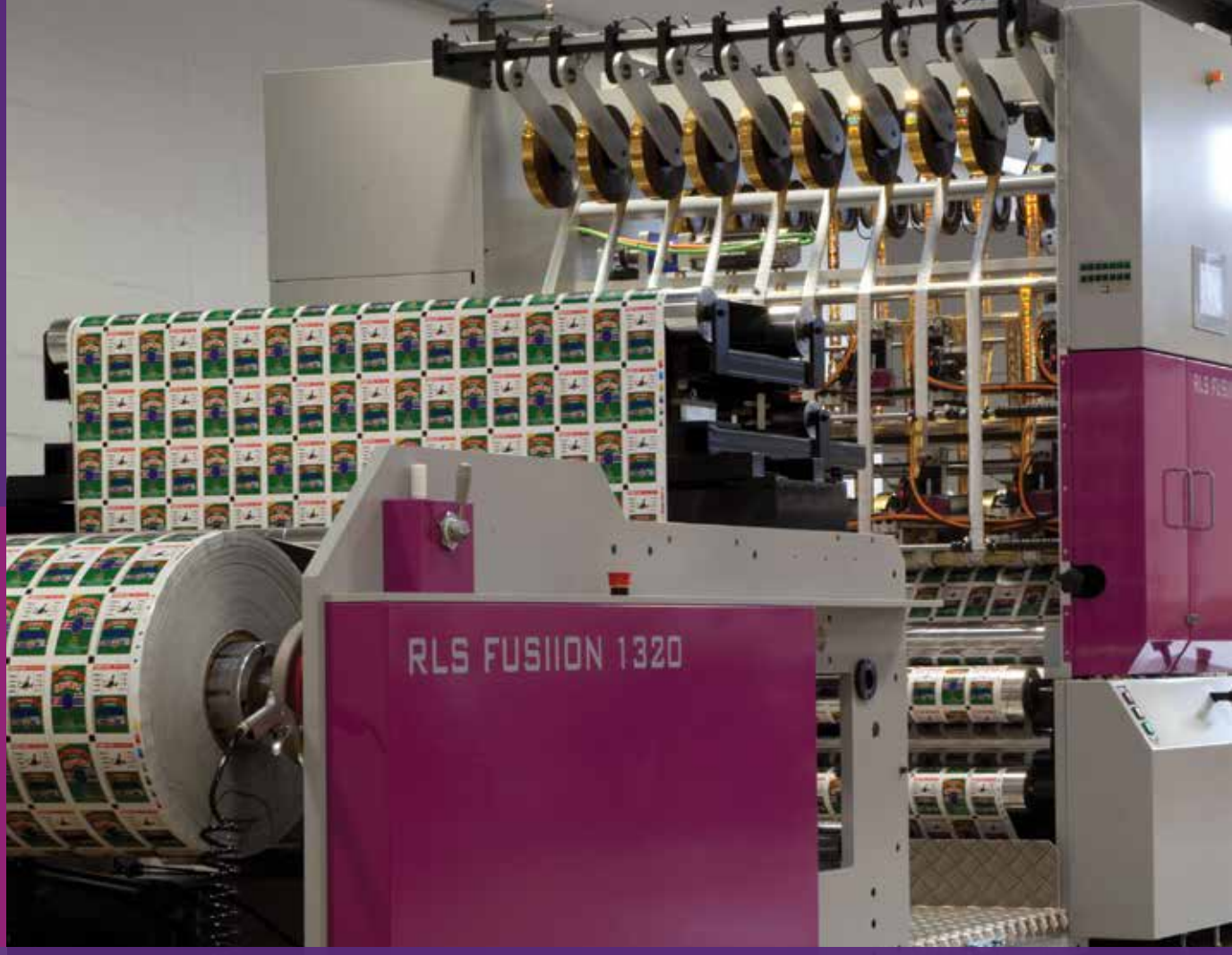

Servo Drives and Motors

Technical Data

High performance AC brushless
servo motors and servo drives

Control Techniques™
Leroy-Somer™

EMERSON™
Industrial Automation

Emerson
Solving your challenges

Emerson - a legacy of performance

Emerson is a diversified global manufacturing and technology company, ranked number 121 in the 2014 Fortune 500® annual list of America's largest corporations. We offer a wide range of products and services in the industrial, commercial and consumer markets through our Process Management, Industrial Automation, Network Power, Climate Technologies and Commercial & Residential Solutions businesses. Recognized widely for our engineering capabilities and management excellence, Emerson has approximately 115,000 employees and 220 manufacturing locations worldwide.

115,000
EMPLOYEES WORLDWIDE

220
MANUFACTURING LOCATIONS WORLDWIDE

Complete servo solutions for continuous and pulse duty applications

Emerson offers a full range of servo drive and motor solutions that are tailored to work together to deliver maximum performance for both continuous and pulse duty servo applications.

Pulse duty

The Digitax ST servo drive and the Unimotor hd servo motor make up Emerson's complete servo solution for pulse duty applications where high peak torque is required.

Combining low torque with high current overload, the Digitax ST - Unimotor hd solution delivers high performance with superior motor control, reduced cabinet size through compact yet powerful design and flexibility via a range of options.

Emerson's pulse duty servo solution offers the highest performance for the most demanding applications such as flying shear, pick and place and industrial robotics.

Continuous duty

The Unidrive M700 servo drive and Unimotor fm servo motor solution is the ideal option for continuous duty applications where continuous torque is required.

The Unidrive M700-Unimotor fm solution brings optimized system performance through an onboard Advanced Motion Controller, maximized throughput with superior motor control, and ultimate flexibility through the option to add significant inertia to the motor.

Emerson's continuous duty servo solution delivers high performance for all continuous duty applications such as theatre hoists, printing machines and material handling.

As well as servo control, the Unidrive M700 offers class leading induction motor performance.

Wide range of complementary products

To complete its servo solution, Emerson can supply a variety of geared Dynabloc servo motors and a wide range of optional drive modules, and additional equipment such as brakes, encoders and cables.

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Industrial Automation

Unimotor fm
& Unimotor hd

Contents

1 Introduction to Unimotor fm - continuous duty

1.1 Overview

Unimotor fm is a high performance brushless AC servo motor range designed for use in demanding continuous duty applications. The motors are available in six frame sizes with various mounting arrangements and motor lengths.

1.1.1 Reliability and innovation

Unimotor fm is designed using a proven development process that prioritises innovation and reliability. This process has resulted in Emerson Industrial Automation's market leading reputation for both performance and quality.

1.1.2 Matched motor and drive combinations

Emerson Industrial Automation motors and drives are designed to function as an optimized system. Unimotor fm is the perfect partner for Unidrive M and Digitax ST.

1.1.3 Features

Unimotor fm is suitable for a wide range of industrial applications, due to its extensive range of features

- Torque range: from 1.4 Nm to 136 Nm
- High energy parking brakes
- Numerous connector variants, e.g. vertical, 90 ° low profile, 90 ° rotatable and hybrid box on frame size 250
- Variety of flange possibilities (IEC/NEMA)
- Various shaft diameters; keyed or plain
- IP65 conformance; sealed against water spray and dust when mounted and connected
- Low inertia for high dynamic performance; high inertia option available
- World class performance
- Supported by rigorous testing for performance and reliability
- Winding voltages for inverter supply of 400 V and 220 V
- Rated speeds from 1,000 to 6,000 rpm and others available
- Thermal protection by PTC thermistor/ optional KTY84.130 sensor
- 48 VDC voltage and lower speeds on request

1.1.4 Faster set-up, optimized performance

When an Emerson Industrial Automation servo drive is connected to a Unimotor fm fitted with a SinCos or Absolute encoder, it can recognize and communicate with the motor to obtain the "electronic nameplate" data. This motor data can then be used to automatically optimize the drive settings. This feature simplifies commissioning and maintenance, ensures consistent performance and saves time.

1.1.5 Accuracy and resolution to suit your application requirements

Choosing the right feedback device for your application is critical in getting optimum performance. Unimotor fm has a range of feedback options that offer different levels of accuracy and resolution to suit most applications:

- Resolver: robust for extreme applications and conditions - low accuracy, medium resolution
- Incremental encoder: high accuracy, medium resolution
- Inductive/capacitive SinCos/Absolute: medium accuracy, high resolution
- Optical/SinCos/Absolute: high accuracy, high resolution
- Single turn and multi-turn: Hiperface and EnDAT protocols supported

1.1.6 Ideal for retrofit

Unimotor fm is an ideal retrofit choice with features to ensure it can integrate easily with your existing servo motor applications. Unimotor fm has been designed so that existing Unimotor customers can easily migrate to the new platform. All connector interface types and mounting dimensions remain the same. If you are planing to retrofit your system, Unimotor fm is the obvious choice.

1.1.7 Custom built motors

As part of our commitment to you, we can design special products to meet your application specific requirements.

Custom built motors are identified by the code S*** added to the end of the part number and can include custom shafts, connections or coatings.

e.g. SPZ – Motor is left unpainted
SON – Motor is fully painted.

(*Indicates additional letters)

1.1.8 Wide range of accessories

Unimotor fm has a wide range of accessories to meet all your system requirements:

- Feedback and power cables for static and dynamic applications
- Fan boxes
- Gearboxes
- Cable connectors

1.1.9 Quick reference table

Frame size	PCD (mm)	0	1.0	3.0	5.0	8.0	10.0	15.0	20.0	30	60	80	100	136.0
075	75		1.40 – 4.70											
			0.78 – 2.07											
095	100			2.50 – 9.30										
				1.45 – 6.0										
115	115				3.9 – 16.0									
					5.4 – 14.8									
142	165					6.20 – 25.0								
						10.2 – 36.9								
190	215							11.3 – 77.0						
								31.3 – 160.8						
250	300												92.0 – 136	
													275 – 400	
Stall	(Nm)	0	1.0	3.0	5.0	8.0	10.0	15.0	20.0	30	60	80	100	136.0
Inertia	(kg.cm²)	0	0.8	1.5	2.5	6.5	8.0	9.0	20.0	60.0	100	150	300.0	400.0

Key: = Nm = Inertia

1.1.10 Conformance and standards

c UL us CE RoHS Compliant 2+ YEAR Worldwide Warranty SYSTEME DE MANAGEMENT QUALITÉ CERTIFIÉ ISO 9001 : 2008 DNV

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Industrial Automation

1.2 Unimotor fm ordering code Information - D+10 lead time

Use the information below in the illustration to create an order code for a Unimotor fm

095	U3	B	30	5	B	A
Frame size	Motor voltage	Stator length	Rated speed	Brake	Connection type	Output shaft
075	075-142 Frames	075 Frame	075-142 Frames	075-142 Frames	075-142 Frames	075-142 Frames
095	U3 = 400 V	B	30 = 3,000 rpm	0 = Not fitted	B = Power and Signal 90 ° rotatable	A = Key fitted
115		D		5 = Parking Brake		F = Key and Half key supplied separately
142		095 Frame			C = Power 90 ° rotatable and signal vertical	
		B				
		C				
		D				
		115 Frame				
		B				
		C				
		D				
		142 Frame		Express availability motors, available in ten days		
		C				
		D				
		E				

Unimotor fm ordering code Information - Standard lead time

Additional options are available upon request but may require a longer lead time to complete, please check with the Industrial Automation Center.

095	U3	B	30	5	B	A
Frame size	Motor voltage	Stator length	Rated speed	Brake	Connection type	Output shaft
075	075-190	075 Frame	075-142 Frames	075-250 Frames	075-250 Frames	075-250 Frames
095	E3 = 220 V	A	20 = 2,000 rpm	0 = No Brake	V = Power and Signal Vertical	A = Key fitted
115	U3 = 400 V	B	30 = 3,000 rpm	5 = Parking brake		B = Plain shaft
142	250 Frame	C	40 = 4,000 rpm		B = Power and Signal 90 ° rotatable	E = Half key fitted
190	U3 = 400 V	D	60 = 6,000 rpm			F = Key and Half key supplied separately
250		095 -142 Frames	190 Frame		C = Power 90 ° rotatable and signal vertical	
		A	20 = 2,000 rpm		115-142 Frames	
		B	30 = 3,000 rpm		J = 1.5 size Power 90 ° rotatable and signal 90 ° rotatable	
		C	40 = 4,000 rpm			
		D	250 Frame		M = 1.5 size power and signal vertical	
		E	10 = 1,000 rpm		190 Frame	
		190 Frame	15 = 1,500 rpm		H = Power hybrid box and signal vertical	
		A	20 = 2,000 rpm		250 Frame	
		B	25 = 2,500 rpm		H = Power hybrid box and signal 90 ° (Std)	
		C				
		D				
		E				
		F				
		G				
		H				
		250 Frame				
		D				
		E				
		F				

- 190 – Lifting eyes will be fitted as standard on all 190 motors. This is to enable easy handling of these motors that are often over 25 kg in weight. If there is an issue with the lifting eyes causing an obstruction when fitting the mating cable then the lifting eyes maybe removed once the motor is installed in the application.
- Hybrid Box Connection – Due to the increased power rating of some of the 190 motors a hybrid box is now being offered. A motor fitted with the Hybrid box will not be UL marked. If a specific motor from the fm range that now has a Hybrid box has previously been purchased with a connector and is working within an application please contact Control Techniques Dynamics to discuss the options available.

	CA			A		100		190	
	Feedback device			Inertia		PCD		Shaft Diameter	
	075-142 Frames			075-142 Frames		075 Frame only			
	AE =	Resolver		A =	Standard + PTC	075	Std	14.0	B/D
	CA =	Incremental Encoder	4096 ppr CFS50	B =	High + PTC	095 Frame only			
	EC =	Inductive Absolute Multi-turn	EQI 1331			100	Std	19.0	B/C/D
	FC =	Inductive Absolute Single turn	ECI 1319			115 Frame only			
	RA =	Optical SinCos Multi-turn	SRM 50			115	Std	19.0	B/C
						115	Std	24.0	D
						142 Frame only			
						165	Std	24.0	C/D/E

	CA			A		100		190	
	Feedback device			Inertia		PCD		Shaft Diameter	
	075-142 Frames			075-250 Frames		075 Frame Only			
	AE =	Resolver		A =	Standard + PTC	075	Std	11.0	A
	CA =	Incremental Encoder	4096 ppr CFS50	B =	High + PTC	080		14.0	B-D
	MA =	Incremental encoder	2048 ppr CFS50	C =	Standard + KTY84-130 thermistor	085		19.0	Max
	EB =	Optical Absolute Multi-turn	EQN 1325	D =	High + KTY84-130 thermistor	095 Frame Only			
	FB =	Optical Absolute Single turn	ECN 1313			100	Std	14.0	A
	EC =	Inductive Absolute Multi-turn	EQI 1331			098		19.0	B-E
	FC =	Inductive Absolute Single turn	ECI 1319			115		22.0	Max
	RA =	Optical SinCos Multi-turn	SRM 50			115 Frame Only			
	SA =	Optical SinCos Single turn	SRS 50			115	Std	19.0	A-C
	190-250 Frames					130		24.0	D-E
	AE =	Resolver						24.0	Max
	CA =	Incremental Encoder	4096 ppr CFS50			142 Frame Only			
	MA =	Incremental encoder	2048 ppr CFS50			165	Std	24.0	A-E
	EB =	Optical Absolute Multi-turn	EQN 1325			149		32.0	Max
	FB =	Optical Absolute Single turn	ECN 1313			190 Frame Only			
	RA =	Optical SinCos Multi-turn	SRM 50			215	Std	32.0	A-H
	SA =	Optical SinCos Single turn	SRS 50					42.0	Max
						250 Frame Only			
						300	Std	48.0	D-F

- Shaft sizing – Please ensure that the correct shaft size is selected to meet the application requirement.
- 142 Connector Rating - Due to the increased power rating of some of the 142 motors a type "J" or "M" Size 1.5 power connector is now being offered. If a specific motor from the fm range that now has a "J" or "M" type connector has previously been purchased with a "B" or "C" or "V" size 1 connector and is working within an application please contact Control Techniques Dynamics to discuss the options available.

1.3 Ratings

1.3.1 3 Phase VPWM drives 200-240 Vrms

Δt= 100 °C winding 40 °C maximum ambient. All data subject to ±10 % tolerance

Motor Frame Size (mm)	075E3				095E3					115E3				
Frame length	A	B	C	D	A	B	C	D	E	A	B	C	D	E
Continuous Stall Torque (Nm)	1.4	2.7	3.7	4.7	2.5	4.5	6.3	7.9	9.3	3.9	7.4	10.8	13.7	16.0
Peak Torque (Nm)	4.3	8.0	11.2	14.0	7.4	13.5	18.9	23.7	27.8	11.7	22.2	32.4	41.0	48.0
Standard Inertia (kg.cm²)	0.78	1.22	1.64	2.07	1.45	2.6	3.72	4.83	6	5.4	7.7	10	12.5	14.8
High Inertia (kg.cm²)	1.18	1.61	2.03	2.46	1.31	4.5	5.6	6.7	7.8	10.0	12.3	14.7	17.1	19.4
Winding thermal time constant (sec)	63	58	73	78	84	82	90	108	112	103	109	116	127	141
Motor weight unbraked (kg)	2.9	3.7	4.5	5.3	4.6	5.8	7	8.2	9.4	6.9	8.8	10.7	12.6	14.5
Motor weight braked (kg)	3.4	4.2	5	5.8	5.2	6.4	7.6	8.8	10	8.1	10	11.9	13.8	15.7
Number of poles	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Speed 2,000 (rpm)													
Kt (Nm/A) =	Kt (Nm/A) = 1.4													
Ke (V/krpm) =	Ke (V/krpm) = 85.5													
Rated Torque (Nm)	1.3	2.5	3.5	4.5	2.4	4.3	5.9	7.3	8.5	3.7	7.3	10.1	11.9	14.1
Stall Current (A)	1.0	1.9	2.7	3.3	1.8	3.2	4.5	5.6	6.6	2.8	5.3	7.7	9.8	11.4
Rated Power(kW)	0.27	0.52	0.73	0.93	0.51	0.90	1.23	1.53	1.77	0.77	1.53	2.12	2.49	2.95
R (ph-ph) (Ohms)	48.24	16.32	8.96	6.22	20.69	6.78	3.79	2.42	1.92	10.65	3.43	1.82	1.81	1.34
L (ph-ph) (mH)	87.47	39.77	24.68	19.15	57.78	26.1	16.36	11.83	9.75	55.83	19.43	12.31	9.5	7.68
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Speed 3,000 (rpm)													
Kt (Nm/A) =	Kt (Nm/A) = 0.93													
Ke (V/krpm) =	Ke (V/krpm) = 57													
Rated Torque (Nm)	1.3	2.3	3.3	4.2	2.33	4.1	5.6	6.9	8.15	3.5	6.7	9.5	11.2	12.7
Stall Current (A)	1.55	2.85	4.00	5.02	2.63	4.84	6.77	8.49	9.95	4.19	7.96	11.61	14.68	17.20
Rated Power(kW)	0.41	0.72	1.04	1.31	0.73	1.29	1.76	2.17	2.56	1.10	2.10	2.98	3.52	3.99
R (ph-ph) (Ohms)	19.8	6.69	3.71	2.72	9.62	2.99	1.64	1.07	0.86	4.91	1.52	0.81	0.57	0.43
L (ph-ph) (mH)	37.2	16.8	10.69	8.27	26.29	11.47	7.15	5.16	4.35	20.26	8.63	5.47	4.35	3.41
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	B	J
	Speed 4,000 (rpm)													
Kt (Nm/A) =	Kt (Nm/A) = 0.7													
Ke (V/krpm) =	Ke (V/krpm) = 42.75													
Rated Torque (Nm)	1.2	2.1	2.8	3.8	2.3	3.8	5.3	6.4	7.4	3.0	5.8	7.5	8.3	8.8
Stall Current (A)	2.06	3.79	5.31	6.67	3.50	6.43	9.00	11.29	13.21	5.57	10.57	15.43	19.50	22.86
Rated Power(kW)	0.50	0.86	1.17	1.59	0.94	1.59	2.20	2.68	3.10	1.26	2.43	3.12	3.46	3.69
R (ph-ph) (Ohms)	12.44	4.01	2.26	1.53	5.26	1.76	1.04	0.74	0.48	3.05	0.93	0.49	0.3	0.27
L (ph-ph) (mH)	23.35	9.62	6.32	4.63	14.94	6.67	4.52	3.53	2.44	12.44	5.13	3.34	2.25	2.18
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	J	J
	Speed 6,000 (rpm)													
Kt (Nm/A) =	Kt (Nm/A) = 0.47													
Ke (V/krpm) =	Ke (V/krpm) = 28.5													
Rated Torque (Nm)	1.1	1.9	2.8	3.4	1.98	3.2	4.2	N/A	N/A	2.7	5	N/A	N/A	N/A
Stall Current (A)	3.06	5.64	7.91	9.94	5.21	9.57	13.40			8.30	15.74			
Rated Power(kW)	0.68	1.21	1.73	2.14	1.24	2.01	2.64			1.70	3.14			
R (ph-ph) (Ohms)	5.37	1.81	1.02	0.68	2.33	0.73	0.46			1.5	0.41			
L (ph-ph) (mH)	9.8	4.42	2.88	2.06	6.57	2.77	2.07			6.08	2.34			
Recommended connector size	B	B	B	B	B	B	B			B	B			

N/A Not available

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

	142E3					190E3								Motor Frame Size (mm)
	A	B	C	D	E	A	B	C	D	E	F	G	H	Frame length
	6.2	11.0	15.7	20.5	25.0	11.3	22.5	33.5	44.5	54.0	63.0	71.0	77.0	Continuous Stall Torque (Nm)
	18.6	33.0	47.1	61.5	75.0	33.8	67.5	100.5	133.5	162.0	189.0	213.0	231.0	Peak Torque (Nm)
	10.2	16.9	23.5	30.2	36.9	31.3	49.8	68.3	86.8	105.3	123.8	142.3	160.8	Standard Inertia (kg.cm^2)
	23.2	29.8	36.5	43.1	49.8	69.8	88.3	106.8	125.3	143.8	162.3	180.8	199.3	High Inertia (kg.cm^2)
	145	148	188	206	249	194	214	215	216	251	285	425	564	Winding thermal time constant (sec)
	8.3	11.4	14.5	17.6	20.7	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0	Motor weight unbraked (kg)
	10	13.1	16.2	19.3	22.5	18.9	23.7	28.5	33.3	38.1	42.9	47.7	52.5	Motor weight braked (kg)
	6	6	6	6	6	8	8	8	8	8	8	8	8	Number of poles
	Speed 2,000 (rpm)													
	Kt (Nm/A) = 1.4													Kt (Nm/A) =
	Ke (V/krpm) = 85.5													Ke (V/krpm) =
	5.9	10.4	14.7	18.5	21.5	10.8	20.6	29.4	37.9	44.3	50.5	54.0	56.0	Rated Torque (Nm)
	4.4	7.9	11.2	14.6	17.9	8.0	16.1	23.9	31.8	38.6	45.0	50.7	55.0	Stall Current (A)
	1.23	2.18	3.08	3.87	4.49	2.26	4.31	6.15	7.94	9.28	10.58	11.31	11.73	Rated Power(kW)
	5.56	1.54	0.8	0.51	0.4	1.8	0.5	0.25	0.19	0.13	0.1	0.08	0.054	R (ph-ph) (Ohms)
	35.43	14.25	8.99	6.35	5.25	17.34	7.77	4.66	3.26	3.02	2.65	2.12	1.55	L (ph-ph) (mH)
	B	B	B	B	J	B	B	J	J	J	H	H	H	Recommended connector size
	Speed 3,000 (rpm)													
	Kt (Nm/A) = 0.93													Kt (Nm/A) =
	Ke (V/krpm) = 57													Ke (V/krpm) =
	5.5	9.5	12.8	16.0	18.15	10.3	19.4	26.5	33.2	34.2	35.2	36.2	37	Rated Torque (Nm)
	6.67	11.83	16.88	22.04	26.88	12.10	24.19	36.02	47.85	58.06	67.74	76.34	82.80	Stall Current (A)
	1.73	2.98	4.02	5.03	5.70	3.24	6.09	8.33	10.43	10.74	11.06	11.37	11.62	Rated Power (kW)
	2.25	0.68	0.35	0.23	0.164	0.83	0.256	0.132	0.09	0.07	0.05	0.05	0.03	R (ph-ph) (Ohms)
	14.68	6.33	3.89	3.66	2.23	7.94	3.874	2.46	1.81	1.55	1.17	1.36	0.86	L (ph-ph) (mH)
	B	B	B	J	J	B	J	J	H	H	H	H	H	Recommended connector size
	Speed 4,000 (rpm)													
	Kt (Nm/A) = 0.7													Kt (Nm/A) =
	Ke (V/krpm) = 42.75													Ke (V/krpm) =
	4.1	8.1	10.2	12.2	14	8.2	18.2	23.0	29.0	N/A	N/A	N/A	N/A	Rated Torque (Nm)
	8.86	15.71	22.43	29.29	35.71	16.07	32.14	47.86	63.57					Stall Current (A)
	1.72	3.37	4.27	5.11	5.86	3.43	7.62	9.63	12.15					Rated Power (kW)
	1.29	0.38	0.23	0.13	0.09	0.46	0.14	0.07	0.06					R (ph-ph) (Ohms)
	8.39	3.44	2.49	1.99	1.2	4.34	2.18	1.39	1.26					L (ph-ph) (mH)
	B	B	J	J	J	B	J	H	H					Recommended connector size
	Speed 6,000 (rpm)													
	Kt (Nm/A) = 0.47													Kt (Nm/A) =
	Ke (V/krpm) = 28.5													Ke (V/krpm) =
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Rated Torque (Nm)
														Stall Current (A)
														Rated Power (kW)
														R (ph-ph) (Ohms)
														L (ph-ph) (mH)
														Recommended connector size

All other figures relate to a 20 °C motor temperature.
Maximum intermittent winding temperature is 140 °C

The recommended connector has be selected using the connector manufacturer's de-rating values applied to a motor at full operational temperature.

1.3.2 3 Phase VPWM drives 380-480 Vrms

Δt = 100 °C winding 40 °C maximum ambient. All data subject to ±10 % tolerance

Motor Frame Size (mm)	75U3				95U3					115U3				
Frame length	A	B	C	D	A	B	C	D	E	A	B	C	D	E
Continuous Stall Torque (Nm)	1.4	2.7	3.7	4.7	2.5	4.5	6.3	7.9	9.3	3.9	7.4	10.8	13.7	16.0
Peak Torque (Nm)	4.3	8.0	11.2	14.0	7.4	13.5	18.9	23.7	27.8	11.7	22.2	32.4	41.0	48.0
Standard Inertia (kg.cm²)	0.78	1.22	1.64	2.07	1.45	2.6	3.72	4.83	6	5.4	7.7	10	12.5	14.8
High Inertia (kg.cm²)	1.18	1.61	2.03	2.46	3.33	4.5	5.6	6.7	7.8	10.0	12.3	14.7	17.1	19.4
Winding thermal time constant (sec)	63	58	73	78	84	82	90	108	112	103	109	116	127	141
Motor weight unbraked (kg)	2.9	3.7	4.5	5.3	4.6	5.8	7	8.2	9.4	6.9	8.8	10.7	12.6	14.5
Motor weight braked (kg)	3.4	4.2	5	5.8	5.2	6.4	7.6	8.8	10	8.1	10	11.9	13.8	15.7
Number of poles	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Speed 2,000 (rpm)														
Kt (Nm/A) =	Kt (Nm/A) = 2.4													
Ke (V/krpm) =	Ke (V/krpm) = 147													
Rated Torque (Nm)	1.3	2.5	3.5	4.5	2.4	4.3	5.9	7.3	8.5	3.7	7.3	10.1	11.9	14.1
Stall Current (A)	0.6	1.1	1.6	1.9	1.0	1.9	2.6	3.3	3.9	1.6	3.1	4.5	5.7	6.7
Rated Power (kW)	0.27	0.52	0.73	0.93	0.51	0.90	1.23	1.53	1.77	0.77	1.53	2.12	2.49	2.95
R (ph-ph) (Ohms)	148.50	52.20	27.30	19.97	64.08	20.88	10.46	7.46	5.09	32.92	10.68	5.25	3.70	2.75
L (ph-ph) (mH)	258.36	117.28	74.20	56.97	173.40	78.16	47.02	35.44	27.18	139.43	59.51	35.90	27.63	21.87
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Speed 3,000 (rpm)														
Kt (Nm/A) =	Kt (Nm/A) = 1.6													
Ke (V/krpm) =	Ke (V/krpm) = 98													
Rated Torque (Nm)	1.3	2.3	3.3	4.2	2.3	4.1	5.6	6.9	8.2	3.5	6.7	9.5	11.2	12.7
Stall Current (A)	0.9	1.7	2.3	2.9	1.5	2.8	3.9	4.9	5.8	2.4	4.6	6.8	8.5	10.0
Rated Power (kW)	0.41	0.72	1.04	1.31	0.73	1.29	1.76	2.17	2.56	1.10	2.10	2.98	3.52	3.99
R (ph-ph) (Ohms)	62.08	21.07	12.54	7.81	26.70	8.63	4.67	3.16	2.27	14.74	4.37	2.30	1.53	1.23
L (ph-ph) (mH)	114.59	52.65	34.18	23.89	76.65	33.71	21.09	15.95	12.06	57.29	25.19	15.57	11.60	9.89
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Speed 4,000 (rpm)														
Kt (Nm/A) =	Kt (Nm/A) = 1.2													
Ke (V/krpm) =	Ke (V/krpm) = 73.5													
Rated Torque (Nm)	1.2	2.1	2.8	3.8	2.3	3.8	5.3	6.4	7.4	3.0	5.8	7.5	8.3	8.8
Stall Current (A)	1.2	2.2	3.1	3.9	2.0	3.8	5.3	6.6	7.7	3.3	6.2	9.0	11.4	13.3
Rated Power (kW)	0.50	0.86	1.17	1.59	0.94	1.59	2.20	2.68	3.10	1.26	2.43	3.12	3.46	3.69
R (ph-ph) (Ohms)	38.01	12.71	6.49	4.94	16.14	5.22	2.61	1.81	1.40	8.49	2.61	1.31	0.84	0.66
L (ph-ph) (mH)	68.39	30.46	18.28	13.97	44.25	19.54	11.75	8.86	7.25	33.79	14.87	8.98	6.27	5.35
Recommended connector size	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Speed 6,000 (rpm)														
Kt (Nm/A) =	Kt (Nm/A) = 0.8													
Ke (V/krpm) =	Ke (V/krpm) = 49													
Rated Torque (Nm)	1.1	1.9	2.8	3.4	2.0	3.2	4.2	N/A	N/A	2.7	5.0	N/A	N/A	N/A
Stall Current (A)	1.8	3.3	4.7	5.8	3.1	5.6	7.9			4.9	9.3			
Rated Power (kW)	0.68	1.21	1.73	2.14	1.24	2.01	2.64			1.70	3.14			
R (ph-ph) (Ohms)	15.48	5.19	2.86	2.12	6.59	2.13	1.22			3.48	1.09			
L (ph-ph) (mH)	28.66	12.77	8.01	6.33	18.62	8.24	5.44			14.31	6.30			
Recommended connector size	B	B	B	B	B	B	B			B	B			

N/A Not available

The information contained in this specification is for guidance only and does not form part of any contract.

Emerson Industrial Automation have an ongoing process of development and reserve the right to change the specification without notice.

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature. Maximum intermittent winding temperature is 140 °C

	142U3					190U3								250U3		
	A	B	C	D	E	A	B	C	D	E	F	G	H	D	E	F
	6.2	11.0	15.7	20.5	25.0	11.3	22.5	33.5	44.5	54.0	63.0	71.0	77.0	92	116	136
	18.6	33.0	47.1	61.5	75.0	33.8	67.5	100.5	133.5	162.0	189.0	213.0	231.0	276	348	408
	10.2	16.9	23.5	30.2	36.9	31.3	49.8	68.3	86.8	105.3	123.8	142.3	160.8	275	337	400
	23.2	29.8	36.5	43.1	49.8	69.8	88.3	106.8	125.3	143.8	162.3	180.8	199.3	408	502	597
	145	148	188	206	249	194	214	215	216	251	285	425	564	439	486	608
	8.3	11.4	14.5	17.6	20.7	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0	57.5	65.5	73.7
	10	13.1	16.2	19.3	22.5	18.9	23.7	28.5	33.3	38.1	42.9	47.7	52.5	68.5	76.5	84.5
	6	6	6	6	6	8	8	8	8	8	8	8	8	10	10	10
														Speed 1,000 (rpm)		
						Kt (Nm/A) = 2.4								Kt (Nm/A) = 5.4		
						Ke (V/krpm) = 147								Ke (V/krpm) = 323		
	5.9	10.4	14.7	18.5	21.5	10.8	20.6	29.4	37.9	44.3	50.5	54.0	56.0	75	92	106
	2.6	4.6	6.5	8.5	10.4	4.7	9.4	14.0	18.5	22.5	26.3	29.6	32.1	17.2	21.7	25.4
	1.23	2.18	3.08	3.87	4.49	2.26	4.31	6.15	7.94	9.28	10.58	11.31	11.73	7.9	9.6	11.1
	14.64	4.71	2.38	1.60	1.11	6.15	1.54	0.83	0.50	0.37	0.28	0.26	0.23	0.61	0.48	0.34
	98.76	42.15	26.32	19.46	15.08	52.90	23.55	15.00	8.81	8.68	7.36	6.89	6.30	22.90	19.10	14.90
	B	B	B	B	B	B	B	B	J	J	J	J	J	B	B	B
														Speed 1,500 (rpm)		
						Kt (Nm/A) = 1.6								Kt (Nm/A) = 3.6		
						Ke (V/krpm) = 98								Ke (V/krpm) = 216		
	5.5	9.5	12.8	16.0	18.2	10.3	19.4	26.5	33.2	34.2	35.2	36.2	37.0	67	76	84
	3.9	6.9	9.8	12.8	15.6	7.0	14.1	20.9	27.8	33.8	39.4	44.4	48.1	25.8	32.5	38.1
	1.73	2.98	4.02	5.03	5.70	3.24	6.09	8.33	10.43	10.74	11.06	11.37	11.62	10.5	11.9	13.2
	6.20	2.12	1.08	0.70	0.50	2.73	0.70	0.41	0.22	0.17	0.14	0.15	0.08	0.27	0.21	0.15
	42.97	19.11	12.06	8.91	6.70	23.50	10.47	7.35	4.89	3.86	3.60	3.06	2.42	10.00	8.60	6.60
	B	B	B	B	B	B	B	J	J	J	J	H	H	B	B	B
														Speed 2,000 (rpm)		
						Kt (Nm/A) = 1.2								Kt (Nm/A) = 2.7		
						Ke (V/krpm) = 73.5								Ke (V/krpm) = 162		
	4.1	8.1	10.2	12.2	14.0	8.2	18.2	23.0	29.0	N/A	N/A	N/A	N/A	65	73	81
	5.2	9.2	13.1	17.1	20.8	9.4	18.8	27.9	37.1					34.4	43.4	50.9
	1.72	3.37	4.27	5.11	5.86	3.43	7.62	9.63	12.15					10.2	11.5	12.7
	3.64	1.18	0.61	0.41	0.29	1.35	0.38	0.21	0.14					0.15	0.1	0.08
	24.44	10.54	6.78	5.06	3.97	13.56	6.05	3.86	2.45					5.7	4.2	3.7
	B	B	B	J	J	B	J	J	J					B	H	H
														Speed 2,500 (rpm)		
						Kt (Nm/A) = 0.8								Kt (Nm/A) = 2.1		
						Ke (V/krpm) = 49								Ke (V/krpm) = 129		
	3.2	5.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	62	70	77
	7.8	13.8												43.0	54.2	63.6
	2.01	3.27												9.7	11	12.1
	1.63	0.53												0.09	0.08	0.06
	11.08	4.78												3.5	3.1	2.6
	B	B												H	H	H

The recommended connector has been selected using the connector manufacturer's de-rating values applied to a motor at full operating temperature.

The Unimotor fm 250 servo motor has been designed to give greatest motor efficiency up to a rated, or rms, speed of 1,500 rpm. The range does include the optional speeds of 2,000 rpm and 2,500 rpm. These windings will allow the end user to enter the intermittent speed zone as well as the intermittent torque zone on the 250 motor.

These higher speed windings are designed with optimum kt values that allow increased speed without demanding very high currents.

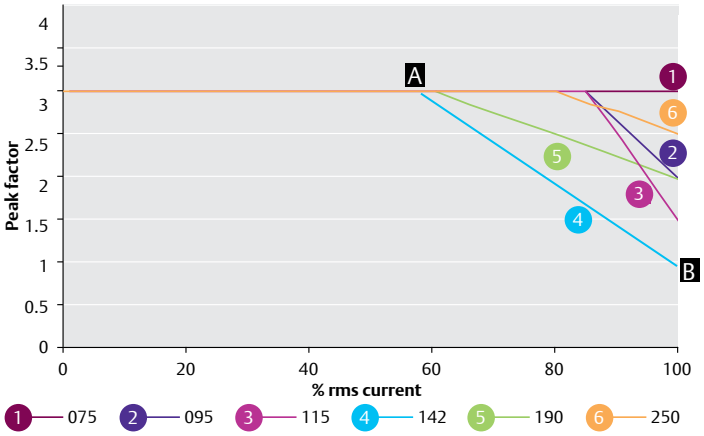
The Unimotor fm 250 is designed for S2 to S6 duties and as such the rms values play an important part in the motor selection for torque and speed.

1.4 Peak torque information

On some of the frame sizes the full peak torque can not be achieved at the full 100 % rms current level. As shown below the 075 motors is not affected by the reduced levels and remains constant up to 100 % rms current, whereas the 250 motors all show a drop at some point along the % rms current line.

The graph below shows the standard peak factor for each frame size.

Standard peak torque factor



To use this graph correctly the rms current and rms speed of the application have to be calculated. The rms current value must then be converted into a percentage of the full motor current available, at that rms speed value. If the full current available is 10 Amps and the rms current is 7.5 Amps, then the percentage rms current value is 75 %. This value can then be plotted onto the graph in order to obtain the peak factor. The peak factor is then used as part of the calculation, shown below, for the peak torque value.

Peak factor	x	Stall current	x	kt	= Peak torque

An example would be with a 142U3E300 motor where the % rms current value is calculated to 50 %, the peak factor would be 3 (point A).

Peak factor	x	Stall current	x	kt	= Peak torque
3.00	x	15.6	x	1.6	= 74.9 Nm

But if the % rms current value were to be calculated at a level of 100 %, the peak factor would equal 1.00 (point B).

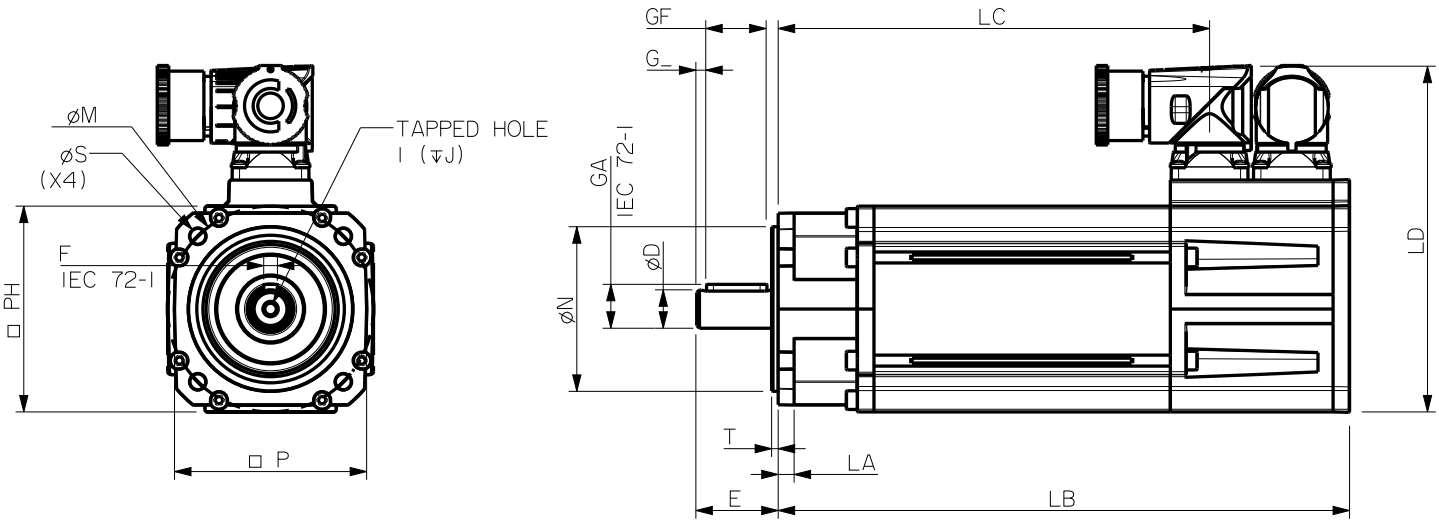
Peak factor	x	Stall current	x	kt	= Peak torque
1.00	x	15.6	x	1.6	= 25 Nm

Peak torque is defined for a maximum period of 250 ms, rms 3,000 rpm Δmax = 100 °C, 40 °C ambient.

