SURESTEP™ STEPPING MOTORS

In This Chapter...

Features

- Step motors available in NEMA 14, NEMA 17, NEMA 23, and NEMA 34 frame sizes.
- Square frame style produces high torque and achieves best torque to volume ratio.
- Holding torque ranges from 8 to 1288 oz·in.
- Available in single-shaft, dual-shaft (encoder ready), encoder mounted, and IP65 (wash-down) configurations.
- 12 inch long connectorized pigtail.
- Optional 6, 10, or 20 foot extension cable with locking connector available.
- All NEMA 14, NEMA 17, and NEMA 23 dual-shaft motors come with pretapped holes ready for a modular encoder to be mounted.
- All "E" models include a premounted line driver encoder (STP-MTRA-ENC9). The ENC9 is a configurable encoder that comes preconfigured with 400ppr. Other ppr and output types are available for purchase (STP-MTRA-ENCx). See Appendix A for more information on encoder options and configuration utility.
- All "W" model motors and extension cables include an IP65 connector attached to the cable.

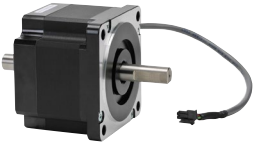
NEMA 14

NEMA 17

NEMA 23

NEMA 34

Dual-shaft Versions Available



Encoder Versions Available

IP65 Versions Available

Note: *Small holes are often drilled into the end of the rotor shaft. This is for manufacturing tooling purposes. These holes do not have a dimensional tolerance and cannot be guaranteed to be present on subsequent orders.*

Design and Installation Tips

Allow sufficient time to accelerate the load and size the step motor with a 100% torque safety factor (i.e.: design the system using a maximum of 50% of the motor's torque). DO NOT disassemble step motors, as motor performance will be reduced and the warranty will be voided. DO NOT connect or disconnect the step motor during operation.

The motor can be mounted in any orientation (horizontal or vertical). Mount it to a surface with good thermal conductivity, such as steel or aluminum, to allow heat dissipation. Use a flexible coupling with "clamp-on" connections to both the motor shaft and the load shaft to prevent thrust and radial loading on bearings from minor misalignment.

In general, the higher the current into a step motor the higher the torque, especially at lower speeds. The higher the voltage to the step motor, the higher the torque at higher speeds. Losses come in to play here, too. The higher you run the current on the motors, the higher your losses are going to be, and the hotter your motors are going to get. For this reason, Automation Direct specs current for motors at the RMS value. This is the value on the motor's label and specification table. This guarantees a very long life for the motor. Multiplying the RMS phase current by 1.2 gives a good balance of torque vs loss. Note that the whole speed torque curve won't be shifted up, only the low speed flat part before the torque starts dropping. The curve can drop for many reasons, but typically it's due to not having enough voltage to push the desired current into the windings, so increasing the voltage is what gives you a boost there, not making more current available.

Specifications

*Sure*Step™ Series Specifications – Connectorized Bipolar Stepping Motors							
Bipolar Stepping Motors		**Low Torque Motors**		**High Torque Motors**			
		STP-MTR*L*-14026x	**STP-MTR*L*-14034x**	**STP-MTR-17040x**	**STP-MTR-17048x**	**STP-MTR-17060x**	**STP-MTR-23055x**
NEMA Frame Size		14	14	17	17	17	23
Optional Encoder		Y	Y	Y	Y	Y	Y
*** Max Holding Torque**	**(lb·in)**	0.5	1.25	3.81	5.19	7.19	10.37
	(oz·in)	8	20	61	83	115	166
	(N·m)	0.06	0.14	0.43	0.59	0.81	1.17
Rotor Inertia	**(oz·in²)**	0.06	0.08	0.28	0.37	0.56	1.46
	(kg·cm²)	0.0003	0.00035	0.05	0.07	0.10	0.27
Rated RMS Current (A/phase)		0.35	0.8	1.7	2.0	2.0	2.8
Resistance (Ω/phase)		8.5	7.66	1.6	1.4	2.0	0.75
Inductance (mH/phase)		5.77	6.92	3.0	2.7	3.3	2.4
Insulation Class		130°C [266°F] Class B; 300V rms					
Basic Step Angle		1.8°					
Shaft Runout		0.002 in [0.051 mm]					
Max Shaft Radial Play @ 1lb load		0.001 in [0.025 mm]					
Perpendicularity		0.003 in [0.076 mm]					
Concentricity		0.003 in [0.076 mm]					
***Max Radial Load (lb [kg])**		6.0 [2.7]					15.0 [6.8]
***Max Axial (Thrust) Load (lb [kg])**		6.0 [2.7]					13.0 [5.9]
Storage Temperature		-20°C to 100°C [-4°F to 212°F]					
Operating Temperature		-20°C to 50°C [-4°F to 122°F] (motor case temperature should be kept below 80°C [176°F])					
Operating Humidity		55% to 85% non-condensing					
Product Material		steel motor case; stainless steel (SUS 303) shaft(s)					
Environmental Rating		IP40		IP40 IP65 (W motors only)			
Weight (lb [kg]) (E models)		0.25 [0.11] (0.3 [0.1])	0.35 [0.15] (0.4 [0.2])	0.6 [0.3] (0.7 [0.3])	0.7 [0.3] (0.8 [0.4])	0.9 [0.4] (0.9 [0.4])	1.5 [0.7] (1.5 [0.7])
Agency Approval		CE					
Accessory Extension Cable		STP-EXT*L*-006, 010, 020		STP-EXT-006, 010, 020 STP-EXTW-006, 010, 020 (W motors only)			

