

# Kollmorgen TBM(S) Motor Selection Guide



# Table of Contents

- ▶ **TBM™ Series Frameless Motor** 3
- ▶ **TBM(S)™ 60 Series Motor**
  - TBM(S) 60 Outline Drawings 4
  - TBM(S) 60 Performance Data and Parameters 5
  - TBM(S) 60 Performance Curves 6
- ▶ **TBM(S)™ 76 Series Motor**
  - TBM(S) 76 Outline Drawings 8
  - TBM(S) 76 Performance Data and Parameters 9
  - TBM(S) 76 Performance Curves 10
- ▶ **TBM(S)™ 129 Series Motor**
  - TBM(S) 129 Outline Drawings 12
  - TBM(S) 129 Performance Data and Parameters 13
  - TBM(S) 129 Performance Curves 14
- ▶ **Commutation & Connection Diagrams** 16
- ▶ **Model Nomenclature** 17
- ▶ **Available TBM(S) Modifications** 17

## Removing the Barriers of Design, Sourcing, and Time

At Kollmorgen, we know that OEM engineers can achieve a lot more when obstacles aren't in the way. So, we knock them down in three important ways:

### Integrating Standard and Custom Products

The optimal solution is often not clear-cut. Our application expertise allows us to modify standard products or develop totally custom solutions across our whole product portfolio so that designs can take flight.

### Providing Motion Solutions, Not Just Components

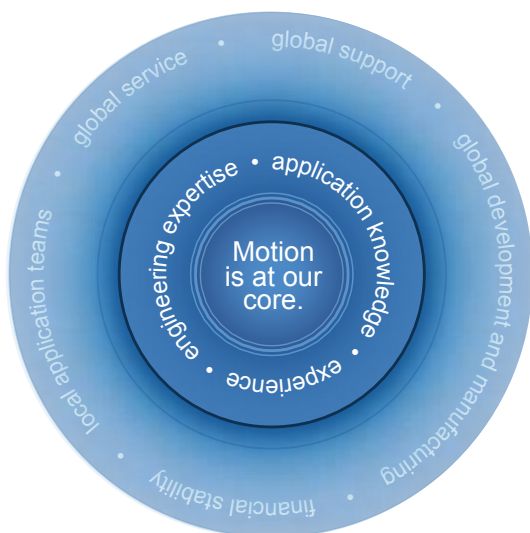
As companies reduce their supplier base and have less engineering manpower, they need a total system supplier with a wide range of integrated solutions. Kollmorgen is in full response mode with complete solutions that combine programming software, engineering services and best-in-class motion components.

### Global Footprint

With direct sales, engineering support, manufacturing facilities, and distributors spanning the Americas, Europe, Middle East, and Asia, we're close to OEMs worldwide. Our proximity helps speed delivery and lend support where and when they're needed.

### Financial and Operational Stability

Kollmorgen is part of Danaher Corporation. A key driver in the growth of all Danaher divisions is the Danaher Business System, which relies on the principle of "kaizen" – or continuous improvement. Using world-class tools, cross-disciplinary teams of exceptional people evaluate processes and develop plans that result in superior performance.



# TBM™ Series Frameless Motor

**The TBM frameless motor is a new series of direct drive torque motors designed for applications that require high power in a small compact form factor with minimized weight, and inertia.**

Typical applications include robotic joints, weapon stations, sensor gimbals, sight systems, UAV propulsion and guidance, as well as many others.

## **TBM(S) Product Features**

- 3 frame sizes ranging from 60mm (2.36 inches) up to 129mm (5.08 inches)
- 3 stacks lengths per frame
- 2 standard winding options per frame
- Latching Hall Effects (pre-aligned / factory installed).
- Low Cogging designs
- Stainless Steel Yokes for max corrosion protection
- RoHS Compliant
- Banded Rotors
- Laser Marked Armatures

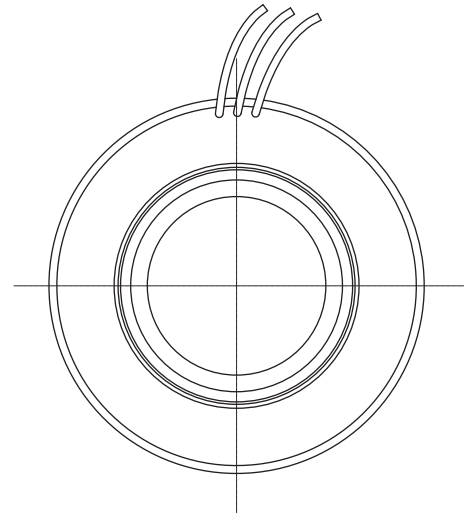
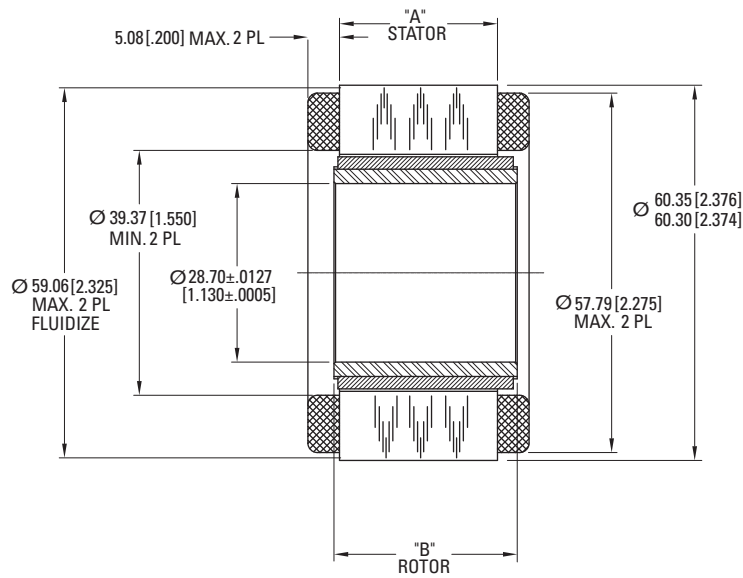
For non-standard requests Kollmorgen provides a variety of standard options and configurations.

If higher levels of customization are required, contact Kollmorgen to help us understand exactly what you need.

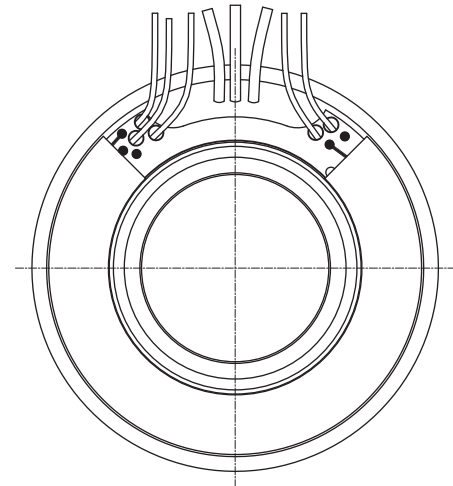
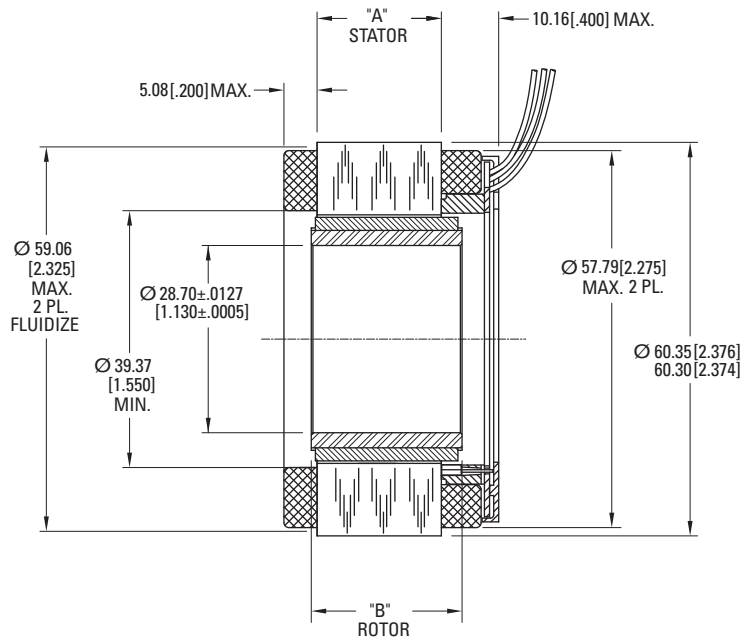
# TBM 60 Series Outline Drawings