Unimotor fm	Peak factor 0 % to 100 % rms	
075	3.0	
095	Peak factor 0 % to 88 % rms	Peak factor @ 100 % rms
	3.0	2.0
115	Peak factor 0 % to 86 % rms	Peak factor @ 100 % rms
	3.0	1.5
142	Peak factor 0 % to 57 % rms	Peak factor @ 100 % rms
	3.0	1.0
190	Peak factor 0 % to 60 % rms	Peak factor @ 100 % rms
	3.0	2.0
250	Peak factor 0 % to 80 % rms	Peak factor @ 100 % rms
	3.0	2.5

1.5 Dimensions

1.5.1 Frame size 075



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height (B)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 1)	P (± 0.4)	S (H14)	M (± 0.4)	PH (± 0.5)	
075A	208.2	157.2	238.2	187.2	5.8	2.4	60.0	126.0	70.0	5.8	75.0	75	M5
075B	238.2	187.2	268.2	217.2									
075C	268.2	217.2	298.2	247.2									
075D	298.2	247.2	328.2	277.2									

Optional flange motor dimensions (mm)

	Unbraked length		Braked length	
	LB (± 1.0)	LC (± 1.0)	LB (± 1.0)	LC (± 1.0)
075A	192.6	141.6	222.6	171.6
075B	222.6	171.6	252.6	201.6
075C	252.6	201.6	282.6	231.6
075D	282.6	231.6	312.6	261.6

Optional connector height (mm)

Connection type	Overall height
	LD (± 1)
V	118.5
C	126.0

Optional flange dimensions (mm)

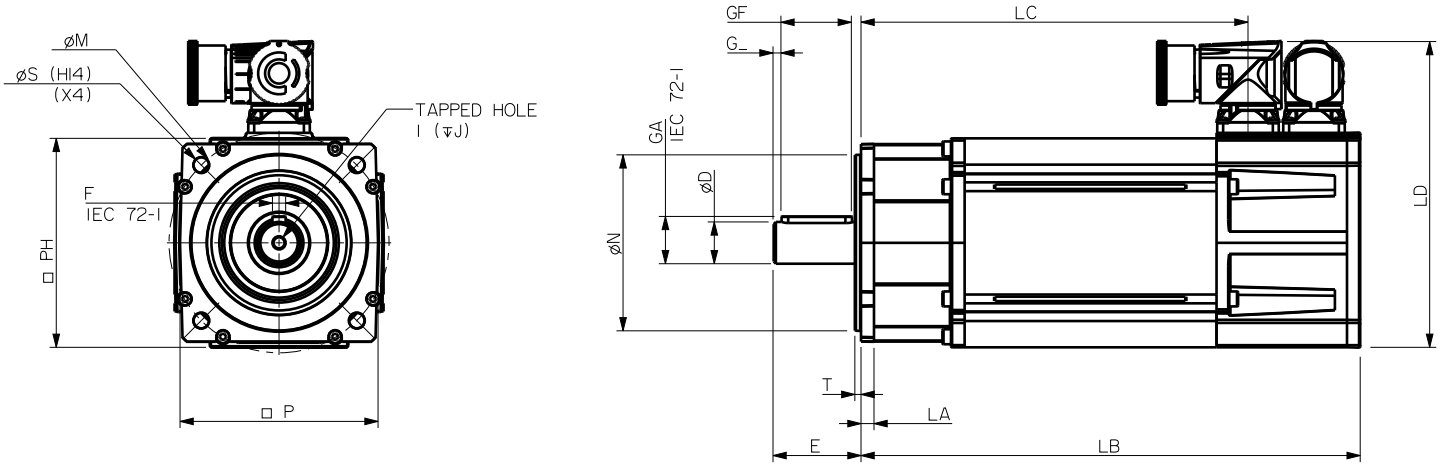
PCD code	Front end frame type	Flange square	Fixing hole PCD	Register diameter	Flange thickness	Fixing hole diameter
		P (± 0.4)	M (± 0.4)	N (j6)	LA (± 0.5)	S (H14)
075	Extended	70.0	66.7 - 75.0	60.0	5.8	5.80
080	Extended	70.0	75.0 - 80.0	60.0	5.8	5.80
085	Flat	80.0	85.0	70.0	5.8	7.00

Output shaft dimensions (mm)

	Shaft Diameter	Shaft Length	Key Height	Key Length	Key to Shaft End	Key Width	Tapped Hole Thread Size	Tapped Hole Depth
	D (j6)	E (± 0.45)	GA	GF (± 0.25)	G (± 1.1)	F	I	J (± 0.4)
075A (Std)	11	23	12.5	14	3.6	4	M4X0.7	11
075B-D (Std)	14	30	16	25	1.5	5	M5X0.8	13.5
075A-D (Opt)	19	40	21.5	32	3.6	6.0	M6X1.0	17.0

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

1.5.2 Frame size 095



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height (B)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 1)	P (± 0.4)	S (H14)	M (± 0.4)	PH (± 0.6)	
095A	226.9	175.9	256.9	205.9									
095B	256.9	205.9	286.9	235.9									
095C	286.9	235.9	316.9	265.9	5.9	2.8	80.0	139.0	90.0	7.0	100.0	95.0	M6
095D	316.9	265.9	346.9	295.9									
095E	346.9	295.9	376.9	325.9									

Optional flat flange motor dimensions (mm)

	Unbraked length		Braked length	
	LB (± 1.0)	LC (± 1.0)	LB (± 1.0)	LC (± 1.0)
095A	201.8	150.8	231.8	180.8
095B	231.8	180.8	261.8	210.8
095C	261.8	210.8	291.8	270.8
095D	291.8	270.8	321.8	270.8
095E	321.8	270.8	351.8	300.8

Optional connector height (mm)

Connection type	Overall height
	LD (± 1)
V	131.5
C	139.0

Optional flange dimensions (mm)

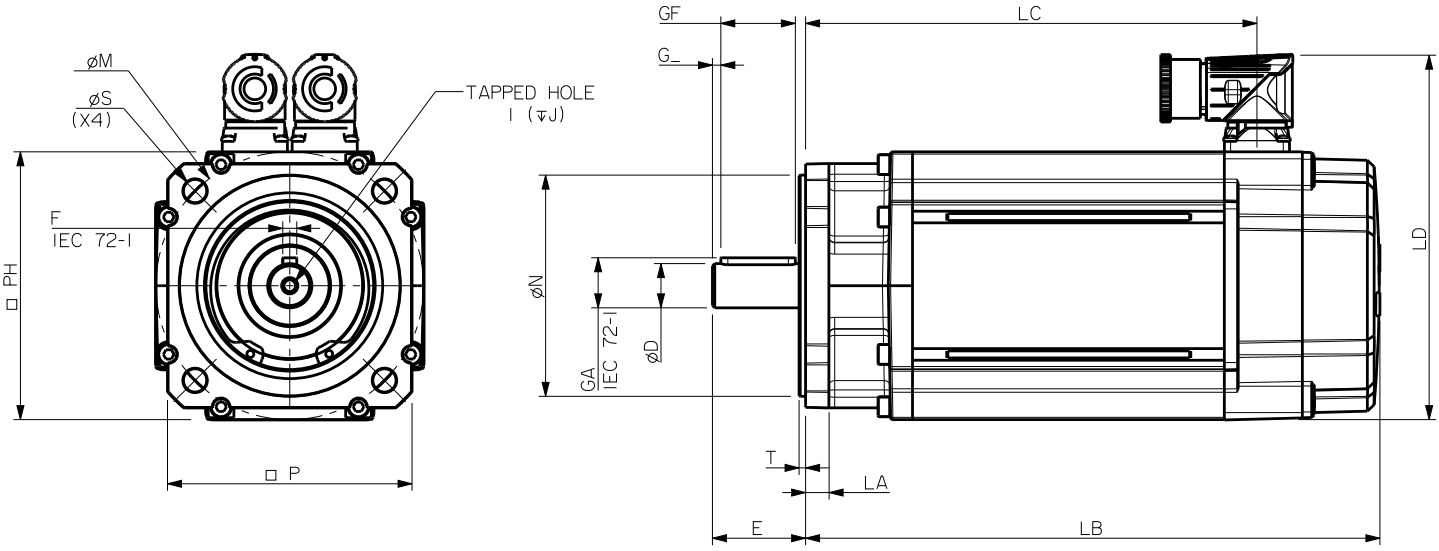
PCD code	Front end frame type	Flange square	Fixing hole PCD	Register diameter	Flange thickness	Fixing hole diameter
		P (± 0.4)	M (± 0.4)	N (j6)	LA (± 0.5)	S (H14)
098	Extended	90.0	98.4	73.0	5.9	7.0
115	Flat	105.0	115.0	95.0	6.8	10.0

Output shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (± 0.45)	GA	GF (± 0.25)	G (± 1.1)	F	I	J (± 0.4)
095A (Std)	14	30	16	25	1.5	5	M5X0.8	13.5
095B-E (Std)	19	40	21.5	32	3.6	6	M6X1.0	17
095A-E (Opt)	22	50	24.5	40	4.6	6	M8X1.25	20

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

1.5.3 Frame size 115



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height (B)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 1)	P (± 0.4)	S (H14)	M (± 0.4)	PH (± 0.6)	
115A	246.6	193.8	276.6	223.8									
115B	276.6	223.8	306.6	253.8									
115C	306.6	253.8	336.6	283.8	10.1	2.8	95	156.5	105	10	115	115	M8
115D	336.6	283.8	366.6	313.8									
115E	366.6	313.8	396.6	343.8									

Optional flat flange motor dimensions (mm)

	Unbraked length		Braked length	
	LB (± 1.0)	LC (± 1.0)	LB (± 1.0)	LC (± 1.0)
115A	213.9	161.1	243.9	191.1
115B	243.9	191.1	273.9	221.1
115C	273.9	221.1	303.9	251.1
115D	303.9	251.1	333.9	281.1
115E	333.9	281.1	363.9	311.1

Optional connector height (mm)

Connection type	Overall height
	LD (± 1)
V	149.0
C	156.5
J	187.5
M	167.5

Optional flange dimensions (mm)

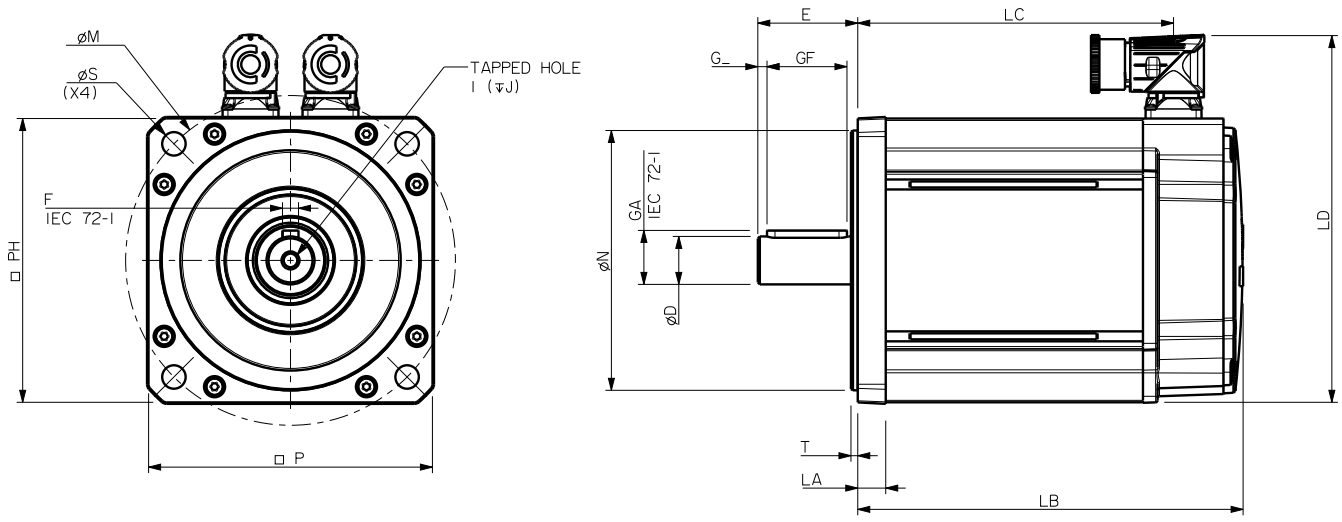
PCD code	Front end frame type	Flange square	Fixing hole PCD	Register diameter	Flange thickness	Fixing hole diameter
		P (± 0.4)	M (± 0.4)	N (j6)	LA (± 0.4)	S (H14)
130	Flat	130.0	130.0	110.0	13.2	10.0

Output shaft dimensions (mm)

	Shaft Diameter	Shaft Length	Key Height	Key Length	Key to Shaft End	Key Width	Tapped Hole Thread Size	Tapped Hole Depth
	D (j6)	E (± 0.45)	GA	GF (± 0.25)	G (± 1.1)	F	I	J (± 0.4)
115A-C (Std)	19.0	40.0	21.5	32.0	3.6	6.0	M6X1.0	17.0
115D-E (Std)	24	50	27	40	4.6	8	M8X1.25	20.0

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

1.5.4 Frame size 142



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height (B)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LA (± 0.1)	T (± 0.1)	N (j6)	LD (± 1)	P (± 0.4)	S (H14)	M (± 0.4)	PH (± 0.7)	
142A	192.8	158	252.8	218	14	3.4	130	183.5	142	12	165	143	M10
142B	222.8	188	282.8	248									
142C	252.8	218	312.8	278									
142D	282.8	248	342.8	308									
142E	312.8	278	372.8	338									

Optional motor flange dimensions (mm)

	Unbraked length		Braked length	
	LB (± 1.0)	LC (± 1.0)	LB (± 1.0)	LC (± 1.0)
142A	241.8	207	301.8	267
142B	271.8	237	331.8	397
142C	301.8	267	361.8	327
142D	331.8	397	391.8	357
142E	361.8	327	421.8	387

Optional connector height (mm)

Connection type	Overall height
	LD (± 1.0)
V	176.0
C	183.5
J	204.5
M	184.5

Optional flange dimensions (mm)

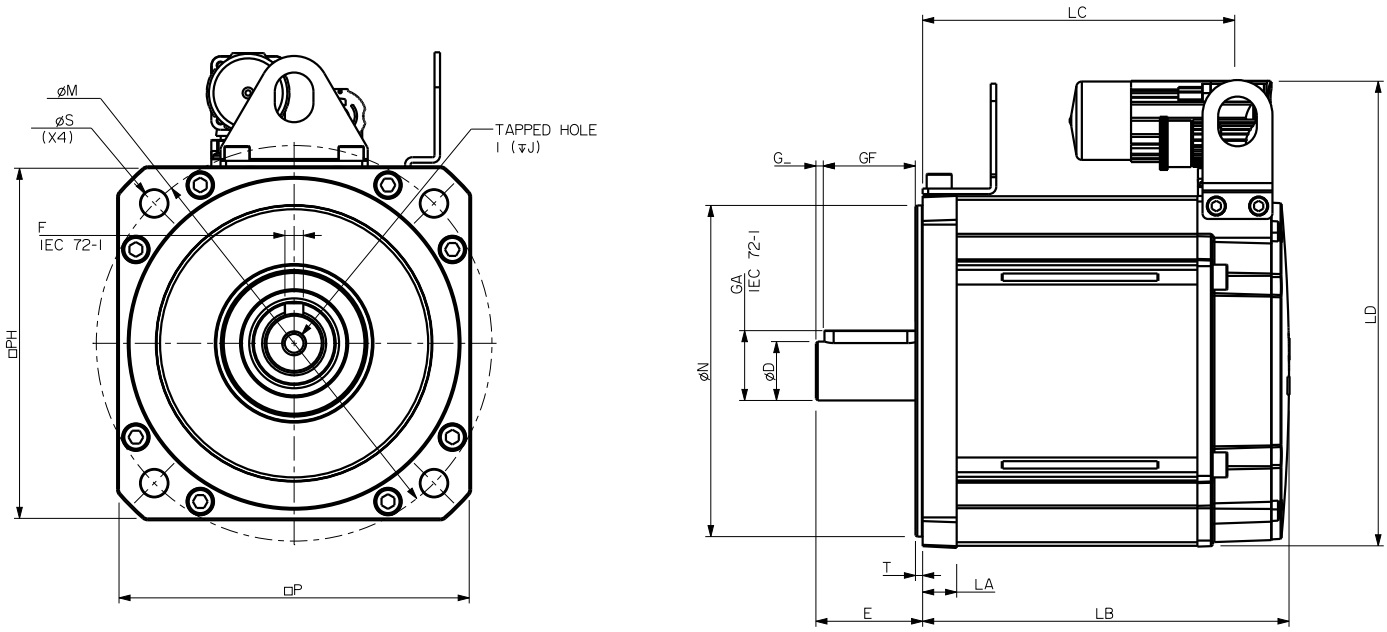
PCD code	Front end frame type	Flange square	Fixing hole PCD	Register diameter	Flange thickness	Fixing hole diameter
		P (± 0.4)	M (± 0.1)	N (j6)	LA (± 0.5)	S (H14)
149	Extended	140.0	149.2	114.3	11.5	12.0

Output shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (± 0.45)	GA	GF (± 0.25)	G (± 1.1)	F	I	J (± 0.4)
142A-E (Std)	24	50	27	40	4.6	8	M8X1.25	20.0
142 A-E (Opt)	22	50	24.5	40	4.6	6	M8x1.25	20
142 A-E (Opt)	28	60	31	50	4.6	8	M10x1.5	23
142 A-E (Opt)	32	58	35	50	4.6	10	M12x1.76	29

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

1.5.5 Frame size 190



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height (B)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB(±1)	LC(±1)	LB(±1)	LC(±1)	LA (± 0.1)	T (± 0.1)	N (j6)	LD (± 1)	P (± 0.4)	S (H14)	M (± 0.4)	PH (± 1.5)	
190 A	199.4	169.6	289.4	259.6	18.5	3.9	180	252.5	190.3	14.5	215	190	M12
190B	229.4	199.6	319.4	289.6									
190C	259.4	229.6	349.4	319.6									
190D	289.4	259.6	379.4	349.6									
190E	319.4	289.6	409.4	379.6									
190F	349.4	319.6	439.4	409.6									
190G	379.4	349.6	469.4	439.6									
190H	409.4	379.6	499.4	469.6									

Optional connector height (mm)

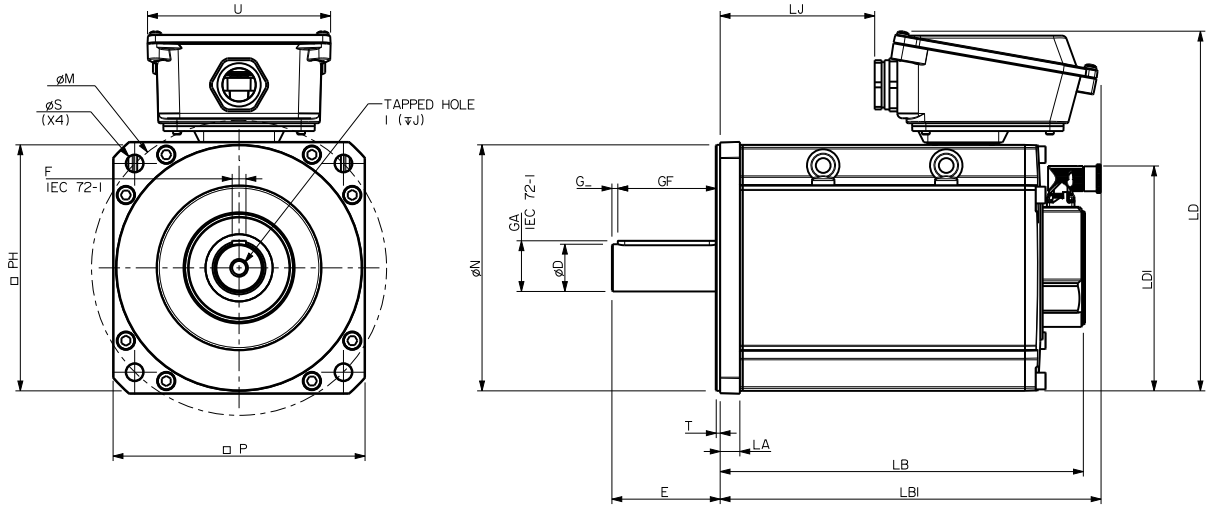
Connection type	Overall height
	LD (± 1.0)
V	232.0
C	252.5
H	299.0

Output shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (± 0.45)	GA	GF (± 0.25)	G (± 1.1)	F	I	J (± 0.4)
190 A-H (Std)	32	58	35	50	4.6	10	M12X1.75	29
190 A-H (Opt)	38	58	41	50	4.6	10	M12X1.75	29
190 A-H (Opt)	28	60	31	50	4.6	8	M10x1.5	23
190 A-H (Opt)	42	110	45	100	4.6	12	M16x2.0	37

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

1.5.6 Frame size 250



Standard motor dimension (mm) Note all dimensions shown are at nominal

	Motor Length			Flange thickness	Register length	Register diameter	Overall height (H)	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Hybrid box width	Signal connector height	Mounting bolts
	LB (± 1.3)	LB1 (± 2.0)	LJ (± 1.3)	LA (± 0.1)	T (± 0.1)	N (j6)	LD (± 1.0)	P (± 0.6)	S (H14)	M (± 0.4)	PH (± 1.0)	U (± 0.4)	LD1 (± 1.0)	
	Unbraked motor													
250D	370.7	406.1	179.7											
250E	400.7	436.1	209.7											
250F	430.7	466.1	239.7											
	Braked motor			20.0	4.50	250.0	363.5	256.0	18.5	300.0	249.5	186.0	228.5	M16
250D	442.5	477.9	251.5											
250E	472.5	507.9	281.5											
250F	502.5	537.9	311.5											

Output shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (k6)	E (± 0.45)	GA (To IEC 72-1)	GF (± 0.25)	G (± 1.1)	F (h9)	I	J (± 1.0)
38.0 Opt	38.0	80.0	41.0	70.0	4.6	10.0	M12 x 1.75	29.0
42.0 Opt	42.0	110.0	45.0	100.0	6.0	12.0	M16 x 2.0	37.0
48.0 D-F Std	48.0	110.0	51.5	100.0	6.0	14.0	M16 x 2.0	37.0

Optional connector height (mm)

Connection type	Power overall height	Signal overall height
	LD (± 1.0)	LD1 (± 1.0)
V	291.5	221.0
C	312.5	221.0
B	312.5	221.0

NOTE: Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty.

Case Study 1 - Emerson servo technology improves reliability and accuracy of new packaging machine

CMC Machines designs and manufactures advanced systems for the paper and film wrapping industry.

The Challenge

CMC needed an advanced servo system for a new design of packaging machine: Cartonwrap. Cartonwrap machines use a cardboard roll to make boxes of virtually any size, adapting the container to the size of the item. Products are fed into the machine on a conveyor and the box is formed around them. This eliminates the need to stock pre-formed boxes and leads to a drastic reduction of filling materials inside boxes.

The Solution

CMC chose a servo drive solution from Emerson: each Cartonwrap machine uses 22 Digitax ST servo drives and Unimotor fm servo motors. Emerson's Digitax ST drives use multi-network management via a central PC and Ethernet for coordinating all production menus and motion parametric equations on the individual process components. CMC machinery uses SM Applications Plus modules in each drive - providing automation controllers with integrated fieldbus communications and I/O.

The Benefits

- Emerson engineers developed bespoke software for CMC's machines
- SM-Applications plus modules eliminate need for external PLC, resulting in increased communication speed due to reduced wiring

2 Introduction to Unimotor hd - pulse duty

2.1 Overview

Unimotor hd is a high dynamic brushless AC servo motor range designed for use in pulse duty applications where rapid acceleration and deceleration are required. The motors are available in six sizes from 0.55 to 190.

2.1.1 Reliability and innovation

Unimotor hd is designed using a proven development process that prioritizes innovation and reliability. This process has resulted in Emerson Industrial Automation's market leading reputation for both performance and quality.

2.1.2 Matched motor and drive combinations

Emerson Industrial Automation motors and drives are designed to function as an optimized system. Unimotor hd is the perfect partner for Unidrive M and Digitax ST

2.1.3 Key features

Unimotor hd is suitable for a wide range of industrial applications, due to its extensive features.

- Torque range: 0.72 Nm to 85.0 Nm
- High torque to inertia ratio for high dynamic performance
- Compact but powerful
- High energy dissipation brakes
- IP65 conformance: sealed against water spray and dust when mounted and connected
- Segmented stator design
- World class performance
- Supported by rigorous testing for performance and reliability
- Winding voltages for inverter supply of 400 V and 220 V
- Rated speeds from 1,000 to 6,000 rpm
- Larger shafts to increase torsional rigidity
- Thermal protection by PTC thermistor/ optional KTY84.130 sensor

2.1.4 The ultimate motor and drive combinations

Emerson Industrial Automation drive and motor combinations provide an optimized system in terms of ratings, performance, cost and ease of use. Unimotor hd motors fitted with high resolution SinCos or Absolute encoders are pre-loaded with the motor "electronic nameplate" data during the manufacturing process. This data can be read by any of our servo drives and used to automatically optimize the drive settings. This feature simplifies commissioning and maintenance, ensures consistent performance and saves time.

2.1.5 Accuracy and resolution to suit your application requirements

Choosing the right feedback device for your application is critical in getting optimum performance. Unimotor hd has a range of feedback options that offer different levels of accuracy and resolution to suit most applications:

- Resolver: robust for extreme applications and conditions - low accuracy, medium resolution
- Incremental encoder: high accuracy, medium resolution
- Inductive/capacitive SinCos/Absolute: medium accuracy, high resolution
- Optical/SinCos/Absolute: high accuracy, high resolution
- Single turn and multi-turn: Hiperface and EnDAT protocols supported

2.1.6 Custom built motors

As part of our commitment to you, we can design special products to meet your application specific requirements.

2.1.7 Quick reference table

Frame size	PCD (mm)											
055	63			0.72 1.65 0.14 0.36								
067	75				1.45 3.70 0.30 0.75							
089	100					3.20 8.00 0.87 2.34						
115	130						5.80 18.80 2.42 8.38					
142	165									25.0 38.0 17.0 27.2		
190	215										52.0 85.0 54.6 103.5	
Stall	(Nm) 0	0.5	1.0	3.0	5.0	8.0	10.0	15.0	20.0	30	60	85.0
Inertia	(kg.cm²) 0	0.1	0.2	0.7	1.5	2.5	6.5	8.0	9.0	20.0	60.0	103.5

Key: = Nm = Inertia

2.1.8 Conformance and standards

RoHS Compliant

2+ YEAR Worldwide Warranty

SYSTEME DE MANAGEMENT QUALITÉ CERTIFIÉ ISO 9001 : 2008 DNV

2.2 Unimotor hd ordering code Information

Unimotor hd ordering code Information - D+10 lead time
Use the information below in the illustration to create an order code for a Unimotor hd.

089	UD	B	30	0	B	A	
Frame size	**Motor voltage**	**Stator length**	**Rated speed**	**Brake**	**Connection type**	**Output shaft**	
055	**055-115 Frame**	**055**	**055-142 Frame**	**055-142 Frame**	**055-142 Frame**	**055-142 Frame**	
067		A	**30 =** 3,000 rpm	**0 =** Not fitted	**B =** Power and Signal	**A =** Key	
089		B	**115 Frame**	**5 =** Parking Brake	90 ° rotatable	**F =** Key and Half key supplied separately	
115			***20 =** 2,000 rpm				
142		**067**	**30 =** 3,000 rpm				
	ED = 220 V	A	* 115UDD20 only				
		089					
		C					
		115					
		B					
	055-142 Frame	**055**					
		A					
		B					
		C					
		067					
		B					
		089					
	UD = 400 V	B					
		C					
		115					
		B					
		C					
		D					
		142					
		C					

Express availability motors, available in ten days

Unimotor hd ordering code Information - Standard lead time

Additional options are available upon request but may require a longer lead time to complete, please check with the Industrial Automation Center.

089	UD	B	30	0	B	A	
Frame size	**Motor voltage**	**Stator length**	**Rated speed**	**Brake**	**Connection type**	**Output shaft**	
055	**ED** = 220 V	**055-067**	**055-067 Frame**	**055-190 Frame**	**55 - 190 Frame**	**055-142 Frame**	
067	**UD** = 400 V	A	**30 =** 3,000 rpm	**0 =** Not fitted	**B =** Power and Signal	**A =** Key	
089		B	**60 =** 6,000 rpm	**5 =** Parking Brake	90 ° rotatable	**B =** Plain	
115		C	**089 Frame**		**142 frame**	**E =** Key with half key fitted	
142		**089**	**30 =** 3,000 rpm		**J =** Connector size 1.5 pwr 90 ° rot, sig 90 ° rot for high current 142 motor	**F =** Key and half key supplied separately	
190		A	**40 =** 4,000 rpm				
		B	**60 =** 6,000 rpm				
		C	**115 Frame**				
		115	**20 =** 2,000 rpm				
		B	**30 =** 3,000 rpm				
		C	**142 Frame**				
		D	**10 =** 1,000 rpm				
		142	**15 =** 1,500 rpm				
		C	**20 =** 2,000 rpm				
		D	**30 =** 3,000 rpm				
		E	**190 Frame**				
		190	**10 =** 1,000 rpm				
		C	**15 =** 1,500 rpm				
		D	**20 =** 2,000 rpm				
		F					

CA			A					
Feedback device			Inertia		PCD		Shaft Diameter	
055-067 Frame			055-142 Frame		055 Frame			
AR =	Resolver		**A =**	Standard + PTC	**063 =**	Standard	**110 =**	11 mm
CR =	Incremental Encoder (Renco)	4096 ppr (R35i)					**140 =**	14 mm
EM =	Inductive Absolute Multi-turn	EQI 1130						
089-142 Frame								
AE =	Resolver							
CA =	Incremental Encoder (Sick)	4096 ppr CFS50						
EB =	Optical Absolute Multi-turn	EQN 1325						
EC =	Inductive Absolute Multi-turn	EQI 1331						
RA =	Optical SinCos Multi-turn	SRM 50						

CA			A					
Feedback device			Inertia		PCD		Shaft Diameter	
055 - 067 Frame			055-190 Frame		055 Frame only			
AR =	Resolver		**A =**	Standard + PTC	**063 =**	Standard	**090 =**	9 mm
CR =	Incremental Encoder (Renco)	4096 ppr (R35i)	**C =**	Standard inertia + KTY84-130 Thermistor			**110 =**	11 mm
MR =	Incremental Encoder (Renco)	2048 ppr (R35i)					**140 =**	14 mm
EM =	Inductive Absolute Multi-turn	EQI 1130						
FM =	Inductive Absolute Single-turn	ECI 1118						
TL =	Optical SinCos Multi-turn	SKM36						
UL =	Optical SinCos Single-turn	SKS36						
089 -190 Frame								
AE =	Resolver							
CA =	Incremental Encoder (Sick)	4096 ppr CFS50						
EB =	Optical Absolute Multi-turn	EQN 1325						
FB =	Optical Absolute Single-turn	ECN 1313						
EC =	Inductive Absolute Multi-turn	EQI 1331						
FC =	Inductive Absolute Single-turn	ECI 1319						
RA =	Optical SinCos Multi-turn	SRM 50						
SA =	Optical SinCos Single-turn	SRS 50						
VF=	Capacitive absolute multi-turn	SEL 52						
WF=	Capacitive absolute single-turn	SEK 52						

2.3 Dimensions

2.3.1 Frame size 055 For 3 Phase VPWM drives

Motor frame size (mm)		055ED			055UD		
Voltage (Vrms)		200-240			380-480		
Frame length		**A**	**B**	**C**	**A**	**B**	**C**
Continuous Stall Torque (Nm)		0.72	1.18	1.65	0.72	1.18	1.65
Peak Torque (Nm)		2.88	4.72	6.60	2.88	4.72	6.60
Inertia (kg.cm²)		0.14	0.25	0.36	0.14	0.25	0.36
Winding thermal time constant (s)		34.0	38.0	42.0	34.0	38.0	42.0
Motor weight unbraked (kg)		1.20	1.50	1.80	1.20	1.50	1.80
Motor weight braked (kg)		1.60	1.90	2.20	1.6	1.90	2.20
Number of poles		8	8	8	8	8	8
Speed 3,000 (rpm)	Kt (Nm/A) =	0.74	0.87	0.91	0.74	1.49	1.65
	Ke (V/krpm) =	45.00	52.50	55.00	45.00	90.00	100.00
Rated torque (Nm)		0.70	1.05	1.48	0.70	1.05	1.48
Stall current (A)		0.97	1.36	1.81	0.97	0.79	1.00
Rated power (kW)		0.22	0.33	0.46	0.22	0.33	0.46
R (ph-ph) (Ω)		28.00	14.12	9.53	28.00	45.00	31.00
L (ph-ph) (mH)		50.00	32.00	23.00	50.00	100.00	75.00
Speed 6,000 (rpm)	Kt (Nm/A) =	0.45	0.43	0.48	0.74	0.79	0.83
	Ke (V/krpm) =	27.00	26.00	29.00	45.00	47.50	50.00
Rated torque (Nm)		0.68	0.90	1.20	0.68	0.90	1.20
Stall current (A)		1.61	2.74	3.44	0.97	1.49	1.99
Rated power (kW)		0.43	0.57	0.75	0.43	0.57	0.75
R (ph-ph) (Ω)		8.50	3.55	2.38	28.00	10.70	7.80
L (ph-ph) (mH)		16.00	8.20	6.30	50.00	25.00	20.00

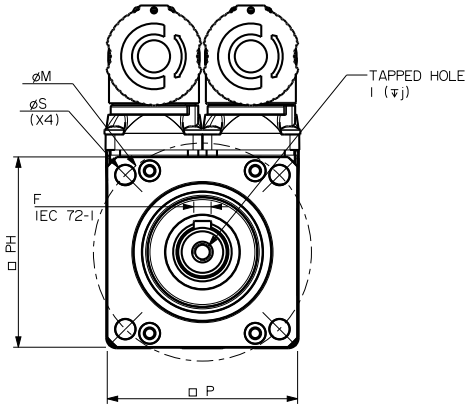
Δt= 100 °C winding 40 °C maximum ambient

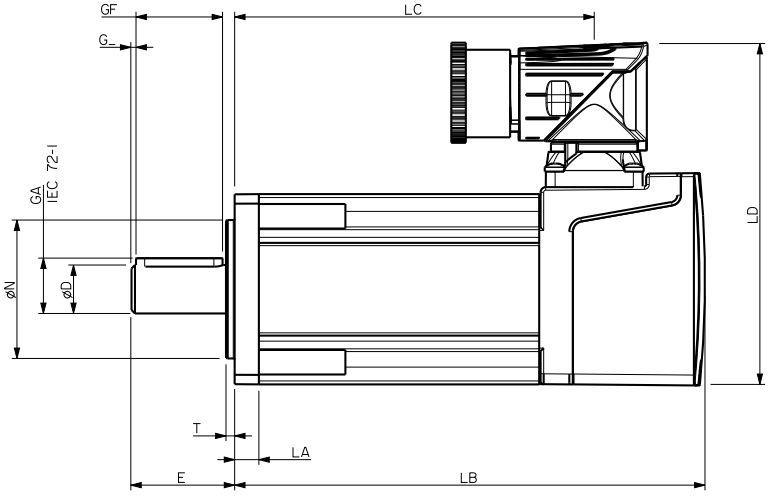
All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C





Motor dimension (mm)

	Feedback AR, CR, EM/FM, UL/TL				Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	Unbraked length		Braked length										
	LB (± 0.9)	LC (± 1.0)	LB (± 0.9)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.4)	PH (± 0.5)	
055A	118.0	90.0	158.0	130.0	7.0	2.5	40.0	99.0	55.0	5.8	63.0	55.0	M5
055B	142.0	114.0	182.0	154.0									
055C	166.0	138.0	206.0	178.0									

Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (±1.0)
9.0 Opt	9	20	10.2	15	1	3.0	M4	10
11.0 Std	11	23	12.5	15	1.5	4.0	M4	10
14.0 Std	14	30.0	16.0	25.0	1.5	5.0	M5	12.5

Note

Shaft options below the standard (Std) dimensions will require customer approval and may not be covered by warranty

2.3.2 Frame size 067 For 3 Phase VPWM drives

Motor frame size (mm)	067ED			067UD		
Voltage (Vrms)	200-240			380-480		
Frame length	**A**	**B**	**C**	**A**	**B**	**C**
Continuous Stall Torque (Nm)	1.45	2.55	3.70	1.45	2.55	3.70
Peak Torque (Nm)	4.35	7.65	11.10	4.35	7.65	11.10
Inertia (kg.cm²)	0.30	0.53	0.75	0.30	0.53	0.75
Winding thermal time constant (s)	54	61	65	54	61	65
Motor weight unbraked (kg)	2.00	2.60	3.20	2.00	2.60	3.20
Motor weight braked (kg)	2.70	3.3	3.90	2.70	3.3	3.90
Number of poles	10	10	10	10	10	10
Speed 3,000 (rpm) Kt (Nm/A) = Ke (V/krpm) =	0.93 57.00			0.80 49.00	1.60 98.00	1.60 98.00
Rated torque (Nm)	1.40	2.45	3.50	1.40	2.45	3.50
Stall current (A)	1.56	2.74	3.98	1.81	1.59	2.31
Rated power (kW)	0.44	0.77	1.10	0.44	0.77	1.10
R (ph-ph) (Ω)	14.92	4.88	3.33	11.69	15.20	13.04
L (ph-ph) (mH)	45.43	17.40	12.70	35.18	54.20	48.65
Speed 6,000 (rpm) Kt (Nm/A) = Ke (V/krpm) =	0.47 28.50			0.8 49.00		
Rated torque (Nm)	1.30	2.20		1.30	2.20	3.10
Stall current (A)	3.12	5.48		1.81	3.19	4.63
Rated power (kW)	0.82	1.38		0.82	1.38	1.95
R (ph-ph) (Ω)	3.86	1.22		11.69	3.79	2.68
L (ph-ph) (mH)	11.06	4.35		35.18	13.60	10.20

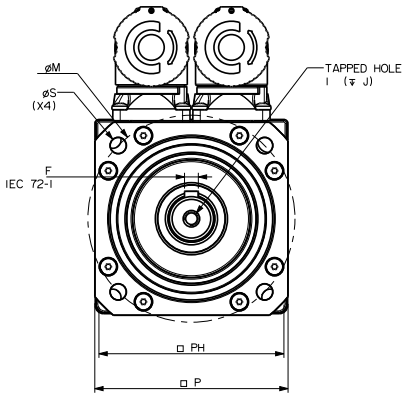
Δt= 100 °C winding 40 °C maximum ambient

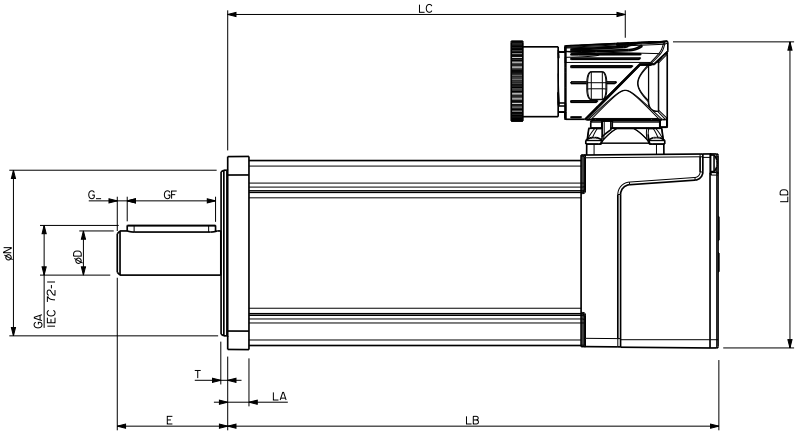
All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C





Motor dimension (mm)

	Feedback AR, CR, EM/FM				Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	Unbraked length		Braked length										
	LB (± 0.9)	LC (± 1.0)	LB (± 0.9)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.5)	PH (± 0.5)	
067A	142.9	109.0	177.9	144.0	7.5	2.50	60.0	111.5	70.0	5.8	75.0	67.00	M5
067B	172.9	139.0	207.9	174.0									
067C	202.9	169.0	237.9	204.0									

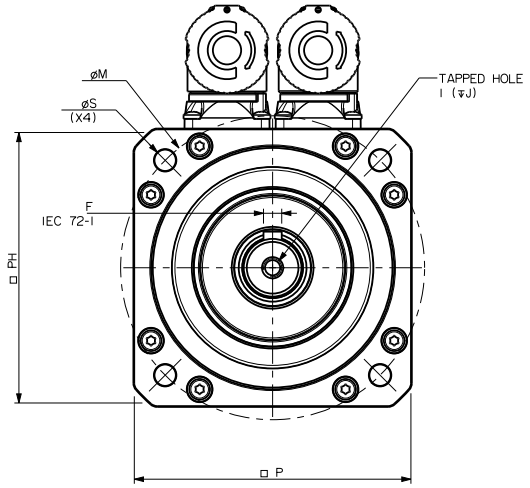
	Feedback TL/UL			
	Unbraked length	Braked length	Unbraked length	Braked length
	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)
067A	157.7	123.5	192.7	158.5
067B	187.7	153.5	222.7	188.5
067C	217.7	183.5	252.7	218.5

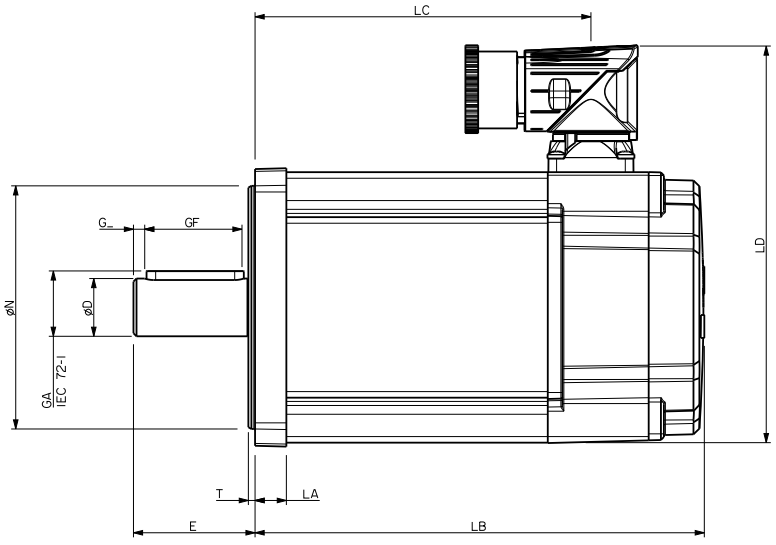
Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (± 1.0)
14.0 Std	14.0	30.0	16.0	25.0	1.5	5.0	M5 x 0.8	13.5

2.3.3 Frame size 089 For 3 Phase VPWM drives

Motor frame size (mm)		089ED			089UD		
Voltage (Vrms)		200-240			380-480		
Frame length		A	B	C	A	B	C
Continuous Stall Torque (Nm)		3.20	5.50	8.00	3.20	5.50	8.00
Peak Torque (Nm)		9.60	16.50	24.00	9.60	16.50	24.00
Inertia (kg.cm²)		0.87	1.61	2.34	0.87	1.61	2.34
Winding thermal time constant (s)		85	93	98	85	93	98
Motor weight unbraked (kg)		3.30	4.40	5.50	3.30	4.40	5.50
Motor weight braked (kg)		4.30	5.40	6.50	4.30	5.40	6.50
Number of poles		10	10	10	10	10	10
Speed 3,000 (rpm)	Kt (Nm/A) = Ke (V/krpm) =	0.93 57.00			1.60 98.00		
Rated torque (Nm)		3.00	4.85	6.90	3.00	4.85	6.90
Stall current (A)		3.44	5.91	8.60	2.00	3.44	5.00
Rated power (kW)		0.94	1.52	2.17	0.94	1.52	2.17
R (ph-ph) (Ω)		3.28	1.57	0.89	12.85	5.05	2.68
L (ph-ph) (mH)		21.55	11.84	7.09	80.66	38.36	21.72
Speed 4,000 (rpm)	Kt (Nm/A) = Ke (V/krpm) =	0.70 42.75			1.2 73.50		
Rated torque (Nm)		2.90	4.55	6.35	2.90	4.55	6.35
Stall current (A)		4.57	7.86	11.43	2.67	4.58	6.67
Rated power (kW)		1.21	1.91	2.66	1.21	1.91	2.66
R (ph-ph) (Ω)		2.04	0.79	0.54	6.16	2.47	1.75
L (ph-ph) (mH)		13.20	5.97	4.38	39.78	18.80	14.03
Speed 6,000 (rpm)	Kt (Nm/A) = Ke (V/krpm) =	0.47 28.50			0.8 49.00		
Rated torque (Nm)		2.65	3.80	5.00	2.65	3.80	5.00
Stall current (A)		6.88	11.83	17.20	4.00	6.88	10.00
Rated power (kW)		1.67	2.39	3.14	1.67	2.39	3.14
R (ph-ph) (Ω)		0.98	0.39	0.23	3.21	1.27	0.83
L (ph-ph) (mH)		6.24	2.96	1.89	20.16	9.59	6.66





