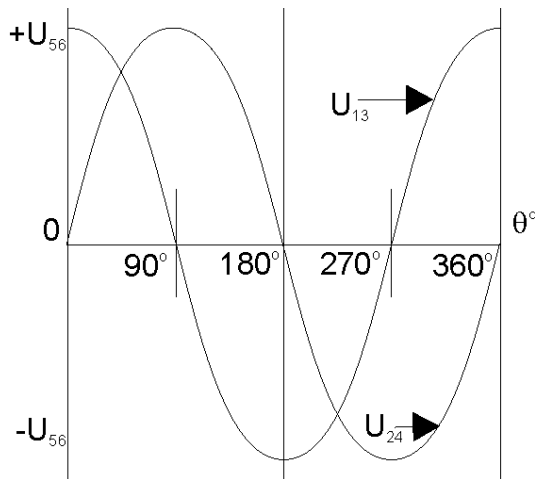


Resolver data

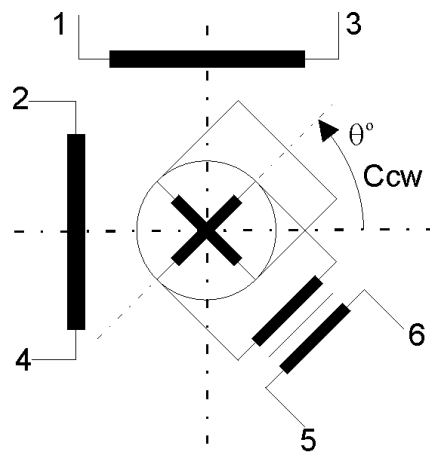
Specification	Size 0, 1, 2	Size 3
Primary	Rotor	Rotor
Speed	One	One
Power supply condition (*)	4 Vrms/7KHz	4Vrms/5kHz
Input current (typical)	35 mA	25 mA
Transformation ratio	.5 ± 5%	.5 ± 5%
Phase Shift	5°	5°
Rotor resistance	21 Ω	20Ω
Stator resistance	74 Ω	58 Ω

(*) Resolver can be used with other input voltages and frequencies, but the give input power must not be exceeded.

Voltage variation

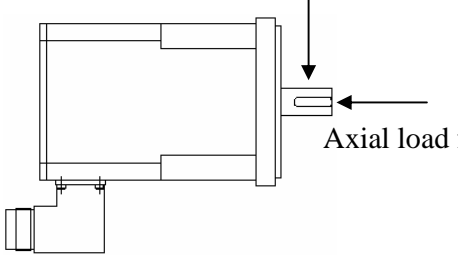


Winding Diagram



Shaft loading

The following table provides guidelines for 20 000 hour – rated speed: 3000 RPM.

	Motor type	Radial force (N)	Axial force (N)
	Size 0	220	80
Size 1	250	90	
Size 2	300	100	
Size 3	570	200	

Brake Motor Application Guidelines

The brakes offered as options on these servo motors are holding brakes. They are designed to hold the motor shaft at 0 RPM for up to the rated brake holding torque. The brakes are permanent magnet type, and release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 RPM, and engage the brake after the servo drive has decelerated the motor to 0 RPM.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source may be controlled by the servo motor controls, in addition to manual operator controls.

Motor type		Size 0	Size 1	Size 2	Size 3
Holding Torque	Nm	1.2	3.2	6	12
Coil Current (at 24 V c.c. \pm 10%)	A	0.37	0.42	0.55	0.75

Motor Installation

Observe the following installation guidelines and those in the Product Notice:



WARNING: Motors and linkages must be securely mounted for a system to be operational. Disassembled equipment should be appropriately identified (tagged-out) and access to electrical power restricted (locked-out).

Failure to observe these safety procedures could result in personal injury and damage to equipment.

1. Do not run motors that are not properly mounted. Attach all power and data cables after the motor is mounted.
2. Mount motors with connectors pointing downward and use a drip loop in the cable to keep liquids flowing away from the connectors.
3. Consider motor case temperature if necessary to safeguard operator and maintenance staff. Maximum case temperature is approximately 100°C for a motor used at continuous rating in a 40°C ambient temperature.
4. The installer must comply with all local regulations and should use equipment and installation practices that promote electromagnetic compatibility and safety.