T B M 6 0 O U T L I N E D R A W I N G S

## TBM 60



## TBMS 60



### MOTOR LEADS:

#18 AWG, TEFLON COATED, PER MIL-W-22759/11  
 3 LEADS - 6 INCHES MIN. LONG EACH  
 1-RED, 1-WHITE, & 1-BLACK

### SENSOR LEADS:

#26 AWG, TYPE "ET", TEFLON COATED, PER MIL-W-16878  
 5 LEADS 6 INCHES MIN. LONG EACH  
 1-BLUE, 1-BROWN, 1-GREEN, 1-ORANGE, & 1-YELLOW

MODEL NUMBER	"A" mm [inch]	"B" mm [inch]
TBM(S)-6013	12.70 [0.500]	16.76 [0.660]
TBM(S)-6025	25.40 [1.000]	29.46 [1.160]
TBM(S)-6051	50.80 [2.000]	54.86 [2.160]

# TBM 60 Series Performance Data

## TBM(S) 60 Series Performance Data and Motor Parameters

Motor Parameter	Symbol	Units	TOL	TBM(S)-6013-X		TBM(S)-6025-X		TBM(S)-6051-X	
				A	B	A	B	A	B
Continuous Stall Torque*	Tc	N-m	NOM	0.413	0.413	0.706	0.706	1.16	1.13
		oz-in		58.5	58.5	100	100	164	160
Continuous Current	Ic	Adc	NOM	5.70	9.00	5.70	10.1	7.00	11.2
		Arms		4.65	7.35	4.65	8.25	5.72	9.14
Peak Stall Torque* (25°C winding temp)	Tp	N-m	NOM	1.37	1.37	2.56	2.56	4.53	3.88
		oz-in		194	194	363	363	642	550
Peak Current	Ip	Adc	NOM	19.0	30.1	21.3	38.0	30.0	36.0
		Arms		15.5	24.6	17.4	31.0	24.5	29.4
Rated Cont Power*	P Rated	Watts	NOM	117	115	146	139	176	166
Speed at Rated Power	N Rated	RPM	NOM	4300	3850	2900	2450	2130	1700
Design Voltage	Vbus	Vdc	NOM	48.0	24.0	48.0	24.0	48.0	24.0
	Vac	Vrms	NOM	33.9	17.0	33.9	17.0	33.9	17.0
Torque Sensitivity at Temp*	Kt (hot)	N-m / Adc	+/-10%	0.078	0.049	0.130	0.074	0.180	0.108
		oz-in / Adc		11.0	6.88	18.5	10.5	25.5	15.3
		N-m / Arms	+/-10%	0.095	0.060	0.160	0.091	0.220	0.132
		oz-in / Arms		13.5	8.42	22.6	12.9	31.2	18.7
Back EMF at Temp*	Kb (hot)	Vpk / kRPM	+/-10%	8.12	5.08	13.7	7.79	18.9	11.3
		Vrms / kRPM		5.74	3.59	9.65	5.51	13.3	8.00
Torque Sensitivity at 25°C	Kt (cold)	N-m / Adc	+/-10%	0.085	0.053	0.143	0.081	0.198	0.119
		oz-in / Adc		12.1	7.57	20.3	11.6	28.0	16.8
		N-m / Arms	+/-10%	0.105	0.065	0.176	0.100	0.242	0.145
		oz-in / Arms		14.8	9.27	24.9	14.2	34.3	20.6
Back EMF	Kb (cold)	Vpk / kRPM	+/-10%	8.93	5.59	15.0	8.57	20.7	12.4
		Vrms/kRPM		6.32	3.95	10.6	6.06	14.7	8.80
Motor Constant	Km	N-m/√watt	+/-10%	0.097	0.097	0.155	0.156	0.240	0.248
		oz-in/√watt		13.8	13.7	22.0	22.2	34.0	35.2
Resistance at 25°C	Rm	Ohms	+/- 10%	0.771	0.303	0.850	0.272	0.680	0.229
Inductance	Lm	mH	+/- 30%	0.36	0.14	0.56	0.18	0.57	0.20
Inertia*	Jm	Kg-m <sup>2</sup>		1.41E-05		2.52E-05		4.75E-05	
		oz-in-s <sup>2</sup>		2.00E-03		3.57E-03		6.72E-03	
Weight*	Wt	grams		213		377		550	
		oz		7.49		13.3		19.4	
Max Static Friction	Tf	N-m		0.021		0.033		0.056	
		oz-in		2.93		4.62		8.00	
Cogging Friction (Peak-to-Peak)	Tcog	N-m		0.009		0.012		0.019	
		oz-in		1.22		1.71		2.70	
Viscous Damping	Fi	N-m/ kRPM		2.04E-03		5.22E-03		1.25E-02	
		oz-in / kRPM		2.89E-01		7.42E-01		1.77E+00	
Thermal Resistance*	TPR	°C / watt		3.55		3.13		2.72	
Number of Poles	P	-		12		12		12	

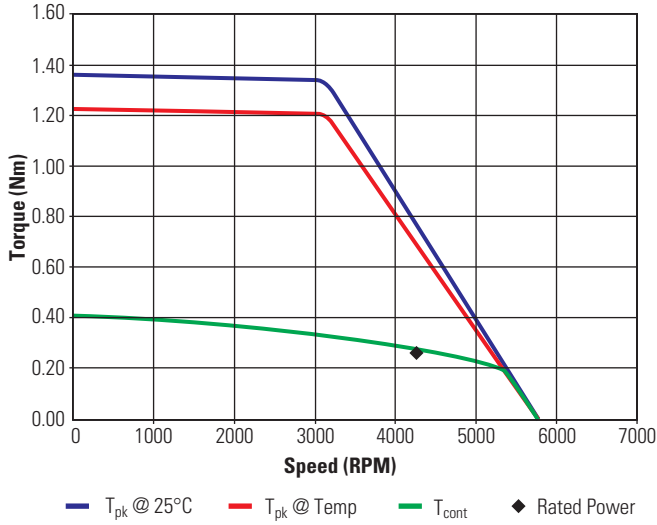
**\*Notes**

- 1) Continuous Stall Torque and Rated Power assume ambient temperature of 25°C
- 2) Winding temp = 155°C for Kt and Kb hot
- 3) Inertia and weight assume max thru-bore
- 4) TPR assumes motor is housed and mounted to a 3.5" x 3.5" x 0.25" heat sink or equivalent
- 5) Some Peak Torques may be limited by lead wire gauge