Δt= 100 °C winding 40 °C maximum ambient

All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C

Motor dimension (mm)

	Feedback EC, FC/VF, WF				Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	Unbraked length		Braked length										
	LB (± 0.9)	LC (± 1.0)	LB (± 0.9)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.5)	PH (± 0.5)	
089A	147.8	110.5	187.9	150.6	10.3	2.20	80.0	130.5	91.0	7.00	100.0	89.0	M6
089B	177.8	140.5	217.9	180.6									
089C	207.8	170.5	247.9	210.6									

	Feedback FB, EB/CA/SA, RA		Feedback AE	
	Unbraked length	Braked length	Unbraked length	Braked length
	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)
089A	160.8	200.9	137.8	177.9
089B	190.8	230.9	167.8	207.9
089C	220.8	260.9	197.8	237.9

Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (± 1.0)
19.0 Std	19.0	40.0	21.5	32.0	3.7	6.0	M6 x 1.0	17.0

2.3.4 Frame size 115 For 3 Phase VPWM drives

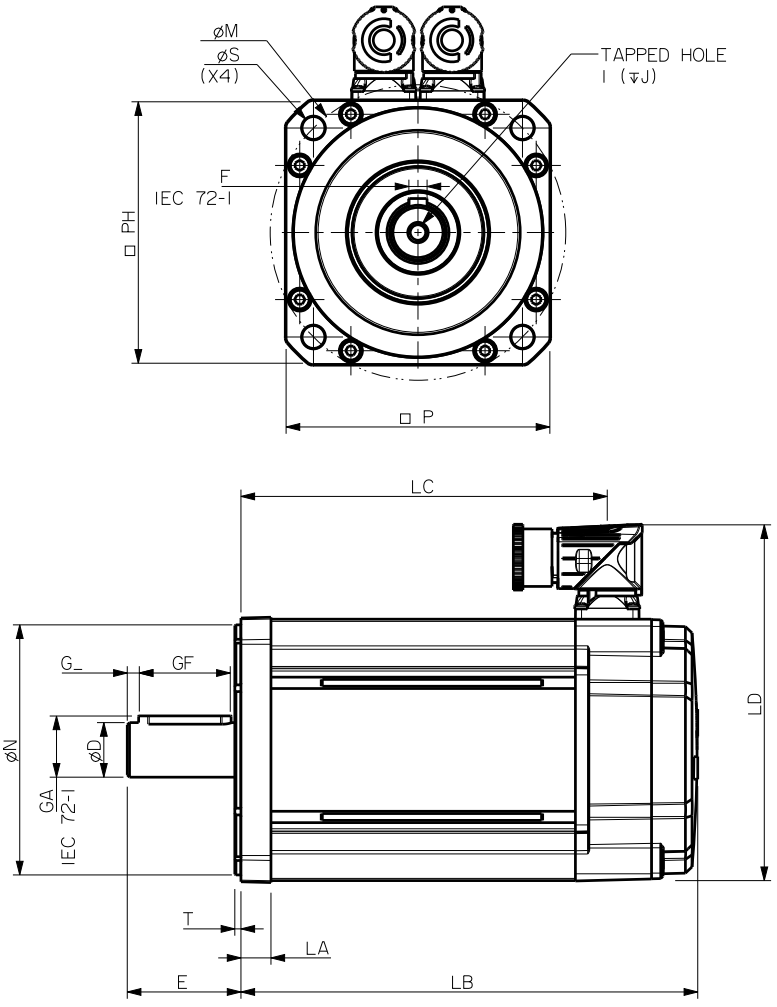
Motor frame size (mm)		115ED			115UD		
Voltage (Vrms)		200-240			380-480		
Frame length		B	C	D	B	C	D
Continuous Stall Torque (Nm)		10.20	14.60	18.80	10.20	14.60	18.80
Peak Torque (Nm)		30.60	43.80	56.40	30.60	43.80	56.40
Inertia (kg.cm²)		4.41	6.39	8.38	4.41	6.39	8.38
Winding thermal time constant (s)		164	168	175	164	168	175
Motor weight unbraked (kg)		7.20	8.90	10.70	7.20	8.90	10.70
Motor weight braked (kg)		8.70	10.40	12.20	8.70	10.40	12.20
Number of poles		10	10	10	10	10	10
Speed 2,000 (rpm)	Kt (Nm/A) =	1.40			2.4		
	Ke (V/krpm) =	85.50			147.00		
Rated torque (Nm)		8.60	11.90	15.60	8.60	11.90	15.60
Stall current (A)		7.29	10.43	13.43	4.25	6.08	7.83
Rated power (kW)		1.80	2.49	3.27	1.80	2.49	3.27
R (ph-ph) (Ω)		1.40	0.77	0.61	4.41	2.41	1.80
L (ph-ph) (mH)		12.84	7.87	6.62	40.59	24.69	19.45
Speed 3,000 (rpm)	Kt (Nm/A) =	0.93			1.60		
	Ke (V/krpm) =	57.00			98.00		
Rated torque (Nm)		7.70	10.50		7.70	10.50	13.60
Stall current (A)		10.97	15.70		6.38	9.13	11.75
Rated power (kW)		2.42	3.30		2.42	3.30	4.27
R (ph-ph) (Ω)		0.58	0.39		1.83	1.21	0.78
L (ph-ph) (mH)		5.40	4.01		16.93	12.72	8.65

Δt= 100 °C winding 40 °C maximum ambient
All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C



Motor dimension (mm)

	Feedback EC, FC/VF, WF				Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	Unbraked length		Braked length										
	LB (± 1)	LC (± 1.0)	LB (± 1)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.5)	PH (± 0.5)	
115B	193.8	154.0	230.9	191.1	13.2	2.70	110.0	156.5	116.0	10.00	130.0	115.0	M8
115C	223.8	184.0	260.9	221.1									
115D	253.8	214.0	290.9	251.1									

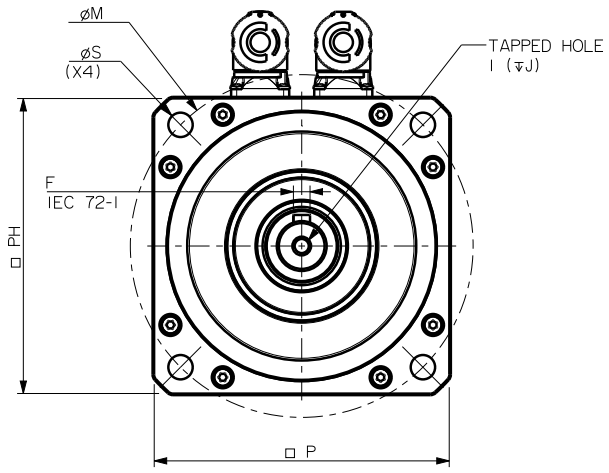
	Feedback FB, EB/CA/SA, RA		Feedback AE	
	Unbraked length	Braked length	Unbraked length	Braked length
	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)	LB (± 1.0)
115B	206.8	243.9	183.8	220.9
115C	236.8	273.9	213.8	250.9
115D	266.8	303.9	243.8	280.9

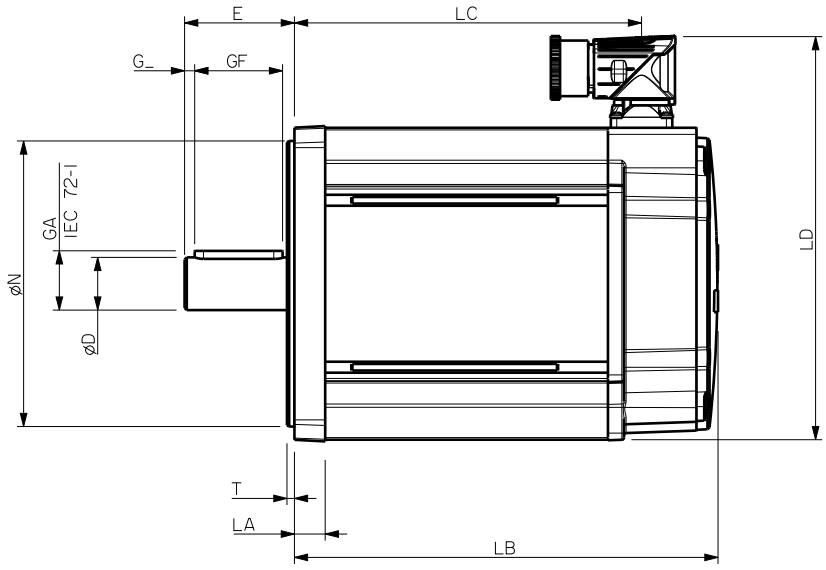
Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (± 1.0)
24.0 Std	24.0	50.0	27.0	40.0	5.3	8.0	M8 x 1.25	20.0

2.3.4 Frame size 142 For 3 Phase VPWM drives

Motor frame size (mm)		142ED			142UD		
Voltage (Vrms)		200-240			380-480		
Frame length		**C**	**D**	**E**	**C**	**D**	**E**
Continuous Stall Torque (Nm)		25.0	31.5	38.0	25.0	31.5	38.0
Peak Torque (Nm)		74.9	94.5	114.0	74.9	94.5	114.0
Inertia (kg.cm²)		17.0	22.1	27.2	17.0	22.1	27.2
Winding thermal time constant (s)		245.0	251.0	256.0	245.0	251.0	256.0
Motor weight unbraked (kg)		11.5	15.0	18.5	11.5	15.0	18.5
Motor weight braked (kg)		14.3	17.8	21.3	14.3	17.8	21.3
Number of poles		10	10	10	10	10	10
Speed 1,000 (rpm)	Kt (Nm/A) =	2.8					
	Ke (V/krpm) =	171.0					
Rated torque (Nm)		23.3	29.0	34.5			
Stall current (A)		8.9	11.2	13.6			
Rated power (kW)		2.44	3.04	3.61			
R (ph-ph) (Ω)		1.36	0.94	0.72			
L (ph-ph) (mH)		21.34	15.17	12.30			
Connection type		B	B	B			
Speed 1,500 (rpm)	Kt (Nm/A) =				3.2		
	Ke (V/krpm) =				196.0		
Rated torque (Nm)					22.3	27.0	31.7
Stall current (A)					7.8	9.8	11.9
Rated power (kW)					3.5	4.2	5.0
R (ph-ph) (Ω)					1.36	0.94	0.72
L (ph-ph) (mH)					21.34	15.17	12.30
Connection type					B	B	B
Speed 2,000 (rpm)	Kt (Nm/A) =	1.4			2.4		
	Ke (V/krpm) =	85.5			147.0		
Rated torque (Nm)		21.4	25.7	29.6	21.4	25.7	29.6
Stall current (A)		17.8	22.5	27.1	10.4	13.1	15.8
Rated power (kW)		4.48	5.38	6.20	4.48	5.38	6.20
R (ph-ph) (Ω)		0.34	0.24	0.18	0.79	0.62	0.49
L (ph-ph) (mH)		5.33	3.79	3.07	12.15	9.66	8.34
Connection type		J	J	J	B	B	B
Speed 3,000 (rpm)	Kt (Nm/A) =	0.93			1.6		
	Ke (V/krpm) =	57.0			98.0		
Rated torque (Nm)		18.4	20.9	C/D	18.4	20.9	23.0
Stall current (A)		26.9	33.9		15.6	19.7	23.8
Rated power (kW)		5.78	6.57		5.78	6.57	7.23
R (ph-ph) (Ω)		0.12	0.10		0.34	0.24	0.18
L (ph-ph) (mH)		1.90	1.57		5.33	3.79	3.07
Connection type		J	J	J	B	J	J





Δt= 100 °C winding 40 °C maximum ambient

All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 12 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C

Motor dimension (mm)

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 1)	LC (± 1.0)	LB (± 1)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.5)	PH (± 0.5)	
142C	217.0	182.5	282.5	248.0	14.0	3.4	130.0	183.5	142.0	12.0	165.0	142.0	M10
142D	247.0	212.5	312.5	278.0				183.5-204.5					
142E	277.0	242.5	342.5	308.0				183.5-204.5					

Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (± 1.0)
32.0 Std	32.0	58.0	35.0	50.0	3.0	10.0	M12 x 1.75	29.0

2.3.5 Frame size 190 For 3 Phase VPWM drives

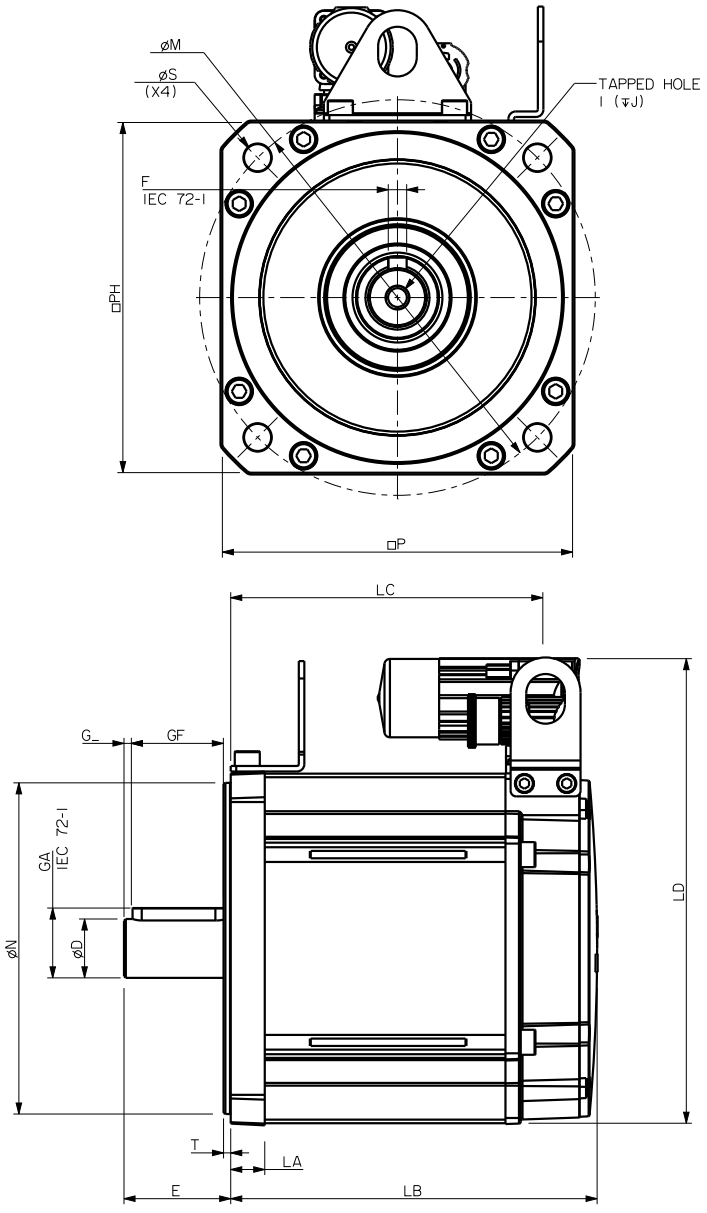
Motor frame size (mm)		190ED			190UD		
Voltage (Vrms)		200-240			380-480		
Frame length		**C**	**D**	**F**	**C**	**D**	**F**
Continuous Stall Torque (Nm)		52.0	62.0	85.0	52.0	62.0	85.0
Peak Torque (Nm)		156.0	186.0	255.0	156.0	186.0	255.0
Inertia (kg.cm²)		54.6	70.9	103.5	54.6	70.9	103.5
Winding thermal time constant (s)		311.0	316.0	324.0	311.0	316.0	324.0
Motor weight unbraked (kg)		23.5	28.6	38.8	23.5	28.6	38.8
Motor weight braked (kg)		28.8	33.9	44.1	28.8	33.9	44.1
Number of poles		10	10	10	10	10	10
Speed 1,000 (rpm)	Kt (Nm/A) = Ke (V/krpm) =	2.8 171.0					
Rated torque (Nm)		49.0	56.5	77.5			
Stall current (A)		18.6	22.1	30.4			
Rated power (kW)		5.13	5.92	8.12			
R (ph-ph) (Ω)		0.47	0.40	0.23			
L (ph-ph) (mH)		12.30	10.40	6.79			
Speed 1,500 (rpm)	Kt (Nm/A) = Ke (V/krpm) =				3.2 196.0		
Rated torque (Nm)					46.2	52.2	68.5
Stall current (A)					16.3	19.4	26.6
Rated power (kW)					7.26	8.20	10.76
R (ph-ph) (Ω)					0.55	0.38	0.23
L (ph-ph) (mH)					14.15	10.40	6.79
Speed 2,000 (rpm)	Kt (Nm/A) = Ke (V/krpm) =	1.4 85.5			2.4 147.0		
Rated torque (Nm)		42.5			42.5		
Stall current (A)		37.1			21.7		
Rated power (kW)		8.90			8.90		
R (ph-ph) (Ω)		0.12			0.32		
L (ph-ph) (mH)		3.07			8.20		

Δt= 100 °C winding 40 °C maximum ambient
All data subject to ±10 % tolerance

Stall torque, rated torque and power relate to maximum continuous operation tested in a 20 °C ambient at 6 kHz drive switching frequency

All other figures relate to a 20 °C motor temperature.

Maximum intermittent winding temperature is 140 °C



Motor dimension (mm)

	Unbraked length		Braked length		Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Mounting bolts
	LB (± 0.9)	LC (± 1.0)	LB (± 0.9)	LC (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	LD (± 0.3)	P (± 0.3)	S (H14)	M (± 0.5)	PH (± 0.5)	
190C	220.6	191.1	319.1	289.6	18.5	3.9	180.0	252.5	190.3	14.5	215.0	190.0	M12
190D	250.6	221.1	349.1	319.6									
190F	310.6	251.1	409.1	379.6									

Shaft dimensions (mm)

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E	GA	GF	G	F (h9)	I	J (± 1.0)
38.0 Std	38.0	80.0	41.0	70.0	4.6	10.0	M12 x 1.75	29.0

3 Generic information

3.1 Performance definitions

Stall torque

This is the maximum torque within the continuous zone at zero speed.

Maximum continuous torque ratings may be intermittently exceeded for short periods provided that the winding Δt max temperature is not exceeded.

Δt max = 100 °C over a maximum ambient of 40 °C for Unimotor fm and Unimotor hd.

Stall current

Stall current = Stall torque / kt

Motor label and performance tables quote stall current when motor is at full power in a maximum ambient of 40 °C.

Rated speed

This is the maximum speed of the motor within the continuous zone. The motor speed can be controlled to any speed subject to the voltage limits and drive constraints as shown by the intermittent zone on the graph (see performance graphs - section 4).

Ke voltage constant

This is the phase to phase rms voltage generated at the stator when the shaft is back driven at 1,000 rpm with the rotor at 20 °C.

Kt torque constant

A brushless motor delivers torque proportional to the current, such that torque = Kt x current.

Where Kt = 0.0165 x Ke (at 20 °C).

Magnets used on all motors are affected by temperature such that Ke and Kt reduce with increasing temperatures of the magnets. The reductions depends upon the magnet type and material grade used.

Winding thermal time constant

The thermal time constant of the winding with respect to the stator temperature as a reference in the exponential temperature rise given by the formula:

Winding temperature at time **t** seconds = **T0+T1(1-e-t/tc)**

Where **T0** is the initial temperature,**T1** is the final winding temperature and tc = thermal time constant (seconds)

Note that temperature = 63.2 % of **T1** when **t=tc**

A thermal protection trip is provided by the drive, based upon calculations using elapsed time, current measurement, and the parameter settings set by the user or directly from the motor map.

Unimotor fm and Unimotor hd windings are ultimately protected by thermistor devices in the winding overhangs. These must be connected to the appropriate drive inputs via the motor feedback signal connector.

Rated power

This is the product of the rated speed (radian/sec) and the rated torque (Nm) expressed in Watts (W).

Δt temperature

Δt temperature is the temperature difference between the copper wires of the motor winding and the ambient air temperature surrounding the motor.

The maximum Δt temperature permitted is 100 °C over a maximum ambient of 40 °C.
(i.e. a maximum winding temperature of 140 °C)

3.2 Motor derating

Motor derating

Any adverse operating conditions require that the motor performance be derated. These conditions include: ambient temperature above 40 °C, motor mounting position, drive switching frequency or the drive being oversized for the motor.

Ambient temperature

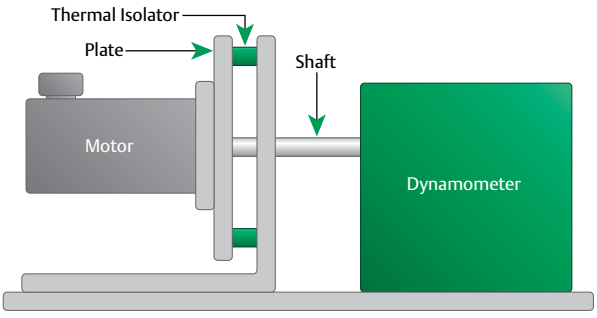
The ambient temperature around the motor must be taken into account. For ambient temperatures above 40 °C the torque must be derated using the following formula as a guideline. (Note: Only applies to 2,000/3, 000 rpm motors and assumes copper losses dominate.)

New derated torque = Specified torque x $\sqrt{[1-((\text{Ambient temperature} - 40\,^{\circ}\text{C}) / 100)]}$

For example with an ambient temperature of 76 °C the new derated torque will be 0.8 x specified torque.

Thermal test conditions

The performance data shown has been recorded under the following conditions. Ambient temperature 20 °C, with the motor mounted on a thermally isolated aluminum plate as shown below.



Motor type/frame	Aluminium heatsink plate
055 mm	110 x 110 x 27 mm
067-089 mm	250 x 250 x 15 mm
115-142 mm	350 x 350 x 20 mm
190 mm	500 x 500 x 20 mm

Mounting arrangements

The motor torque must be derated if:

- The motor mounting surface is heated from an external source, such as a gearbox.
- The motor is connected to a poor thermal conductor.
- The motor is in a confined space with restricted air flow.

Drive switching frequency

Most Unidrive M and Digitax ST nominal current ratings are reduced for the higher switching frequencies. See the appropriate drive manual for details.

See the table below for the motor derate factors.
These figures are for guidance only.

3.2.1 Unimotor fm derate factors

Switching frequency	075	095	115		142		190		250
	A-D	A-E	A-C	D-E	A-C	D-E	A-B	C-H	D-F
3 kHz	0.93	0.88	0.89	0.84	0.87	0.81	0.98	N/A	0.88
4 kHz	0.94	0.91	0.91	0.87	0.91	0.86	0.99	0.55	0.90
6 kHz	0.95	0.93	0.93	0.90	0.94	0.89	0.99	0.77	0.94
8 kHz	0.98	0.97	0.97	0.95	0.97	0.96	1	0.90	0.98
12/16 kHz	1	1	1	1	1	1	1	1	1

Note

Only applies to motors up to 3,000 rpm (rms) or lower. Assumes copper losses dominate on all frame sizes. Derate factor is applied to stall torque, rated torque, stall current and rated power.

3.2.2 Unimotor hd derate factors

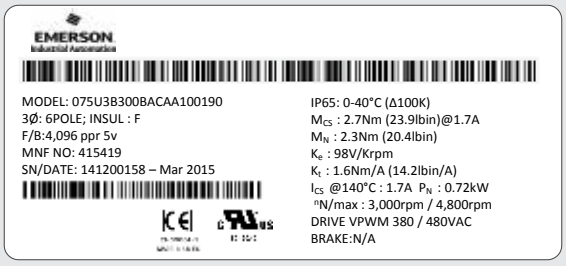
Switching frequency	Motor type/frame					
	055	067	089	115	142	190
3 kHz	0.92	0.93	0.89	0.89	0.83	0.90
4 kHz	0.93	0.94	0.91	0.92	0.85	0.95
6 kHz	0.95	0.95	0.95	0.96	0.88	1
8 kHz	0.96	0.98	0.97	0.98	0.91	1
12/16 kHz	1	1	1	1	1	1

Note

Only applies to motors up to 3,000 rpm (rms) or lower. Assumes copper losses dominate on all frame sizes. Derate factor is applied to stall torque, rated torque, stall current and rated power.

3.3 Nameplate

3.3.1 Unimotor fm/hd



Model	This is the full part number of the motor
3Ø	Indicates this motor is a 3 phase motor
POLES	Number of poles: ➜ 055-8 poles - 4 pole pairs (hd only) ➜ 067-190 - 10 poles - 5 pole pairs (hd only) ➜ 075-142 - 6 poles - 3 pole pairs (fm only) ➜ 190-8 pole - 4 pole pairs (fm only) ➜ 250-10 poles - 5 pole pairs (fm only)
Insul	Windings are built to class F (155 °C)
F/B	This gives the feedback device, count and working voltage or the feedback type
MNF NO	This is the work order for the motor
S/N DATE	The serial number and date the motor was manufactured
IP	Ingress protection rating IP 65S
M_{CS}	The stall torque at stall current

M_N	The rated torque of the motor
Ke	This is the AC Volts per 1,000 rpm with the motor at 20 °C
Kt	Value shown is for the magnet's temperature at 20 °C
I_{CS}	The constant stall current at the maximum winding temperature of 140 °C
P_N	The rated power of the motor
^{n}N/max	The rated speed/ this is the maximum speed allowed when taking into account these three factors: 1) Maximum drive voltage 2) Maximum encoder speed 3) Maximum mechanical speed
Drive VPWM	This indicates that the motor is for use with a voltage pulse width modulated drive with the supply voltage shown
Brake	The current, that rated torque and the operation voltage for the brake or N/A if the brake is not fitted

3.4 Motor selection

A reliable servo system depends upon the initial system design and correct selection of the motor, feedback, gearbox and drive. To ensure success careful attention should be paid to the following points:

- Speed, acceleration and inertia
- Peak and rms torque
- Motor feedback type
- Gear ratios
- Drive system operational mode
- Thermal effects
- Environmental conditions
- Mechanical restrictions
- Cost of motor-drive combination

It is necessary to estimate the root mean square (rms) torque value of the load. Where the motor has varying duty cycles it may be necessary to consider the worst case only.

Never exceed the maximum peak torque ratings.

Calculate the rms load torque at the motor and ensure that this is less than the motor rated torque. An additional allowance should be made on the load for inefficiencies and tolerance.

Choose a suitable motor within the size limitations of the installation. The frame size and motor speed may be selected using the performance data. Look for the rated torque at the appropriate temperature.

3.5 Checklist of operating details

Complete this checklist to help select which Unimotor fm best suits your application requirements.

Torque speed

- What motor operating speed do you require (rpm)?
  - 500
  - 1,000
  - 2,000
  - 3,000
  - 4,000
  - 6,000
  - Other (non standard speed)
- What is the rms torque?
  Decide on switching frequencies for the drive, and derate motor or drive accordingly
- If the ambient temperature is above 40 °C, apply a derating factor. If the motor is mounted to a hot interface; or interfaced with a low thermal mass; or high thermal resistance; apply a derating factor. Torque ratings of motors are stated in controlled conditions mounted on a reference front plate. Details can be found in the *Performance data* selection
- Inertia mismatch (ratio of the motor inertia to load inertia reflected to motor shaft) can be as high as 3:1 for acceleration rates of 1,000 rad/s² for a typical system. Larger mismatches or acceleration can be tolerated with a rigid mechanical system and high resolution feedback
- Do you require a brake?

Motor mounting

- Does the motor fit the machine?
  Make allowances for cables and connections.
- Do you require an output key?
  - Output key
  - Plain shaft

Feedback

- Do you want an encoder or resolver?
  - Incremental
  - SinCos Multi turn
    - SICK Hiperface
    - Heidenhain EnDat
    - Inductive absolute
    - High accuracy
  - SinCos Single turn
    - SICK Hiperface
    - Heidenhain EnDat
    - Inductive
    - High accuracy
  - Resolver

Electrical connections

- Connectors
  - Power and Signal 90 ° rotatable
  - Power 90 ° rotatable and Signal vertical
  - Power and Signal vertical

Other options

- Do you require a gearbox?
  - Yes see Dynobloc fm/hd catalogue
  - No
- Many other customer special motors are made by Emerson Industrial Automation. For further details, contact us.

3.6 Other points to consider

Torque and temperature

- The maximum allowable temperature of the motor windings or feedback device should not be exceeded. The windings have a thermal time constant ranging from 90 seconds to over an hour. Dependent upon motor temperature the motor can be overdriven for shorter periods without exceeding the temperature limitations. The motor winding thermal time constant should be set-up in the drive; this parameter is used for thermal shock (I^2t) calculations within the drive
- The motor winding thermal time constant should be large in comparison with the medium term periods of high rms torque
- Ensure that the drive's features, such as switching frequency, waveforms, peak and continuous currents are suitable for the application. Low switching frequencies of the drive will require motor derating
- Torque estimates should include friction and acceleration (and hence inertia) calculations
- Consider the motor cooling effects; for example, is the conductive thermal path adequate? Is the motor mounted on a gearbox or heat source?
- Ensure that the motor and drive can meet the short term peak torque requirements

Braking

- The installation may require static parking brake

Inertia

- Ensure that the motor has correct inertia matching to suit the acceleration requirements. Consider inertia load matching especially for acceleration levels above 1,000 rad/s². Motors with larger frame diameters have higher inertia. Higher inertia rotor options are available

Environmental conditions

- Other environmental factors, such as vibration, pressure, shock,heat and hazardous zones should be considered

Cables

- The cable lengths required for the installation should be considered. For maximum cable length, see *Maximum cable length* in the *Cable* section. Compliance with both Safety and EMC regulations should be ensured
- Ensure motor is mounted firmly and properly earthed. Screen all cables to reduce system noise and EMC

Feedback

- To achieve an efficient system it is necessary to ensure stiff mechanical connections and couplings to all rotating parts, so that a high servo bandwidth can be achieved. This will improve stability and enable higher servo gains to be set, ensuring higher accuracy and positional repeatability
- High resolution feedbacks will increase stability and allow greater acceleration or inertia mismatch

Bearing loads

- Check the radial and axial loadings are within the limits of the motor

3.7 Special motor requests

Emerson Industrial Automation offers many "special" motors. These motors are designed to meet a specific customer's requirements.

Special motors are denoted by a code on the end of the part number. S*** 3 or 4 digits; e.g. 115U3E100BACAA115240-SON (special coating)

To request a "special" motor please contact Emerson Industrial Automation with the customer requirements. A product enquiry form will be raised and R&D/Engineering will investigate the feasibility of the request. If acceptable then a "special" part number reference will be allocated to the motor and a quote will be issued.

Once an order is placed a Product Approval Schedule (PAS) form will be raised and sent to the Drive Center for approval.

Special motors can include:

- Special paint finishes or unpainted motors
- Special motors with customer specific connector wiring
- Special motors with customer specific brakes
- Special motors with customer specific shaft dimension
- Special motors for harsh environments motors

3.8 Calculating load torque

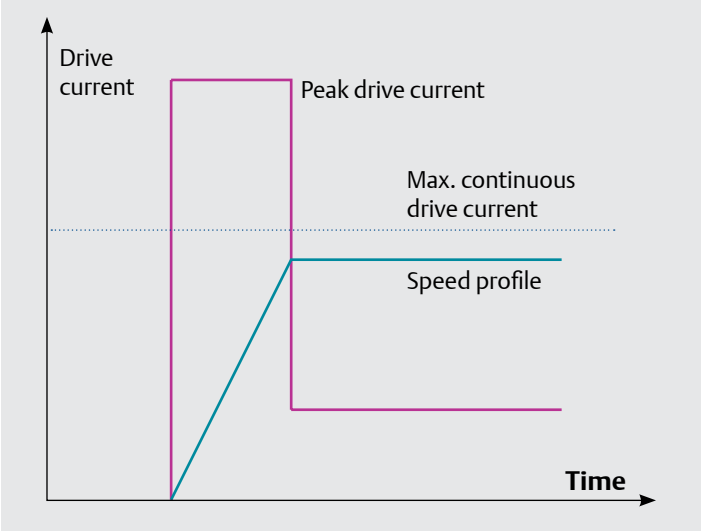
In any application, the load consists of various torque loads plus acceleration and decelerations of inertia.

Constant torque periods

Periods where a torque is maintained at constant or near constant motor speeds.

Acceleration and deceleration

Torque is required to achieve acceleration and deceleration. Acceleration times of less than one second can often be achieved using peak torque capability of the drive and motor.



Note

Peak drive current may be set by drive control to the motors continuous current rating. If this is required, check that it is within the drives capability. Medium periods of up to 200 % over current are often acceptable for the motor, provided that the heating effects are not too rapid and that the motor thermal time constant is long in comparison.

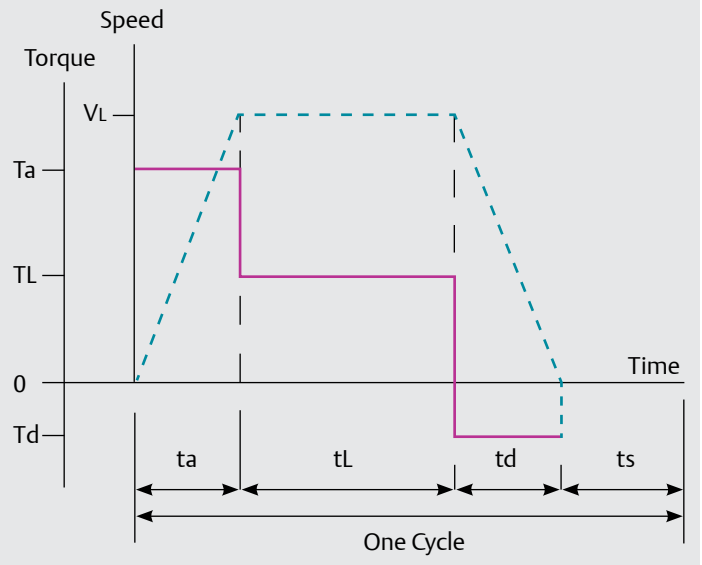
Inertia formula and accelerating or decelerating torques:

Inertial loads on a common shaft may be added together. Inertial loads may be reflected from the output of a reduction gearbox to the motor by dividing the output ratio by the square of the ratio.

Total inertia = reflected inertial load at motor + motor inertia

rms torque for a repetitive duty cycle:

Draw a graph of torque (T) against time for one complete repetitive cycle of events (or choose the worst case of various events). Make the torque axis vertical. On the same graph, draw the speed profile against time for one cycle.



From the above speed-torque diagram calculate the rms torque using the formula:

$$\mathbf{Trms} = \sqrt{\frac{\mathbf{Ta^2 \times ta + TL^2 \times tL + Td^2 \times td \times Ts^2 \times ts}}{\mathbf{ta + tL + td + ts}}}$$

Where:

Ta = Acceleration Torque (Nm)
TL = Load torque (Nm)
Td = Deceleration torque (Nm)
ta = Acceleration Time (s)
Ts = Dwell torque (Nm=0)
tL = On load running time (s)
td = Deceleration time (s)
ts = Dwell time (s)
VL = Full load speed (rpm)

Example

In an application where the torque speed profile is as above with **Ta** = 20 Nm, **TL** = 5 Nm, **Td** = -10 Nm, **ta** = 20 ms, **tL** = 5 s, **td** = 30 ms, **ts** = 3 s, **VL** = 3,000 rpm, **Ts** = 0 calculate the rms torque for this application.

$$\mathbf{Trms} = \sqrt{\frac{\mathbf{20^2 \times 0.02 + 5^2 \times 5 + 10^2 \times 0.03 \times 0^2 \times 3}}{\mathbf{0.02 + 5 + 0.03 + 3}}}$$

$$\mathbf{Trms} = \sqrt{\frac{\mathbf{136}}{\mathbf{8.05}}}$$

Trms = 4.11 Nm

15 % tolerance required hence the rms torque for this application = **4.73 Nm**

3.9 Understanding motor heating effects

During operation, the motor is subjected to heating effects from several sources. Some of these are obvious; others obscure. Whilst the motor specification allows for most of these heating effects, others depend on the application. This section examines some of the causes of motor heating.

Motor copper losses

Motor copper loss is a product of the rms current squared and the resistance of the motor windings. It includes ripple currents, determined by the switching frequency of the drive and the inductance of the motor. The inductance of the winding is generally low, so that the maximum drive frequencies should be selected commensurate with drive heating losses. Data in this manual is for switching frequencies as stated in the performance data section. If lower frequencies are used, motor performance is reduced.

Motor copper loss also includes losses arising from waveform distortions of either the drive or motor or both. The motor's back EMF waveform is sinusoidal and of low harmonic distortion. If lower frequencies are used, the drive current has higher distortion and hence the motor performance is reduced.

Motor current depends on the torque demanded by the load at any instant. This is normally given by the motor torque constant (Kt) in Nm/A. Although regarded as a constant, Kt decreases slightly when the motor is at maximum temperature.

The Ke for a brushless three phase motor is always quoted Volts(rms) per krpm, since the motor back emf is sinusoidal.

Motor iron losses

Motor iron loss is a heating effect produced in the motor laminations. It is caused by the rotating magnetic field cutting through the laminations, the higher the speed the higher the losses. For this reason the motor stall torque is greater than the motor rated torque at speed.

Iron loss depends on the strength of the magnetic field and type of laminations material.

Friction and windage

The bearings, oil seals and the air resistance to rotor speed cause internal friction. Its effect is relatively small and is included in the data provided.

Thermal protection

An incorrect system set up can give rise to excessive motor temperatures. This can be guarded against by the use of the motor thermistor protection facility.

Servo motor/drive system faults

Common but often unnoticed causes of motor overheating can be created by:

- ➜ Instability (self induced oscillation) within the overall servo feedback system
- ➜ Incorrect parameter settings in the drive protection system, for example peak current, and I^2t (thermal protection calculation for the drive)

The increase in resistance is measured by the drive and a "th trip" will occur. Only once the motor has cooled can the trip be cleared.

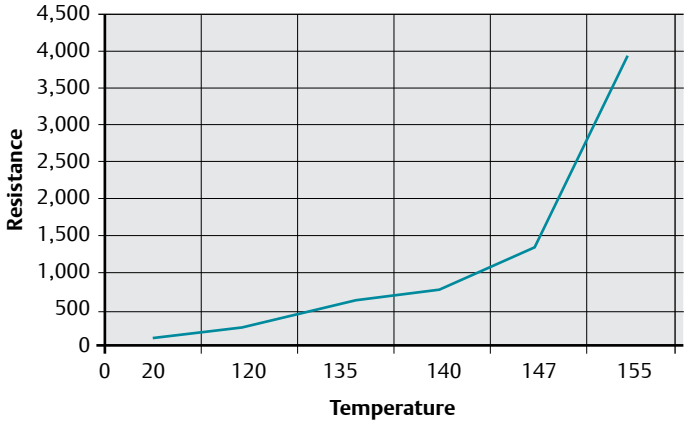
The installer must connect the motor thermistor to the drive to cause motor power shutdown in the event of overheating.

It is the installer's responsibility to ensure that this protection facility is properly connected and set at the drive.

Failure to ensure the correct operation of the protection facility invalidates the warranty in respect of a burnt out winding.

The ambient temperature of the environment into which the Unimotor is mounted must be considered.

Unimotor PTC 145 °C

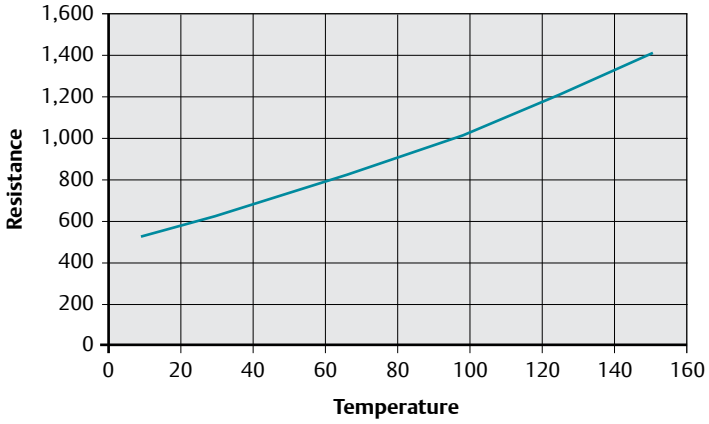


Thermistor protection

A PTC thermistor rated to 145 C, is built into the motor windings and is used to protect the motor against overheating problems.

The device remains a low resistance until a critical temperature is reached, where it will then switch to a very high resistance.

Unimotor KTY 84 -130 °C



KTY protection

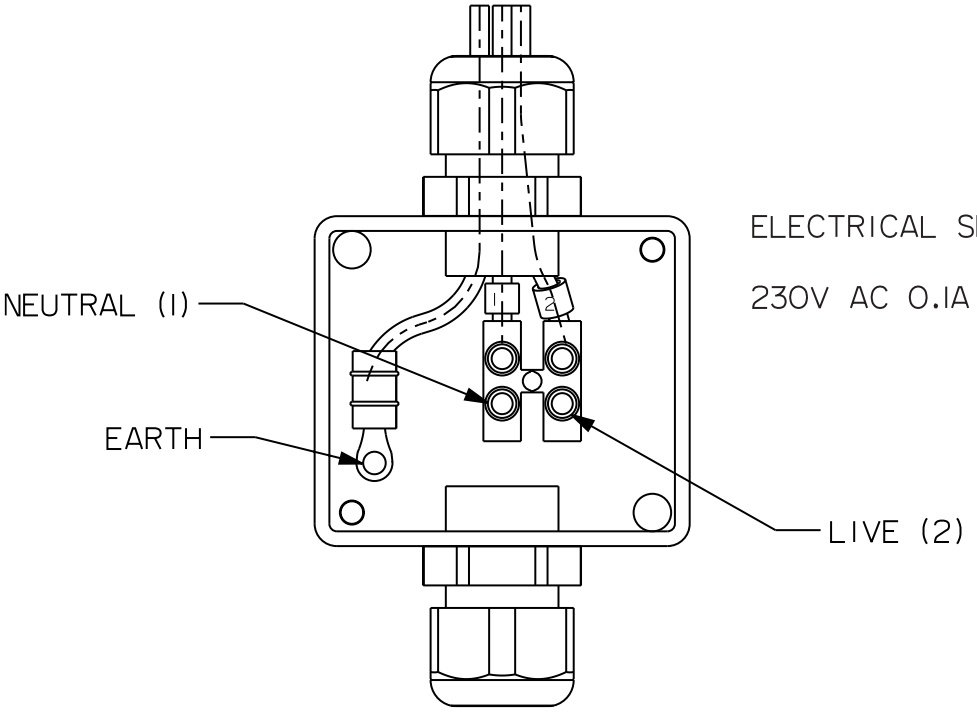
A KTY 84-130 temperature sensors is built into the motor windings and is used to protect the motor against overheating problems. This device returns a resistance proportional to the winding temperature.