** For dual-shaft motors (STP-MTR-xxxxxD): The sum of the front and rear Torque Loads, Radial Loads, and Thrust Loads must not exceed the applicable Torque, Radial, and Thrust load ratings of the motor.*

Specifications (continued)

Table continued from previous page

*Sure*Step™ Series Specifications – Connectorized Bipolar Stepping Motors							
Bipolar Stepping Motors		**High Torque Motors**		**Higher Torque Motors**			
		STP-MTR-23079x	**STP-MTR-34066x**	**STP-MTR*H*-23079x**	**STP-MTR*H*-34066x**	**STP-MTR*H*-34097x**	**STP-MTR*H*-34127x**
NEMA Frame Size		23	34	23	34	34	34
Optional Encoder		Y	N	Y	N	N	N
Max Holding Torque	(lb·in)	17.25	27.12	17.87	27.12	50.00	80.50
	(oz·in)	276	434	286	434	800	1288
	(N·m)	1.95	3.06	2.02	3.06	5.65	9.10
Rotor Inertia	($oz·in^2$)	2.60	7.66	2.60	7.66	14.80	21.90
	($kg·cm^2$)	0.48	1.40	0.48	1.40	2.71	4.01
Rated RMS Current (A/phase)		2.8	2.8	5.6	6.3	6.3	6.3
Resistance (Ω/phase)		1.1	1.11	0.4	0.25	0.3	0.49
Inductance (mH/phase)		3.8	6.6	1.2	1.5	2.1	4.1
Insulation Class		130°C [266°F] Class B; 300V rms					
Basic Step Angle		1.8°					
Shaft Runout		0.002 in [0.051 mm]					
Max Shaft Radial Play @ 1lb load		0.001 in [0.025 mm]					
Perpendicularity		0.003 in [0.076 mm]					
Concentricity		0.003 in [0.076 mm]					
Maximum Radial Load (lb [kg])		15.0 [6.8]	39.0 [17.7]	15.0 [6.8]	39.0 [17.7]		
Max Axial (Thrust) Load (lb [kg])		13.0 [5.9]	25.0 [11.3]	13.0 [5.9]	25.0 [11.3]		
Storage Temp.		-20°C to 100°C [-4°F to 212°F]					
Operating Temperature		-20°C to 50°C [-4°F to 122°F] (motor case temperature should be kept below 80°C [176°F])					
Operating Humidity		55% to 85% non-condensing					
Product Material		steel motor case; stainless steel (SUS 303) shaft(s)					
Environmental Rating		IP40 IP65 (W motors only)					
Weight (lb [kg]) (E models)		2.2 [1.0] (2.4 [1.1])	3.9 [1.7]	2.4 [1.1] (2.4 [1.1])	3.9 [1.7]	5.9 [2.7]	8.4 [3.8]
Agency Approval		CE					
Accessory Extension Cable		STP-EXT-006, 010, 020		STP-EXT*H*-006, 010, 020 STP-EXTW*H*-006, 010, 020 (W motors only)			