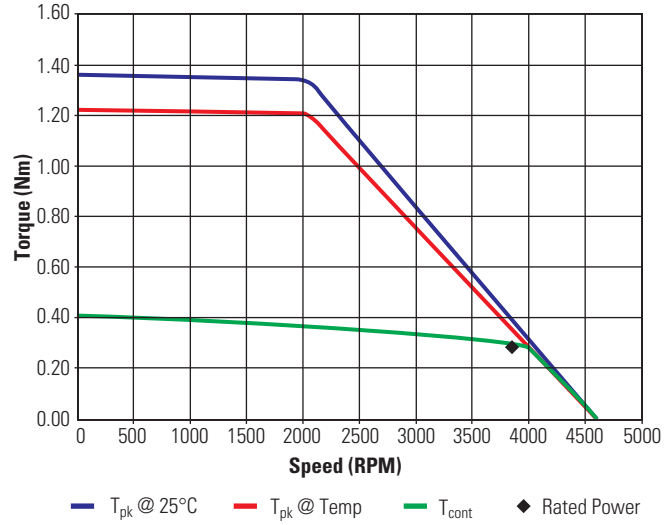
# TBM 60 Series Performance Curves

T B M 6 0 P E R F O R M A N C E C U R V E S

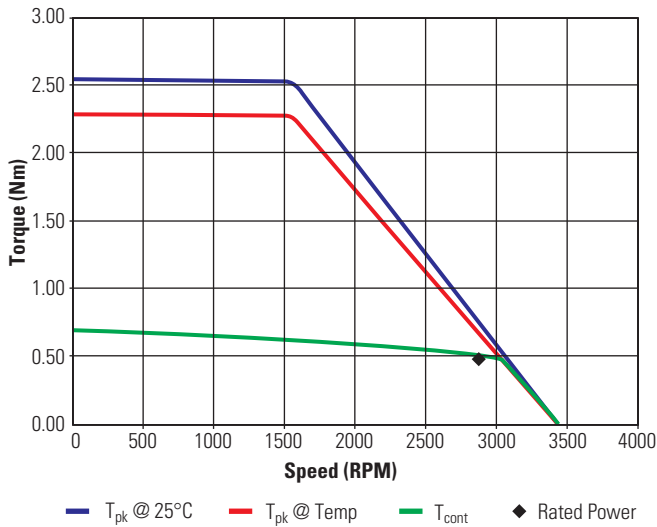
**TBM(S)-6013-A**  
 48 Vdc – 6 step



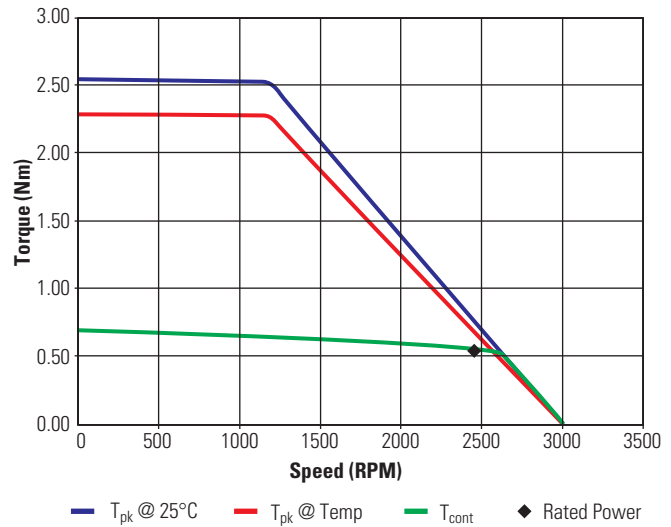
**TBM(S)-6013-B**  
 24 Vdc – 6 step



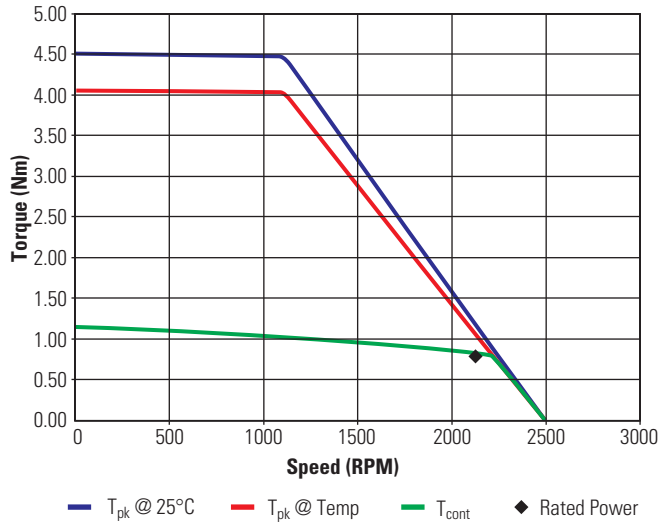
**TBM(S)-6025-A**  
 48 Vdc – 6 step



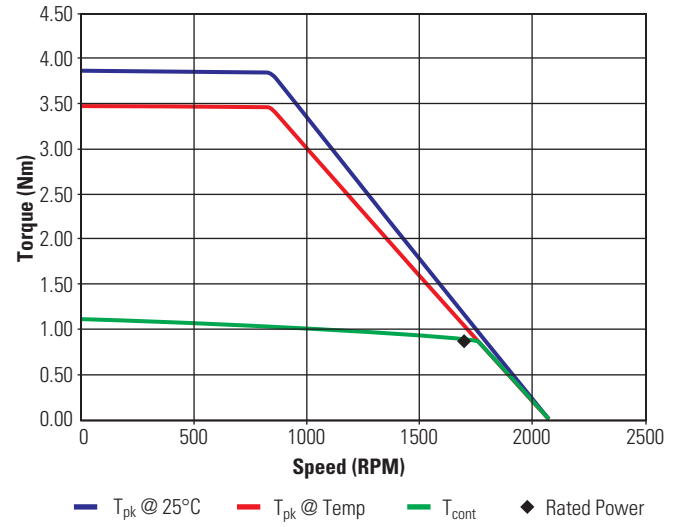
**TBM(S)-6025-B**  
 24 Vdc – 6 step



**TBM(S)-6051-A**  
 48 Vdc – 6 step



**TBM(S)-6051-B**  
 24 Vdc – 6 step



Notes:

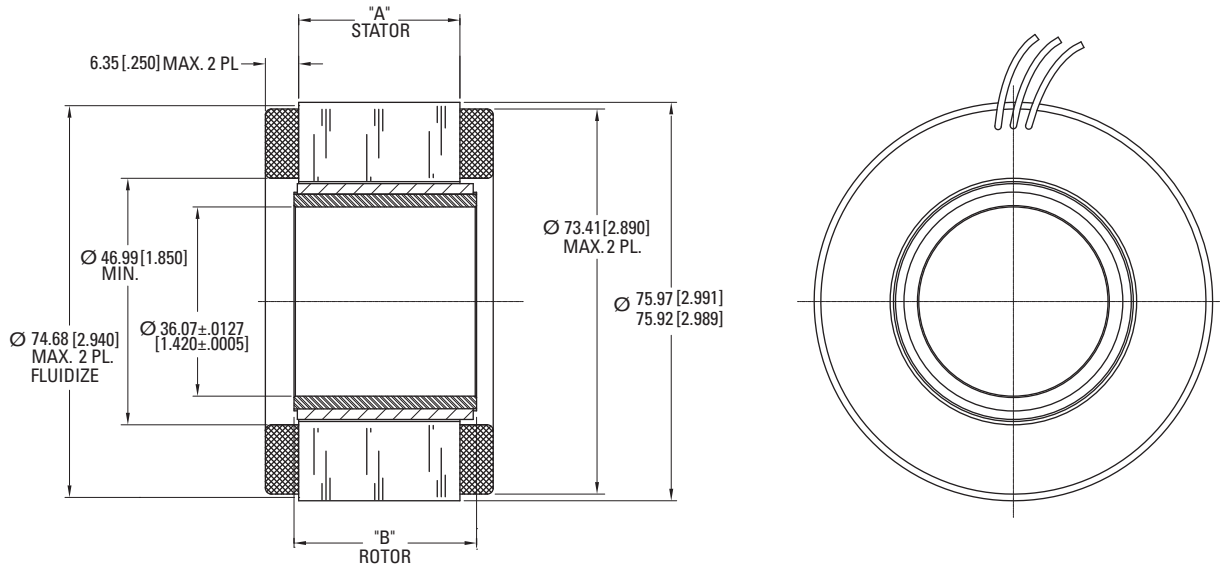




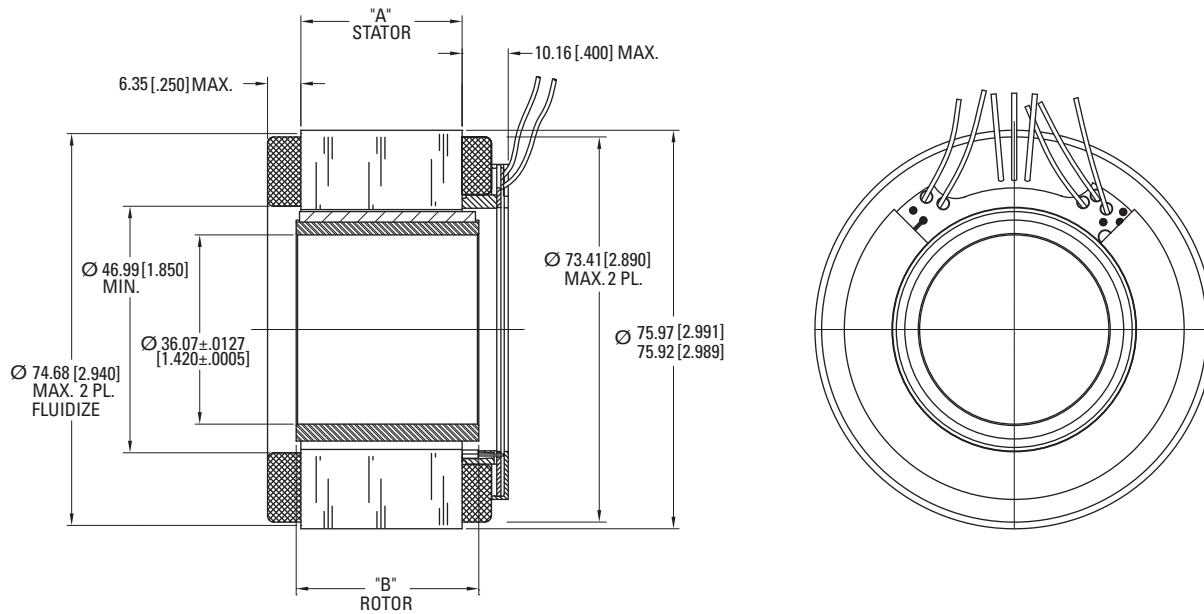
# TBM 76 Series Outline Drawings

T B M 7 6 O U T L I N E D R A W I N G S

## TBM 76



## TBMS 76



### MOTOR LEADS:

#18 AWG, TEFLON COATED, PER MIL-W-22759/11  
 3 LEADS - 6 INCHES MIN. LONG EACH  
 1-RED, 1-WHITE, & 1-BLACK

### SENSOR LEADS:

#26 AWG, TYPE "ET", TEFLON COATED, PER MIL-W-16878  
 5 LEADS 6 INCHES MIN. LONG EACH  
 1-BLUE, 1-BROWN, 1-GREEN, 1-ORANGE, & 1-YELLOW