Fan boxes

The Unimotor fm and hd range can support a fan box unit, this can be retrofitted to the motor in the field and is used in applications where the motor's rated performance is not being exceeded and the fan box is used just to maintain a reduced motor temperature.

Fan Box units	Clearance distance behind fan box	Voltage	Free Air flow	Fan Current rating
075 / 067 motor	40mm	230V AC	50 m³/h	0.05A
095 / 089 motor	40mm	230V AC	67 m³/h	0.05A
115 motor	40mm	230V AC	160 m³/h	0.08A
142 motor	50mm	230V AC	180 m³/h	0.07A
190 motor	60mm	230V AC	325 m³/h	0.13A

Fan box wiring



ELECTRICAL SPECIFICATION:

230V AC 0.1A

3.10 Feedback selection

Feedback Device Order Code	Feedback Type	Manufacturer	Encoder Supply Voltage	SinCos Cycle or Incremental Pulses per Revolution	Resolution Available to Position Loop[2&3]	Absolute Multi-Turn Revolutions	Feedback Accuracy[1]	Other Information
055-067 Motors								
AR	Resolver	LTN RE-15	7 Vdc	1	Medium 16384 (14 bits)		Low ± 600"	Transformation ratio 0.5 Resolver Rotor 2 Pole
CR	Incremental Encoder	Renco R35i	5 Vdc	4096	Medium 16384 (14 bits)	–	Medium ± 150"	
MR				2048	Medium 8192 (13 bits)	–		
EM (Multi Turn)	Inductive SinCos Encoder Endat01	EQI 1130	5 Vdc	16	High 2.62x10^5 (18 bits)	4096 (12 bits)	Medium ± 480"	Comunication Protocol EnDat 2.2 / EnDat01 with SinCos output 1 Vpp
FM (Single Turn)		ECI 1118				–		
TL (Multi Turn)	Optical SincCos Encoder Hiperface	SKM 36	7 - 12 Vdc	128	High 1.31x10^5 (17 bits)	4096 (12 bits)	High ± 52"	Hiperface
UL (Single Turn)		SKS 36				–		
075 -250 Motors								
AE	Resolver	API Harrowe	6 Vdc Excitation 6 kHz	1	Medium 16384 (14 bits)	-	Low ± 720"	Transformation ratio 0.31 Resolver Rotor 2 Pole
CA	Incremental Encoder	SICK	5 Vdc	4096	Medium 16384 (14 bits)	–	High ± 60"	
MA				2048	Medium 8192 (13 bits)	–		
EC (Multi Turn)	Inductive SinCos Encoder Endat01	EQI 1331	5 Vdc	32	High 5.24x10^5 (19 bits)	4096 (12 bits)	Medium ± 280"	Comunication Protocol EnDat 2.2 / EnDat01 with SinCos output 1 Vpp
FC (Single Turn)		ECI 1319				–		
EB (Multi Turn)	Optical SinCos Encoder Endat01	EQN 1325	3.6-14 Vdc	2048	Very High 2.08x10^6 (21 bits)	4096 (12 bits)	Very High ± 20 (differential non linearity ± 1 % signal period)	Comunication Protocol EnDat 2.2 / EnDat01 with SinCos output 1 Vpp"
FB (Single Turn)		ECN 1313				–		
RA (Multi Turn)	Optical SinCos Encoder Hiperface	SRM 50	7 - 12 Vdc	1024	Very High 1.04x10^6 (20 bits)	4096 (12 bits)	High ± 52"	Hiperface
SA (Single Turn)		SRS 50				–		
VF (Multi Turn)	Capacitive SinCos Encoder Hiperface	SEL 52	7 - 12 Vdc	16	Medium 16,384 (14 bits)	4096 (12 bits)	Medium ± 360"	Hiperface
WF (Single Turn)		SEK 52				–		

[1] The information is supplied by the feedback device manufacturer and relates to it as a standalone device. The values may change when mounted into the motor and connected to a drive. These values have not been verified by Emerson Industrial Automation.

[2] The output from the resolver is an analogue output. The resolution is determined by the analogue to digitial converter used. The value shown is when the resolver is used in conjunction with the SM-Resolver.

[3] The sin and cosine outputs from the SinCos optical encoders are analogue outputs. With Unidrive M and Digitax ST the resolutions quoted above are when the encoder type is set to either SC Endat or SC Hiper depending on the encoder.

3.11 Feedback terminology

Accuracy

Accuracy is the measure of the difference between the expected position and actual measured value. Rotary feedback accuracy is usually given as an angle representing the maximum deviation from the expected position. Linear feedback accuracy is usually given as a distance representing the maximum deviation from the expected. Generally, as accuracy increases the cost of the feedback device increases.

Absolute encoder

Absolute encoders output unique information for each mechanical measured position. With the motor shaft or plate in any position when the drive is turned on the feedback device will always be able to sense a unique position and transmit this value to the drive. For an absolute single turn rotary encoder these unique positions will be over one revolution.

When power is removed from the encoder and the shaft or plate moves the device will know its current position when the power is restored.

A non-absolute feedback mechanism must start from a known position, such as the index or marker pulse.

Bit

A bit is short for **B**inary Digi**t**. It is the smallest unit of information in a machine/drive. A single bit has a binary value of either 0 or 1. These bits do not normally exist on their own, but usually in groups. The larger the number of bits in a group the larger the amount of information that is available and thus the higher the resolution. This group can be converted to decimal using binary arithmetic. The group of bits can be converted to decimal by starting at the right most bit and multiplying each successive bit to the left by two. So for example a 12 bit number would give a decimal equivalent of 4,096 and a 19 bit number would give a decimal equivalent of 524,288.

Commutation

All brushless AC permanent magnet motors require commutation information to enable the drive to synchronize the stator flux field with the rotor of the motor.

To ensure optimum torque at all rotor positions both when stationary and at speed the drive is required to maintain motor current in phase with the peak of the motor's sinusoidal waveform. The drive must therefore know the position of the rotor with respect to the stator at all times.

Commutation phase offset

Most drives, including the Unidrive M and Digitax ST, provide a "Phase Offset" adjustment as a means of correctly setting the commutation position.

For feedback devices that are not aligned, the Unidrive M has an Encoder Phasing Test (Autotune) (Pr **5.012**) that automatically creates a Phase Offset value (Encoder phase angle) (Pr **3.025**).

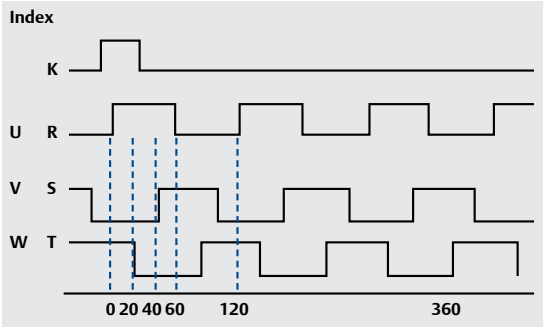
All fm motor feedback devices are set to match the Unidrive M definition of zero phase offset, so that the drive may operate with zero phase offset adjustment, thus allowing interchange of motors between drives without further adjustment.

Note that not all drives have the same zero offset definition.

Commutation outputs

Commutation outputs are used on devices that are non-absolute. For AC Synchronous 3 phase motors there are 3 commutation output signal channels from the feedback device, for example S1, S2 and S3.

The diagram below shows commutation outputs for 6 pole commutation (3 pole pairs). The 3 phase motor sinusoidal power from the drive runs synchronously with motor speed at N/2 cycles per revolution;



Where N = number of poles. For example a 6 pole motor the encoder commutation tracks will output 3 pulses per channel per revolution and for an 8 pole motor the encoder commutation tracks will give 4 pulses per channel per revolution.

The commutation signals allow the drive to operate the motor at 'switch on' with only a small possible reduction in efficiency and torque in the motor. The best way to explain this is to use an example where an encoder is connected to a motor with 6 poles.

On power up the drive would look at the S1, S2 and S3 signals to determine where the stator is relative to the rotor or magnetic plate. This would give a known position that is within 60 ° electrical of an electrical cycle (20 ° mechanical). During this initial period, the drive assumes that it is in the middle of this 60 ° unknown region. So the worse case error of this is 30 ° electrical (10 ° mechanical), which equates to a drop of 13.4 % in the rated torque when 100 % current is delivered into the motor winding. When the drive is commanded to move the motor position, the stator is energized causing the plate or rotor to move. While the rotor or plate is moving, the drive detects that a signal switch (edge detection) has occurred on one of the commutation channels (S1, S2 or S3). At this point the drive knows exactly where it is in the electrical cycle and adjusts the field orientation to compensate for the error. At this point the drive switches over to using only the incremental signals for commutation and the commutation channels are no longer used.

Electronic nameplate

Available on some feedback devices the electronic nameplate provides the facility to electronically store information about the motor and feedback device. This information can then automatically be used to configure the drive for operation.

Feedback terminology

Environment

The environment is the external conditions that physically surround the Feedback device. The main factors that affect the feedback device are temperature and mechanical shock and vibration.

Motors are designed to allow the feedback devices to be within their operational temperature limits. Generally it is assumed that there is free air movement around the motor. If the motor is positioned where there is little or no airflow or it is connected to a heat source such as a gearbox, it can cause the air temperature around the feedback device to be operating outside its recommended operating temperature and can lead to problems.

Mechanical shock and vibration tends to be transmitted from the load, through the motor shaft and into the feedback device. This should be considered when the motor and feedback device are being specified for the application.

Position

The defined position is the location in a coordinate system which is usually in two or more dimensions.

For a rotary feedback device this is defined as the location within one revolution. If it is a multi-turn device it is the location within one revolution plus the location within a number of rotations.

For a linear feedback device this is defined as the distance from a known point.

Resolution

The resolution of a feedback device is the smallest change in position or angle that it can detect in the quantity that it is measuring.

Feedback resolution of the system is a function of the type of feedback device used and drive receiving the information.

Generally, as the resolution of the feedback device increases the level of control that can be used in the servo system increases.

As with accuracy, as the resolution of the device increases the cost increases.

Resolver

A passive wound device consisting of a stator and rotor elements excited from an external source, such as an SM-Resolver, the resolver produces two output signals that correspond to the sine and cosine angle of the motor shaft. This is a robust absolute device of low accuracy, capable of withstanding high temperature and high levels of vibration. Positional information is absolute within one turn - i.e. position is not lost when the drive is powered down.

Incremental encoder

An electronic device using an optical disc. The position is determined by counting steps or pulses. Two sequences of pulses in quadrature are used so the direction sensing may be determined and 4 x (pulses per rev) may be used for resolution in the drive. A marker pulse occurs once per revolution and is used to zero the position count. The encoder also provides commutation signals, which are required to determine the absolute position during the motor phasing test. This device is available in 4,096, 2,048 and 1024 ppr versions. Positional information is non absolute - i.e. position is lost when the drive is powered down.

SinCos/ Absolute Encoders

Types available are: Optical or Inductive - which can be single or multi-turn.

1) Optical

An electronic device using an optical disc. An absolute encoder with high resolution that employs a combination of absolute information, transmitted via a serial link, and sine/cosine signals with incremental techniques.

2) Inductive/ Capacitive:

An electronic device using inductively coupled PCBs. An absolute encoder with medium resolution that employs a combination of absolute information, transmitted via a serial link, and sine/cosine signals with incremental techniques. This encoder can be operated with the drive using either sine/consine or absolute (serial) values only. Positional information is absolute within 4,096 turns - i.e. position is not lost when the drive is powered down.

Multi-turn

As previous but with extra gear wheels included so that the output is unique for each shaft position and the encoder has the additional ability to count complete turns of the motor shaft up to 4,096 revolutions.

Serial Interface

Serial communication is available on some feedback devices. It is the process of sending data one bit at one time, sequentially, over a communication channel. The specification normally used to define this method of communication is the EIA485 specification. These can be synchronous, which means that they operate with additional clock channels. The main advantage of synchronous data transmission is that it can operate at high speed. A disadvantage is that if the receiver goes out of synchronization it can take time for it to resyncronize and data may be lost. Note that not all serial interfaces use the clock channels.

Serial interface communication allows data to be sent and received from the feedback device. In addition to the position and speed data other information can be sent such as multi-turn count, absolute position and diagnostic information.

Synchronous

If something is synchronous it means that events are coordinated in time. For serial interfaces this means that clock channels are used.

Asynchronous

If something is asynchronous it means that events are not coordinated in time. For serial interfaces this means that clock channels are not used.

Speed

Speed is the rate of change in position which can be either angular or linear traveled per unit of time. For rotational motors this is usually defined as revolutions per minute (rpm).

Volatile

Stored information will be lost when power is removed.

Non volatile

Stored information will not be lost when power is removed.

3.12 Brake specification

Unimotor fm and hd may be ordered with an internal rear mounted spring applied parking brake. The brake works on a fail safe principle: the brake is active when the supply voltage is switched off and the brake is released when the supply voltage is switched on.

The standard parking brake is noted by the 5 code in the part number.

If a motor is fitted with a fail safe brake, take care not to expose the motor shaft to excessive torsional shocks or resonances when the brake is engaged or disengaged. Doing so can damage the brake.

Note.

Shunting the brake primary coil with an external diode to avoid switching peaks increases the release time considerably. This is usually required to protect solid state switches, or to reduce arcing at the brake relay contacts (Diode 1N4001 recommended)

SAFETY NOTE

The Fail-Safe Brake is for use as a holding brake with the motor shaft stationary.

Do NOT use it as a dynamic brake. Using it in this manner will cause brake wear and eventual failure. Emergency Stop situations can contribute to brake wear and failure.

3.12.1 Unimotor fm

Motor frame	Supply volts	Input Power	Static torque	Release time	Moment of inertia	Backlash
			Parking Brake (05)			
Size	Vdc	W	Nm	ms nom	kg.cm2*	Degrees**
75	24	6.3	2.2	22	0.07	1.03
95	24	16	12.2	60	0.39	0.94
115	24	23	20	120	0.24	0.75
142	24	23	20	120	0.3	0.75
190	24	25	42/67	95/120	0.39	0.77
250	24	62	135	250	16.37	0.5

*Note 1 kg.cm² = 1x10-4 kg.m² **Backlash figure will increase with time

- The brake is intended for parking duty and is not for dynamic or safety use
- Refer to your Automation Center or Distributor if your application requires dynamic braking in emergency conditions
- To provide protection to the brake control circuit it is recommended that a diode is connected across the output terminals of the solid state or relay contacts devices
- Larger torque brakes are available as an option. Contact your Automation Center or Distributor for details
- Figures are shown at 20 °C brake temperature. Apply the derate factor of 0.7 to the standard brake torque figures if motor temperature is above 100 °C. A derate factor of 0.9 applies to the high energy brake if motor temperature is above 100 °C
- The brake will engage when power is removed

It is recommended to run extensive application validation testing and confirm the motor brake life span when the motor is mounted vertically and the motor runs through high acceleration and deceleration.

3.11.2 Unimotor hd

Motor frame	Supply volts	Input power	Static torque	Release time	Moment of inertia	Backlash
			Parking brake (05)			
Size	Vdc	W	Nm	ms nom	kg.cm² *	Degrees**
055	24	6.3	1.8	22	0.03	0.73
067	24	10.2	4	<50	0.073	0.75
089	24	23.35	10	<50	0.115	0.75
115	24	19.5	20	120	0.327	0.75
142	24	25	42	95	2.54	0.77
190 C-D	24	25	67	120	4.57	0.77
190 F	24	54.5	100	TBD	7.72	0.75

*Note 1 kg.cm² = 1x10-4 kg.m² **Backlash figure will increase with time

3.13 Radial load

When selecting a motor some consideration must be made to the loading that the required application will put on the motor shaft. All shaft loads are transferred to the motor's bearing system, so a poorly selected motor could result in premature bearing failure.

Maximum axial and radial load

The following graphs show the Unimotor in terms of bearing strength. It has to be noted that the graphs are based on theoretical calculation, and that the bearing life of the motor is affected by the following:

- Speed
- Radial load applied to the bearings
- Axial load applied to the bearings
- Shock and vibration
  (external shock/vibration applied to the motor)
- Bearing temperature
- Bearing cleanliness
- Motor mounting to the application

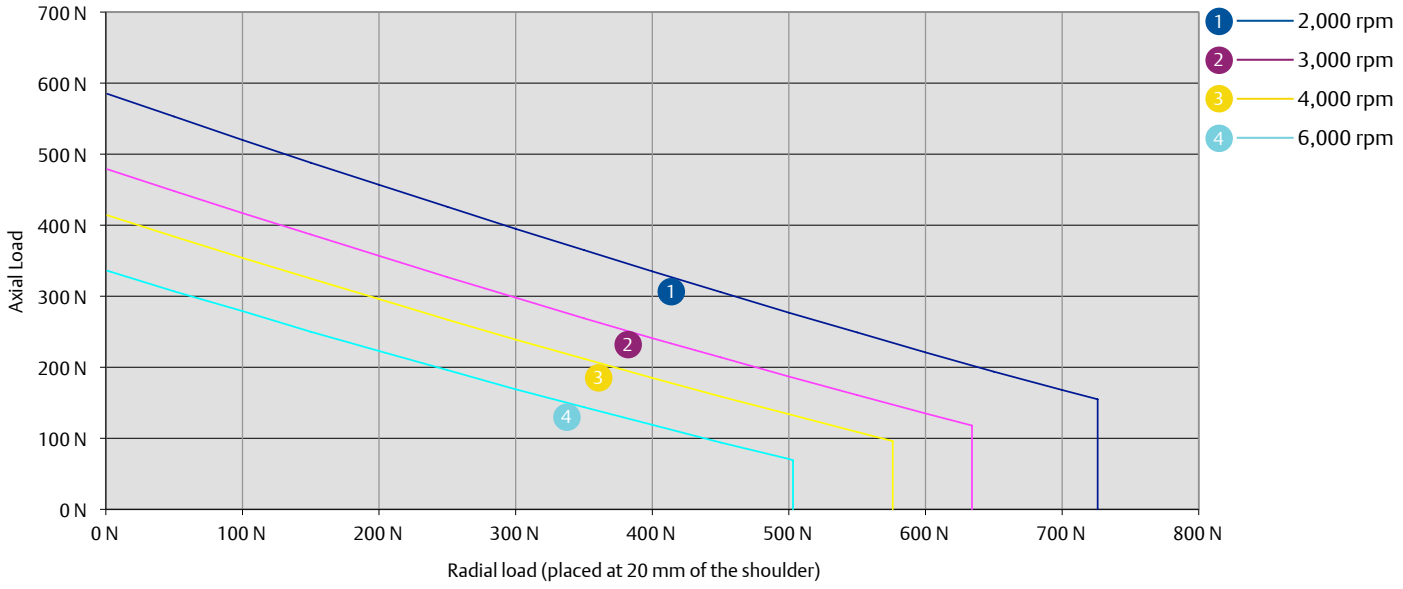
The loads in the following graphs have been calculated using ISO 281 calculation L10(h). The loads and speeds used are considered to be constant throughout the life of the bearing.

The following factors have been taken into consideration when calculating the loads:

- 90 % reliability
- Radial load applied on the output shaft away from the shoulder and constant. The distance can be read on the different graphs
- Axial load going toward the motor and constant
- Load factor of 1: no vibration applied to the motor
- Temperature of the bearing: 100 °C max
- Grease clean

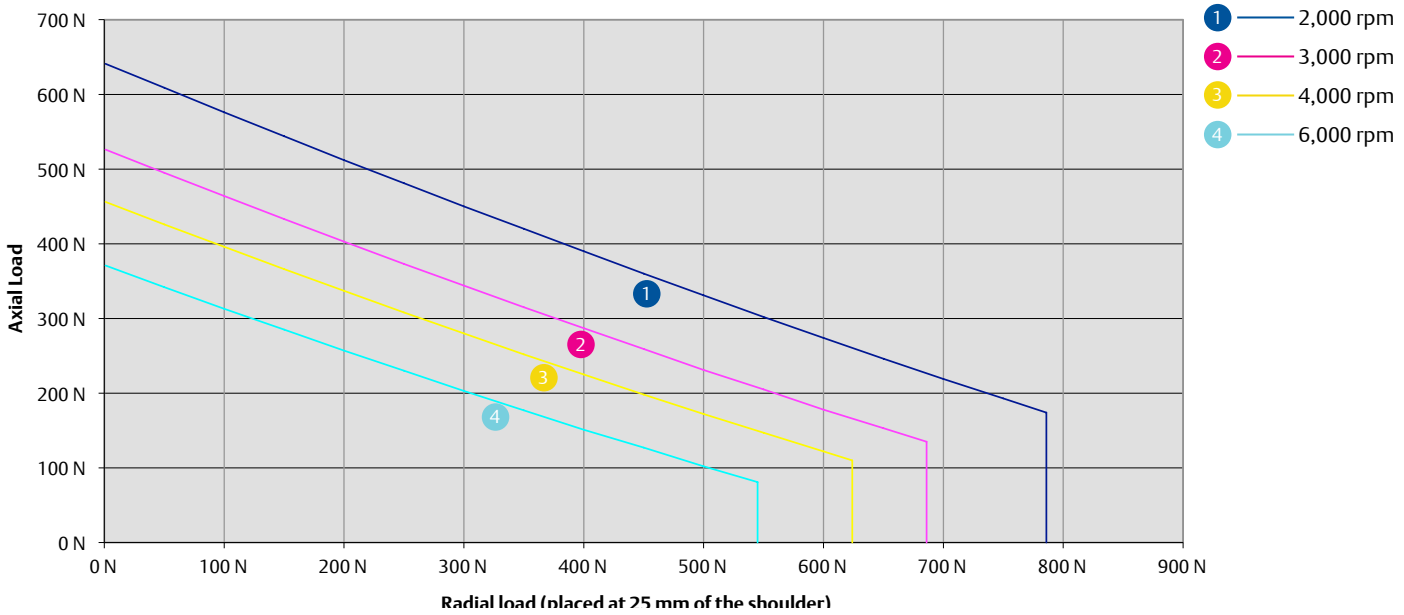
3.13.1 Radial load Unimotor fm

Radial load vs. axial load on 75U3/E3



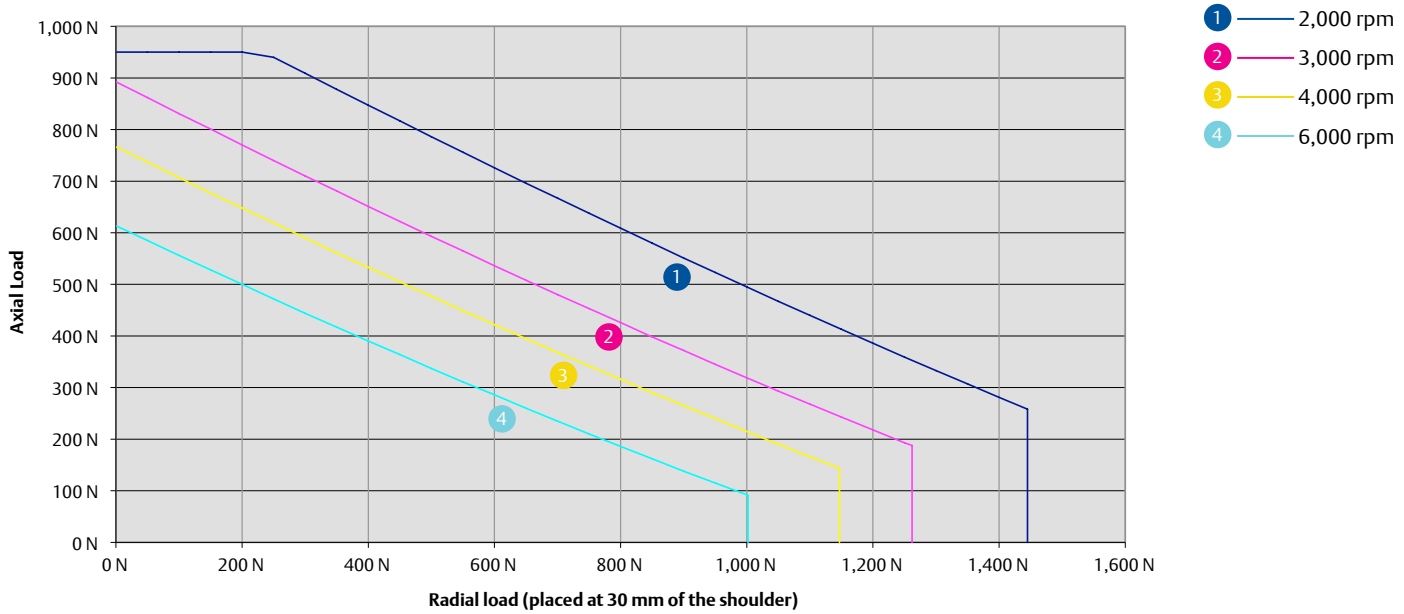
75U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 900 N

Radial load vs. axial load on 95U3/E3



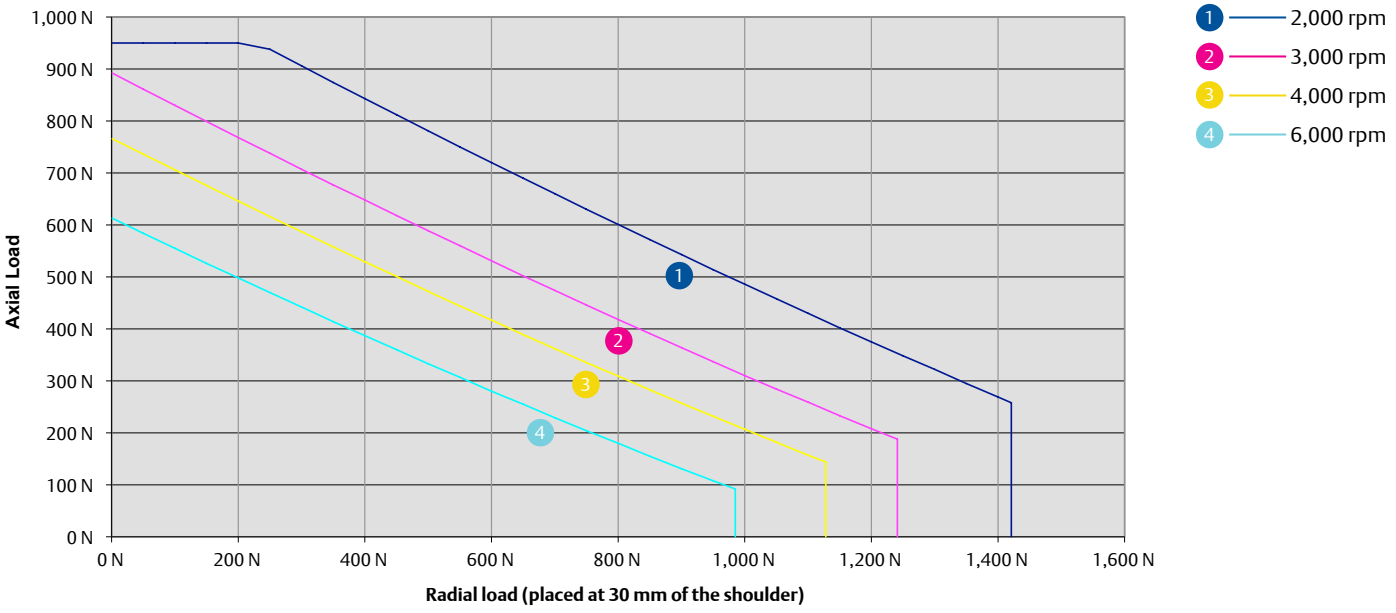
95U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 850 N

Radial load vs. axial load on 115U3/E3



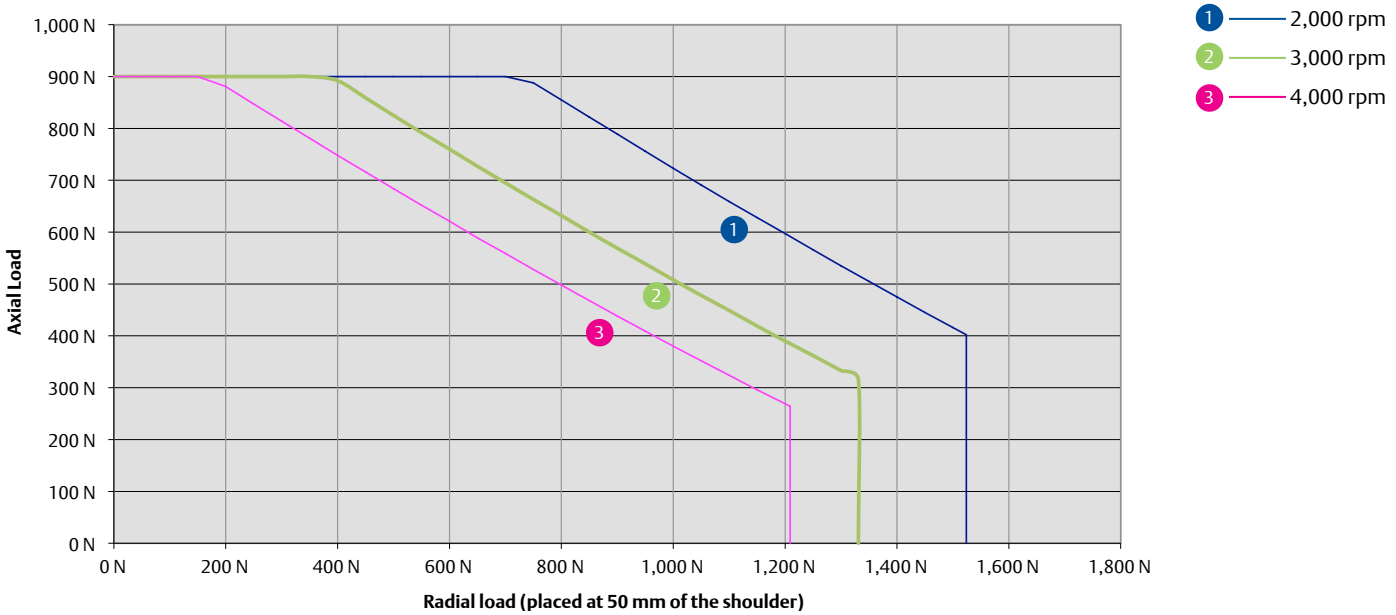
115U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 950 N

Radial load vs. axial load on 142U3/E3



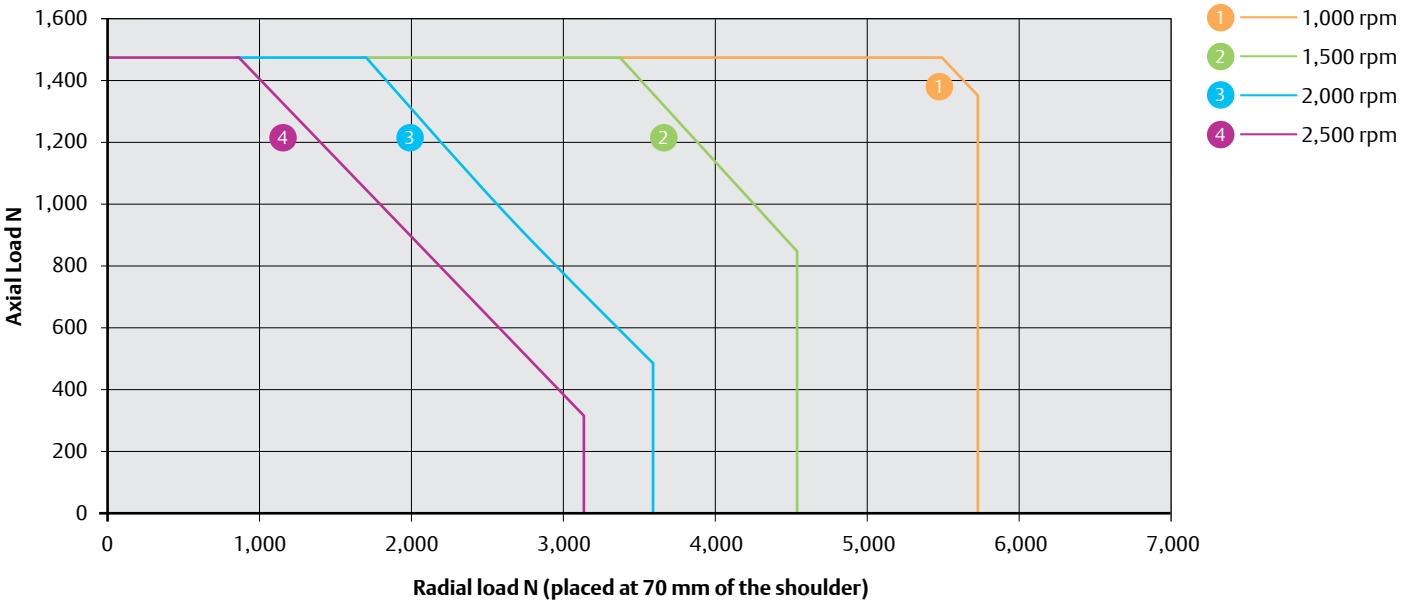
142U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 950 N

Radial load vs. axial load on 190U3/E3

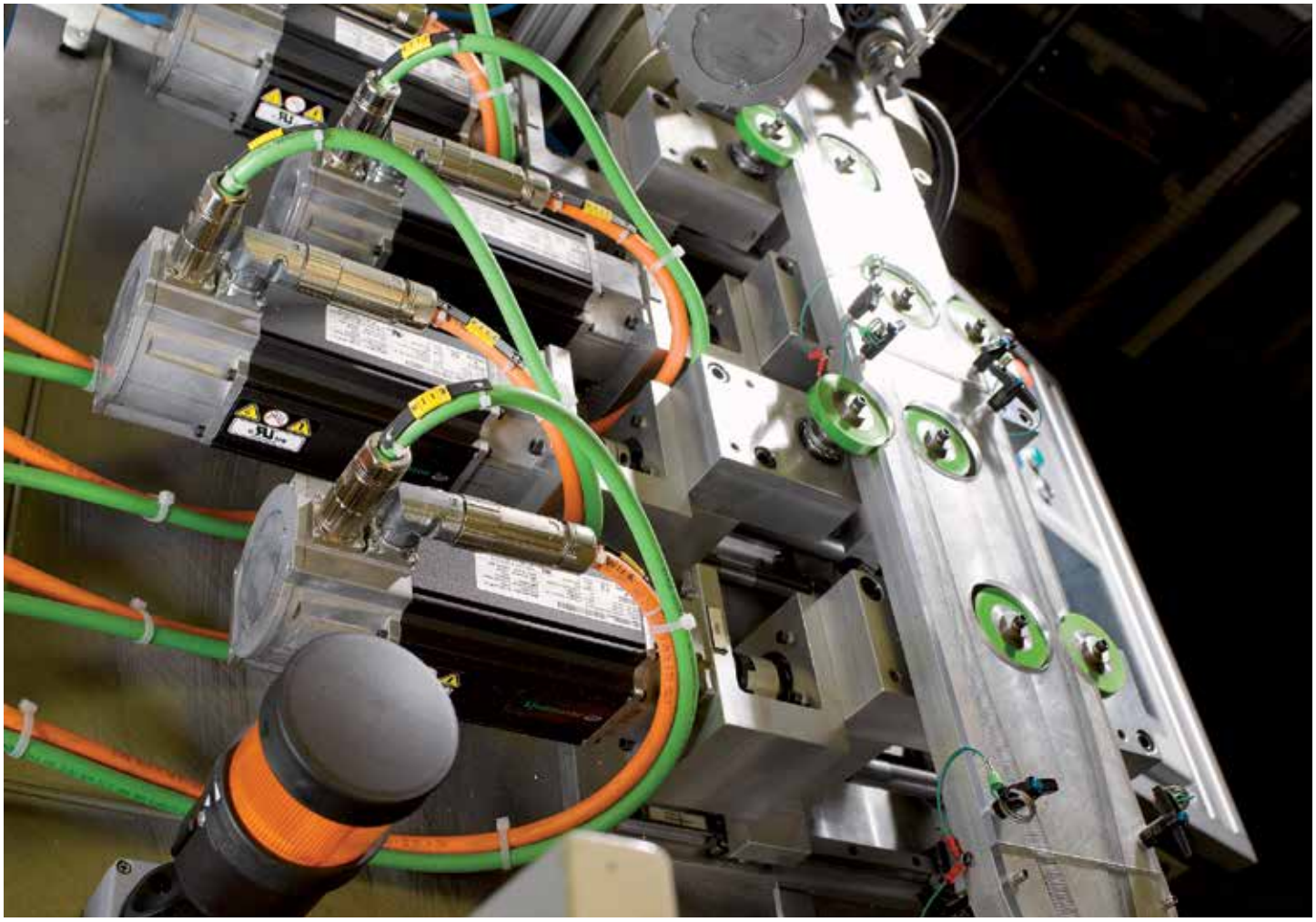


190U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 900 N

Radial load vs. axial load on 250U3

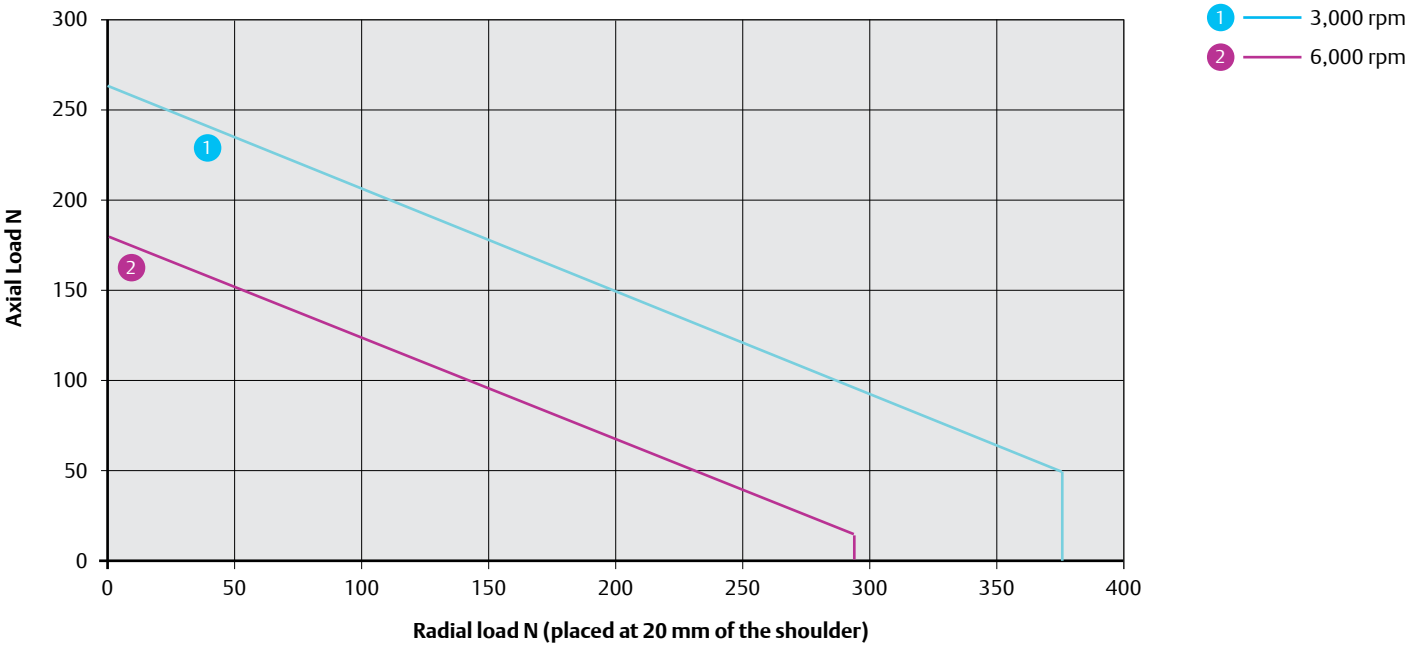


250U3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 1,450 N



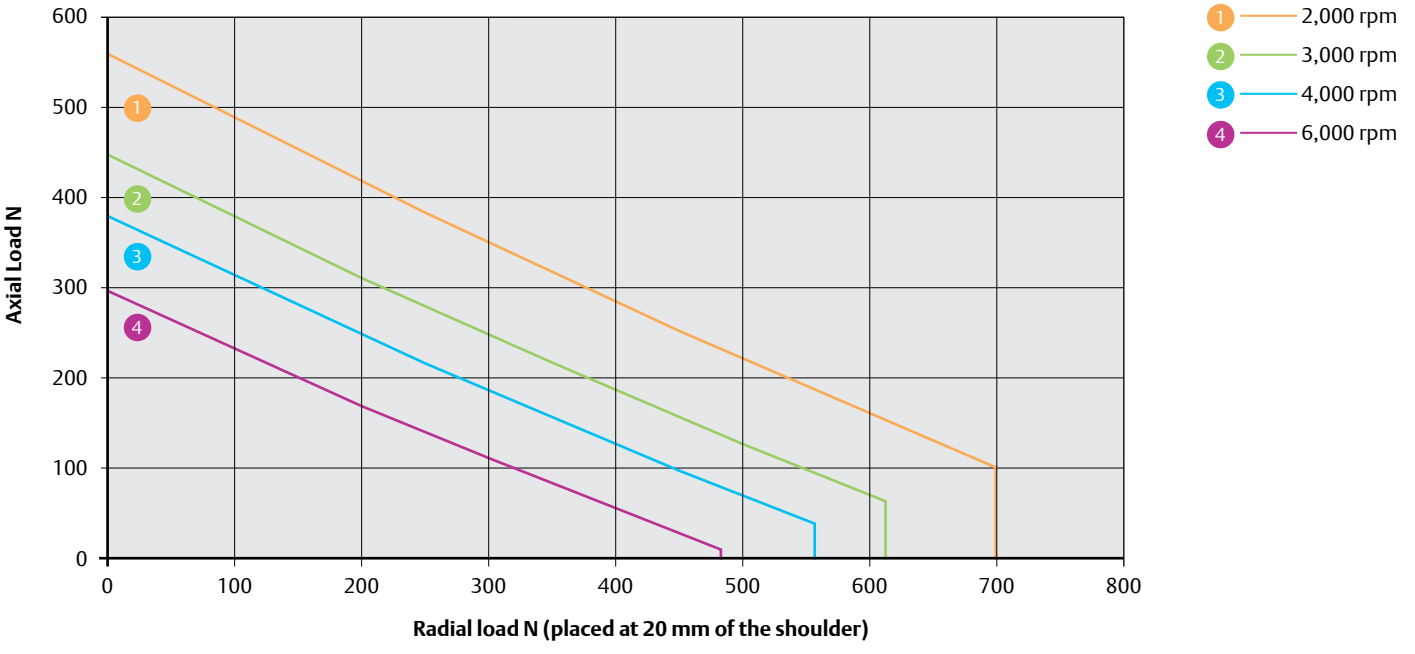
3.13.2 Unimotor hd

Radial load vs. axial load on 055UD/ED



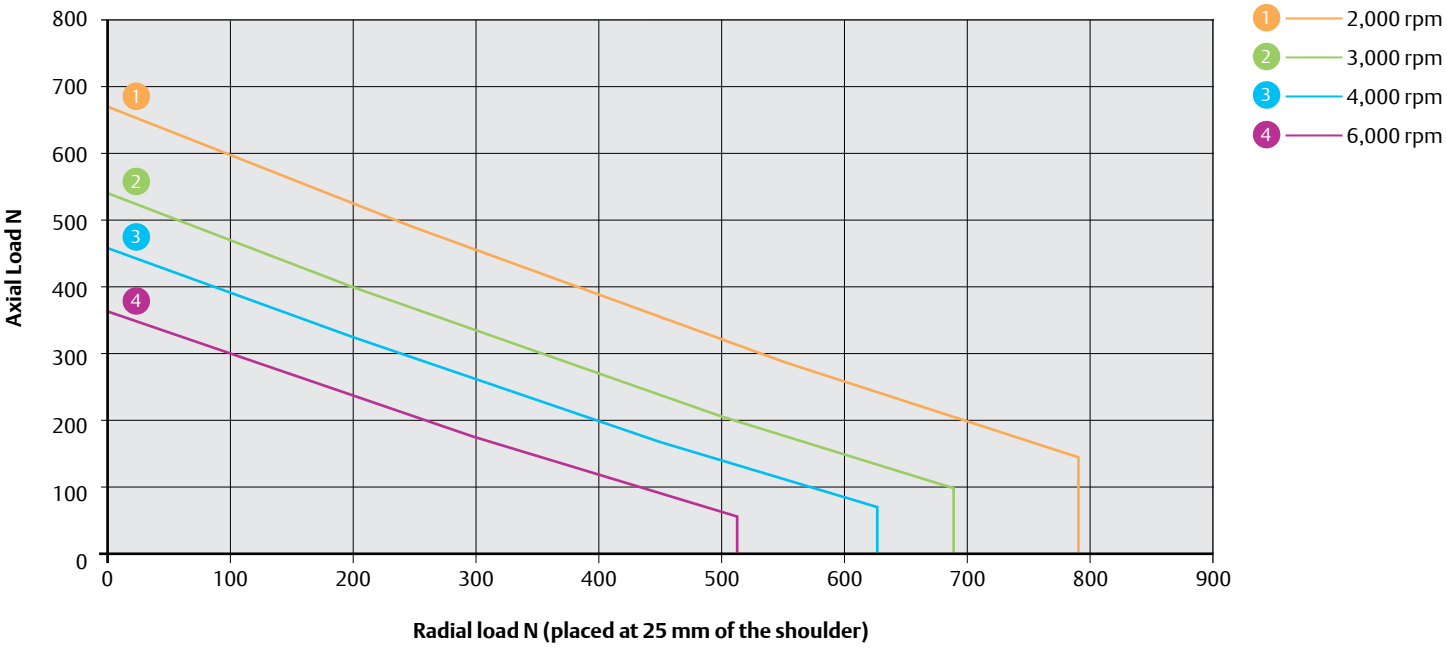
055UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 650 N