Power Supply and Step Motor Drive

An STP-PWR-xxxx linear power supply from AutomationDirect is the best choice to power AutomationDirect and other step motors. These power supplies were designed to work with the AutomationDirect SureStep™ STP-DRV-xxxx series bipolar microstepping motor drives. PSBxx switching power supplies are also available from AutomationDirect. Only use SureStep stepper motors with DC power supplies 70VDC and less. SureStep motors are not wound for high bus voltages. Higher DC power supply voltages and AC-input stepper drives generate very high bus voltages and will result in excessive losses (heat) in the SureStep motors. Typically, stepper motors are specifically wound for these higher bus voltage systems

Mounting the Motor

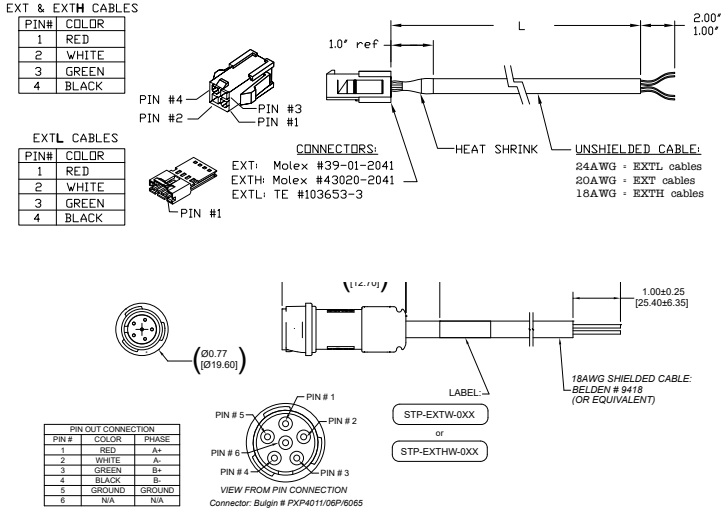
We recommend mounting the motor to a metallic surface to help dissipate heat generated by the motor.

Connecting the Motor

WARNING: When connecting a step motor to a drive or indexer, be sure that the motor power supply is switched off. Never disconnect the motor while the drive is powered up. Never connect the motor leads to ground or directly to the power supply.

All SureStep step motors have connectorized cables which connect directly to available SureStep extension cables. Due to the different current ranges of the three motor torque classes, three different ampacity rated cables are available in three different lengths. The MTR*L* motors use EXT*L* cables, the MTR motors use EXT cables, and the MTR*H* motors use EXT*H* cables. The extension cables have the same wire color coding as the motor pigtail cables, as shown in the extension cable wiring diagram and in the motor dimension and cabling diagram.