MODEL NUMBER	"A" mm [inch]	"B" mm [inch]
TBM(S)-7615	15.24 [0.600]	19.30 [0.760]
TBM(S)-7631	30.73 [1.210]	38.40 [1.370]
TBM(S)-7646	46.23 [1.820]	50.29 [1.980]



# TBM 76 Series Performance Data

## TBM(S) 76 Series Performance Data and Motor Parameters

Motor Parameter	Symbol	Units	TOL	TBM(S)-7615-X		TBM(S)-7631-X		TBM(S)-7646-X	
				A	B	A	B	A	B
Continuous Stall Torque*	Tc	N-m	NOM	0.996	0.996	1.69	1.69	2.39	2.25
		oz-in		141	141	239	239	338	319
Continuous Current	Ic	Adc	NOM	10.8	15.1	11.1	13.6	12.7	15.0
		Arms		8.82	12.3	9.06	11.1	10.4	12.2
Peak Stall Torque* (25°C winding temp)	Tp	N-m	NOM	2.86	2.15	5.06	4.34	6.89	5.65
		oz-in		405	305	716	615	975	800
Peak Current	Ip	Adc	NOM	36.0	36.0	36.0	36.0	36.0	36.0
		Arms		29.4	29.4	29.4	29.4	29.4	29.4
Rated Cont Power*	P Rated	Watts	NOM	280	230	325	210	380	230
Speed at Rated Power	N Rated	RPM	NOM	4025	2600	2375	1300	1900	1100
Design Voltage	Vbus	Vdc	NOM	48.0	24.0	48.0	24.0	48.0	24.0
	Vac	Vrms	NOM	33.9	17.0	33.9	17.0	33.9	17.0
Torque Sensitivity at Temp*	Kt (hot)	N-m / Adc	+/-10%	0.095	0.068	0.158	0.132	0.194	0.156
		oz-in / Adc		13.5	9.68	22.4	18.6	27.5	22.0
		N-m / Arms	+/-10%	0.117	0.084	0.193	0.161	0.238	0.191
		oz-in / Arms		16.5	11.9	27.4	22.8	33.7	27.0
Back EMF at Temp*	Kb (hot)	Vpk / kRPM	+/-10%	9.98	7.15	16.5	13.8	20.4	16.3
		Vrms / kRPM		7.05	5.06	11.7	9.74	14.4	11.5
Torque Sensitivity at 25°C	Kt (cold)	N-m / Adc	+/-10%	0.105	0.075	0.174	0.145	0.213	0.172
		oz-in / Adc		14.9	10.6	24.6	20.5	30.3	24.2
		N-m / Arms	+/-10%	0.129	0.092	0.212	0.177	0.262	0.210
		oz-in / Arms		18.2	13.0	30.1	25.1	37.1	29.7
Back EMF	Kb (cold)	Vpk / kRPM	+/-10%	11.0	7.87	18.2	15.1	22.4	17.9
		Vrms/kRPM		7.76	5.56	12.9	10.7	15.8	12.7
Motor Constant	Km	N-m/√watt	+/-10%	0.175	0.176	0.279	0.287	0.370	0.352
		oz-in/√watt		24.9	25.1	39.5	40.5	52.5	49.8
Resistance at 25°C	Rm	Ohms	+/- 10%	0.356	0.180	0.388	0.256	0.333	0.237
Inductance	Lm	mH	+/- 30%	0.37	0.19	0.55	0.39	0.58	0.37
Inertia*	Jm	Kg-m <sup>2</sup>		3.04E-05		5.64E-05		8.19E-05	
		oz-in-s <sup>2</sup>		4.31E-03		7.98E-03		1.16E-02	
Weight*	Wt	grams		400		704		1027	
		oz		14.1		24.8		36.2	
Max Static Friction	Tf	N-m		0.032		0.050		0.068	
		oz-in		4.49		7.09		9.70	
Cogging Friction (Peak-to-Peak)	Tcog	N-m		0.013		0.017		0.020	
		oz-in		1.79		2.35		2.90	
Viscous Damping	Fi	N-m/ kRPM		6.65E-03		1.68E-02		2.97E-02	
		oz-in / kRPM		9.46E-01		2.38		4.21	
Thermal Resistance*	TPR	°C / watt		2.11		1.83		1.62	
Number of Poles	P	-		12		12		12	

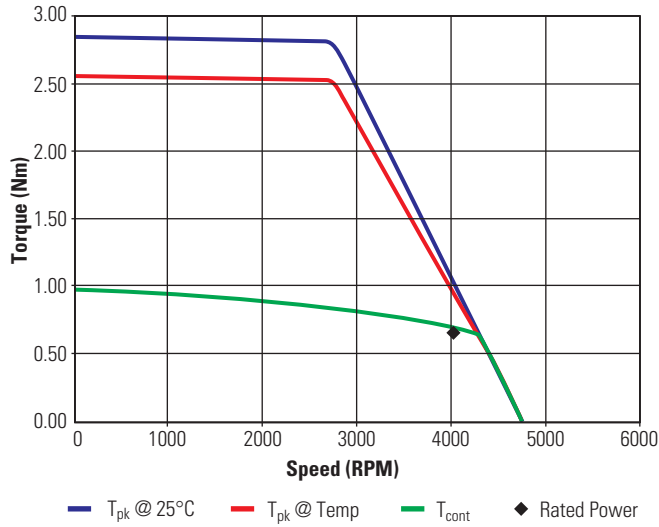
**\*Notes**

- 1) Continuous Stall Torque and Rated Power assume ambient temperature of 25°C
- 2) Winding temp = 155°C for Kt and Kb hot
- 3) Inertia and weight assume max thru-bore
- 4) TPR assumes motor is housed and mounted to a 7.0" x 7.5" x 0.375" heat sink or equivalent
- 5) Peak Torques limited by lead wire gauge