Radial load vs. axial load on 067UD/ED



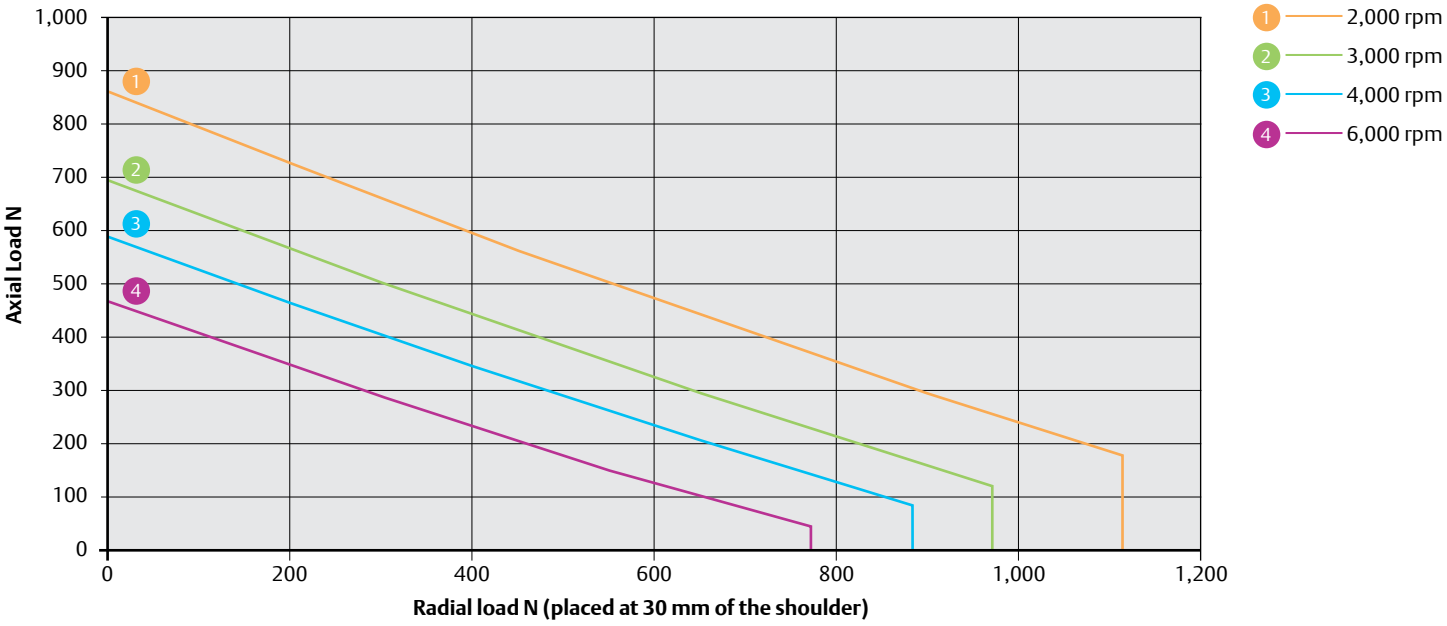
067UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 650 N

Radial load vs. axial load on 089UD/ED



089UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 1,000 N

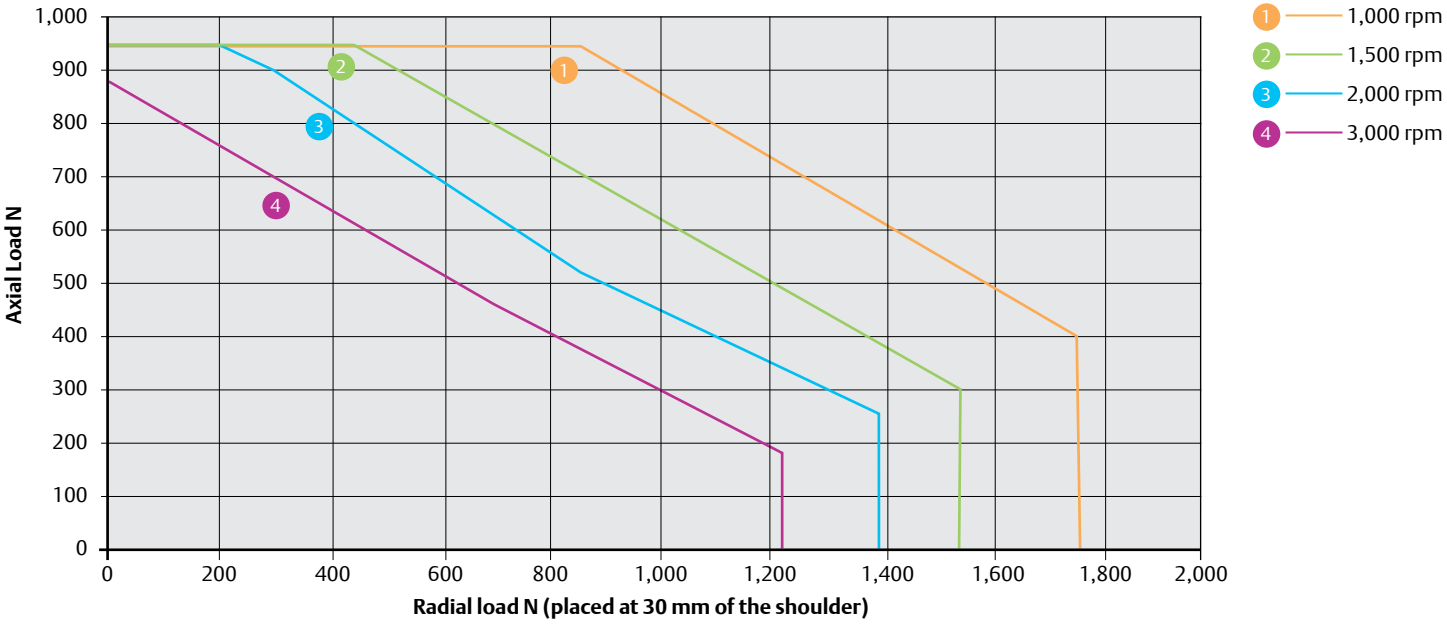
Radial load vs. axial load on 115UD/ED



115UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 1,200 N

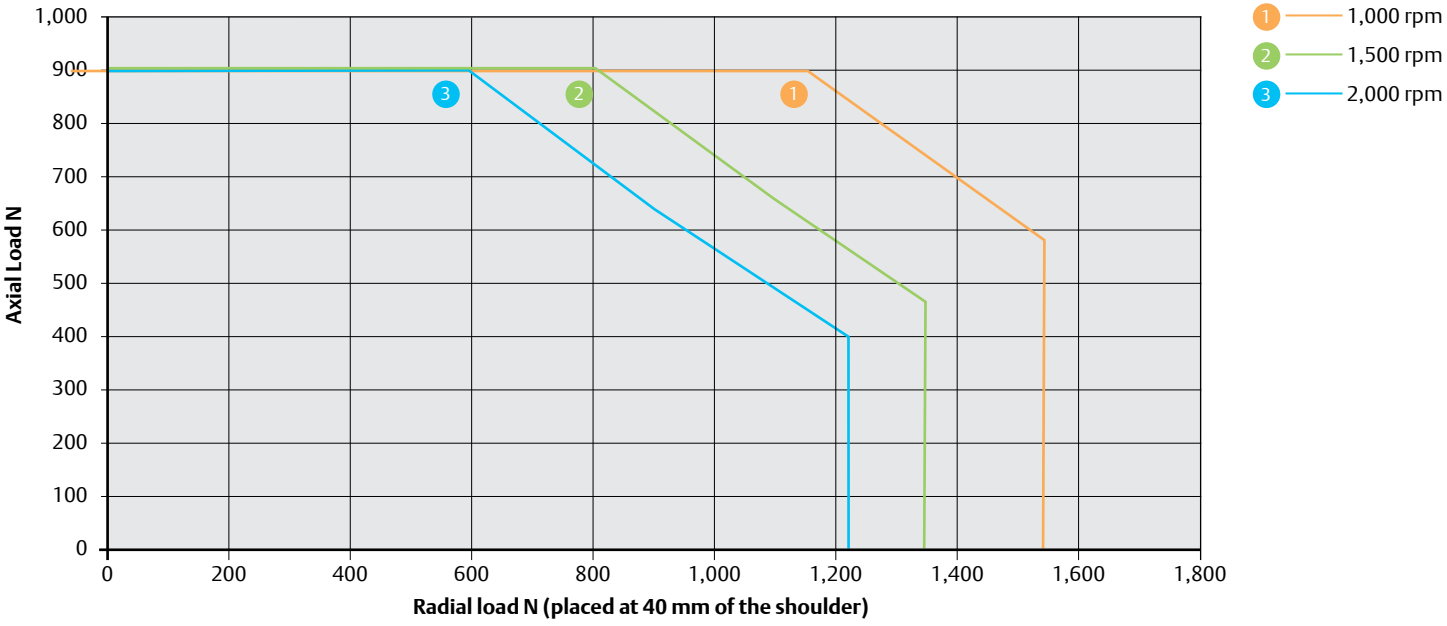
It can be seen on some graphs that the curve line becomes horizontal. This is due to the axial pushing load on the shaft (see *Shaft push back load*). This limit should not be exceeded in case the shaft moves.

Radial load vs. axial load on 142UD/ED



142UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 950 N

Radial load vs. axial load on 190UD/ED



190UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 900 N

3.14 Bearing life and output shaft strength

The maximum output shaft that can be machined on the motor is determined by the inner diameter of the bearings. The bearing sizes on Unimotor fm motors have increased in comparison with the Unimotor UMs and this allows a larger output shaft to be machined. Larger output shafts mean stronger output shafts.

The following graphs show this improvement.

Maximum Bearing life

It has to be noted that the graphs are based on theoretical calculations and the motor is affected by the following.

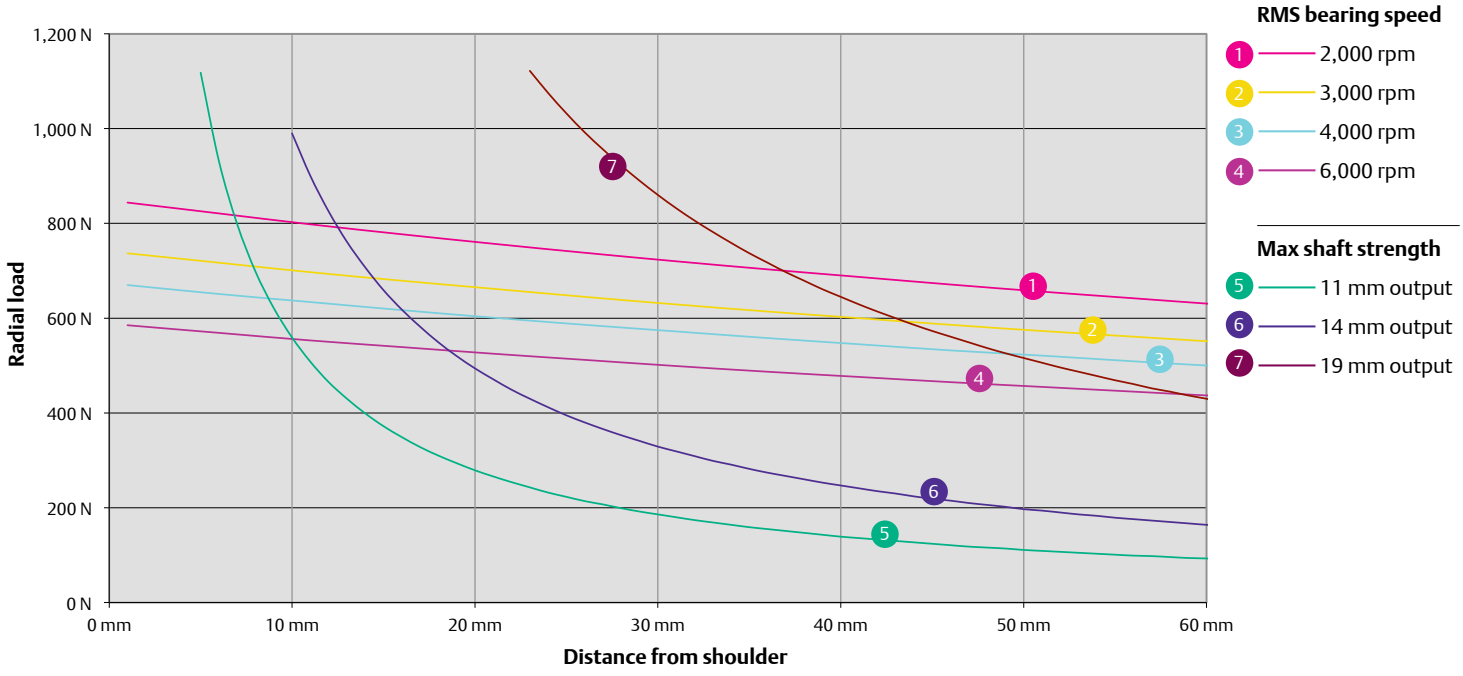
- Speed
- Radial load applied to the bearings
- Axial load applied to the bearings
- Shock and vibration
  (external shock/vibration applied to the motor)
- Bearing temperature
- Bearing cleanliness
- Motor mounting to the application

The loads in the following graphs have been theoretically calculated. The following factors were taken into consideration:

- 90 % reliability (for bearing life only)
- Radial load applied on the output shaft away from the shoulder and constant. The distance can be read on the different graphs.
- Axial loads going towards the motor and constant (Axial load = 0 Nm)
- Load factor of 1 - no vibration applied to the motor
  (for bearing life only).
- Temperature of the bearing: 100 °C max.
- Grease clean (for bearing life only).
- Torque alternating (for shaft strength only).

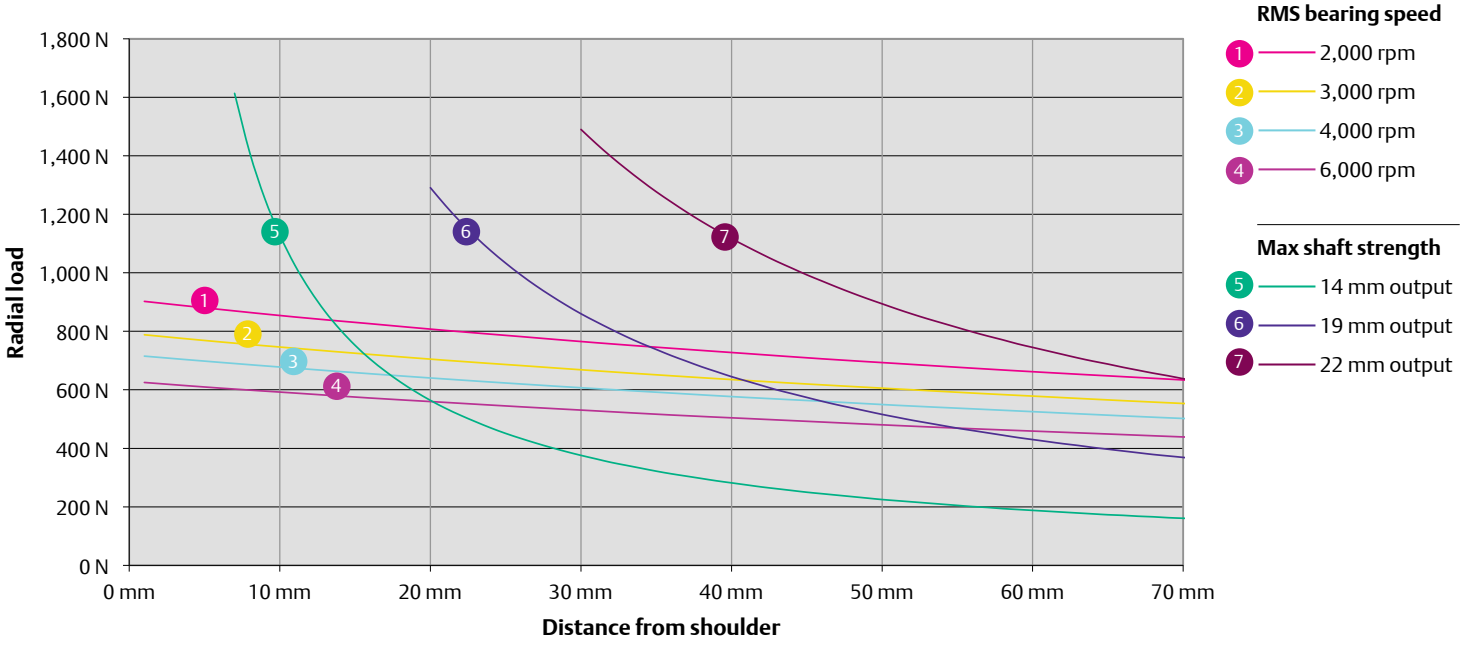
3.14.1 Unimotor fm

Bearing life and output shaft strength on 75U3/E3



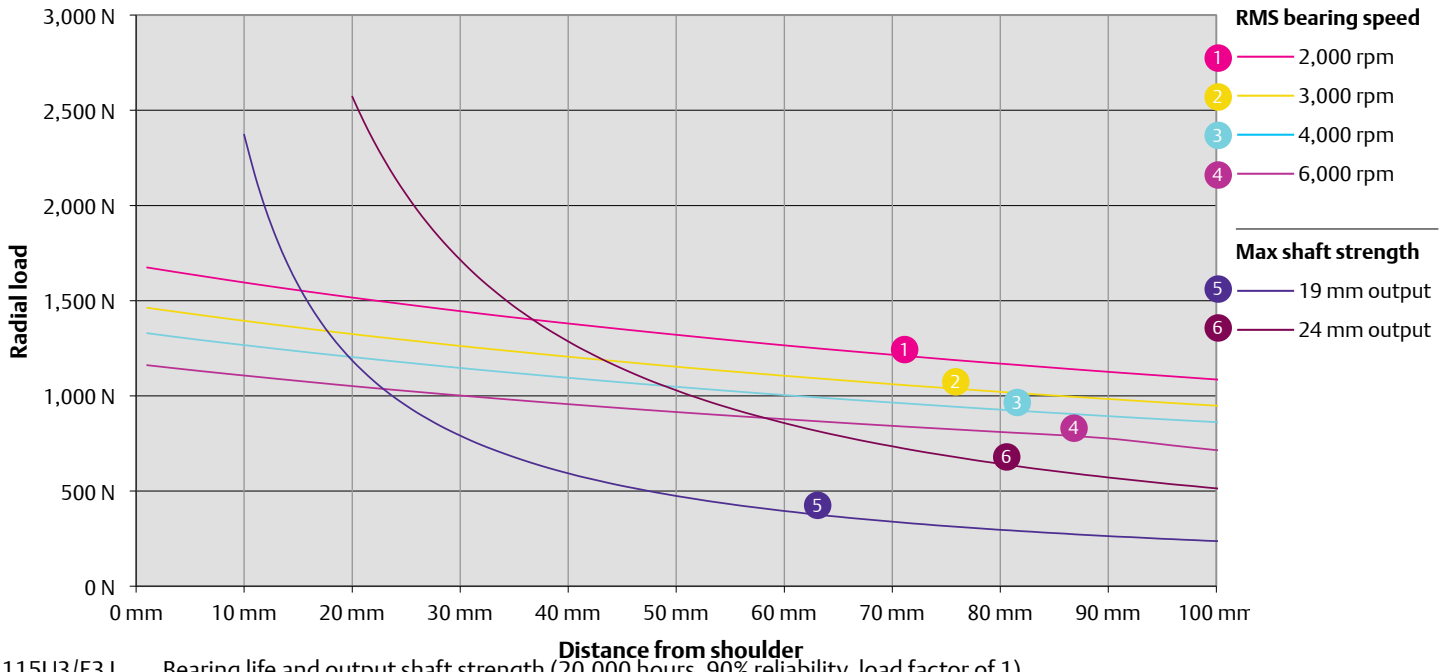
75U3/E3 $L_{10(h)}$ Bearing life and output shaft strength (20,000 hours, 90% reliability, load factor of 1)

Bearing life and output shaft strength on 95U3/E3



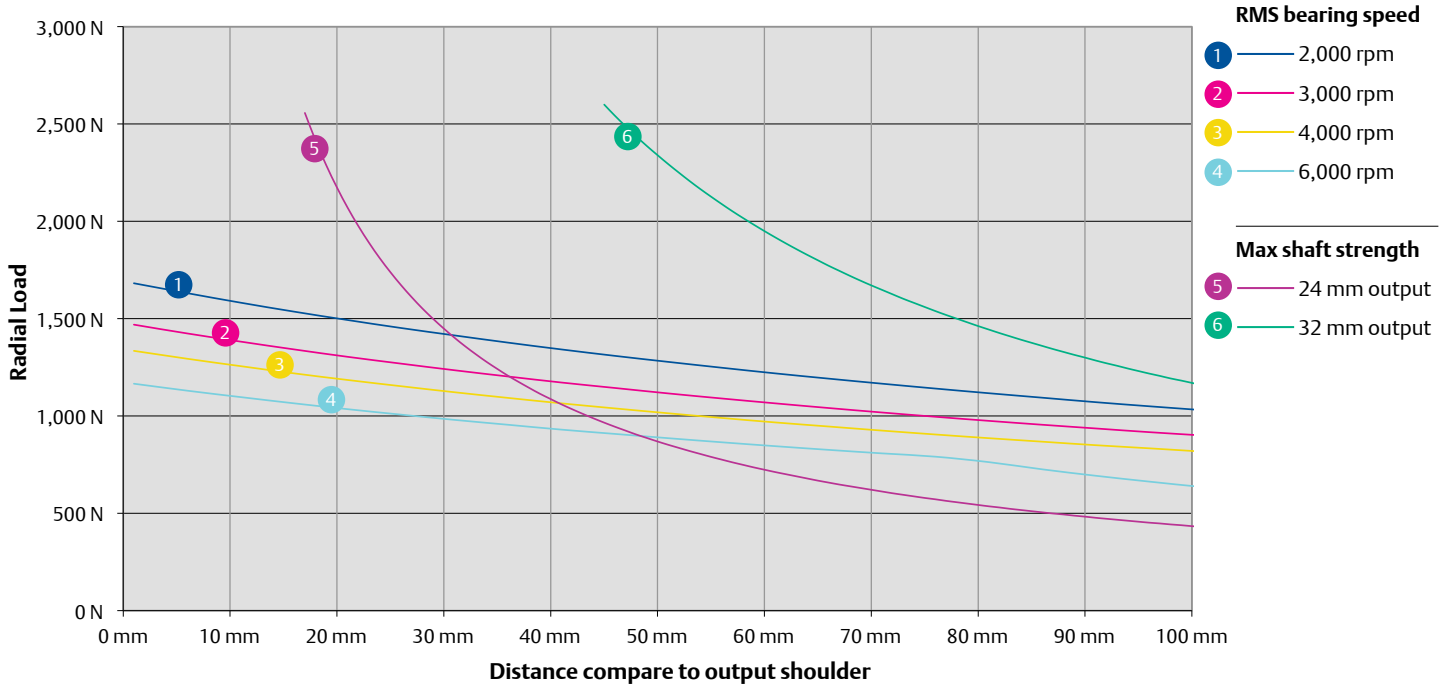
95U3/E3 $L_{10(h)}$ Bearing life and output shaft strength (20,000 hours, 90% reliability, load factor of 1)

Bearing life and output shaft strength on 115U3/E3



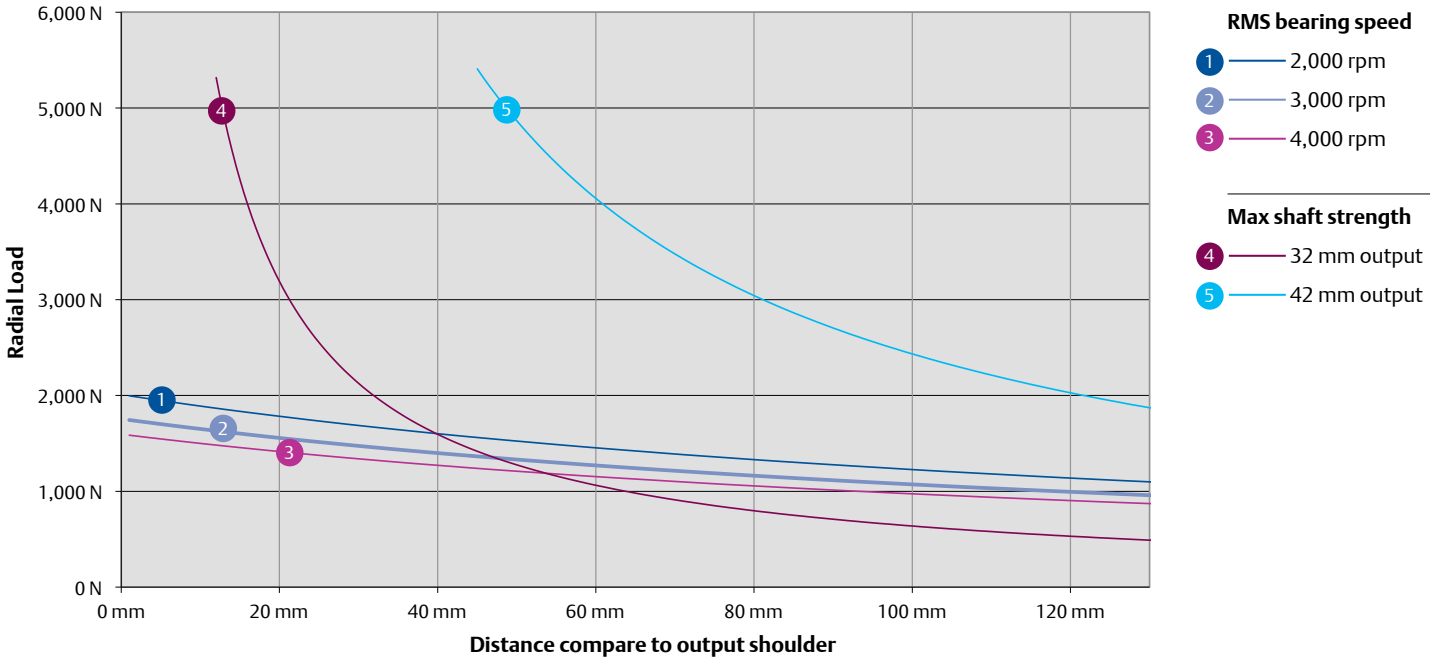
115U3/E3 $L_{10(h)}$ Bearing life and output shaft strength (20,000 hours, 90% reliability, load factor of 1)

Bearing life and output shaft strength on 142U3/E3



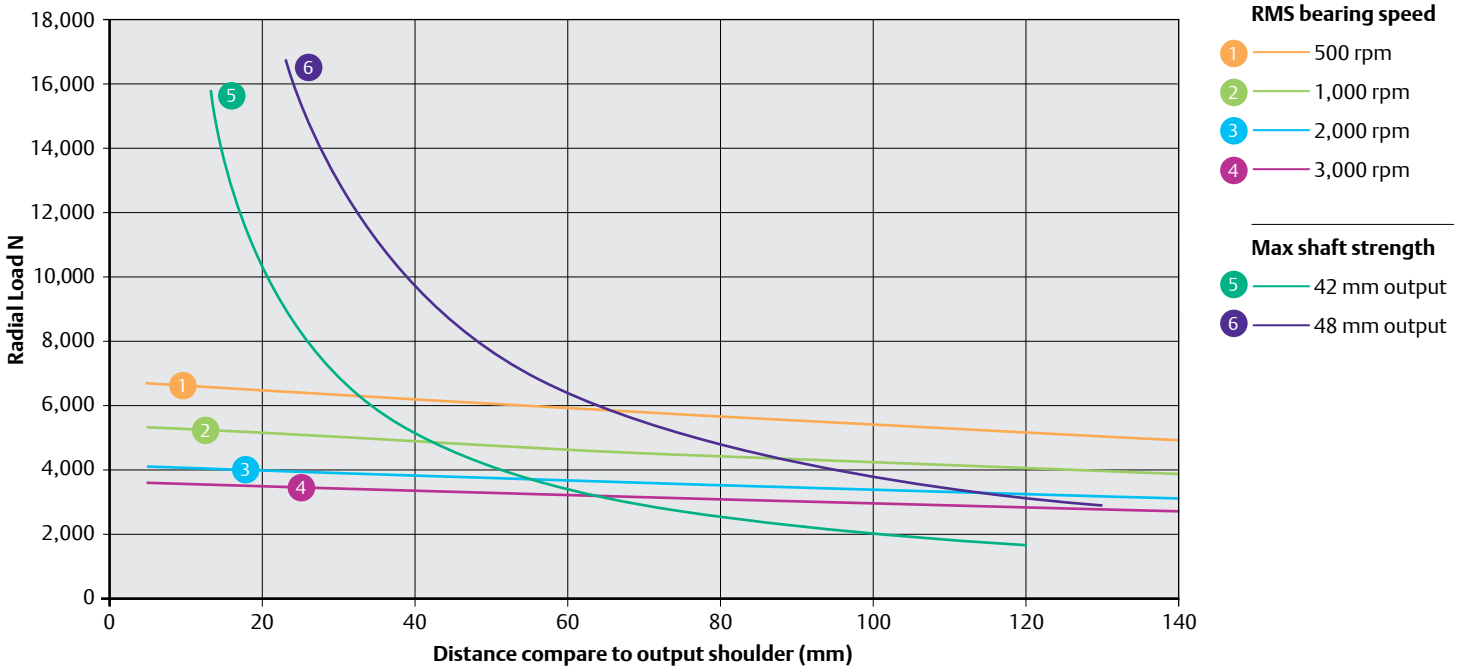
142U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1)

Bearing life and output shaft strength on 190U3/E3



190U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1)

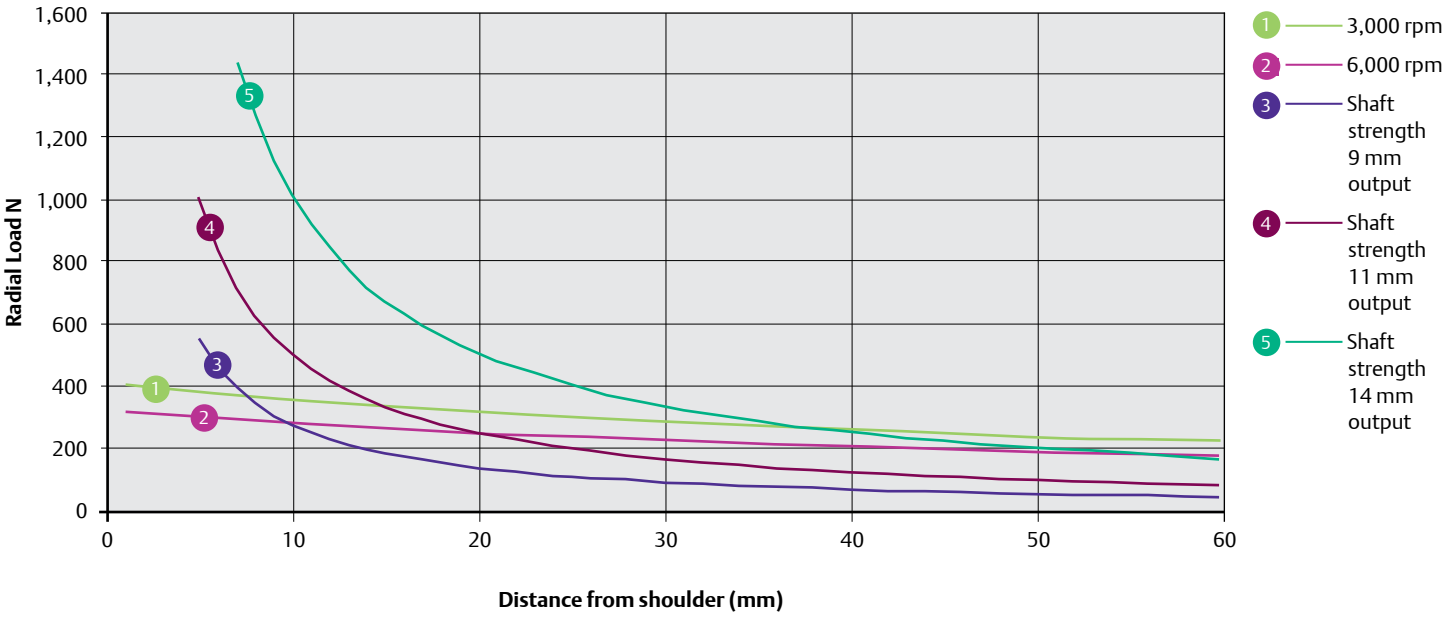
Bearing life and output shaft strength on 250U3/E3



250U3/E3 $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1)

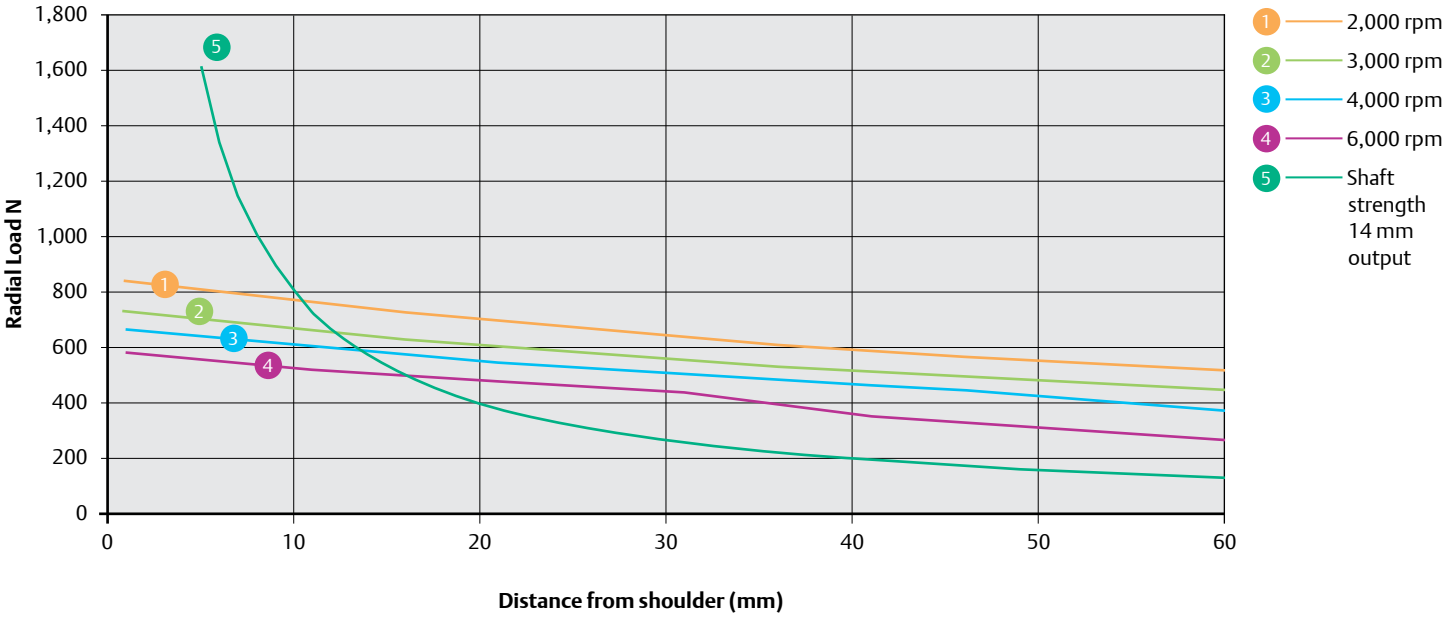
3.14.2 Unimotor hd

Bearing life and output shaft strength on 055UD/ED



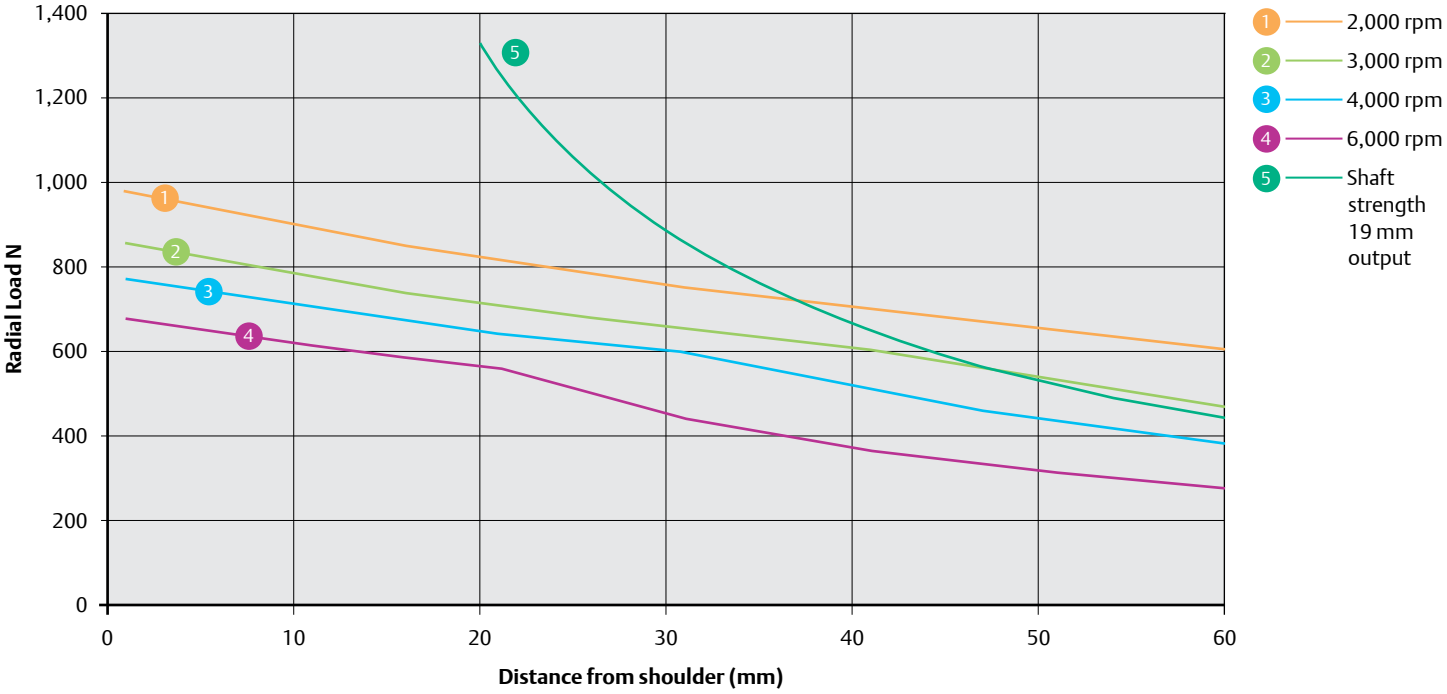
055UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1). Do not exceed a maximum axial load of 450 N

Bearing life and output shaft strength on 067UD/ED



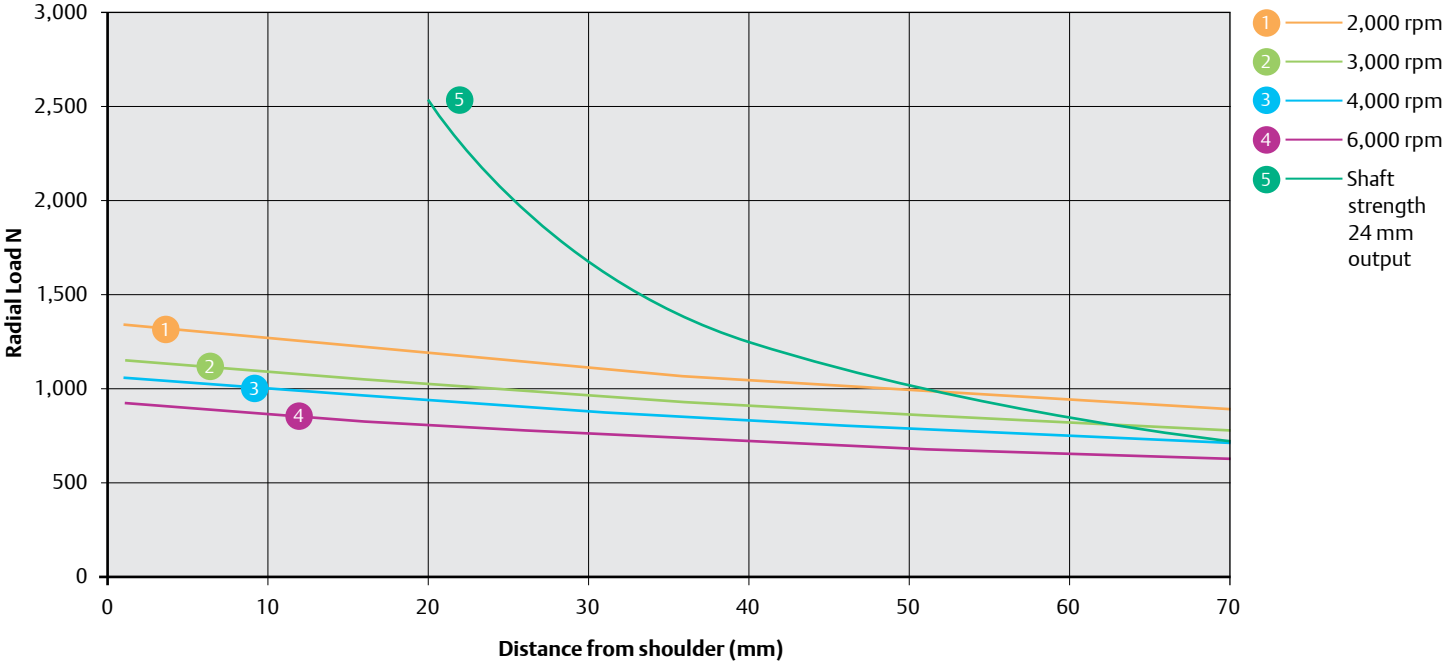
067UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1).