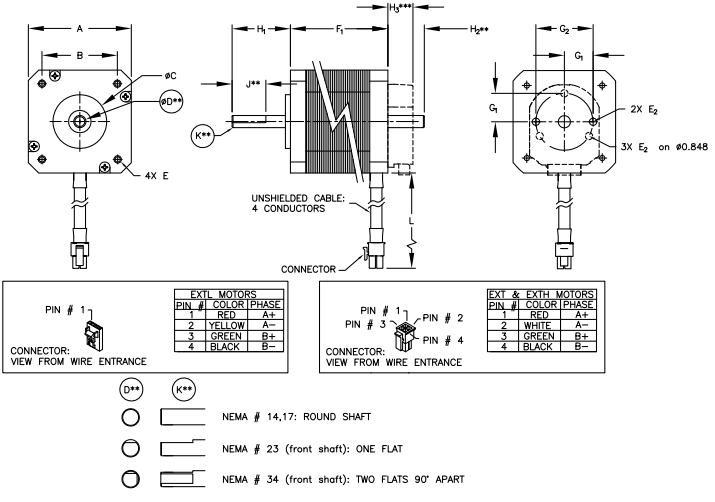
Extension Cable Wiring Diagrams



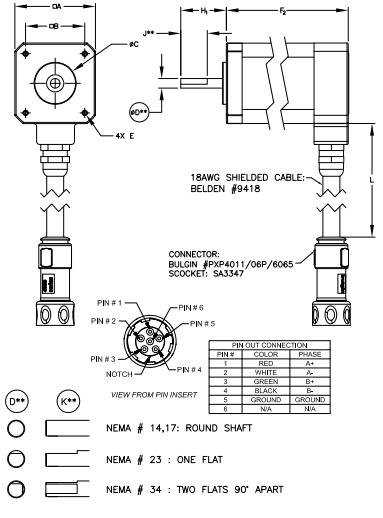
Motor Dimensions and Cabling

Typical Dimension & Cable Diagrams

STP-MTR-xxxxx



STP-MTR-xxxxxW



SureStep™ Series Dimensions & Cabling – STP-MTR-x*** Step Motors								
Dimensions (in [mm])*	**Low Torque Motors**		**High Torque Motors STP-MTR-x**					
	STP-MTRL -14026x	**STP-MTRL -14034x**	**STP-MTR -17040x**	**STP-MTR -17048x**	**STP-MTR -17060x**	**STP-MTR -23055x**	**STP-MTR -23079x**	**STP-MTR -34066x**
A	1.39 [35.3]	1.39 [35.3]	1.67 [42.3]			2.25 [57.2]		3.39 [86.1]
B	1.02 [25.9]	1.02 [25.9]	1.22 [31.0]			1.86 [47.2]		2.74 [69.6]
C	Ø 0.87 [22.1]					Ø 1.50 [38.1]		Ø 2.88 [73.0]
D**	Ø 0.20 [5.0]					Ø 0.25 [6.4]		Ø 0.50 [12.7]
E	0.15 DP	0.15 DP	M3 x 0.5 thread 0.15 [3.8] min depth			Ø 0.20 [5.1] through		Ø 0.26 [6.6] through
E^2	M2.5 X 0.45 thread				M2 x 0.4 thread	4-40		n/a
F_1**	1.02 [25.9]	1.34 [34.0]	1.58 [40.1]	1.89 [48.0]	2.34 [59.5]	2.22 [56.4]	3.10 [78.7]	2.64 [67.1]
F_2**	n/a		1.90 [48.3]	2.24 [56.9]	2.67 [67.8]	2.33 [59.1]	3.19 [81.0]	2.64 [67.1]
G^1	0.375	0.375	0.375	0.375	0.411	0.906	0.906	0.906
G^2	0.75	0.75	0.75	0.75	n/a	1.812	1.812	1.812
H_1	0.60 [15.2]	0.60 [15.2]	0.94 [24.0]			0.81 [20.6]		1.46 [37.1]
H_2**	0.51 [13.0]	0.51 [13.0]	0.51 [13]			0.51 [13]		1.13 [28.7]
H_3**	0.40							n/a
J**	n/a					0.59 [15.0]		0.98 [25.0]
K**	n/a					0.23 [5.8]		0.45 [11.4]
L	12 [305]							
Conductor	(4) #26 AWG		(4) #20 AWG (5) #18 AWG (for W motors)					
Connector	TE # 103653-3		Molex # 43025-0400 PXP4010/06S/6065 (for W motors)					
Pin	TE # 1-104505-3 (LOOSE)		Molex # 43030-0007 Socket: SA3347 (for W motors)					

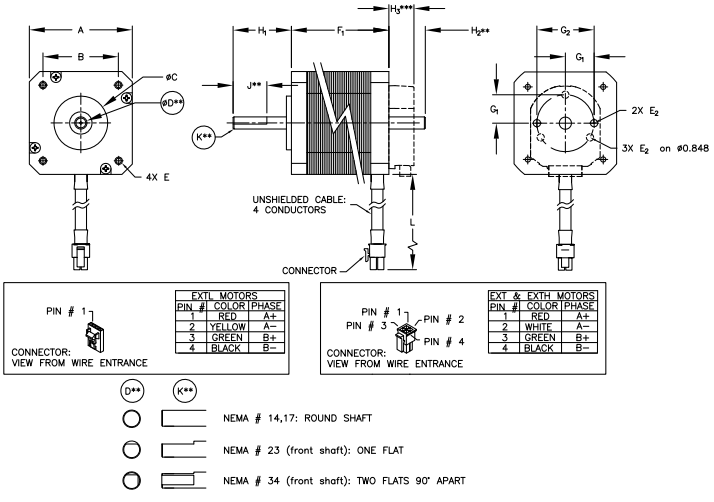
* *mm dimensions are for reference purposes only.*

** *Dimension D (shaft diameter) is the same for both front and rear shafts of dual-shaft and encoder motors. Dimension H_2 applies only to dual-shaft (D) and encoder (E) motors. Dimensions J & K do NOT apply to rear shafts of dual-shaft or encoder motors (all rear shafts are round style). Dimension H3 applies only to "E" models with the encoder pre-mounted. Dimension F2 applies to "W" models only.*