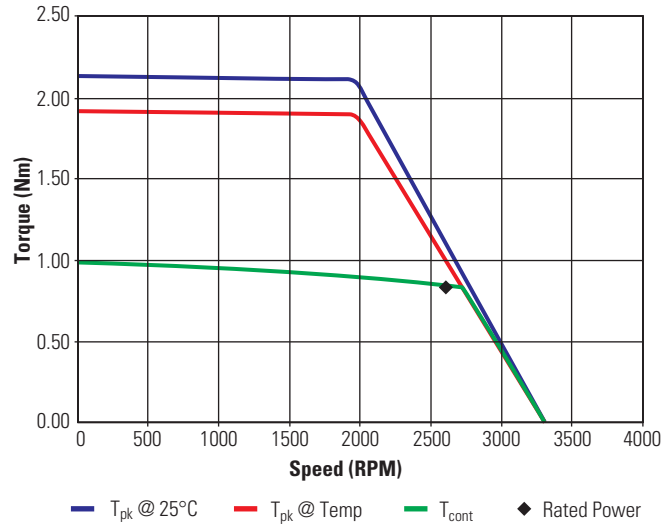
# TBM 76 Series Performance Curves

T B M 7 6 P E R F O R M A N C E C U R V E S

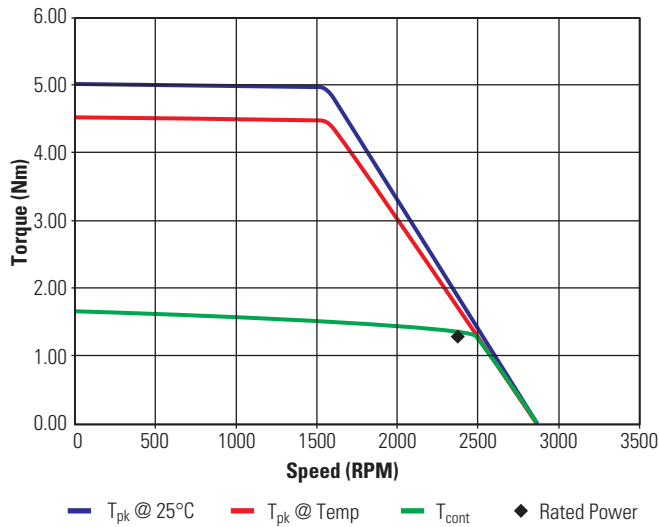
**TBM(S)-7615-A**  
 48 Vdc – 6 step



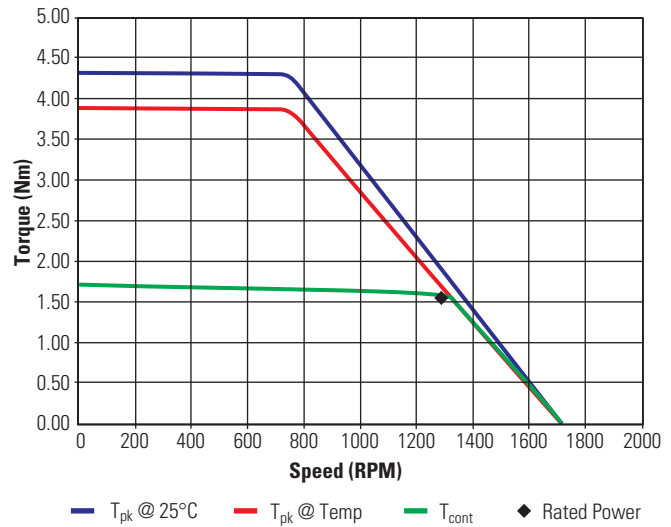
**TBM(S)-7615-B**  
 24 Vdc – 6 step



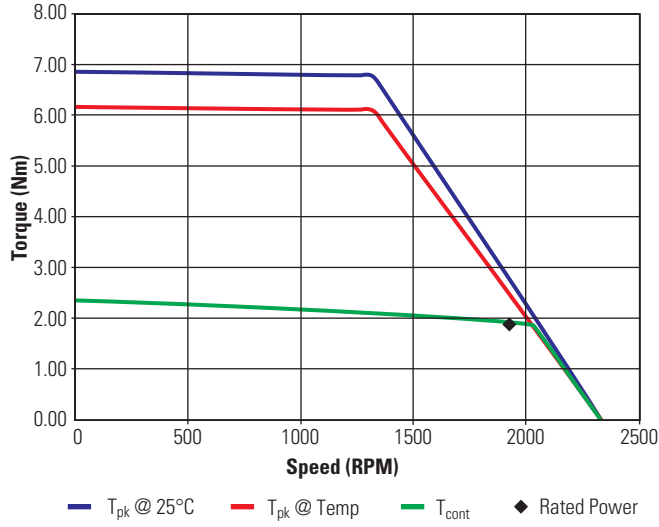
**TBM(S)-7631-A**  
 48 Vdc – 6 step



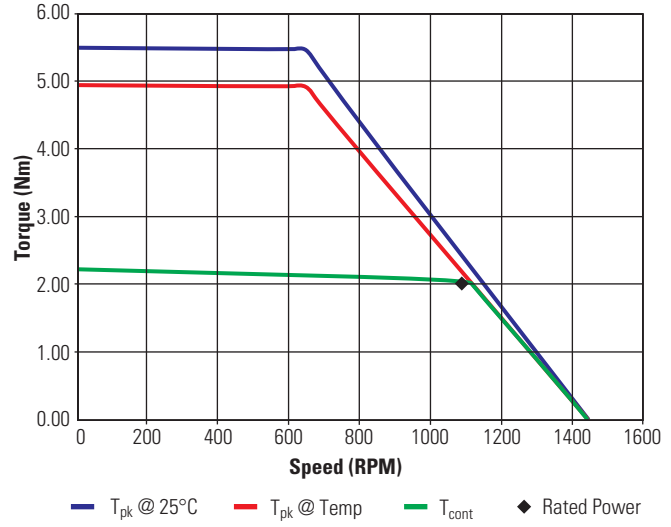
**TBM(S)-7631-B**  
 24 Vdc – 6 step



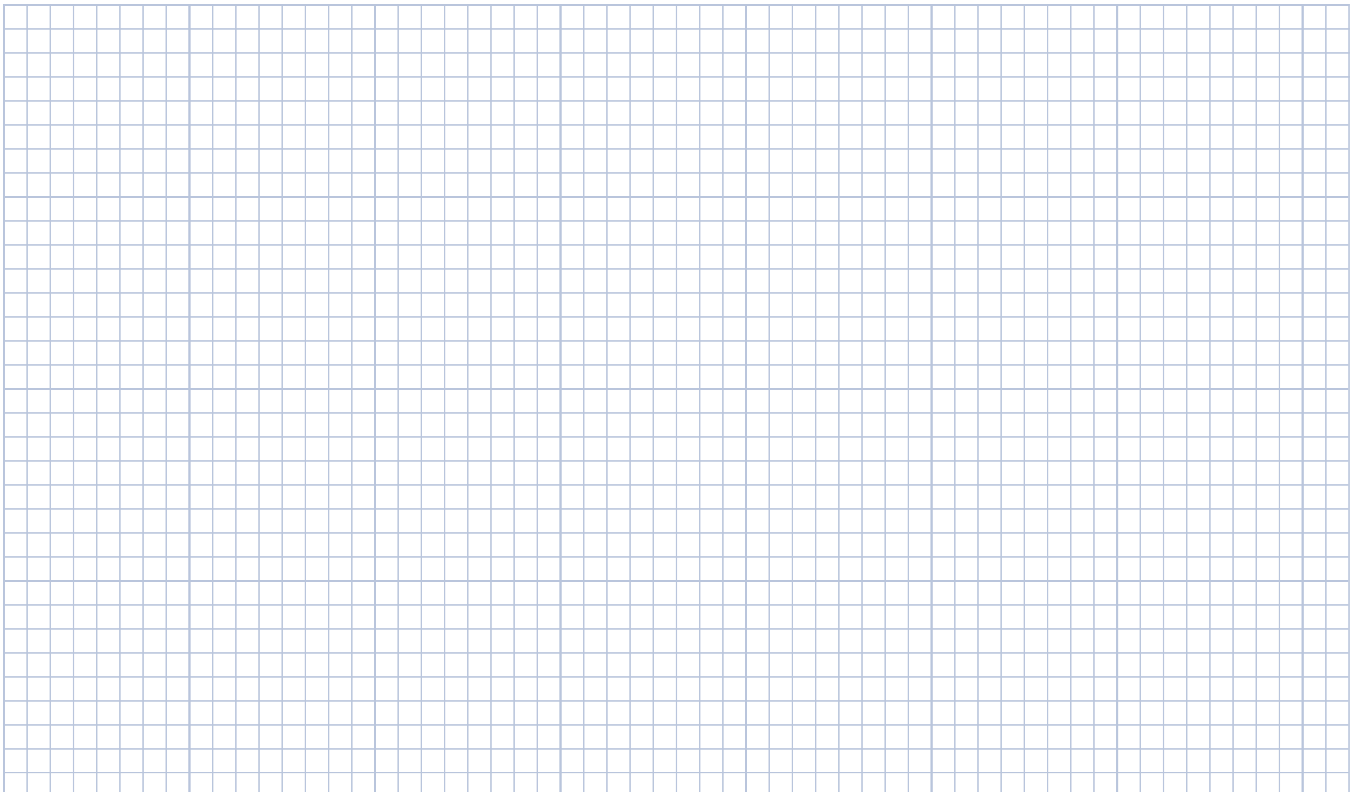
**TBM(S)-7646-A**  
 48 Vdc – 6 step



**TBM(S)-7646-B**  
 24 Vdc – 6 step



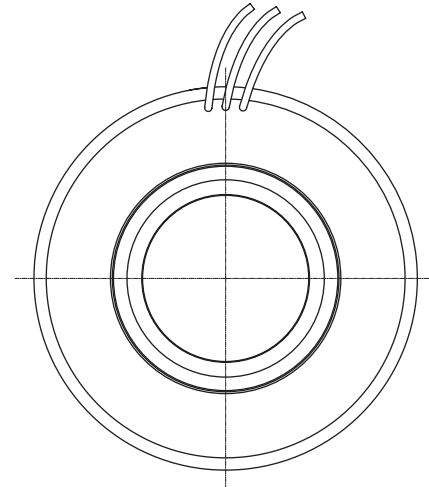
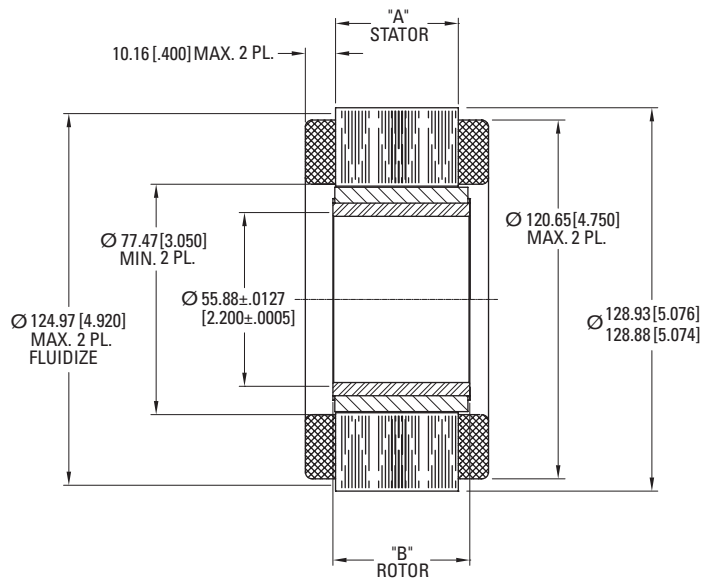
Notes:



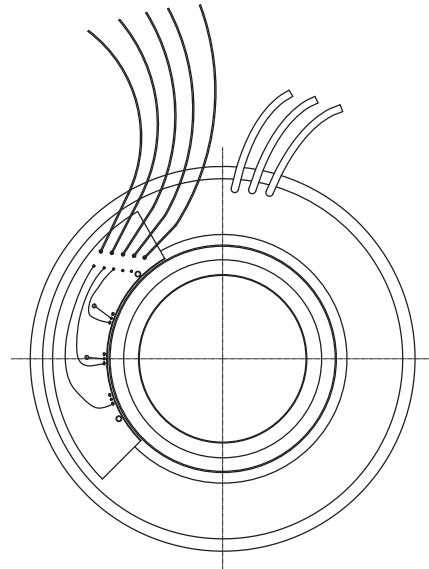
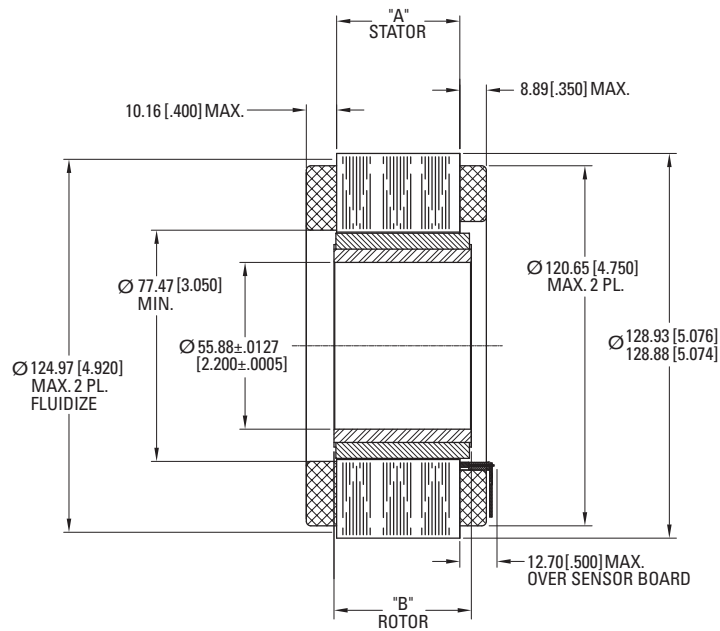
# TBM 129 Series Outline Drawings

T B M 1 2 9 O U T L I N E D R A W I N G S

## TBM 129



## TBMS 129



### MOTOR LEADS:

#16 AWG, TEFLON COATED, PER MIL-W-22759/11  
 3 LEADS - 6 INCHES MIN. LONG EACH  
 1-RED, 1-WHITE, & 1-BLACK

### SENSOR LEADS:

#26 AWG, TYPE "ET", TEFLON COATED, PER MIL-W-16878  
 5 LEADS 6 INCHES MIN. LONG EACH  
 1-BLUE, 1-BROWN, 1-GREEN, 1-ORANGE, & 1-YELLOW

MODEL NUMBER	"A" mm [inch]	"B" mm [inch]
TBM(S)-12913	13.33 [0.525]	17.40 [0.685]
TBM(S)-12941	41.28 [1.625]	45.35 [1.785]
TBM(S)-12955	54.61 [2.150]	58.67 [2.310]

# TBM 129 Series Performance Data

T B M 1 2 9 P E R F O R M A N C E D A T A A N D P A R A M E T E R S

## TBM(S) 129 Series Performance Data and Motor Parameters

Motor Parameter	Symbol	Units	TOL	TBM(S)-12913-X		TBM(S)-12941-X		TBM(S)-12955-X	
				A	B	A	B	A	B
Continuous Stall Torque*	Tc	N-m	NOM	3.12	3.12	8.27	8.27	10.3	10.3
		Lb-Ft		2.30	2.30	6.10	6.10	7.60	7.60
Continuous Current	Ic	Adc	NOM	12.5	21.5	16.8	19.5	16.1	18.3
		Arms		10.2	17.6	13.7	15.9	13.1	14.9
Peak Stall Torque* (25°C winding temp)	Tp	N-m	NOM	11.9	8.07	29.6	25.0	39.4	33.9