Bearing life and output shaft strength on 089UD/ED



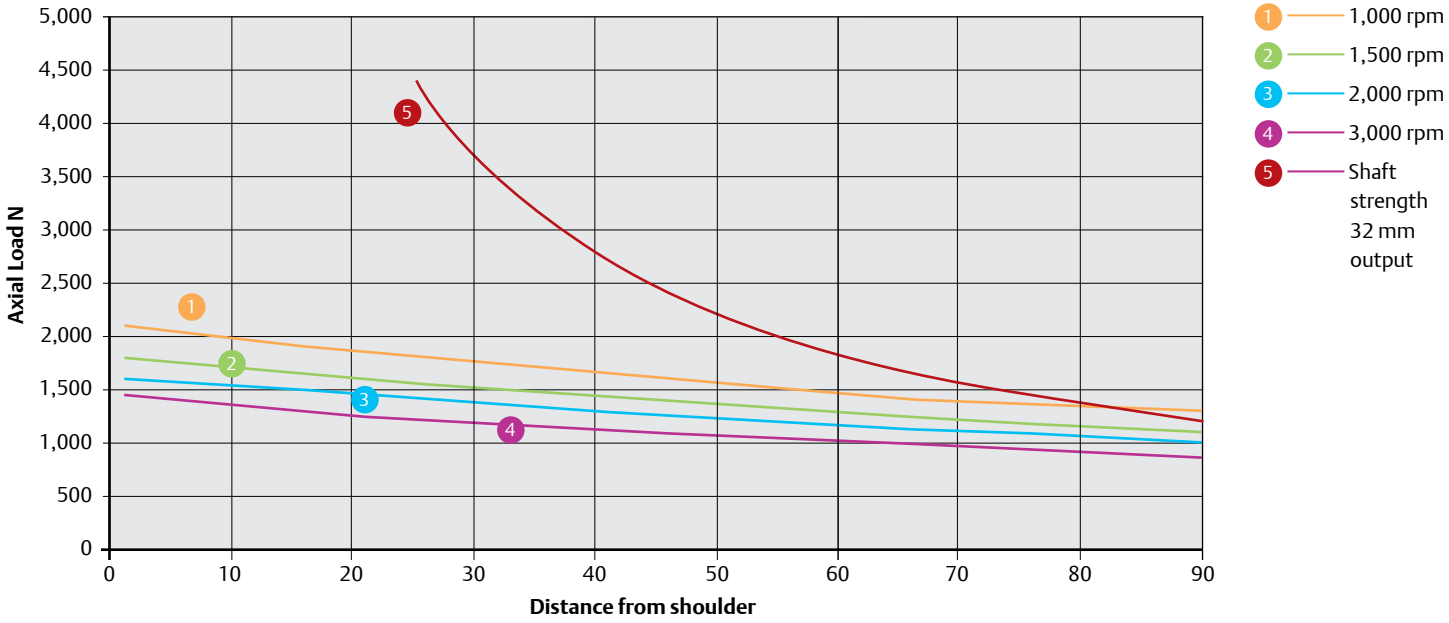
089UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1).

Bearing life and output shaft strength on 115UD/ED



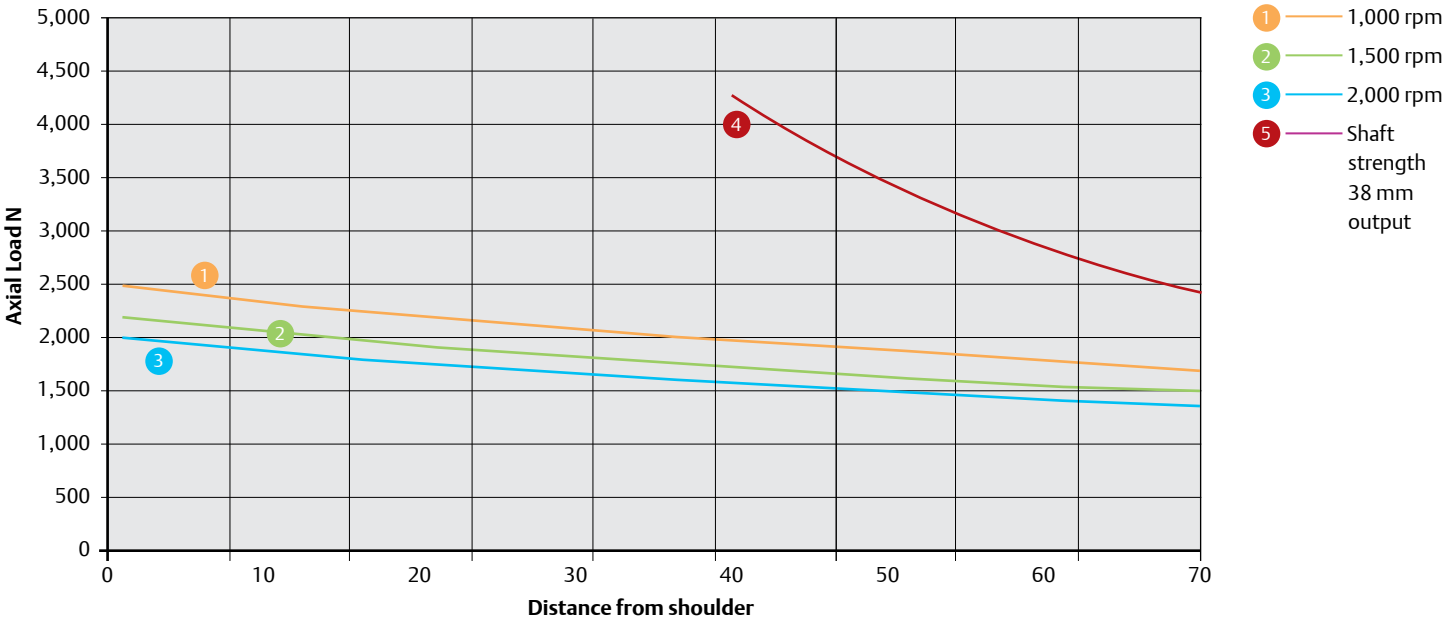
115UD/ED $L_{10(h)}$ bearing life for 20,000 hours (reliability 90 %, load factor of 1).

Radial load vs. axial load on 142UD/ED



142UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1).

Radial load vs. axial load on 190UD/ED



190UD/ED $L_{10(h)}$ Bearing life for 20,000 hours (reliability 90 %, load factor of 1).

Shaft push back load

The minimum pushing load needed to move the rotor relative to the bearings.

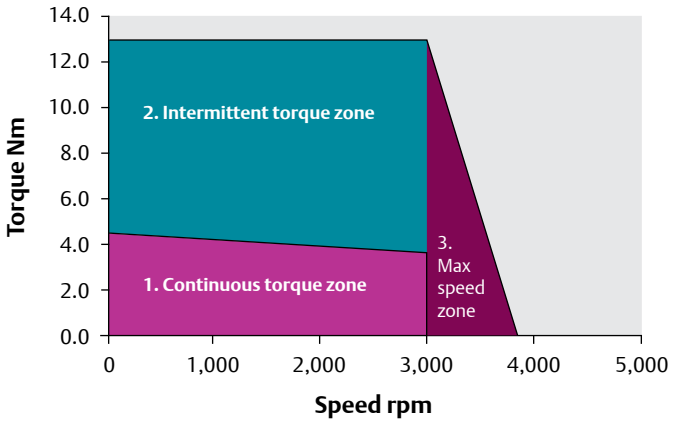
The table (right) shows the minimum push back force on Unimotor.

Motor	Push back force (N)	Motor	Push back force (N)
Unimotor fm		Unimotor hd	
075	900	**055**	190
095	850	**067**	650
115	950	**089**	1,000
142	950	**115**	1,200
190	900	**142**	1,350
250	1,450	**190**	1,600

4 Performance graphs

The torque speed graph depicts the limits of operation for a given motor. The limits of operation are shown for three categories.

Torque/speed graph



1. Continuous or rms torque zone

This area gives the effective continuous or rms torque available for repetitive torque sequences. Continuous or rms torque must be within this area otherwise the motor may overheat and cause the system to trip out.

2. Intermittent or peak torque zone

Above the continuous zone is the intermittent zone where the motor may be safely operated for short periods of time. Operation within the intermittent zone is permissible provided that the defined peak torque limit is not exceeded. On some frame sizes the peak torque factor of 3 x stall current only applies up to a certain percentage level of rms current before it starts to reduce.
Please refer to the *Standard (2) peak torque* section for details.

Maximum peak torque is the upper limit of the intermittent zone and must never be exceeded, to do so will damage the motor.

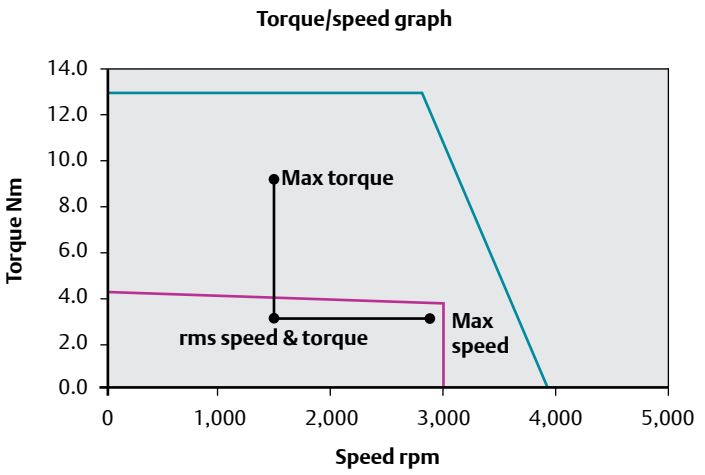
3. Maximum speed zone

To the right of the graph is a sloping line depicting the maximum motor speed when using a 200 V/400 V drive supply. The speed limit line is dependent upon the motor windings, and the voltage supplied to the drive. Operation within the maximum speed zone is permissible as long as the maximum speed limit is not exceeded. If the speed is increased beyond the limit shown, the motors sinusoidal waveform would have insufficient voltage and will clip and distort, causing inefficiency and higher temperature. If the distortion increases further, the drive may loose control of the motor and trip.

Plotting an operating point

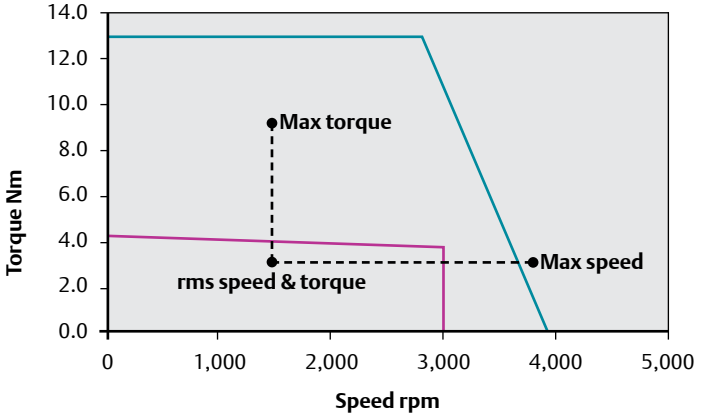
To estimate whether a motor is the correct choice for a given system, it is necessary to calculate or measure the rms torque and the rms speed for a given system in its normal continual stop/start sequenced mode. These operating points may be plotted on the torque speed graph. As shown in the first graph below, if the rms speed and torque point lies well within the continuous zone, then the motor is suitable for the application. The second graph below shows the max speed has increased to 3,900 rpm and this is now outside the safe area and another speed motor must be selected.

Torque/speed graph

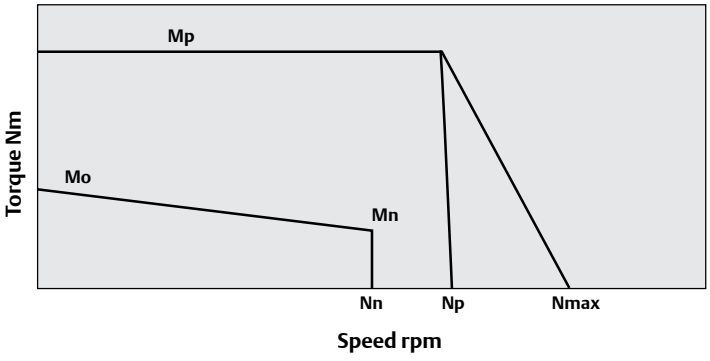


Max torque =10 Nm: Max speed = 2,900 rms torque =3 Nm: rms speed = 1,500

Torque/speed graph



Max torque =10 Nm: Max speed = 3,900 rms torque =3 Nm: rms speed = 1,500



Mn = continuous torque at the rated speed: Nn = rated speed:
Np = maximum speed at the peak torque: Mo = stall torque:
Mp = peak torque: Nmax = maximum speed with no torque

Performance graph data

hd 400 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
hd055UDA30	3,000	0.72	0.7	2.88	4,569	8,444
hd055UDA60	6,000	0.72	0.68	2.88	4,569	8,444
hd055UDB30	3,000	1.18	1.05	4.72	2,306	4,222
hd055UDB60	6,000	1.18	0.9	4.72	5,607	8,000
hd055UDC30	3,000	1.65	1.48	6.6	2,327	3,800
hd055UDC60	6,000	1.65	1.2	6.6	5,321	7,600
hd067UDA30	3,000	1.45	1.4	4.35	3,569	7,755
hd067UDA60	6,000	1.45	1.3	4.35	3,569	7,755
hd067UDB30	3,000	2.55	2.45	7.65	2,176	3,877
hd067UDB60	6,000	2.55	2.2	7.65	4,797	7,755
hd067UDC30	3,000	3.7	3.5	11.1	2,083	3,877
hd067UDC60	6,000	3.7	3.1	11.1	4,590	7,755
hd089UDA30	3,000	3.2	3	9.6	1,760	3,877
hd089UDA40	4,000	3.2	2.9	9.6	2,244	5,170
hd089UDA60	6,000	3.2	2.65	9.6	3,750	7,755
hd089UDB30	3,000	5.5	4.85	16.5	1,795	3,877
hd089UDB40	4,000	5.5	4.55	16.5	2,704	5,170
hd089UDB60	6,000	5.5	3.8	16.5	3,743	7,755
hd089UDC30	3,000	8	6.9	24	2,082	3,877
hd089UDC40	4,000	8	6.35	24	2,546	5,170
hd089UDC60	6,000	8	5	24	3,726	7,755
hd115UDB20	2,000	10.2	8.6	30.6	1,277	2,585
hd115UDB30	3,000	10.2	7.7	30.6	2,109	3,877
hd115UDC20	2,000	14.6	11.9	43.8	1,445	2,585
hd115UDC30	3,000	14.6	10.5	43.8	2,027	3,877
hd115UDD20	2,000	18.8	15.6	56.4	1,445	2,585
hd115UDD30	3,000	18.8	13.6	56.4	2,232	3,877
hd142UDC15	1,500	25	22.3	74.9	1,242	1,938
hd142UDC20	2,000	25	21.4	74.9	1,674	2,585
hd142UDC30	3,000	25	18.4	74.9	2,581	3,877
hd142UDD15	1,500	31.5	27	94.5	1,329	1,938
hd142UDD20	2,000	31.5	25.7	94.5	1,674	2,585
hd142UDD30	3,000	31.5	20.9	94.5	2,743	3,877
hd142UDE15	1,500	38	31.7	114	1,346	1,938
hd142UDE20	2,000	38	29.6	114	1,641	2,585
hd142UDE30	3,000	38	23	114	2,781	3,877
hd190UDC15	1,500	52	46.2	156	1,028	1,938
hd190UDC20	2,000	52	42.5	156	1,361	2,585
hd190UDD15	1,500	62	52.2	186	1,135	1,938
hd190UDF15	1,500	85	68.5	255	1,224	1,938

fm 400 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
fm075U3A20	2,000	1.44	1.3	4.32	371	2,585
fm075U3A30	3,000	1.44	1.3	4.32	1,638	3,877
fm075U3A40	4,000	1.44	1.2	4.32	2,539	5,170
fm075U3A60	6,000	1.44	1.1	4.32	4,838	7,755
fm075U3B20	2,000	2.65	2.48	7.95	1,102	2,585
fm075U3B30	3,000	2.65	2.29	7.95	2,299	3,877
fm075U3B40	4,000	2.65	2.06	7.95	3,367	5,170
fm075U3B60	6,000	2.65	1.9	7.95	5,751	7,755
fm075U3C20	2,000	3.72	3.5	11.16	1,413	2,585
fm075U3C30	3,000	3.72	3.31	11.16	2,583	3,877
fm075U3C40	4,000	3.72	2.79	11.16	3,827	5,170
fm075U3C60	6,000	3.72	2.8	11.16	6,142	7,755
fm075U3D20	2,000	4.67	4.46	14.01	1,561	2,585
fm075U3D30	3,000	4.67	4.18	14.01	2,847	3,877
fm075U3D40	4,000	4.67	3.8	14.01	3,897	5,170
fm075U3D60	6,000	4.67	3.4	14.01	6,248	7,755
fm095U3A20	2,000	2.45	2.42	7.35	902	2,585
fm095U3A30	3,000	2.45	2.33	7.35	2,021	3,877
fm095U3A40	4,000	2.45	2.25	7.35	2,929	5,170
fm095U3A60	6,000	2.45	2	7.35	4,996	7,755
fm095U3B20	2,000	4.5	4.3	13.5	1,418	2,585
fm095U3B30	3,000	4.5	4.1	13.5	2,589	3,877
fm095U3B40	4,000	4.5	3.8	13.5	3,550	5,170
fm095U3B60	6,000	4.5	3.2	13.5	5,868	7,755
fm095U3C20	2,000	6.3	5.85	18.9	1,740	2,585
fm095U3C30	3,000	6.3	5.6	18.9	2,864	3,877
fm095U3C40	4,000	6.3	5.25	18.9	3,973	5,170
fm095U3C60	6,000	6.3	4.2	18.9	6,128	7,755

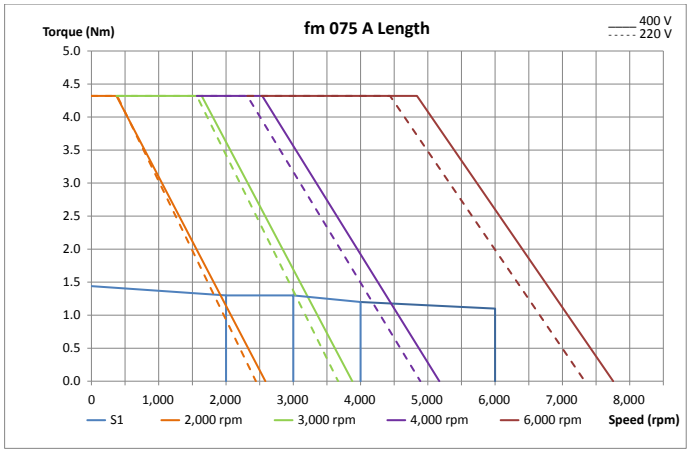
fm 400 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
fm095U3D20	2,000	7.9	7.3	23.7	1,810	2,585
fm095U3D30	3,000	7.9	6.9	23.7	2,982	3,877
fm095U3D40	4,000	7.9	6.4	23.7	4,115	5,170
fm095U3E20	2,000	9.25	8.47	27.75	1,948	2,585
fm095U3E30	3,000	9.25	8.15	27.75	3,133	3,877
fm095U3E40	4,000	9.25	7.4	27.75	4,211	5,170
fm115U3A20	2,000	3.9	3.7	11.7	1,027	2,585
fm115U3A30	3,000	3.9	3.5	11.7	1,994	3,877
fm115U3A40	4,000	3.9	3	11.7	2,764	5,170
fm115U3A60	6,000	3.9	2.7	11.7	4,701	7,755
fm115U3B20	2,000	7.4	7.3	22.2	1,428	2,585
fm115U3B30	3,000	7.4	6.7	22.2	2,502	3,877
fm115U3B40	4,000	7.4	5.8	22.2	3,365	5,170
fm115U3B60	6,000	7.4	5	22.2	5,421	7,755
fm115U3C20	2,000	10.8	10.1	32.4	1,659	2,585
fm115U3C30	3,000	10.8	9.5	32.4	2,701	3,877
fm115U3C40	4,000	10.8	7.45	32.4	3,696	5,170
fm115U3D20	2,000	13.65	11.9	40.95	1,717	2,585
fm115U3D30	3,000	13.65	11.2	40.95	2,839	3,877
fm115U3D40	4,000	13.65	8.25	40.95	3,948	5,170
fm115U3E20	2,000	16	14.1	48	1,807	2,585
fm115U3E30	3,000	16	12.7	48	2,854	3,877
fm115U3E40	4,000	16	8.8	48	3,981	5,170
fm142U3A20	2,000	6.2	5.85	18.6	1,162	2,585
fm142U3A30	3,000	6.2	5.5	18.6	2,012	3,877
fm142U3A40	4,000	6.2	4.1	18.6	2,780	5,170
fm142U3A60	6,000	6.2	3.2	18.6	4,308	7,755
fm142U3B20	2,000	11	10.4	33	1,567	2,585
fm142U3B30	3,000	11	9.5	33	2,473	3,877
fm142U3B40	4,000	11	8.05	33	3,429	5,170
fm142U3B60	6,000	11	5.2	33	5,227	7,755
fm142U3C20	2,000	15.7	14.7	47.1	1,749	2,585
fm142U3C30	3,000	15.7	12.8	47.1	2,690	3,877
fm142U3C40	4,000	15.7	10.2	47.1	3,657	5,170
fm142U3D20	2,000	20.5	18.5	61.5	1,803	2,585
fm142U3D30	3,000	20.5	16	61.5	2,769	3,877
fm142U3D40	4,000	20.5	12.2	61.5	3,729	5,170
fm142U3E20	2,000	25	21.5	75	1,874	2,585
fm142U3E30	3,000	25	18.2	75	2,900	3,877
fm142U3E40	4,000	25	14	75	3,836	5,170
fm190U3A20	2,000	11.3	10.8	33.8	1,087	2,585
fm190U3A30	3,000	11.3	10.3	33.8	1,761	3,877
fm190U3A40	4,000	11.3	8.2	33.8	2,387	5,170
fm190U3B30	3,000	22.5	19.4	67.5	2,013	3,877
fm190U3B40	4,000	22.5	18.2	67.5	2,675	5,170
fm190U3C20	2,000	33.5	29.4	100.5	1,376	2,585
fm190U3C30	3,000	33.5	26.5	100.5	1,972	3,877
fm190U3C40	4,000	33.5	23	100.5	2,801	5,170
fm190U3D20	2,000	44.5	37.9	133.5	1,633	2,585
fm190U3D30	3,000	44.5	33.2	133.5	2,178	3,877
fm190U3D40	4,000	44.5	29	133.5	3,146	5,170
fm190U3E20	2,000	54	44.3	162	1,474	2,585
fm190U3E30	3,000	54	34.2	162	2,243	3,877
fm190U3F20	2,000	63	50.5	189	1,491	2,585
fm190U3F30	3,000	63	35.2	189	2,123	3,877
fm190U3G20	2,000	71	54	213	1,438	2,585
fm190U3G30	3,000	71	36.2	213	1,950	3,877
fm190U3H20	2,000	77	56	231	1,449	2,585
fm190U3H30	3,000	77	37	231	2,439	3,877
fm250U3D10	1,000	92	75	276	697	1,176
fm250U3D15	1,500	92	67	276	1,081	1,759
fm250U3D20	2,000	92	65	276	1,444	2,345
fm250U3D25	2,500	92	62	276	1,873	2,945
fm250U3E10	1,000	116	92	348	676	1,176
fm250U3E15	1,500	116	76	348	1,029	1,759
fm250U3E20	2,000	116	73	348	1,519	2,345
fm250U3E25	2,500	116	70	348	1,743	2,945
fm250U3F10	1,000	136	106	408	723	1,176
fm250U3F15	1,500	136	84	408	1,107	1,759
fm250U3F20	2,000	136	81	408	1,493	2,345
fm250U3F25	2,500	136	77	408	1,767	2,945

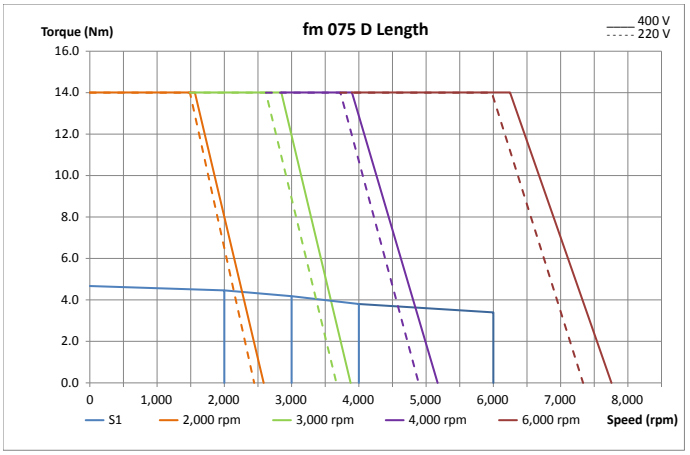
hd 220 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
hd055EDA30	3,000	0.72	0.7	2.88	1,913	4,644
hd055EDA60	6,000	0.72	0.68	2.88	4,649	7,740
hd055EDB30	3,000	1.18	1.05	4.72	2,207	3,980
hd055EDB60	6,000	1.18	0.9	4.72	5,403	8,038
hd055EDC30	3,000	1.65	1.48	6.6	2,320	3,800
hd055EDC60	6,000	1.65	1.2	6.6	5,237	7,206
hd067EDA30	3,000	1.45	1.4	4.35	1,395	3,666
hd067EDA60	6,000	1.45	1.3	4.35	3,547	7,333
hd067EDB30	3,000	2.55	2.45	7.65	2,138	3,666
hd067EDB60	6,000	2.55	2.2	7.65	4,725	7,333
hd067EDC30	3,000	3.7	3.5	11.1	2,052	3,666
hd089EDA30	3,000	3.2	3	9.6	1,703	3,666
hd089EDA40	4,000	3.2	2.9	9.6	2,161	4,888
hd089EDA60	6,000	3.2	2.65	9.6	3,226	7,333
hd089EDB30	3,000	5.5	4.85	16.5	1,800	3,666
hd089EDB40	4,000	5.5	4.55	16.5	2,669	4,888
hd089EDB60	6,000	5.5	3.8	16.5	3,789	7,333
hd089EDC30	3,000	8	6.9	24	2,007	3,666
hd089EDC40	4,000	8	6.35	24	2,592	4,888
hd089EDC60	6,000	8	5	24	3,700	7,333
hd115EDB20	2,000	10.2	8.6	30.6	1,274	2,444
hd115EDB30	3,000	10.2	7.7	30.6	2,072	3,666
hd115EDC20	2,000	14.6	11.9	43.8	1,423	2,444
hd115EDC30	3,000	14.6	10.5	43.8	2,006	3,666
hd115EDD20	2,000	18.8	15.6	56.4	1,354	2,444
hd142EDC10	1,000	25	23.3	74.9	616	1,222
hd142EDC20	2,000	25	21.4	74.9	1,327	2,444
hd142EDC30	3,000	25	18.4	74.9	2,357	3,666
hd142EDD10	1,000	31.5	29	94.5	668	1,222
hd142EDD20	2,000	31.5	25.7	94.5	1,436	2,444
hd142EDD30	3,000	31.5	20.9	94.5	2,297	3,666
hd142EDE10	1,000	38	34.5	114	686	1,222
hd142EDE20	2,000	38	29.6	114	1,467	2,444
hd190EDC10	1,000	52	49	156	568	1,222
hd190EDC20	2,000	52	42.5	156	1,193	2,444
hd190EDD10	1,000	62	56.5	186	565	1,222
hd190EDF10	1,000	85	77.5	255	622	1,222

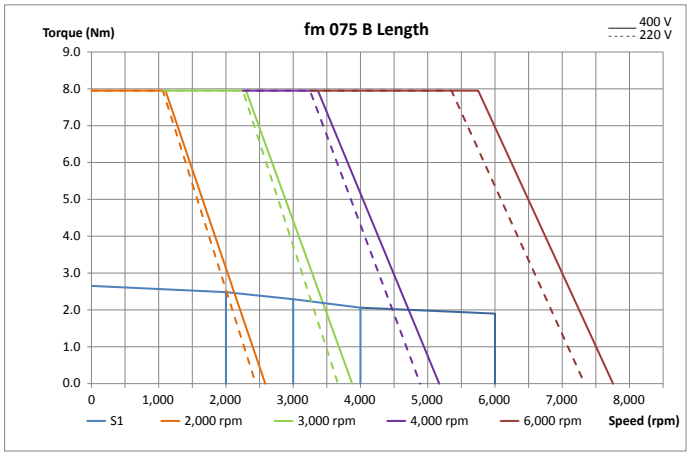
fm 220 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
fm075E3A20	2,000	1.44	1.3	4.32	283	2,444
fm075E3A30	3,000	1.44	1.3	4.32	1,503	3,666
fm075E3A40	4,000	1.44	1.2	4.32	2,316	4,888
fm075E3A60	6,000	1.44	1.08	4.32	4,438	7,333
fm075E3B20	2,000	2.65	2.48	7.95	992	2,444
fm075E3B30	3,000	2.65	2.29	7.95	2,172	3,666
fm075E3B40	4,000	2.65	2.06	7.95	3,224	4,888
fm075E3B60	6,000	2.65	1.92	7.95	5,354	7,333
fm075E3C20	2,000	3.72	3.5	11.2	1,339	2,444
fm075E3C30	3,000	3.72	3.31	11.2	2,533	3,666
fm075E3C40	4,000	3.72	2.79	11.2	3,543	4,888
fm075E3C60	6,000	3.72	2.75	11.2	5,685	7,333
fm075E3D20	2,000	4.67	4.46	14	1,488	2,444
fm075E3D30	3,000	4.67	4.18	14	2,617	3,666
fm075E3D40	4,000	4.67	3.8	14	3,726	4,888
fm075E3D60	6,000	4.67	3.4	14	5,976	7,333
fm095E3A20	2,000	2.45	2.42	7.35	779	2,444
fm095E3A30	3,000	2.45	2.33	7.35	1,764	3,666
fm095E3A40	4,000	2.45	2.25	7.35	2,717	4,888
fm095E3A60	6,000	2.45	1.98	7.35	4,621	7,333
fm095E3B20	2,000	4.5	4.3	13.5	1,324	2,444
fm095E3B30	3,000	4.5	4.1	13.5	2,397	3,666
fm095E3B40	4,000	4.5	3.8	13.5	3,349	4,888
fm095E3B60	6,000	4.5	3.2	13.5	5,525	7,333
fm095E3C20	2,000	6.3	5.85	18.9	1,560	2,444
fm095E3C30	3,000	6.3	5.6	18.9	2,641	3,666
fm095E3C40	4,000	6.3	5.25	18.9	3,518	4,888
fm095E3C60	6,000	6.3	4.2	18.9	5,690	7,333

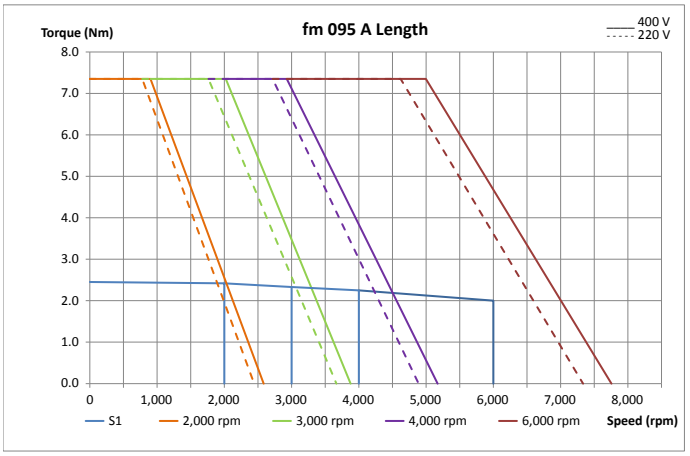
fm 220 V	Nn [rpm]	Mo [Nm]	Mn [Nm]	Mp [Nm]	Np [rpm]	Nmax [rpm]
fm095E3D20	2,000	7.9	7.3	23.7	1,721	2,444
fm095E3D30	3,000	7.9	6.9	23.7	2,816	3,666
fm095E3D40	4,000	7.9	6.4	23.7	3,798	4,888
fm095E3E20	2,000	9.25	8.47	27.8	1,763	2,444
fm095E3E30	3,000	9.25	8.15	27.8	2,859	3,666
fm095E3E40	4,000	9.25	7.4	27.8	3,962	4,888
fm115E3A20	2,000	3.9	3.7	11.7	875	2,444
fm115E3A30	3,000	3.9	3.5	11.7	1,791	3,666
fm115E3A40	4,000	3.9	3	11.7	2,448	4,888
fm115E3A60	6,000	3.9	2.7	11.7	3,777	7,333
fm115E3B20	2,000	7.4	7.3	22.2	1,373	2,444
fm115E3B30	3,000	7.4	6.7	22.2	2,299	3,666
fm115E3B40	4,000	7.4	5.8	22.2	3,115	4,888
fm115E3B60	6,000	7.4	5	22.2	4,888	7,333
fm115E3C20	2,000	10.8	10.1	32.4	1,535	2,444
fm115E3C30	3,000	10.8	9.5	32.4	2,491	3,666
fm115E3C40	4,000	10.8	7.45	32.4	3,420	4,888
fm115E3D20	2,000	13.7	11.9	41	1,436	2,444
fm115E3D30	3,000	13.7	11.2	41	2,525	3,666
fm115E3D40	4,000	13.7	8.25	41	3,618	4,888
fm115E3E20	2,000	16	14.1	48	1,540	2,444
fm115E3E30	3,000	16	12.7	48	2,652	3,666
fm115E3E40	4,000	16	8.8	48	3,423	4,888
fm142E3A20	2,000	6.2	5.85	18.6	999	2,444
fm142E3A30	3,000	6.2	5.5	18.6	1,841	3,666
fm142E3A40	4,000	6.2	4.1	18.6	2,574	4,888
fm142E3B20	2,000	11	10.4	33	1,477	2,444
fm142E3B30	3,000	11	9.5	33	2,369	3,666
fm142E3B40	4,000	11	8.05	33	3,312	4,888
fm142E3C20	2,000	15.7	14.7	47.1	1,634	2,444
fm142E3C30	3,000	15.7	12.8	47.1	2,591	3,666
fm142E3C40	4,000	15.7	10.2	47.1	3,298	4,888
fm142E3D20	2,000	20.5	18.5	61.5	1,731	2,444
fm142E3D30	3,000	20.5	16	61.5	2,477	3,666
fm142E3D40	4,000	20.5	12.2	61.5	3,281	4,888
fm142E3E20	2,000	25	21.5	75	1,730	2,444
fm142E3E30	3,000	25	18.2	75	2,752	3,666
fm142E3E40	4,000	25	14	75	3,807	4,888
fm190E3A20	2,000	11.3	10.8	33.8	1,068	2,444
fm190E3A30	3,000	11.3	10.3	33.8	1,670	3,666
fm190E3A40	4,000	11.3	8.2	33.8	2,345	4,888
fm190E3B30	3,000	22.5	19.4	67.5	1,774	3,666
fm190E3B40	4,000	22.5	18.2	67.5	2,416	4,888
fm190E3C20	2,000	33.5	29.4	101	1,310	2,444
fm190E3C30	3,000	33.5	26.5	101	1,876	3,666
fm190E3C40	4,000	33.5	23	101	2,533	4,888
fm190E3D20	2,000	44.5	37.9	134	1,449	2,444
fm190E3D30	3,000	44.5	33.2	134	1,916	3,666
fm190E3D40	4,000	44.5	29	134	2,700	4,888
fm190E3E20	2,000	54	44.3	162	1,363	2,444
fm190E3E30	3,000	54	34.2	162	1,867	3,666
fm190E3F20	2,000	63	50.5	189	1,351	2,444
fm190E3F30	3,000	63	35.2	189	2,056	3,666
fm190E3G20	2,000	71	54	213	1,350	2,444
fm190E3G30	3,000	71	36.2	213	1,683	3,666
fm190E3H20	2,000	77	56	231	1,350	2,444
fm190E3H30	3,000	77	37	231	2,226	3,666