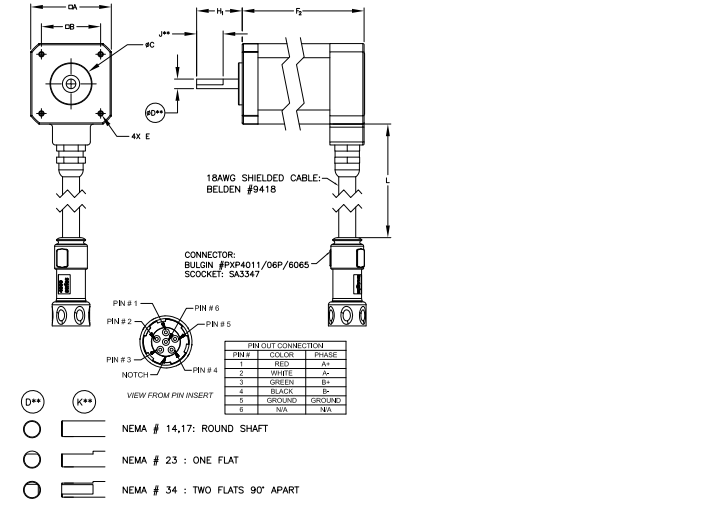
*** *Higher Torque STP-MTRH motors are shown in a separate table.*

Typical Dimension & Cable Diagram for STP-MTRH

STP-MTRH-xxxxx



STP-MTRH-xxxxxW



SureStep™ Series Dimensions & Cabling – STP-MTR*H*-x*** Step Motors				
Dimensions (in [mm])*	**Higher Torque Motors STP-MTR*H*-x**			
	STP-MTR*H*-23079x	**STP-MTR*H*-34066x**	**STP-MTR*H*-34097x**	**STP-MTR*H*-34127x**
A	2.25 [57.2]	3.39 [86.1]		
B	1.86 [47.2]	2.74 [69.6]		
C	Ø 1.50 [38.1]	Ø 2.88 [73.0]		
D**	Ø 0.25 [6.4]	Ø 0.50 [12.7]		
E	Ø 0.20 [5.1] through	Ø 0.26 [6.6] through		
E2	4-40	n/a		
F_1**	3.10 [78.7]	2.64 [67.1]	3.82 [97.1]	5.00 [127.0]
F_2**	3.19 [81.0]	2.74 [67.1]	3.82 [97.1]	5.00 [127.0]
G1	0.906	0.906	0.906	0.906
G2	1.812	1.812	1.812	1.812
H_1	0.81 [20.6]	1.46 [37.1]		
H_2**	0.51 [13]	1.13 [28.7]		
H_3**	0.40	n/a		
J**	0.59 [15.0]	0.98 [25.0]		
K**	0.23 [5.8]	0.45 [11.4]		
L	12 [305]			
Conductor	(4) #18 AWG (5) #18 AWG (for W motors)			
Connector	Molex # 39-01-3042 PXP4010/06S/6065 (for W motors)			
Pin	Molex # 39-00-0039 Socket: SA3347 (for W motors)			

** mm dimensions are for reference purposes only.*

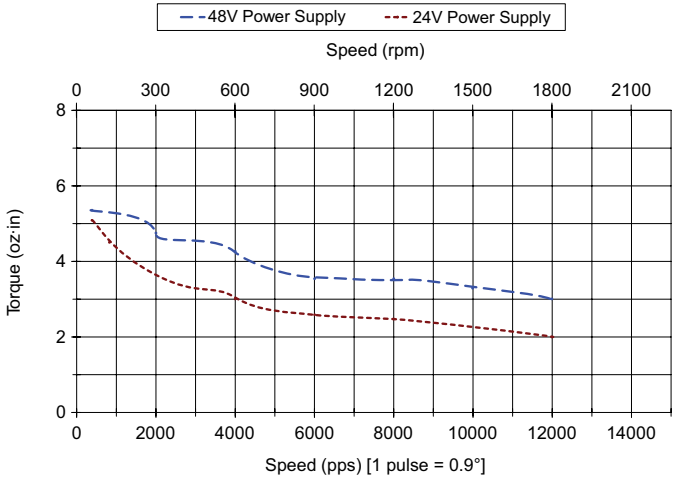
*** Dimension D (shaft diameter) is the same for both front and rear shafts of dual-shaft and encoder motors. Dimension H_2 applies only to dual-shaft (D) and encoder (E) motors. Dimensions J & K do NOT apply to rear shafts of dual-shaft and encoder motors (all rear shafts are round style). Dimension H3 applies only to "E" models with the encoder pre-mounted. Dimension F2 applies to "W" models only.*