		Lb-Ft		8.75	5.95	21.9	18.4	29.0	25.0
Peak Current	Ip	Adc	NOM	57.0	57.0	57.0	57.0	57.0	57.0
		Arms		46.5	46.5	46.5	46.5	46.5	46.5
Rated Cont Power*	P Rated	Watts	NOM	560	572	900	640	940	600
Speed at Rated Power	N Rated	RPM	NOM	2700	2600	1600	860	1225	640
Design Voltage	Vbus	Vdc	NOM	100	48.0	100	48.0	100	48.0
	Vac	Vrms	NOM	70.7	33.9	70.7	33.9	70.7	33.9
Torque Sensitivity at Temp*	Kt (hot)	N-m / Adc	+/-10%	0.256	0.154	0.520	0.445	0.681	0.583
		Lb-Ft / Adc		0.189	0.113	0.383	0.328	0.502	0.430
		N-m / Arms	+/-10%	0.314	0.188	0.637	0.545	0.834	0.714
		Lb-Ft / Arms		0.231	0.139	0.470	0.402	0.615	0.527
Back EMF at Temp*	Kb (hot)	Vpk / kRPM	+/-10%	26.8	16.1	54.4	46.4	71.3	61.0
		Vrms / kRPM		19.0	11.4	38.5	32.8	50.4	43.1
Torque Sensitivity at 25°C	Kt (cold)	N-m / Adc	+/-10%	0.282	0.169	0.572	0.490	0.749	0.641
		Lb-Ft / Adc		0.208	0.124	0.421	0.361	0.552	0.473
		N-m / Arms	+/-10%	0.345	0.207	0.701	0.600	0.917	0.785
		Lb-Ft / Arms		0.254	0.153	0.517	0.442	0.677	0.580
Back EMF	Kb (cold)	Vpk / kRPM	+/-10%	29.5	17.7	59.9	51.0	78.4	67.1
		Vrms/kRPM		20.9	12.5	42.3	36.1	55.5	47.4
Motor Constant	Km	N-m/√watt	+/-10%	0.470	0.488	1.14	1.12	1.38	1.35
		Lb-Ft/√watt		0.347	0.358	0.843	0.826	1.02	1.00
Resistance at 25°C	Rm	Ohms	+/- 10%	0.359	0.121	0.250	0.191	0.294	0.224
Inductance	Lm	mH	+/- 30%	0.77	0.28	1.2	0.86	1.5	1.1
Inertia*	Jm	Kg-m <sup>2</sup>		2.71E-04		7.21E-04		9.37E-04	
		Lb-Ft-s <sup>2</sup>		2.00E-04		5.32E-04		6.91E-04	
Weight*	Wt	Kg		1.32		3.25		4.15	
		Lbs		2.90		7.17		9.14	
Max Static Friction	Tf	N-m		0.127		0.346		0.450	
		Lb-Ft		0.0938		0.255		0.332	
Cogging Friction (Peak-to-Peak)	Tcog	N-m		0.071		0.216		0.285	
		Lb-Ft		0.0521		0.159		0.210	
Viscous Damping	Fi	N-m/ kRPM		4.78E-02		2.83E-01		4.13E-01	
		Lb-Ft / kRPM		3.53E-02		0.21		0.30	
Thermal Resistance*	TPR	°C / watt		1.55		1.20		1.14	
Number of Poles	P	-		12		12		12	