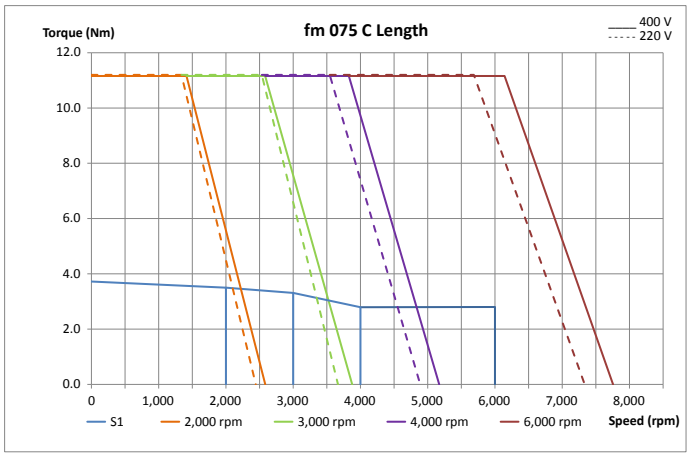
4.1 Unimotor fm

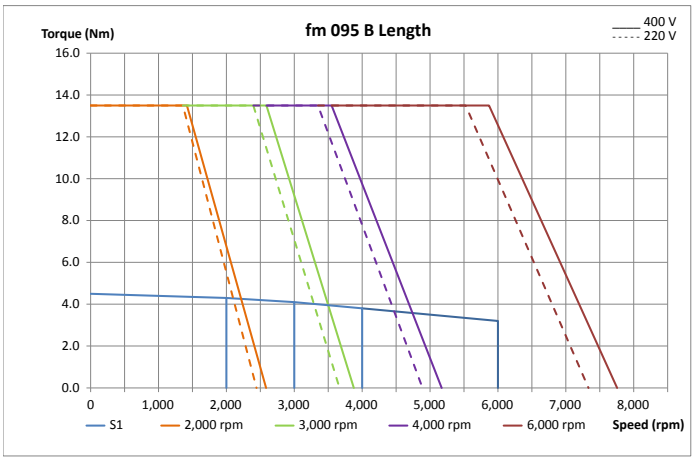


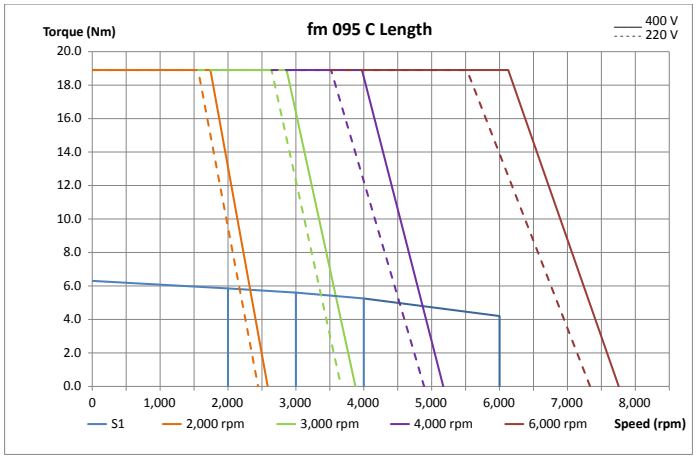








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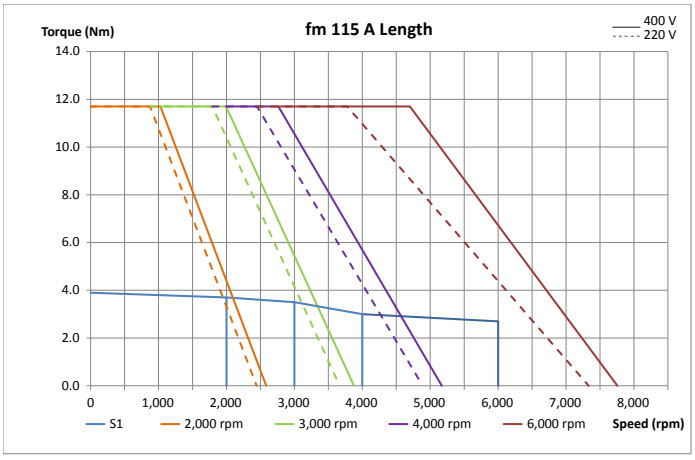
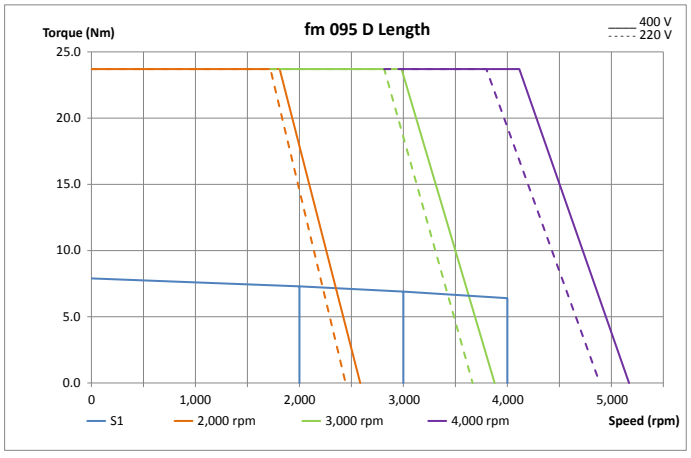
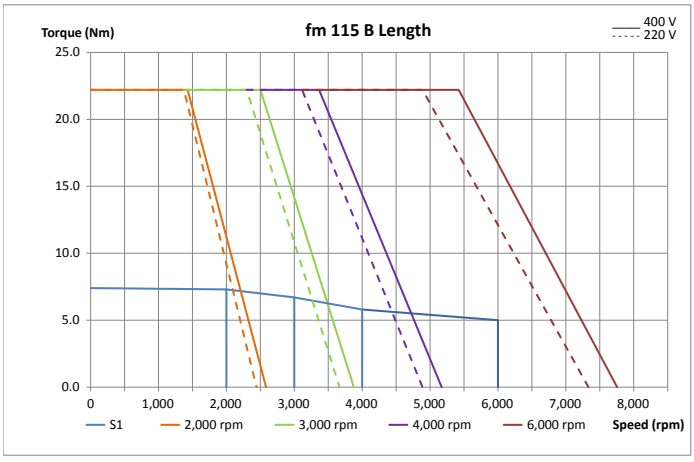
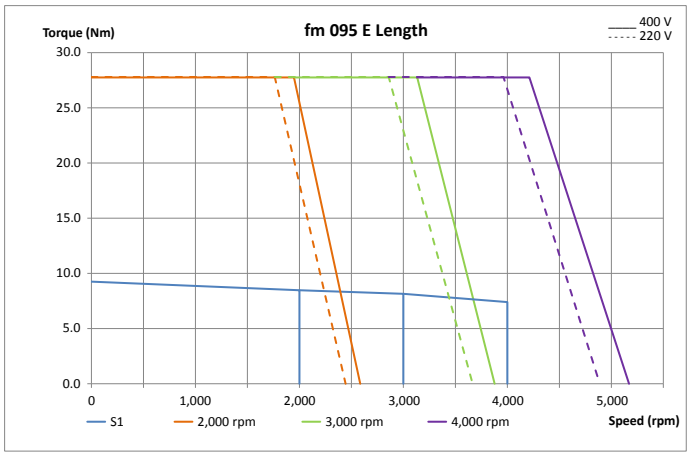
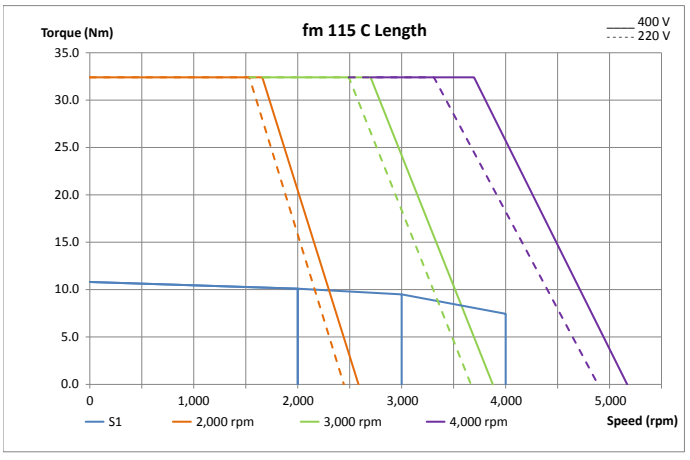
Torque (Nm)
400 V
220 V
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

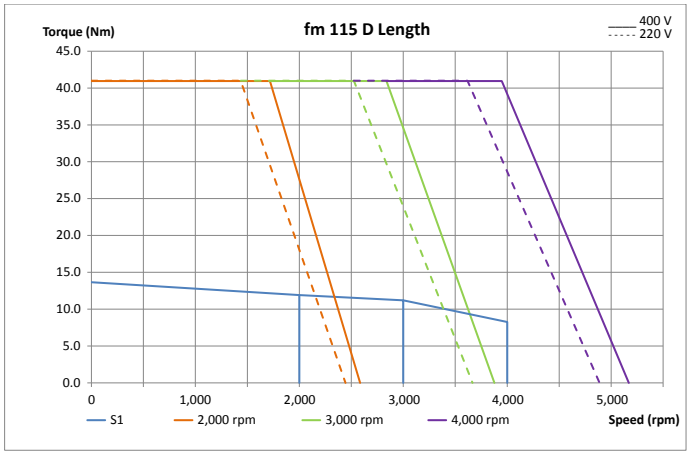

fm 115 A Length
Torque (Nm)
400 V
220 V
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

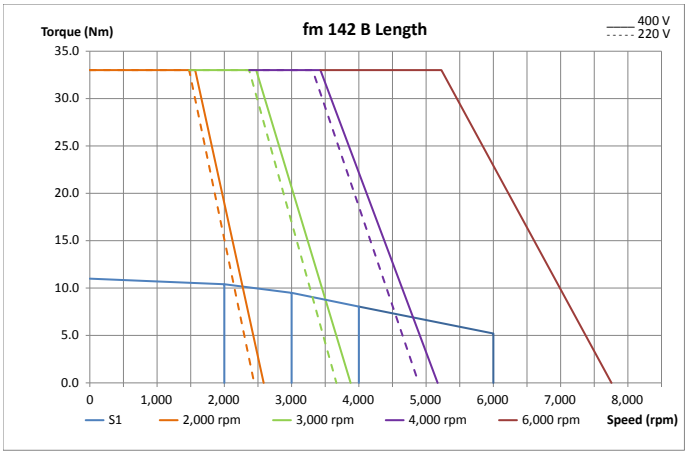

fm 095 D Length
Torque (Nm)
400 V
220 V
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

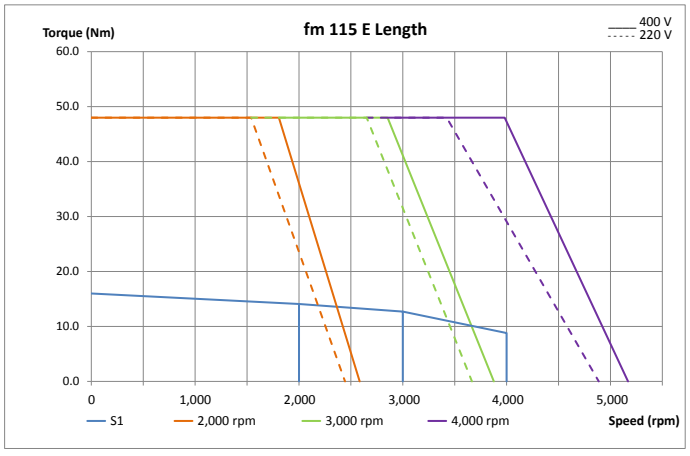

fm 115 B Length
Torque (Nm)
400 V
220 V
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

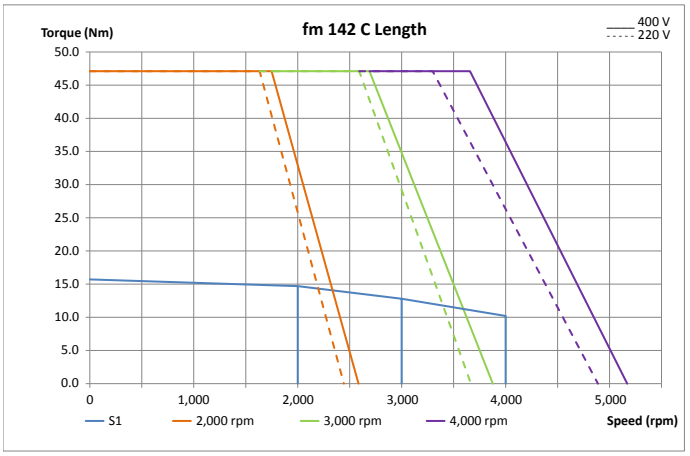

fm 095 E Length
Torque (Nm)
400 V
220 V
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

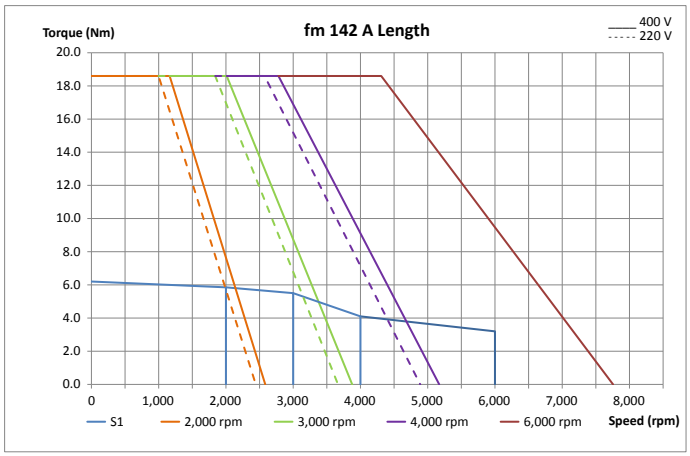

fm 115 C Length
Torque (Nm)
400 V
220 V
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

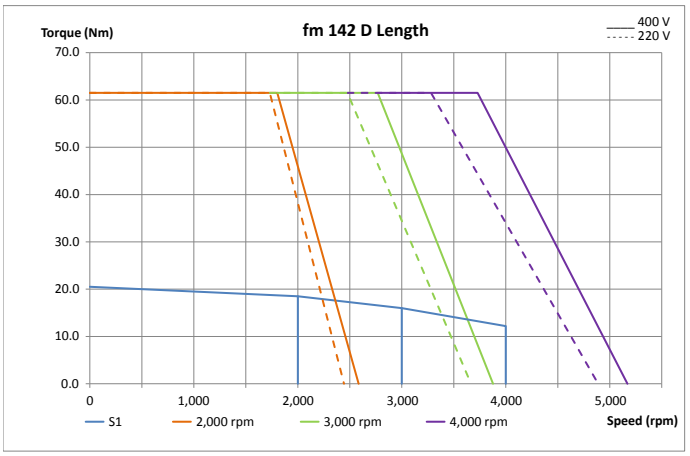

fm 115 D Length
Torque (Nm)
400 V
220 V
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

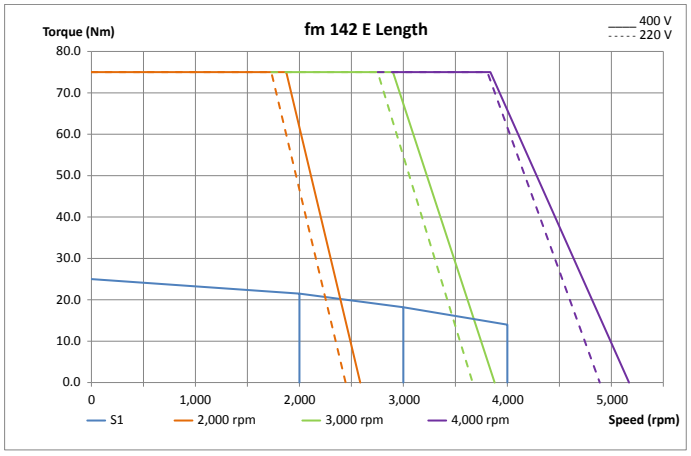

fm 142 B Length
Torque (Nm)
400 V
220 V
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

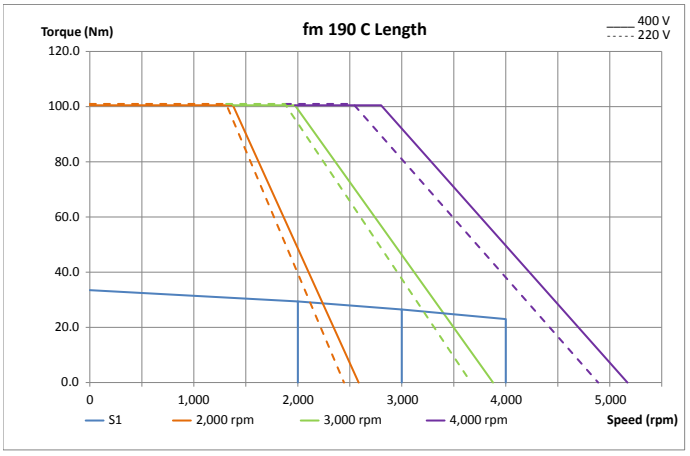

fm 115 E Length
Torque (Nm)
400 V
220 V
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

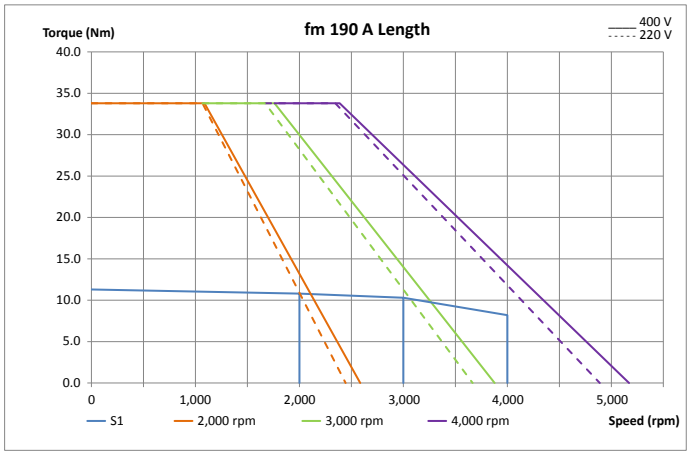

fm 142 C Length
Torque (Nm)
400 V
220 V
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

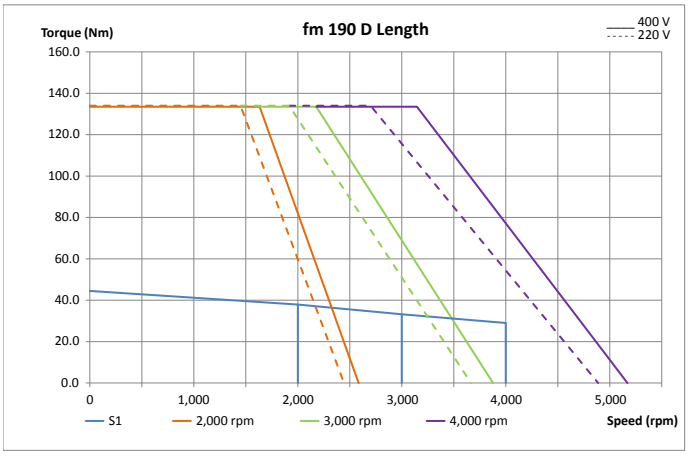

fm 142 A Length
Torque (Nm)
400 V
220 V
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

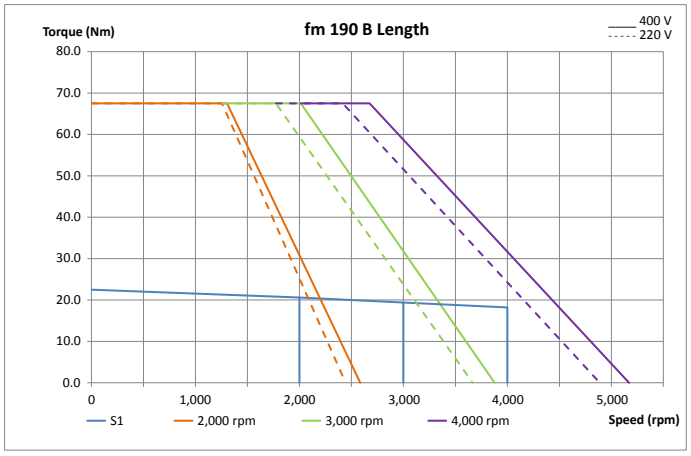

fm 142 D Length
Torque (Nm)
400 V
220 V
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

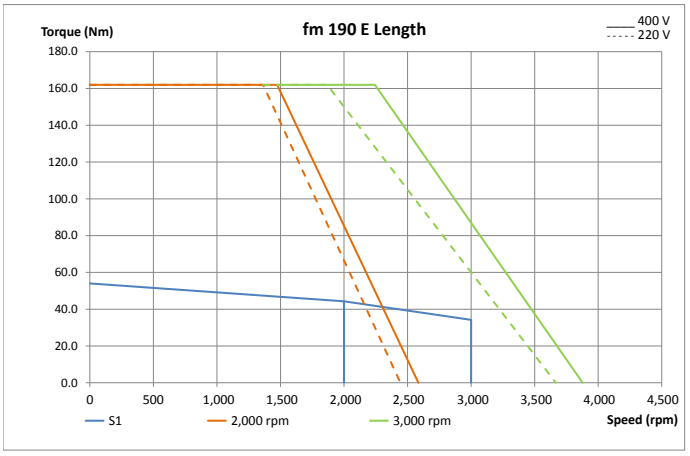

fm 142 E Length
Torque (Nm)
400 V
220 V
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

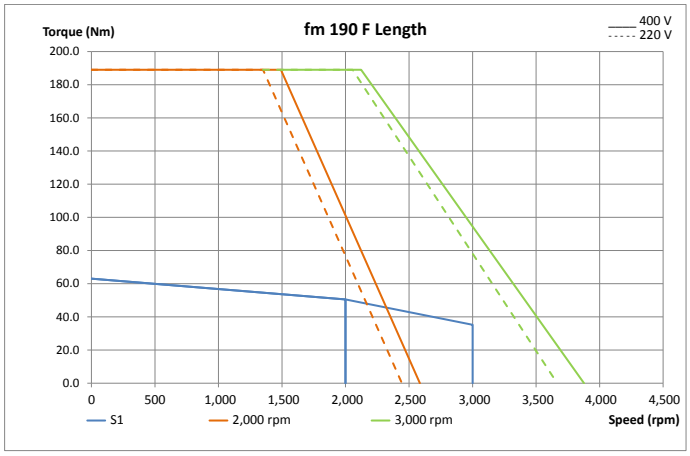

fm 190 C Length
Torque (Nm)
400 V
220 V
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

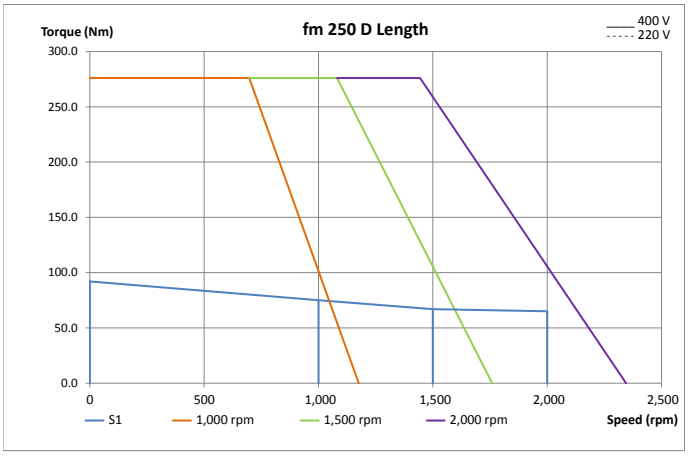

fm 190 A Length
Torque (Nm)
400 V
220 V
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

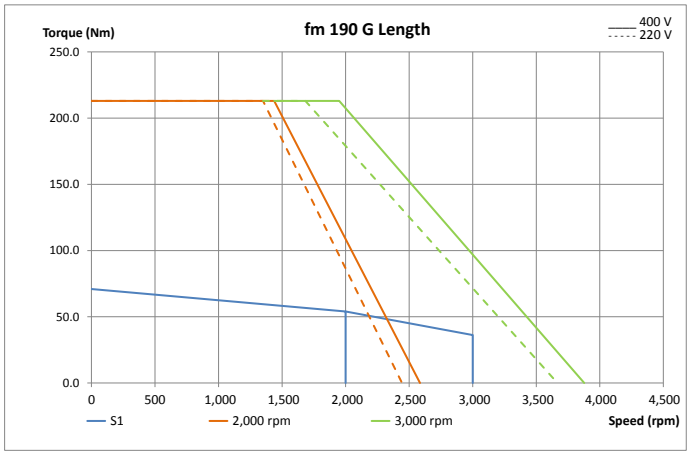

fm 190 D Length
Torque (Nm)
400 V
220 V
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

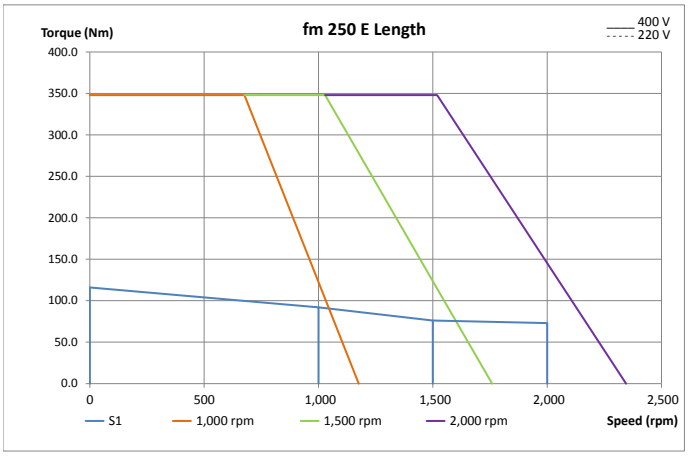

fm 190 B Length
Torque (Nm)
400 V
220 V
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
1,000
2,000
3,000
4,000
5,000
S1
2,000 rpm
3,000 rpm
4,000 rpm
Speed (rpm)

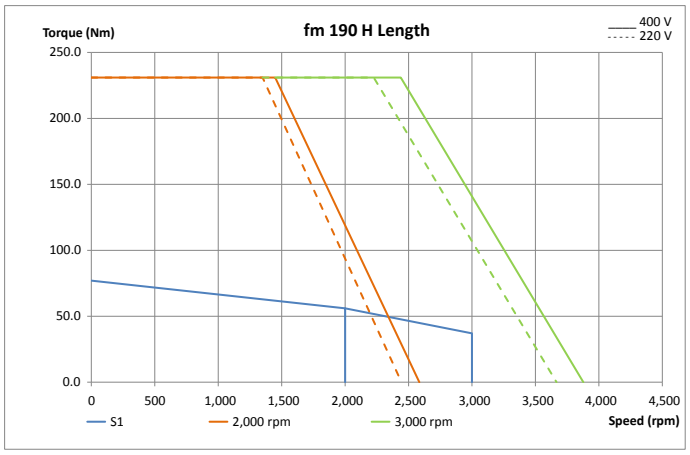

fm 190 E Length
Torque (Nm)
400 V
220 V
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

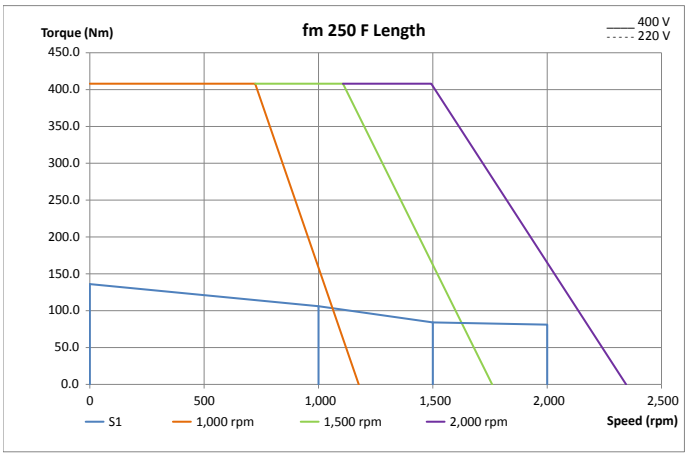

fm 190 F Length
Torque (Nm)
400 V
220 V
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)


fm 250 D Length
Torque (Nm)
400 V
220 V
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
Speed (rpm)

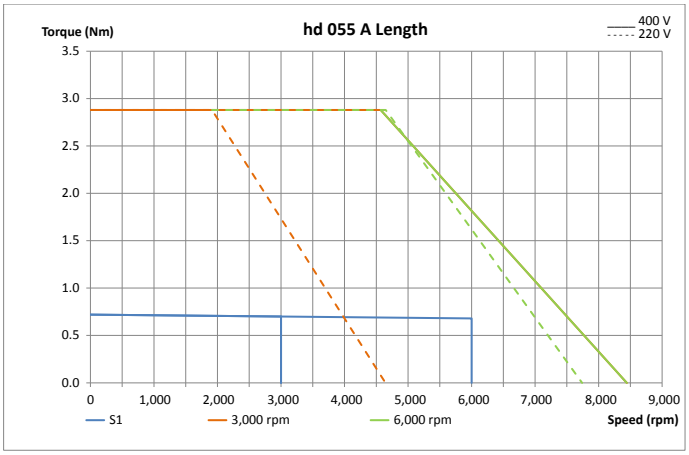

fm 190 G Length
Torque (Nm)
400 V
220 V
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

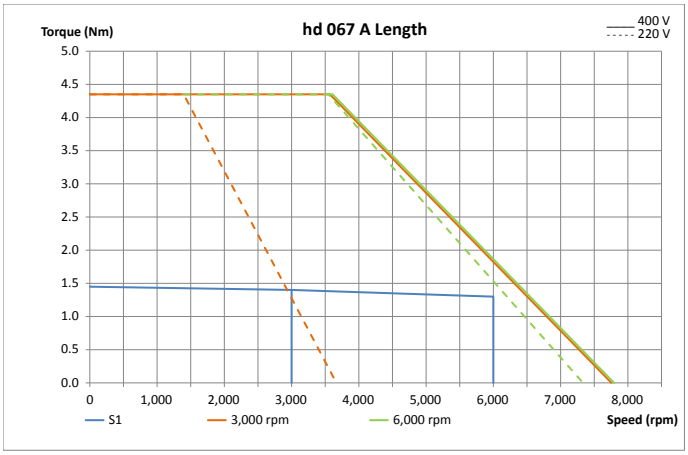

fm 250 E Length
Torque (Nm)
400 V
220 V
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
Speed (rpm)

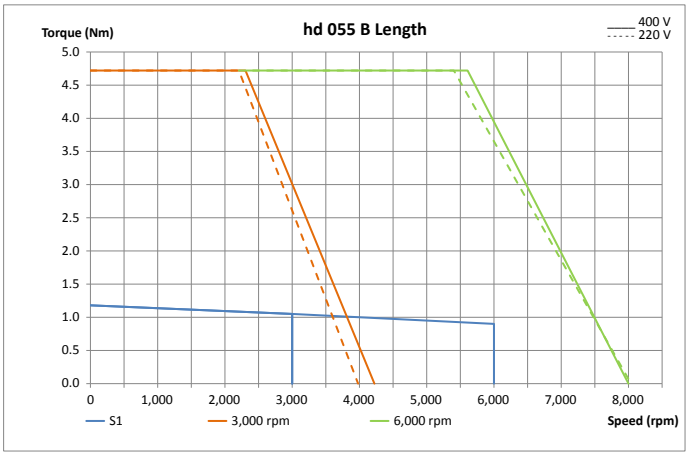

fm 190 H Length
Torque (Nm)
400 V
220 V
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

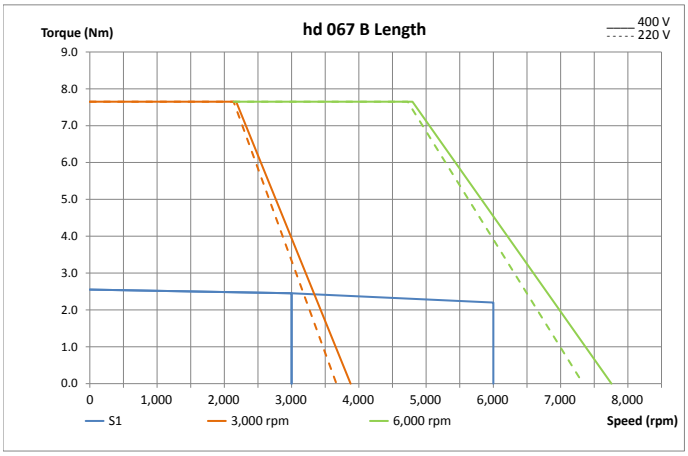

fm 250 F Length
Torque (Nm)
400 V
220 V
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
Speed (rpm)

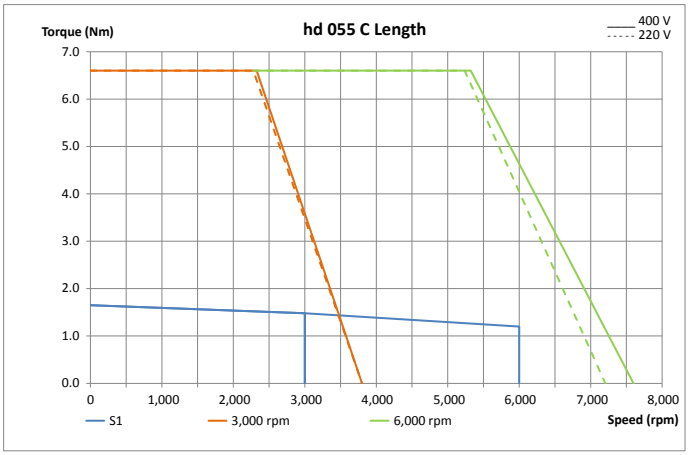
4.2 Unimotor hd

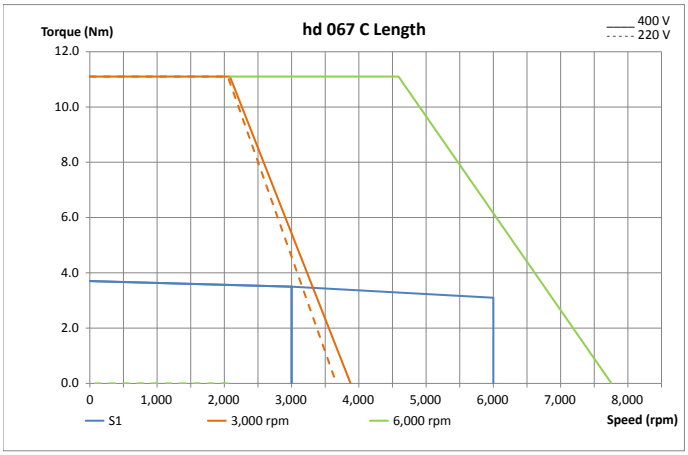


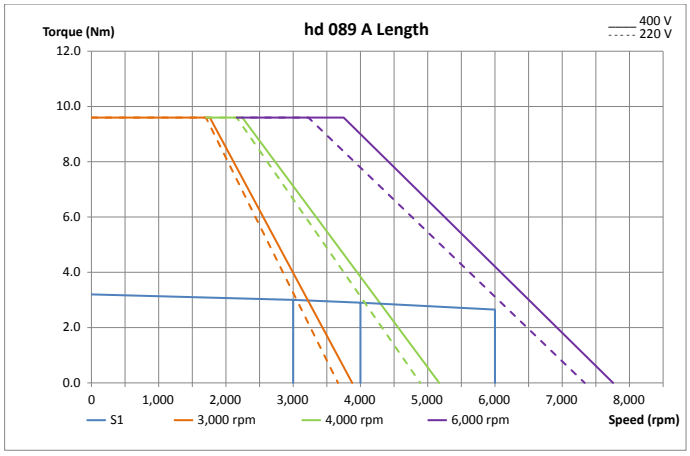


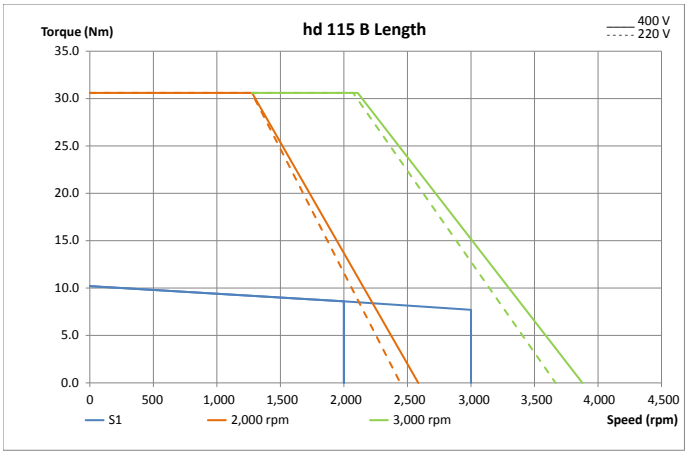


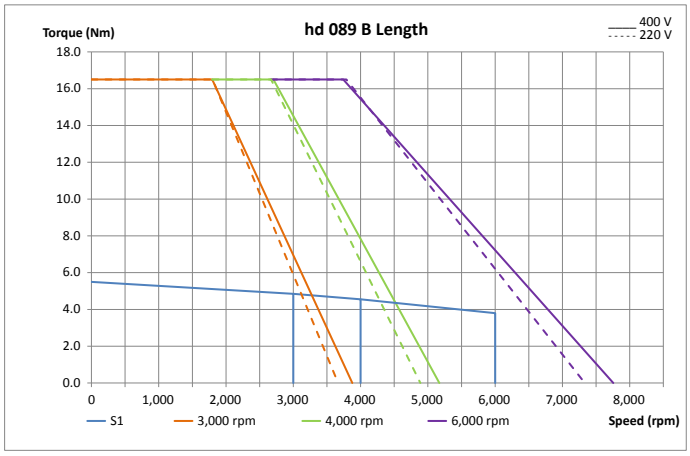


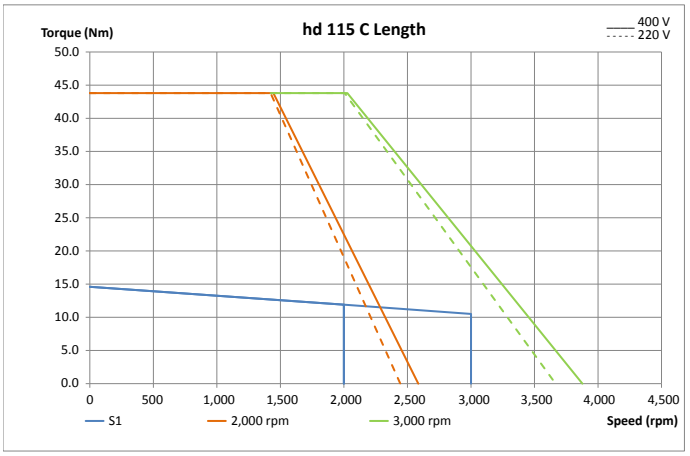


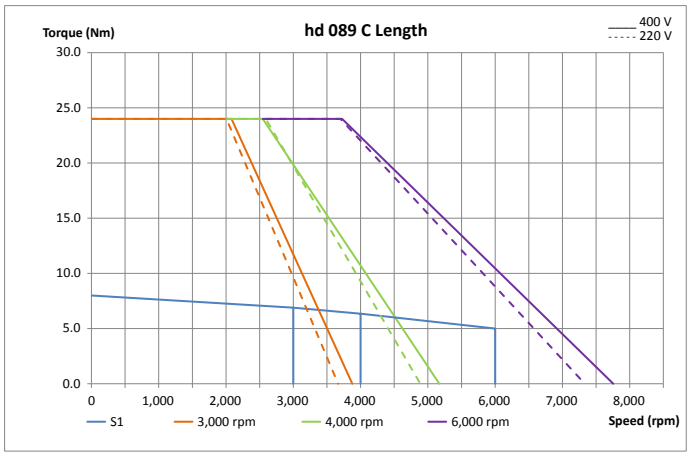


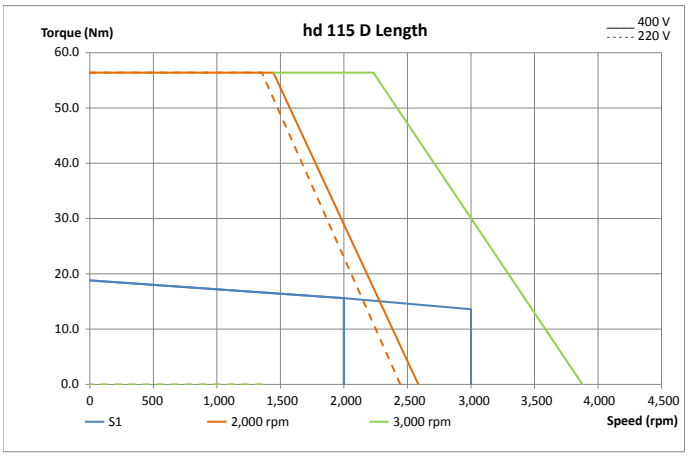

hd 089 A Length
Torque (Nm)
400 V
220 V
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

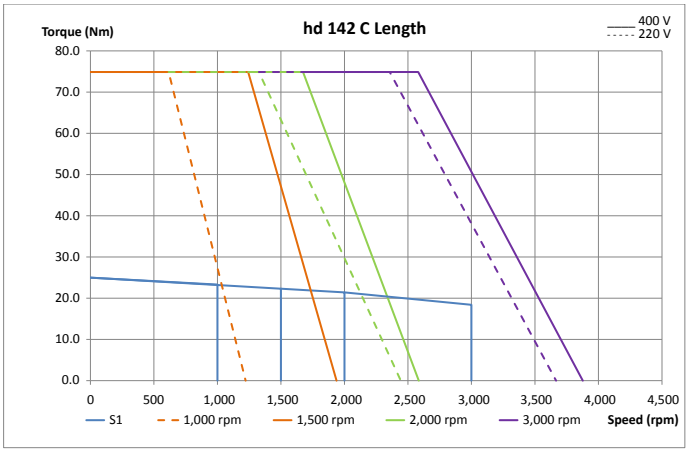

hd 115 B Length
Torque (Nm)
400 V
220 V
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

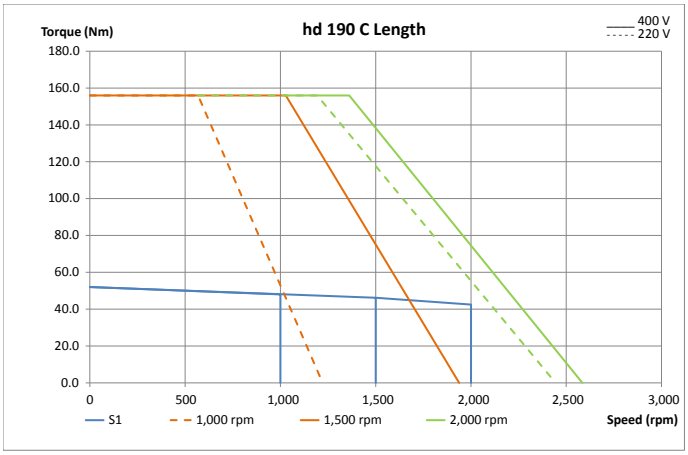

hd 089 B Length
Torque (Nm)
400 V
220 V
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

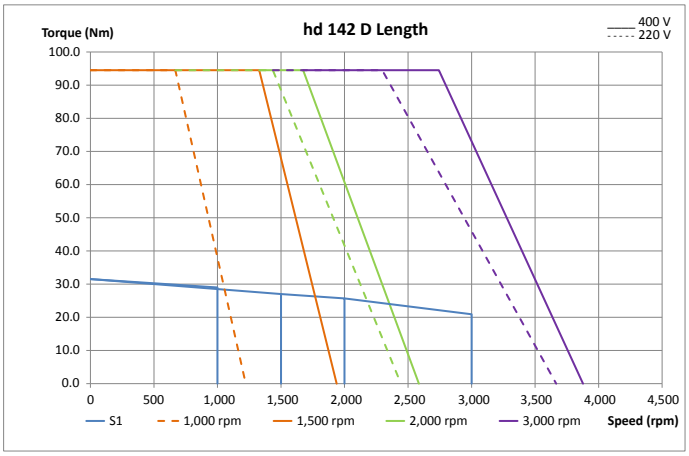

hd 115 C Length
Torque (Nm)
400 V
220 V
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

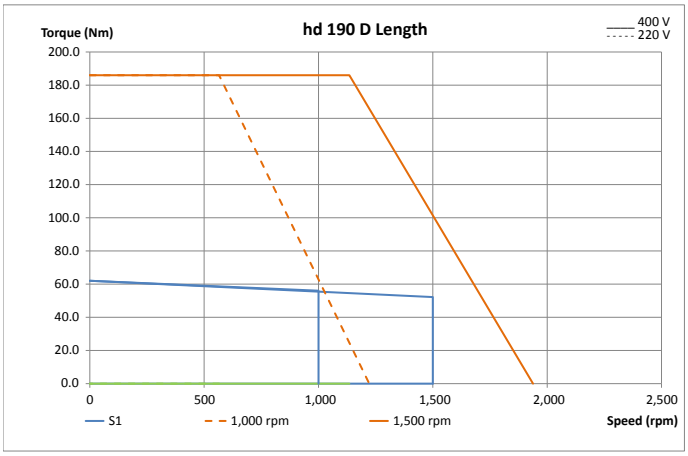

hd 089 C Length
Torque (Nm)
400 V
220 V
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
S1
3,000 rpm
4,000 rpm
6,000 rpm
Speed (rpm)

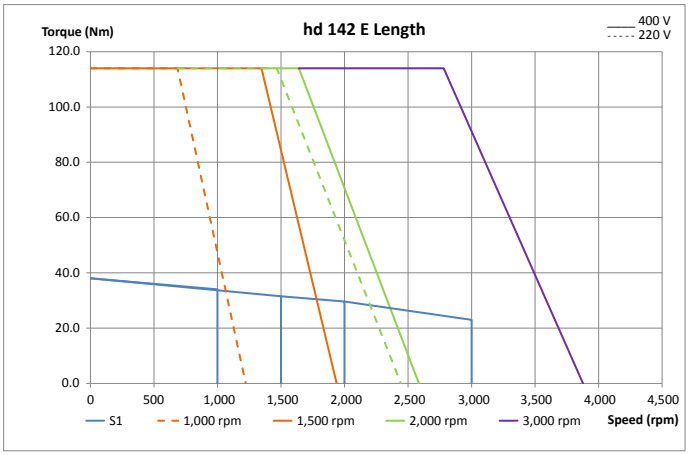

hd 115 D Length
Torque (Nm)
400 V
220 V
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
2,000 rpm
3,000 rpm
Speed (rpm)

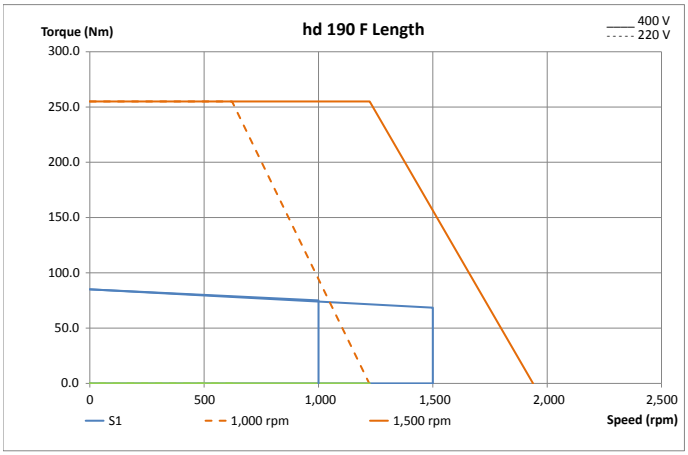

hd 142 C Length
Torque (Nm)
400 V
220 V
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
3,000 rpm
Speed (rpm)


hd 190 C Length
Torque (Nm)
400 V
220 V
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
S1
1,000 rpm
1,500 rpm
2,000 rpm
Speed (rpm)


hd 142 D Length
Torque (Nm)
400 V
220 V
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
3,000 rpm
Speed (rpm)


hd 190 D Length
Torque (Nm)
400 V
220 V
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
500
1,000
1,500
2,000
2,500
S1
1,000 rpm
1,500 rpm
Speed (rpm)


hd 142 E Length
Torque (Nm)
400 V
220 V
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
S1
1,000 rpm
1,500 rpm
2,000 rpm
3,000 rpm
Speed (rpm)


hd 190 F Length
Torque (Nm)
400 V
220 V
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
500
1,000
1,500
2,000
2,500
S1
1,000 rpm
1,500 rpm
Speed (rpm)

Case Study 2 - Emerson servo drives increase throughput of shrink wrapping machines

MIMI is one of Italy's leading manufacturers of shrink-wrapping machines.