**** High Torque STP-MTR motors are shown in a separate table.*

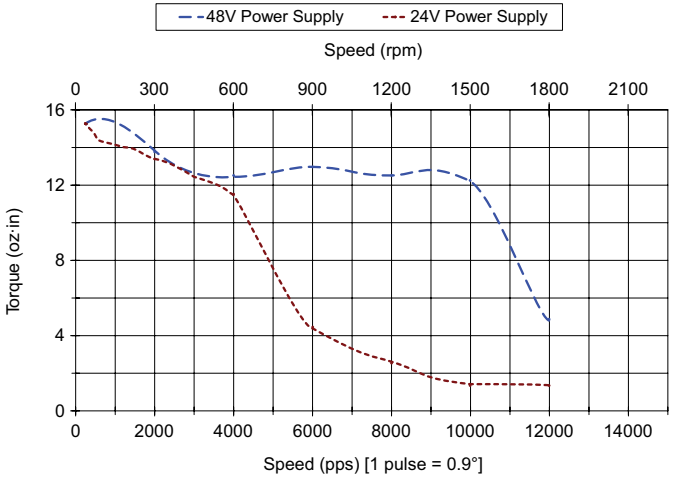
Torque vs. Speed Charts

STP-MTR-14xxx(D) NEMA 14 Step Motors

STP-MTR-14026(x) Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



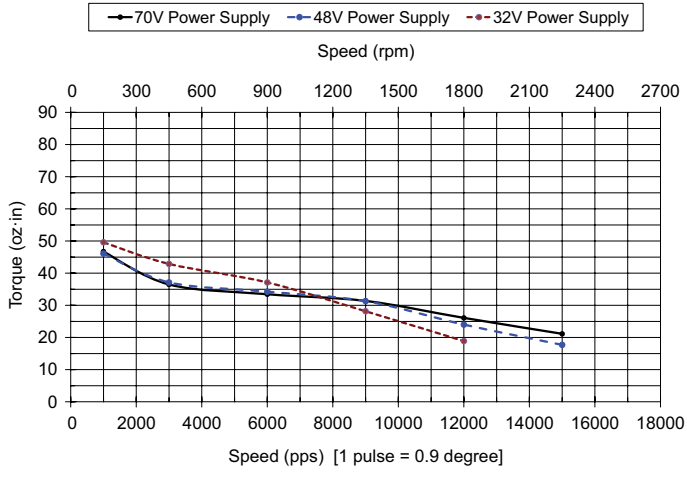
STP-MTR-14034(x) Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



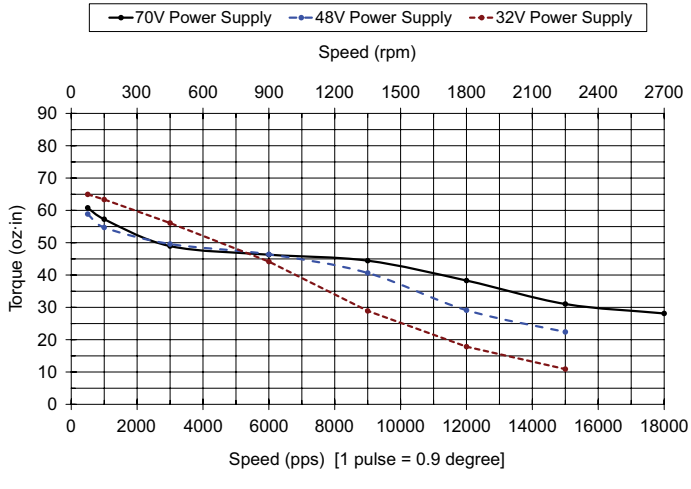
STP-MTR-17xxx(D) NEMA 17 Step Motors

Note: "W" series motors have 5% less running torque than other models.