Preventing Electrical Noise

ElectroMagnetic Interference (EMI), commonly called “noise”, may adversely impact motor performance by inducing stray signals. Effective techniques to counter EMI include filtering the AC power, shielding and separating signal carrying lines, and practicing good grounding techniques. Effective AC power filtering can be achieved through the use of isolated AC power transformers or properly installed AC line filters. Physically separate signal lines from motor cabling and power wiring; do *not* parallel signal wires with motor or power wires or route signal wires over the vent openings of servo drives. Ground all equipment using a single-point parallel ground system that employs ground bus bars or straps. If necessary, use electrical noise remediation techniques to mitigate EMI in “noisy” environments.

Knowledgeable cable routing and careful cable construction improves system electromagnetic compatibility (EMC). General cable build and installation guidelines include:

1. Keep wire lengths as short as physically possible.
2. Route signal cables (encoder, serial, analog) away from motor and power wiring.
3. Separate cables by 1 foot minimum for every 30 feet of parallel run.
4. Ground both ends of the encoder cable and twist the signal wire pairs.
5. Use shielded motor cables when necessary to prevent electromagnetic interference (EMI) with other equipment.

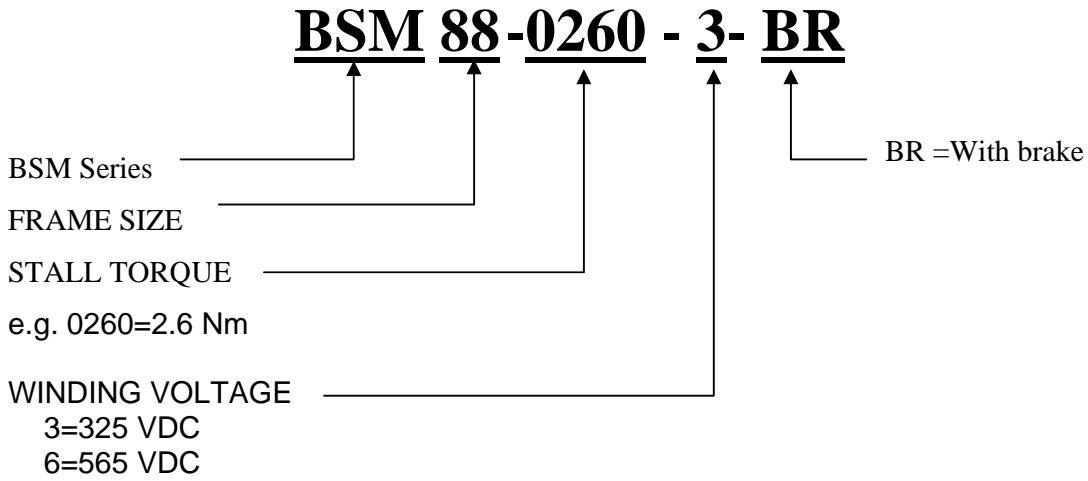
Couplings and Pulleys

Mechanical connections to the motor shaft, such as couplings and pulleys, require a rigid coupling or a reinforced timing belt. The high dynamic performance of servo motors can cause couplings, pulleys or belts to loosen or slip over time. A loose or slipping connection will cause system instability and may damage the motor shaft and keyway. All connections between the system and the servo motor shaft must be rigid to achieve acceptable response from the system. Connections should be periodically inspected to verify the rigidity.

When mounting couplings or pulleys to the motor shaft, ensure that the connections are properly aligned and that axial and radial loads are within the specifications of the motor. The section “Load Force Ratings” provides guidelines to achieve 20,000 hours of bearing life.

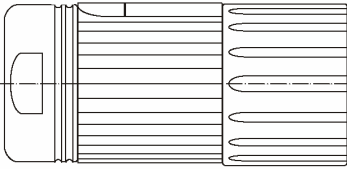
Product Identification Information

Motor Part Number Identification



NOTE: the sealing kit is available only for motors under 3000 rpm.

Mating Connectors Part Numbers

	Connector Type	Part Number
	Power – Crimp	BSTA078FR19230005000
	Resolver – Crimp	ASTA035FR11190005000

Disposal or Warranty Return of Motors

Motors may contain environmentally regulated materials, such as lead solder and circuit boards. When disposing of a motor, please recycle motors per regulations at your location. You may choose to return a motor for disposal by contacting your supplier. Please contact the source that supplied the motor for warranty, non-warranty, or disposal work.

For more information refer to our web site: info03@icpe.ro