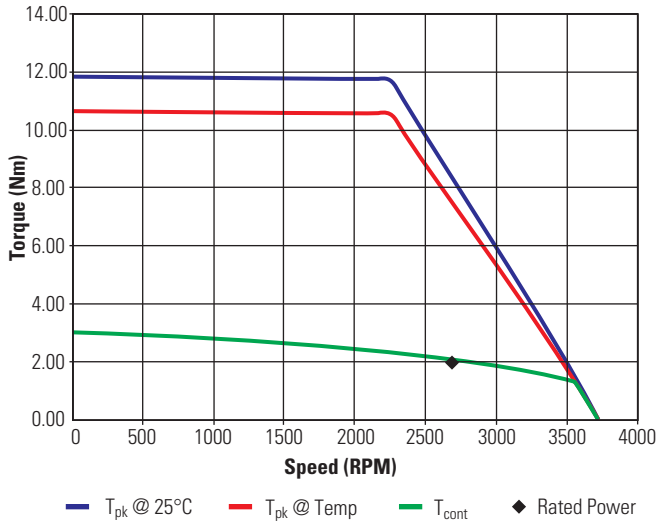
**\*Notes**

- 1) Continuous Stall Torque and Rated Power assume ambient temperature of 25°C
- 2) Winding temp = 155°C for Kt and Kb hot
- 3) Inertia and weight assume max thru-bore
- 4) TPR assumes motor is housed and mounted to a 7.0" x 7.5" x 0.375" heat sink or equivalent
- 5) Peak Torques limited by lead wire gauge