STP-MTR-17040x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



STP-MTR-17048x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)

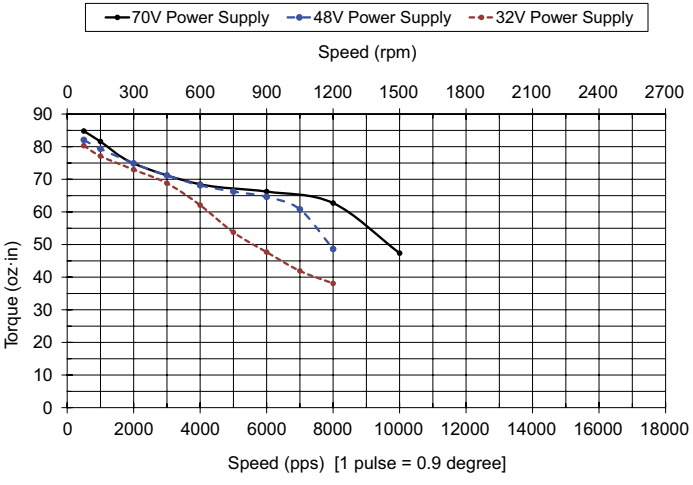


Torque vs. Speed Charts (continued)

Note: "W" series motors have 5% less running torque than other models.

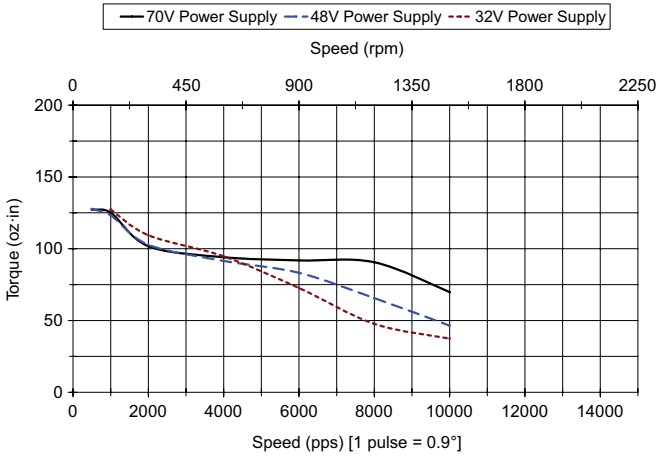
STP-MTR-17xxx(D) NEMA 17 Step Motors (continued)

STP-MTR-17060x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



STP-MTR(H)-23xxx(D) NEMA 23 Step Motors

STP-MTR-23055x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)

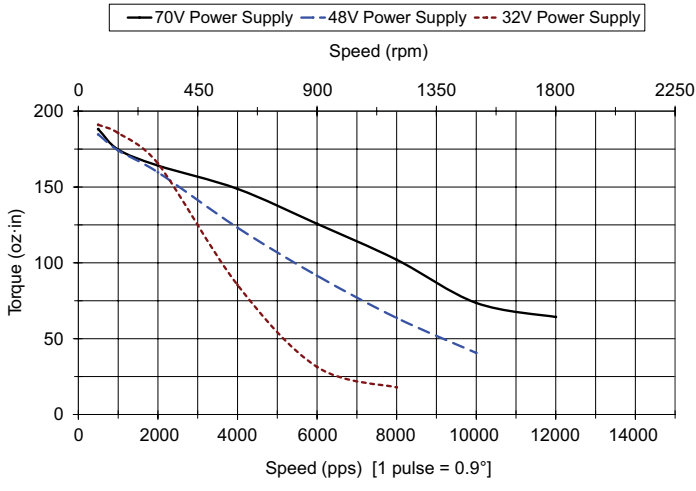


Torque vs. Speed Charts (continued)

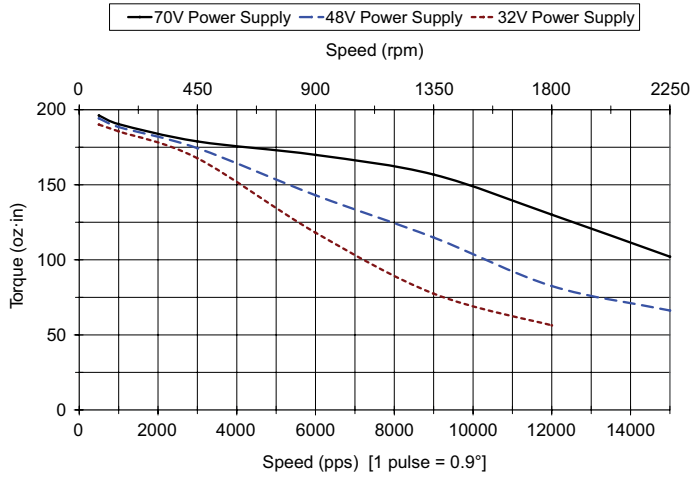
Note: "W" series motors have 5% less running torque than other models.