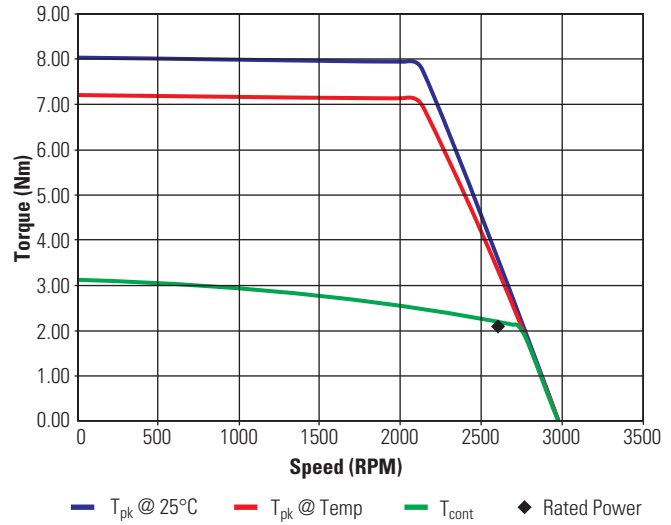
# TBM 129 Series Performance Curves

T B M 1 2 9 P E R F O R M A N C E C U R V E S

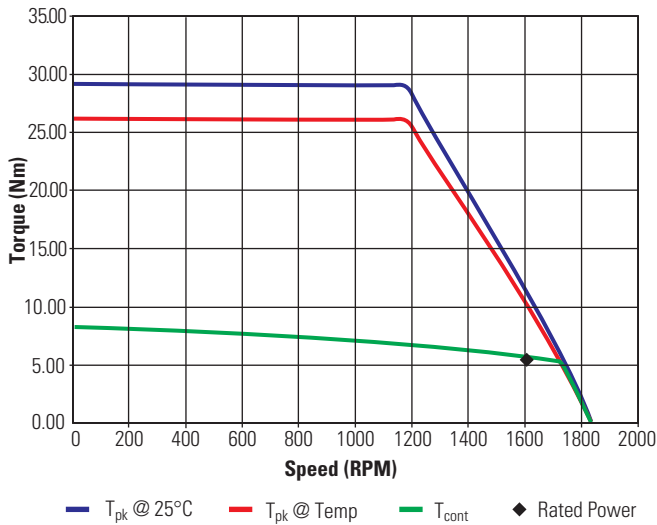
**TBM(S)-12913-A**  
 100 Vdc – 6 step



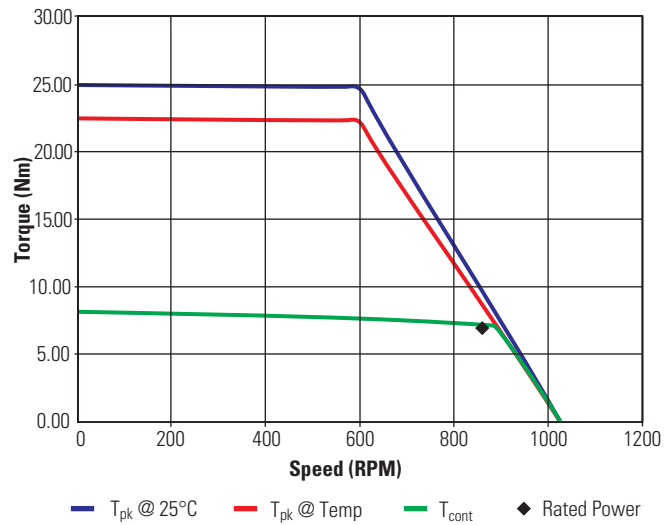
**TBM(S)-12913-B**  
 48 Vdc – 6 step



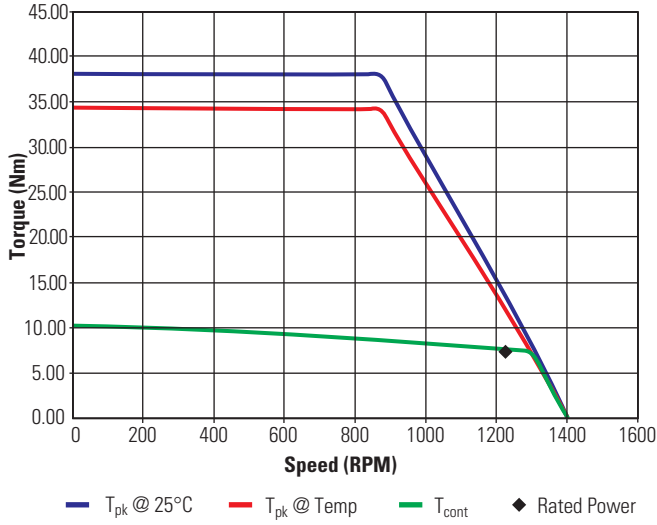
**TBM(S)-12941-A**  
 100 Vdc – 6 step



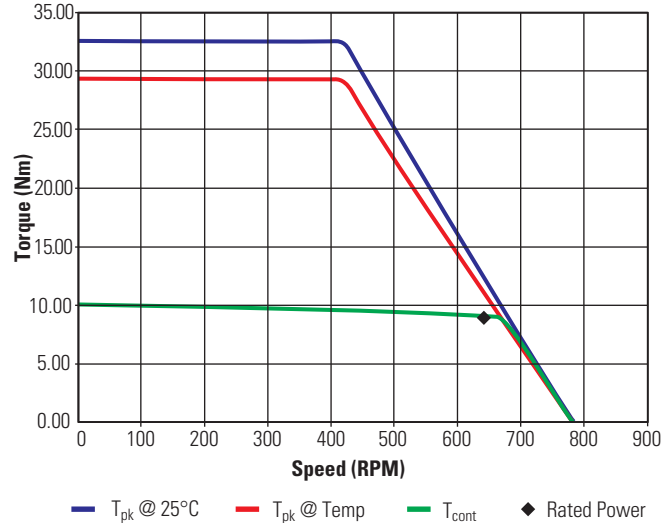
**TBM(S)-12941-B**  
 48 Vdc – 6 step



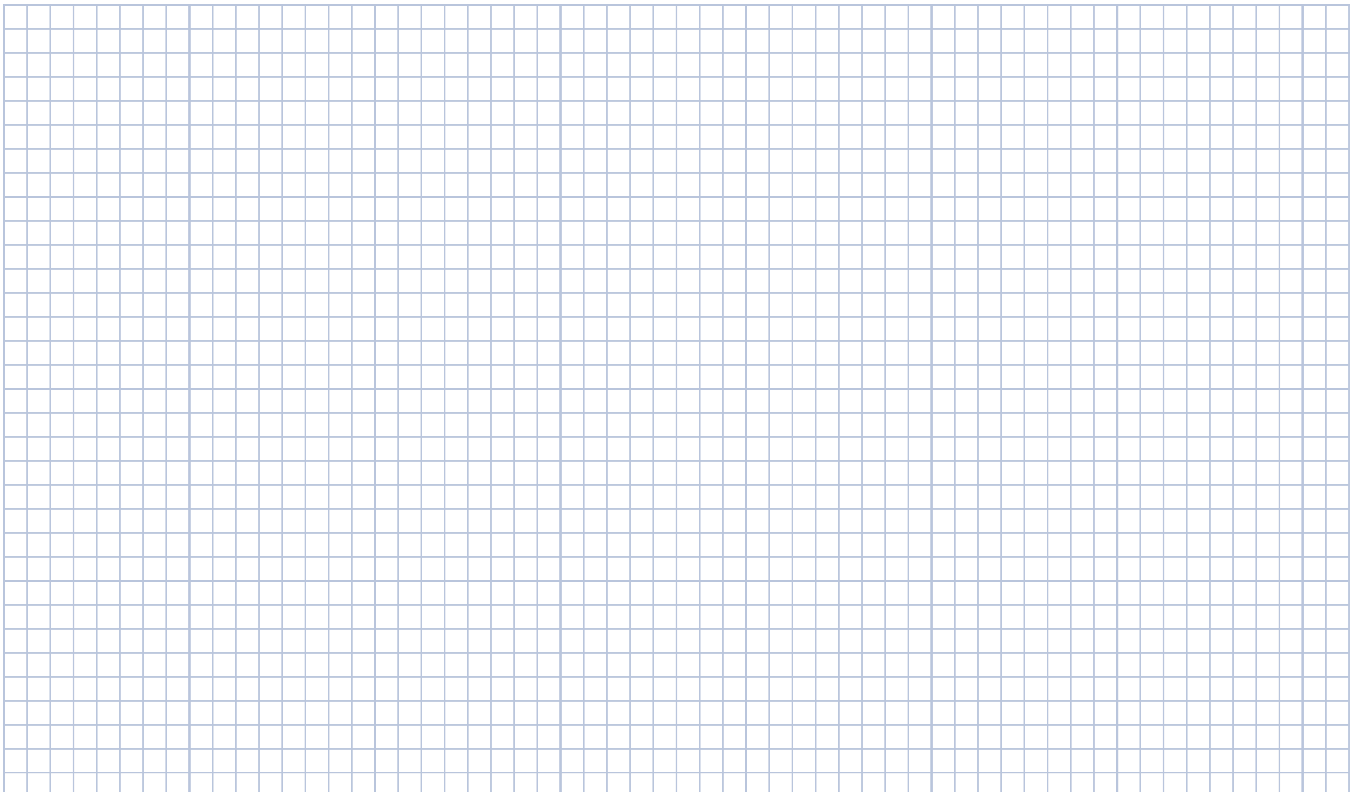
**TBM(S)-12955-A**  
**100 Vdc – 6 step**



**TBM(S)-12955-B**  
**48 Vdc – 6 step**



Notes:





# Commutation & Connection Diagrams

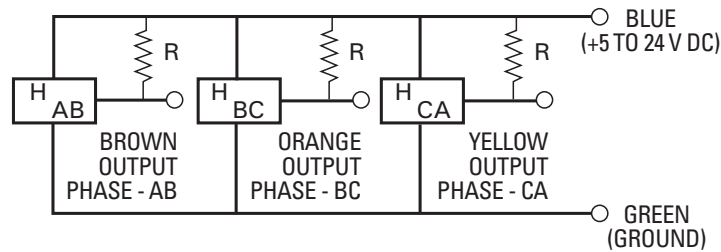
COMMUTATION & CONNECTION DIAGRAMS

## Excitation Sequence Table

STEP	Power Connection		
	Phase "A" Red	Phase "B" White	Phase "C" Black
1	⊕	⊖	
2	⊕		⊖
3		⊕	⊖
4	⊖	⊕	
5	⊖		⊕
6		⊖	⊕

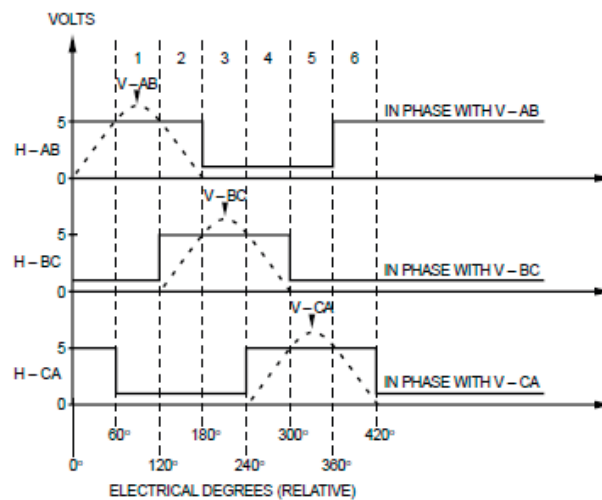
CW viewed from lead end

## Sensor Wiring Diagram



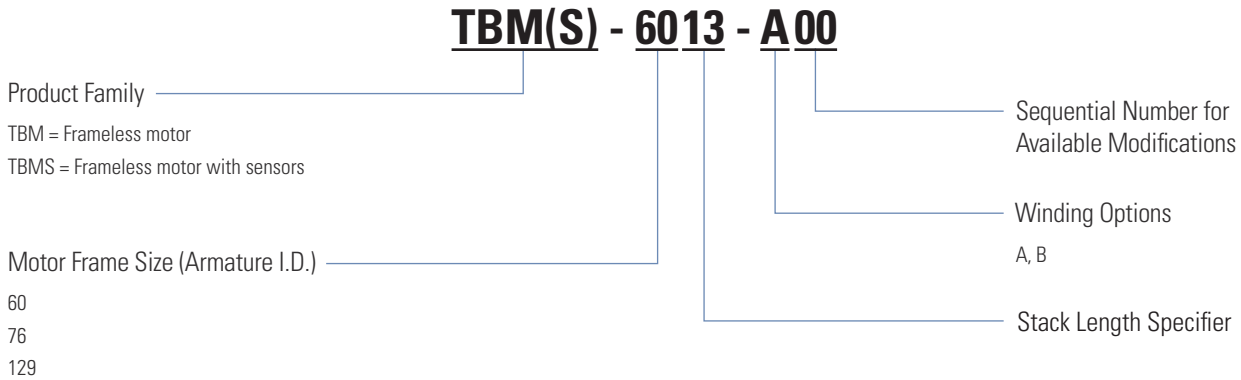
## Sensor Output

CW viewed from lead end



# TBM Frameless Motor Nomenclature

## TBM Frameless Motor



MODEL NOMENCLATURE

## Available TBM(S) Modifications

### Speed/Torque Changes

- Winding Gages
- Stack Lengths

### Generally Available Capability

#00 – #48 AWG (includes lead wire change)  
 Dependent on frame size

### Installation Features

- Rotor Hub Geometry  
 Round, hollow, flanged, keyway, flat  
 Thru bores from 5 mm (0.20 in) up to max published (refer to outline drawing)
- Mounting  
 Bolt hole diameter and circumferential pattern (customer specified)
- Lead Length  
 152 mm (6.00 in) min (base model)  
 150 mm (5.90 in) to 1200 mm (47.0 in) (customer specified)
- Lead Colors  
 Red / White / Black (base model)  
 Other colors to be specified by customer
- Thermal Sensor  
 KTY or PTC type devices (embedded in motor slot only)