STP-MTR(H)-23xxx(D) NEMA 23 Step Motors (continued)

STP-MTR-23079x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



STP-MTR*H*-23079x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)

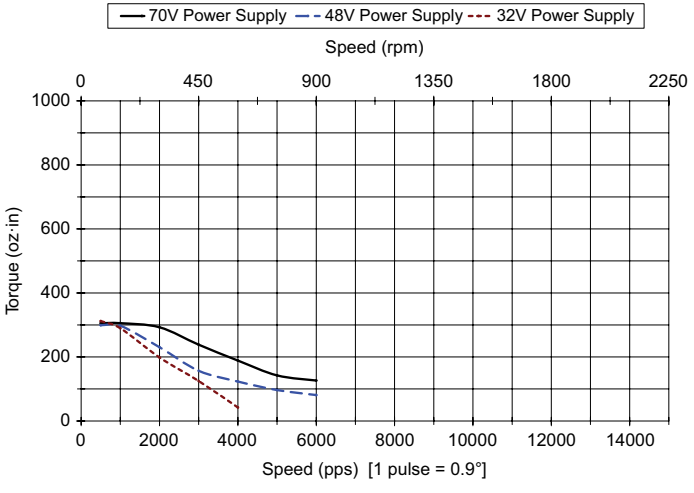


Torque vs. Speed Charts (continued)

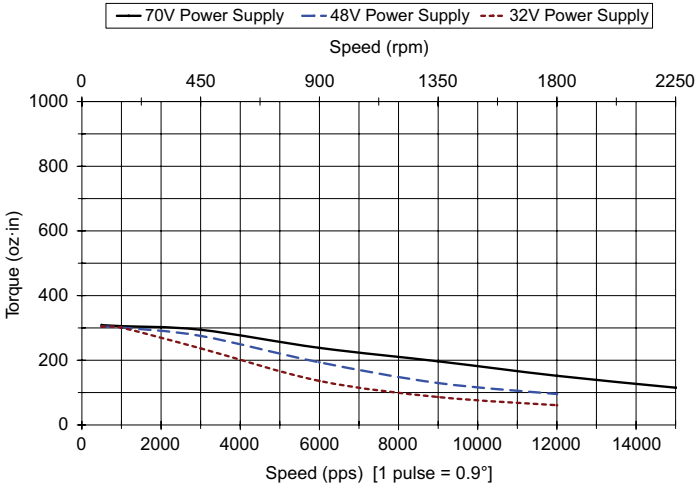
Note: "W" series motors have 5% less running torque than other models.

STP-MTR(H)-34xxx(D) NEMA 34 Step Motors

STP-MTR-34066x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



STP-MTR*H*-34066x Torque vs Speed (1.8° motor; 1/2 stepping, RMS phase current)

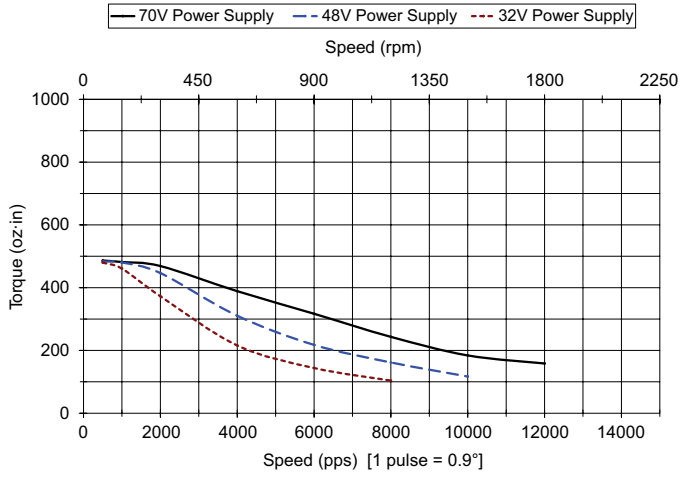


Torque vs. Speed Charts (continued)

Note: "W" series motors have 5% less running torque than other models.

STP-MTR(H)-34xxx(D) NEMA 34 Step Motors (continued)

STP-MTR*H*-34097x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)



STP-MTR*H*-34127x Torque vs Speed (1.8° step motor; 1/2 stepping, RMS phase current)