The Challenge

When MIMI was developing its new MITO shrink-wrapping machine, the company turned to Emerson to provide a servo solution. The MITO machine is designed for wrapping different configurations and pack sizes of bottles, cartons, cans and tubs, and its key selling point is its flexibility. MITO needed a drive that could be quickly and easily set up for different bundles and pack sizes, with different configurations and even different products.

The Solution

MIMI chose Digitax ST for its MITO machines. The drives were incorporated into three critical areas of the machines – speed of throughput, the cutting of the wrapping film and control of the wrapping action. Each Digitax ST is equipped with an SM-Applications module that provides onboard PLC functionality. Emerson's expert automation engineers worked closely with MIMI to help develop MITO and to ensure that the chosen automation solution met their needs.

The Benefits

- Increased machine throughput
- Onboard PLC functionality
- Easy reconfiguring of motors

5 Unidrive M700 and Digitax ST servo drives for continuous and pulse duty applications

5.1 Unidrive M700 – continuous duty

0.7 Nm – 136 Nm (408 Nm peak)

Unidrive M700 is an AC and servo drive optimized for continuous duty. Unidrive M700 offers class leading servo and induction motor performance with onboard real-time Ethernet. The drive provides high performance motor control to satisfy the requirements of machine builders and high performance industrial applications.

5.1.1 Benefits

Maximize throughput with superior motor control

- High bandwidth motor control algorithm for open and closed-loop induction, permanent magnet and servo motors
- Flexible speed and position feedback interface supports a wide range of feedback technologies from robust resolvers to high resolution encoders
  - Up to three encoder channels simultaneously e.g. 1 feedback encoder, 1 reference encoder and 1 simulated output
  - Quadrature, SinCos (including absolute), communication-based encoders (up to 4 Mb), line compensation (up to 100 m), EnDat 2.2, HIPERFACE, SSI and resolvers
  - Simulated encoder output can provide position reference for CAMs, digital lock and electronic gearbox applications

Optimize system performance with onboard Advanced Motion Controller

- M700 incorporates an Advanced Motion Controller capable of controlling 1.5 axis. The motion functions are carried out 'on the drive' so that system performance is maximized.

Design flexible centralized and decentralized control systems

- MCi modules can be added to execute larger programs for advanced system control capability
- Engineering Control Studio is an industry standard IEC61131-3 programming environment for efficient system design and configuration
- Integrated dual port Ethernet switch provides simple connectivity using standard connections
- Onboard real-time Ethernet (IEEE 1588 V2) uses RTMoE (Real Time Motion over Ethernet) to provide fast communication and accurate axis synchronization
- Three 'SI' ports are available to fit additional fieldbus, position feedback and I/O options

Flexible machine design with options modules

Unidrive M700 can be tailored for a wide variety of demanding servo and induction applications. The drive has three option slots for System Integration modules, giving maximum flexibility

- Machine control: MCi200, MCi210, SI-Applications Plus
- Communications: SI-Ethernet, SI-PROFINET RT, SI-EtherCAT, SI-CANopen, SI-PROFIBUS, SI-DeviceNet
- Safety: SI-Safety
- Additional I/O: SI-I/O
- Feedback: SI-Encoder, SI-Universal Encoder
- 15 way D-type converter
- Single ended encoder interface (15 V or 24 V)

Conform to safety standards, maximize uptime and reduce costs by integrating directly with safety systems

- M700 has an integrated STO input and can accommodate an SI-Safety module for safe motion functions

Auxiliary power system flexibility

- Unidrive M can run with a wider operating DC voltage input, from 24 V up to maximum rated Volts providing optimum choice of auxiliary power supply for back-up purposes

5.1.2 Unidrive M700 variants: M701 and M702

Unidrive M701

Unidrive M701 has 2 x RS485 ports onboard instead of Ethernet. Parameter sets can be ported to Unidrive M using a smartcard or Unidrive M connect. Unidrive M701 is a direct upgrade for Unidrive SP users.

Unidrive M702 – Enhanced Safety

Unidrive M702 has an additional STO input for applications that require onboard Ethernet and dual STO to comply with SIL 3 PLe.

5.2 Servo drives: Digitax ST – pulse duty

From 0.72 Nm to 18.8 Nm (56.4 Nm Peak)

Digitax ST is a dedicated servo drive optimized for pulse duty. The drive is designed to help meet the demands of modern manufacturers for smaller, more flexible and higher performing machinery.

5.2.1 Benefits

Maximize throughput with superior motor control

- High bandwidth motor control algorithm for servo motors
- Optimum performance for high-dynamic applications with 300 % motor torque overload
- Flexible speed and position feedback interface supports a wide range of feedback technologies from robust resolvers to high resolution encoders
  - Up to three encoder channels simultaneously e.g. 1 feedback encoder, 1 reference encoder and 1 simulated output
  - Quadrature, SinCos (including absolute), SSI, EnDat (up to 4 Mb with EnDat 2.2 and 100 m of cable as line compensation is supported) and resolvers (SM resolver module required)
  - Simulated encoder output can provide position reference for CAMs, digital lock and electronic gearbox applications

Reduce cabinet size with compact drive design

- Digitax ST is compact and can be flush mounted which at high current ratings can save up to 50 % of cabinet space compared to competitor products
- Onboard features such as synchronized motion control and Safe Torque Off reduce the need for external components

Flexible machine design with option modules

Digitax drives can be tailored for a variety of applications. Two options slots allow increasing capabilities.

- Communications: Ethernet, Ethernet/IP, PROFIBUS-DP, DeviceNet, CANopen, INTERbus, CTNet, EtherCAT, SERCOS
- Feedback: Resolver, Universal Encoder, Incremental Encoder
- Input and output: Additional I/O lite, Additional I/O plus, High density I/O, I/O with real-time clock
- Applications: Register

Reduced development time

- Three motion programming options
  - CTSoft index motion
  - IEC61131-3 environment
  - PowerTools Pro
- Servo and fieldbus option modules independently certified for conformity with open standards
- 2D and 3D CAD files to make it easier and quicker to design the drive into your machine

Quicker installation

- The bottom of the drive can be quickly clipped onto a standard DIN rail
- The cable mounting system features rigid mounting and grounding brackets
- Pluggable control terminals enable looms to be easily prepared

Reduced commissioning time

- Digitax ST can be quickly configured using the removable keypad, smartcard and supplied commissioning software
- Autotune gets the best performance by measuring machine dynamics and automatically optimizing control loop gains
- CTScope – a realtime software oscilloscope – is supplied for tuning and monitoring

Auxiliary power system flexibility

- Digitax ST can run with a wider operating DC voltage input, from 48 V up to maximum rated Volts providing optimum choice of auxiliary power supply for back-up purposes

5.2.2 Digitax ST is available in five variants:

- EtherCAT - Built in EtherCAT connectivity
- Plus - With on board APC motion controller
- EZ Motion - Easy-to-use motion programming
- Indexer - Point-to-point positioning functionality
- Base - Digital or analog control

5.3 Drive and motor combinations

055 hd

Drive part number				DST1201 1Ph	DST1201 3Ph	DST1202 1Ph	DST1202 3Ph	DST1203 1Ph	DST1203 3Ph	DST1204 1Ph	DST1204 3Ph	DST1401 3Ph	DST1402 3Ph	DST1403 3Ph	M700-03200050 A	M700-03200066A	M700-03200080 A	M700-03400025A	M700-03400031A	M700-03400045A
Drive switching frequency				12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Rated drive current				1.1	1.7	2.4	3.8	2.9	5.4	4.7	7.6	1.5	2.7	3.8	5.0	6.6	8.0	2.5	3.1	4.5
Drive output maximal current				1.8	4.3	4.0	9.5	4.8	13.5	7.8	19.0	3.8	6.8	10.0	10.0	13.2	16.0	5.0	6.2	9.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																	
3,000	0.7	055 ED A 30	Mo	0.7	0.7	0.7									0.7					
			Mn	0.7	0.7	0.7									0.7					
			Mmax	1.3	2.9	2.9									2.9					
		055 UD A 30	Mo									0.7	0.7					0.7		
			Mn									0.7	0.7					0.7		
			Mmax									2.8	2.9					2.9		
	1.2	055 ED B 30	Mo		1.2	1.2	1.2	1.2		1.2					1.2					
			Mn		1.1	1.1	1.1	1.1		1.1					1.1					
			Mmax		3.7	3.5	4.7	4.2		4.7					4.7					
		055 UD B 30	Mo									1.2						1.2		
			Mn									1.1						1.1		
			Mmax									4.7						4.7		
	1.7	055 ED C 30	Mo			1.7	1.7	1.7		1.7					1.7					
			Mn			1.5	1.5	1.5		1.5					1.5					
			Mmax			3.6	6.6	4.4		6.6					6.6					
		055 UD C 30	Mo									1.7	1.7					1.7		
			Mn									1.5	1.5					1.5		
			Mmax									6.3	6.6					6.6		
6,000	0.7	055 ED A 60	Mo		0.7	0.7	0.7	0.7		0.7					0.7					
			Mn		0.7	0.7	0.7	0.7		0.7					0.7					
			Mmax		1.9	1.8	2.9	2.1		2.9					2.9					
		055 UD A 60	Mo									0.7	0.7					0.7		
			Mn									0.7	0.7					0.7		
			Mmax									2.8	2.9					2.9		
	1.2	055 ED B 60	Mo				1.2	1.2	1.2	1.2					1.2	1.2				
			Mn				0.9	0.9	0.9	0.9					0.9	0.9				
			Mmax				4.1	2.1	4.7	3.4					4.3	4.7				
		055 UD B 60	Mo									1.2	1.2					1.2	1.2	
			Mn									0.9	0.9					0.9	0.9	
			Mmax									3.0	4.7					4.0	4.7	
	1.7	055 ED C 60	Mo				1.7		1.7	1.7	1.7				1.7	1.7	1.7			
			Mn				1.2		1.2	1.2	1.2				1.2	1.2	1.2			
			Mmax				4.6		6.5	3.7	6.6				4.8	6.3	6.6			
		055 UD C 60	Mo										1.7	1.7				1.7	1.7	1.7
			Mn										1.2	1.2				1.2	1.2	1.2
			Mmax										5.6	6.6				4.2	5.2	6.6

Key

Mo = stall torque (Nm)

Mn = rated torque

Mmax = maximum torque

Case Study 3 - Unidrive M brings throughput and efficiency improvements to fastening presses

Penn Engineering, a global leader in fastening solutions, is using Unidrive M in servo-driven presses to insert fasteners primarily for the European and North American markets.

The Challenge

Penn needed to change its existing systems from air over oil to electric. This would result in a number of positive benefits, including the elimination of oil leak issues which were crucial in specific markets. The new system would also need to deliver greater flexibility, increased cycle rates and RoHS compliance.

The solution

Working with Emerson Industrial Automation, a highly customized system was commissioned utilizing Unidrive M700 and M701 drives which control one linear device. The motors enable and disable on the fly to hand off from one motor to the other, with seamless motion, to control the same linear device.

The Benefits

- Increased efficiency and throughput
- RoHS compliance
- Significant cost savings

067 hd

Drive part number				DST1201 3Ph	DST1202 1Ph	DST1202 3Ph		DST1203 1Ph	DST1203 3Ph	DST1204 1Ph	DST1204 3Ph	DST1402 3Ph	DST1403 3Ph	DST1404 3Ph	M700-03200050 A	M700-03200066A	M700-03200080 A	M700-03200106A	M700-03400025A	M700-03400031A	
Drive switching frequency				12	12	12	6	12	12	12	12	12	12	8	12	12	12	12	12	12	
Rated drive current				1.7	2.4	3.8	3.8	2.9	5.4	4.7	7.6	2.7	3.8	5.0	5.0	6.6	8.0	8.8	2.5	3.1	
Drive output maximal current				4.3	4.0	9.5	9.5	4.8	13.5	7.8	19.0	6.8	10.0	14.8	10.0	13.2	16.0	21.2	5.0	6.2	
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																		
3,000	1.5	067 ED A 30	Mo	1.5	1.5	1.5		1.5							1.5						
			Mn	1.4	1.4	1.4		1.4							1.4						
			Mmax	4.0	3.7	4.4		4.4							4.4						
		067 UD A 30	Mo									1.5							1.5	1.5	
			Mn									1.4							1.4	1.4	
			Mmax									4.4							4.0	4.4	
	2.6	067 ED B 30	Mo			2.6		2.6		2.6					2.6						
			Mn			2.5		2.5		2.5					2.5						
			Mmax			7.7		4.5		7.3					7.7						
		067 UD B 30	Mo									2.6							2.6		
			Mn									2.5							2.5		
			Mmax									7.7							7.7		
	3.7	067 ED C 30	Mo				3.5		3.7	3.7					3.7	3.7					
			Mn				3.3		3.5	3.5					3.5	3.5					
			Mmax				8.8		11.1	7.3					9.3	11.1					
		067 UD C 30	Mo									3.7	3.7						3.7	3.7	
			Mn									3.5	3.5						3.5	3.5	
			Mmax									10.9	11.1						8.0	9.9	
6,000	1.5	067 ED A 60	Mo			1.5				1.5					1.5						
			Mn			1.3				1.3					1.3						
			Mmax			4.4				3.7					4.4						
		067 UD A 60	Mo									1.5							1.5	1.5	
			Mn									1.3							1.3	1.3	
			Mmax									4.4							4.0	4.4	
	2.6	067 ED B 60	Mo								2.6					2.6	2.6	2.6			
			Mn								2.2					2.2	2.2	2.2			
			Mmax								7.7					6.2	7.5	7.7			
		067 UD B 60	Mo										2.6								
			Mn										2.2								
			Mmax										7.7								
	3.7	067 UD C 60	Mo											3.7							
			Mn											3.1							
			Mmax											11.1							

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

	M700-03400045A	M700-03400062A		M700-03400078A
	12	12	8	12
	4.5	4.5	5.8	5.7
	9.0	12.4	12.4	15.6
	3.7			
	3.5			
	11.1			
	2.6	2.6		
	2.2	2.2		
	7.2	7.7		
			3.7	3.7
			3.1	3.1
			9.9	11.1

089 hd

Drive part number				DST1202 3Ph	DST1203 3Ph	DST1204 1Ph	DST1204 3Ph	DST1402 3Ph	DST1403 3Ph		DST1404 3Ph	DST1405 3Ph	M700-03200050 A	M700-03200066A	M700-03200080 A		M700-03200106A	M700-03400025A	
Drive switching frequency				12	12	12	12	12	12	8	8	6	12	12	12	4	12	12	
Rated drive current				3.8	5.4	4.7	7.6	2.7	3.8	4.0	5.0	6.0	5.0	6.6	8.0	8.0	8.8	2.5	
Drive output maximal current				9.5	13.5	7.8	19.0	6.8	10.0	10.0	14.8	20.0	10.0	13.2	16.0	16.0	21.2	5.0	
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																
3,000	3.2	089 ED A 30	Mo	3.2	3.2	3.2							3.2	3.2					
			Mn	3.0	3.0	3.0							3.0	3.0					
			Mmax	8.8	9.6	7.3							9.3	9.6					
		089 UD A 30	Mo					3.2										3.2	
			Mn					3.0										3.0	
			Mmax					9.6										8.0	
	5.5	089 ED B 30	Mo				5.5							5.5	5.5		5.5		
			Mn				4.9							4.9	4.9		4.9		
			Mmax				16.5							12.3	14.9		16.5		
		089 UD B 30	Mo						5.5		5.3								
			Mn						4.9		4.7								
			Mmax						16.0		16.5								
	8.0	089 ED C 30	Mo													7.3	8.0		
			Mn													6.3	6.9		
			Mmax													14.9	19.7		
		089 UD C 30	Mo								7.8	7.6							
			Mn								6.7	6.6							
			Mmax								23.7	24.0							
4,000	3.2	089 ED A 40	Mo		3.2	3.2	3.2						3.2	3.2	3.2				
			Mn		2.9	2.9	2.9						2.9	2.9	2.9				
			Mmax		9.5	5.5	9.6						7.0	9.2	9.6				
		089 UD A 40	Mo					3.2	3.2										
			Mn					2.9	2.9										
			Mmax					8.2	9.6										
	5.5	089 ED B 40	Mo												5.5		5.5		
			Mn												4.6		4.6		
			Mmax												11.2		14.8		
		089 UD B 40	Mo								5.5								
			Mn								4.6								
			Mmax								16.5								
	8.0	089 ED C 40	Mo																
			Mn																
			Mmax																
		089 UD C 40	Mo																
			Mn																
			Mmax																
6,000	3.2	089 ED A 60	Mo				3.2								3.2		3.2		
			Mn				2.7								2.7		2.7		
			Mmax				8.9								7.5		9.6		
		089 UD A 60	Mo							3.2	3.2								
			Mn							2.7	2.7								
			Mmax							8.0	9.6								
	5.5	089 ED B 60	Mo																
			Mn																
			Mmax																
		089 UD B 60	Mo																
			Mn																
			Mmax																
	8.0	089 ED C 60	Mo																
			Mn																
			Mmax																
		089 UD C 60	Mo																
			Mn																
			Mmax																

	M700-03400031A		M700-03400045A			M700-03400062A	M700-03400078A		M700-03400100 A		M700-04200137A	M700-04200185A	M700-04400150 A	M700-05200250 A	M700-06200330A
	12	3	12	3	12	8	12	8	8	4	12	12	12	12	12
	3.1	3.1	4.5	4.5	4.5	5.8	5.7	7.6	7.7	10.0	13.7	17.6	11.5	21.5	25 A
	6.2	6.2	9.0	9.0	12.4	12.4	15.6	15.6	20.0	20.0	27.4	37.0	30.0	50.0	66.0
	3.2														
	3.0														
	9.6														
		4.9	5.5		5.5										
		4.3	4.9		4.9										
		9.9	14.4		16.5										
											8.0				
											6.9				
											24.0				
				7.1		7.8	8.0								
				6.1		6.7	6.9								
				14.4		19.8	24.0								
	3.2		3.2												
	2.9		2.9												
	7.4		9.6												
											5.5				
											4.6				
											16.5				
						5.5	5.5								
						4.6	4.6								
						14.9	16.5								
											8.0	8.0			
											6.4	6.4			
											19.2	24.0			
								8.0	8.0						
								6.4	6.4						
								18.7	24.0						
			3.2		3.2										
			2.7		2.7										
			7.2		9.6										
											5.5	5.5			
											3.8	3.8			
											12.9	16.5			
								5.5	5.5				5.5		
								3.8	3.8				3.8		
								12.5	16.0				16.5		
												8.0		8.0	8.0
												5.0		5.0	5.0
												17.4		23.5	24.0
										8.0			8.0		
										5.0			5.0		
										16.0			24.0		

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

115 hd

Drive part number				DST1204 3Ph	DST1404 3Ph		DST1405 3Ph	M700-03200066A	M700-03200080 A	M700-03200106A			M700-03400045A	M700-03400062A		M700-03400078A		
Drive switching frequency				12	8	6	6	3	12	12	8	6	12	12	6	12	8	6
Rated drive current				7.6	5.0	5.9	6.0	6.6	8.0	8.8	10.6	10.6	4.5	4.5	6.2	5.7	7.6	7.8
Drive output maximal current				19.0	14.8	14.8	20.0	13.2	16.0	21.2	21.2	21.2	9.0	12.4	12.4	15.6	15.6	15.6
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**															
2,000	10.2	115 ED B 20	Mo	10.2				9.1	10.2	10.2								
			Mn	8.6				7.7	8.6	8.6								
			Mmax	26.6				18.5	22.4	29.7								
		115 UD B 20	Mo		10.0								10.2	10.2		10.2		
			Mn		8.4								8.6	8.6		8.6		
			Mmax		30.6								21.6	29.8		30.6		
	14.6	115 ED C 20	Mo								14.3							
			Mn								11.7							
			Mmax								29.7							
		115 UD C 20	Mo			14.0	14.0								14.0		14.3	
			Mn			11.4	11.4								11.4		11.7	
			Mmax			35.5	43.8								29.8		37.4	
	18.8	115 ED D 20	Mo															
			Mn															
			Mmax															
		115 UD D 20	Mo															18.0
			Mn															15.0
			Mmax															37.4
3,000	10.2	115 ED B 30	Mo									9.8						
			Mn									7.4						
			Mmax									19.7						
		115 UD B 30	Mo												9.8		10.0	
			Mn												7.4		7.5	
			Mmax												19.8		25.0	
	14.6	115 ED C 30	Mo															
			Mn															
			Mmax															
		115 UD C 30	Mo															
			Mn															
			Mmax															
	18.8	115 UD D 30	Mo															
			Mn															
			Mmax															

	M700-03400100 A		M700-04200137A	M700-04200185A	M700-04400150 A	M700-04400172A	M700-05200250 A	M700-05400270 A
	8	6	12	12	12	8	8	12	12
	7.7	9.2	13.7	17.6	11.5	14.4	14.4	21.5	13.8
	20.0	20.0	27.4	37.0	30.0	30.0	34.4	50.0	54.0
			10.2						
			8.6						
			30.6						
			14.6	14.6					
			11.9	11.9					
			38.4	43.8					
	14.3				14.6				
	11.7				11.9				
	43.8				43.8				
			18.8	18.8				18.8	
			15.6	15.6				15.6	
			38.4	51.8				56.4	
	18.4				18.8				
	15.3				15.6				
	48.0				56.4				
			10.2	10.2					
			7.7	7.7					
			25.5	30.6					
	10.0				10.2				
	7.5				7.7				
	30.6				30.6				
				14.6				14.6	
				10.5				10.5	
				34.4				43.8	
		14.0			14.6				
		10.1			10.5				
		32.0			43.8				
						18.4	18.4		18.8
						13.3	13.3		13.6
						48.0	55.0		56.4

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

142 hd

Drive part number				M700-03200080 A	M700-03200106A	M700-03400078A	M700-03400100 A			M700-04200137A	M700-04200185A		M700-04400150 A			M700-04400172A			
Drive switching frequency				6	8	8	8	6	3	12	12	8	12	8	6	12	8	6	4
Rated drive current				8.0	10.6	7.6	7.7	9.2	10.0	13.7	17.6	18.5	11.5	14.4	15.0	11.5	14.4	16.1	17.2
Drive output maximal current				16.0	21.2	15.6	20.0	20.0	20.0	27.4	37.0	37.0	30.0	30.0	30.0	34.4	34.4	34.4	34.4
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																
1,000	25.0	142 ED C 10	Mo	22.0	22.8					25.0									
			Mn	20.5	21.2					23.3									
			Mmax	44.8	59.4					74.9									
	31.5	142 ED D 10	Mo		28.7					31.5	31.5								
			Mn		26.4					29.0	29.0								
			Mmax		59.4					76.7	94.5								
	38.0	142 ED E 10	Mo							38.0	38.0								
			Mn							34.5	34.5								
			Mmax							76.7	104.0								
1,500	25.0	142 UD C 15	Mo			22.8	22.8						25.0						
			Mn			20.3	20.3						22.3						
			Mmax			49.9	64.0						74.9						
	31.5	142 UD D 15	Mo					27.7					31.5						
			Mn					23.8					27.0						
			Mmax					64.0					94.5						
	38.0	142 UD E 15	Mo						31.5					34.6			34.6		
			Mn						26.3					28.8			28.8		
			Mmax						64.0					96.0			110.0		
2,000	25.0	142 ED C 20	Mo									22.8							
			Mn									19.5							
			Mmax									51.8							
		142 UD C 20	Mo					22.0					25.0			25.0			
			Mn					18.8					21.4			21.4			
			Mmax					48.0					72.0			74.9			
	31.5	142 ED D 20	Mo																
			Mn																
			Mmax																
		142 UD D 20	Mo											28.7			28.7		
			Mn											23.4			23.4		
			Mmax											72.0			82.6		
	38.0	142 ED E 20	Mo																
			Mn																
			Mmax																
		142 UD E 20	Mo												33.4			33.4	
			Mn												26.0			26.0	
			Mmax												72.0			82.6	
3,000	25.0	142 ED C 30	Mo																
			Mn																
			Mmax																
		142 UD C 30	Mo											22.8			22.8		
			Mn											16.7			16.7		
			Mmax											48.0			55.0		
	31.5	142 ED D 30	Mo																
			Mn																
			Mmax																
		142 UD D 30	Mo															26.8	
			Mn															17.8	
			Mmax															55.0	
	38.0	142 UD E 30	Mo																
			Mn																
			Mmax																

	M700-05200250 A		M700-05400270 A				M700-05400300 A		M700-06200330 A		M700-06200440 A		M700-06400350 A		M700-06400420 A	M700-07200610 A	M700-07400660 A
	12	8	12	8	6	4	8	6	12	8	12	8	12	8	8	12	12
	21.5	24.8	13.8	17.6	20.3	23.7	21.0	24.0	32.0	33.0	33.0	40.0	23.0	30.0	30.0	61.0	41.0
	50.0	50.0	54.0	54.0	54.0	54.0	66.0	66.0	66.0	66.0	88.0	88.0	70.0	70.0	84.0	122.0	132.0
	38.0																
	34.5																
	114.0																
			38.0														
			31.7														
			114.0														
	25.0								25.0								
	21.4								21.4								
	70.0								74.9								
		28.7							31.5		31.5						
		23.4							25.7		25.7						
		70.0							92.4		94.5						
			31.5														
			25.7														
			94.5														
		34.6							38.0		38.0						
		26.9							29.6		29.6						
		70.0							92.4		114.0						
				34.6									38.0				
				26.9									29.6				
				114.0									114.0				
		22.8							25.0		25.0						
		16.7							18.4		18.4						
		46.5							61.4		74.9						
				22.8									25.0				
				16.7									18.4				
				74.9									74.9				
										28.7		28.7				31.5	
										19.0		19.0				20.9	
										61.4		81.8				94.5	
					27.7		28.7						31.5				
					18.4		19.0						20.9				
					86.4		94.5						94.5				
						32.3		33.4						34.6	34.6		38.0
						19.6		20.2						20.9	20.9		23.0
						86.4		106.0						112.0	114.0		114.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

190 hd

Drive part number				M700-04200185A	M700-04400150 A	M700-04400172A	M700-05200250 A		M700-05400270 A			M700-05400300 A			M700-06200330 A	M700-06200440 A		M700-06400350 A	M700-06400420 A	M700-07200610 A
Drive switching frequency				4	3	4	12	8	8	6	4	3	8	6	4	12	12	8	8	8	12
Rated drive current				18.5	15.0	17.2	21.5	24.8	17.6	20.3	23.7	25.4	21.0	24.0	27.9	32.0	33.0	40.0	30.0	30.0	61.0
Drive output maximal current				37.0	30.0	34.4	50.0	50.0	54.0	54.0	54.0	54.0	66.0	66.0	66.0	66.0	88.0	88.0	70.0	84.0	122.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																		
1,000	52.0	190 ED C 10	Mo	49.4			52.0									52.0					
			Mn	46.6			49.0									49.0					
			Mmax	104.0			140.0									156.0					
	62.0	190 ED D 10	Mo					62.0								62.0	62.0				
			Mn					56.5								56.5	56.5				
			Mmax					140.0								185.0	186.0				
	85.0	190 ED F 10	Mo													85.0	85.0				85.0
			Mn													77.5	77.5				77.5
			Mmax													185.0	246.0				255.0
1,500	52.0	190 UD C 15	Mo		46.8	49.4			52.0												
			Mn		41.6	43.9			46.2												
			Mmax		96.0	110.0			156.0												
	62.0	190 UD D 15	Mo							62.0			62.0								
			Mn							52.2			52.2								
			Mmax							173.0			186.0								
	85.0	190 UD F 15	Mo									76.5			80.8				85.0	85.0	
			Mn									61.7			65.1				68.5	68.5	
			Mmax									173.0			211.0				224.0	255.0	
2,000	52.0	190 ED C 20	Mo															52.0			52.0
			Mn															42.5			42.5
			Mmax															123.0			156.0
		190 UD C 20	Mo								49.4			52.0							
			Mn								40.4			42.5							
			Mmax								130.0			156.0							

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

075 E3

Drive part number				DST1201 1Ph	DST1201 3Ph	DST1202 1Ph	DST1202 3Ph		DST1203 1Ph	DST1203 3Ph	DST1204 1Ph	DST1204 3Ph	M700-03200050 A	M700-03200066A	M700-03200080 A	M700-03200106A		M700-04200137A	M700-04200185A
Drive switching frequency				12	12	12	12	6	12	12	12	12	12	8	12	12	12	8	12	12
Rated drive current				1.1	1.7	2.4	3.8	3.8	2.9	5.4	4.7	7.6	5.0	5.0	6.6	8.0	8.8	10.6	13.7	17.6
Drive output maximal current				1.8	4.3	4.0	9.5	9.5	4.8	13.5	7.8	19.0	10.0	10.0	13.2	16.0	21.2	21.2	27.4	37.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																	
2,000	1.4	075 E3 A 20	Mo	1.4	1.4	1.4							1.4							
			Mn	1.3	1.3	1.3							1.3							
			Mmax	2.5	4.3	4.3							4.3							
	2.7	075 E3 B 20	Mo			2.7	2.7		2.7		2.7		2.7							
			Mn			2.5	2.5		2.5		2.5		2.5							
			Mmax			5.6	8.0		6.7		8.0		8.0							
	3.7	075 E3 C 20	Mo				3.7		3.7		3.7		3.7							
			Mn				3.5		3.5		3.5		3.5							
			Mmax				11.2		6.7		10.9		11.2							
	4.7	075 E3 D 20	Mo				4.7			4.7	4.7		4.7							
			Mn				4.5			4.5	4.5		4.5							
			Mmax				13.3			14.0	10.9		14.0							
3,000	1.4	075 E3 A 30	Mo		1.4	1.4	1.4		1.4				1.4							
			Mn		1.3	1.3	1.3		1.3				1.3							
			Mmax		4.0	3.7	4.3		4.3				4.3							
	2.7	075 E3 B 30	Mo				2.7		2.7		2.7		2.7							
			Mn				2.3		2.3		2.3		2.3							
			Mmax				8.0		4.5		7.3		8.0							
	3.7	075 E3 C 30	Mo					3.5		3.7	3.7		3.7		3.7					
			Mn					3.1		3.3	3.3		3.3		3.3					
			Mmax					8.8		11.2	7.3		9.3		11.2					
	4.7	075 E3 D 30	Mo							4.7		4.7		4.6	4.7	4.7				
			Mn							4.2		4.2		4.1	4.2	4.2				
			Mmax							12.6		14.0		9.3	12.3	14.0				
4,000	1.4	075 E3 A 40	Mo			1.4	1.4		1.4		1.4		1.4							
			Mn			1.2	1.2		1.2		1.2		1.2							
			Mmax			2.8	4.3		3.4		4.3		4.3							
	2.7	075 E3 B 40	Mo				2.7			2.7	2.7		2.7		2.7					
			Mn				2.1			2.1	2.1		2.1		2.1					
			Mmax				6.7			8.0	5.5		7.0		8.0					
	3.7	075 E3 C 40	Mo							3.7		3.7			3.7	3.7				
			Mn							2.8		2.8			2.8	2.8				
			Mmax							9.5		11.2			9.2	11.2				
	4.7	075 E3 D 40	Mo									4.7				4.7	4.7			
			Mn									3.8				3.8	3.8			
			Mmax									13.3				11.2	14.0			
6,000	1.4	075 E3 A 60	Mo				1.4				1.4		1.4							
			Mn				1.1				1.1		1.1							
			Mmax				4.3				3.7		4.3							
	2.7	075 E3 B 60	Mo									2.7			2.7	2.7	2.7			
			Mn									1.9			1.9	1.9	1.9			
			Mmax									8.0			6.2	7.5	8.0			
	3.7	075 E3 C 60	Mo													3.7	3.7		3.7	
			Mn													2.8	2.8		2.8	
			Mmax													7.5	10.0		11.2	
	4.7	075 E3 D 60	Mo															4.7	4.7	4.7
			Mn															3.4	3.4	3.4
			Mmax															10.0	12.9	14.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

095 E3

Drive part number				DST1201 3Ph	DST1202 1Ph	DST1202 3Ph	DST1203 1Ph	DST1203 3Ph		DST1204 1Ph		DST1204 3Ph	M700-03200050 A		M700-03200066A		M700-03200080 A	
Drive switching frequency				8	12	12	12	12	6	12	8	12	12	3	12	8	12	6
Rated drive current				1.7	2.4	3.8	2.9	5.4	5.4	4.7	4.7	7.6	5.0	5.0	6.6	6.6	8.0	8.0
Drive output maximal current				4.3	4.0	9.5	4.8	13.5	13.5	7.8	7.8	19.0	10.0	10.0	13.2	13.2	16.0	16.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**															
2,000	2.5	095 E3 A 20	Mo	2.4	2.5	2.5	2.5			2.5			2.5					
			Mn	2.3	2.4	2.4	2.4			2.4			2.4					
			Mmax	6.0	5.6	7.4	6.7			7.4			7.4					
	4.5	095 E3 B 20	Mo			4.5		4.5		4.5			4.5					
			Mn			4.3		4.3		4.3			4.3					
			Mmax			13.3		13.5		10.9			13.5					
	6.3	095 E3 C 20	Mo					6.3		6.3			6.3		6.3		6.3	
			Mn					5.9		5.9			5.9		5.9		5.9	
			Mmax					18.9		10.9			14.0		18.5		18.9	
	7.9	095 E3 D 20	Mo						7.4			7.9		7.0	7.9		7.9	
			Mn						6.8			7.3		6.4	7.3		7.3	
			Mmax						18.9			23.7		14.0	18.5		22.4	
	9.3	095 E3 E 20	Mo									9.3				9.0	9.3	
			Mn									8.5				8.2	8.5	
			Mmax									26.6				18.5	22.4	
3,000	2.5	095 E3 A 30	Mo			2.5	2.5			2.5			2.5					
			Mn			2.3	2.3			2.3			2.3					
			Mmax			7.4	4.5			7.3			7.4					
	4.5	095 E3 B 30	Mo					4.5			4.4	4.5	4.5		4.5		4.5	
			Mn					4.1			4.0	4.1	4.1		4.1		4.1	
			Mmax					12.6			7.3	13.5	9.3		12.3		13.5	
	6.3	095 E3 C 30	Mo									6.3				6.1	6.3	
			Mn									5.6				5.4	5.6	
			Mmax									17.7				12.3	14.9	
	7.9	095 E3 D 30	Mo															7.4
			Mn															6.4
			Mmax															14.9
	9.3	095 E3 E 30	Mo															
			Mn															
			Mmax															
4,000	2.5	095 E3 A 40	Mo			2.5		2.5		2.5			2.5		2.5			
			Mn			2.3		2.3		2.3			2.3		2.3			
			Mmax			6.7		7.4		5.5			7.0		7.4			
	4.5	095 E3 B 40	Mo									4.5			4.5		4.5	
			Mn									3.8			3.8		3.8	
			Mmax									13.3			9.2		11.2	
	6.3	095 E3 C 40	Mo															
			Mn															
			Mmax															
	7.9	095 E3 D 40	Mo															
			Mn															
			Mmax															
	9.3	095 E3 E 40	Mo															
			Mn															
			Mmax															
6,000	2.5	095 E3 A 60	Mo					2.5				2.5			2.5		2.5	
			Mn					2.0				2.0			2.0		2.0	
			Mmax					6.4				7.4			6.2		7.4	
	4.5	095 E3 B 60	Mo															
			Mn															
			Mmax															
	6.3	095 E3 C 60	Mo															
			Mn															
			Mmax															
	7.9	095 E3 D 60	Mo															
			Mn															
			Mmax															
	9.3	095 E3 E 60	Mo															
			Mn															
			Mmax															

	M700-03200106A		M700-04200137A	M700-04200185A		M700-05200250 A	M700-06200330 A
	12	8	12	12	6	12	12
	8.8	10.6	13.7	17.6	18.5	21.5	32.0
	21.2	21.2	27.4	37.0	37.0	50.0	66.0
	7.9						
	7.3						
	23.7						
	9.3						
	8.5						
	27.8						
	6.3						
	5.6						
	18.9						
	7.9		7.9				
	6.9		6.9				
	19.7		23.7				
		9.0	9.3	9.3			
		7.9	8.2	8.2			
		19.7	25.5	27.8			
	4.5						
	3.8						
	13.5						
		6.3	6.3				
		5.3	5.3				
		14.8	18.9				
			7.9	7.9			
			6.4	6.4			
			19.2	23.7			
			9.3	9.3		9.3	
			7.4	7.4		7.4	
			19.2	25.9		27.8	
		4.5	4.5	4.5			
		3.2	3.2	3.2			
		10.0	12.9	13.5			
			6.3	6.3		6.3	
			4.2	4.2		4.2	
			12.9	17.4		18.9	
				7.9		7.9	7.9
				0.0		0.0	0.0
				17.4		23.5	23.7
					8.6	9.3	9.3
					0.0	0.0	0.0
					17.4	23.5	27.8

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

115 E3

Drive part number				DST1202 3Ph	DST1203 1Ph	DST1203 3Ph	DST1204 1Ph	DST1204 3Ph			M700-03200050 A		M700-03200066A	M700-03200080 A	M700-03200106A			
Drive switching frequency				12	12	12	12	12	8	6	12	6	12	12	12	8	6	4
Rated drive current				3.8	2.9	5.4	4.7	7.6	7.6	7.6	5.0	5.0	6.6	8.0	8.8	10.6	10.6	10.6
Drive output maximal current				9.5	4.8	13.5	7.8	19.0	19.0	19.0	10.0	10.0	13.2	16.0	21.2	21.2	21.2	21.2
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**															
2,000	3.9	115 E3 A 20	Mo	3.9	3.9		3.9				3.9							
			Mn	3.7	3.7		3.7				3.7							
			Mmax	11.7	6.7		10.9				11.7							
	7.4	115 E3 B 20	Mo			7.4		7.4				6.9	7.4	7.4				
			Mn			7.3		7.3				6.8	7.3	7.3				
			Mmax			18.9		22.2				14.0	18.5	22.2				
	10.8	115 E3 C 20	Mo						10.5					10.8	10.8			
			Mn						9.8					10.1	10.1			
			Mmax						26.6					22.4	29.7			
	13.7	115 E3 D 20	Mo													13.0		
			Mn													11.3		
			Mmax													29.7		
	16.0	115 E3 E 20	Mo														14.4	
			Mn														12.7	
			Mmax														29.7	
3,000	3.9	115 E3 A 30	Mo			3.9	3.9				3.9		3.9					
			Mn			3.5	3.5				3.5		3.5					
			Mmax			11.7	7.3				9.3		11.7					
	7.4	115 E3 B 30	Mo							6.9				7.4	7.4			
			Mn							6.2				6.7	6.7			
			Mmax							17.7				14.9	19.7			
	10.8	115 E3 C 30	Mo															9.8
			Mn															8.6
			Mmax															19.7
	13.7	115 E3 D 30	Mo															
			Mn															
			Mmax															
	16.0	115 E3 E 30	Mo															
			Mn															
			Mmax															
4,000	3.9	115 E3 A 40	Mo					3.9					3.9	3.9	3.9			
			Mn					3.0					3.0	3.0	3.0			
			Mmax					11.7					9.2	11.2	11.7			
	7.4	115 E3 B 40	Mo													7.4		
			Mn													5.8		
			Mmax													14.8		
	10.8	115 E3 C 40	Mo															
			Mn															
			Mmax															
	13.7	115 E3 D 40	Mo															
			Mn															
			Mmax															
	16.0	115 E3 E 40	Mo															
			Mn															
			Mmax															
6,000	3.9	115 E3 A 60	Mo												3.9			
			Mn												2.7			
			Mmax												10.0			
	7.4	115 E3 B 60	Mo															
			Mn															
			Mmax															

	M700-04200137A		M700-04200185A	M700-05200250 A		M700-06200330 A	M700-06200440 A
	12	6	12	12	8	12	12
	13.7	13.7	17.6	21.5	24.8	32.0	33.0
	27.4	27.4	37.0	50.0	50.0	66.0	88.0
	10.8						
	10.1						
	32.4						
	13.7		13.7				
	11.9		11.9				
	38.4		41.0				
	16.0		16.0				
	14.1		14.1				
	38.4		48.0				
	7.4						
	6.7						
	22.2						
	10.8		10.8				
	9.5		9.5				
	25.5		32.4				
		12.3	13.7	13.7			
		10.1	11.2	11.2			
		25.5	34.4	41.0			
			16.0	16.0		16.0	
			12.7	12.7		12.7	
			34.4	46.5		48.0	
	7.4		7.4				
	5.8		5.8				
	19.2		22.2				
			10.8	10.8			
			7.5	7.5			
			25.9	32.4			
				13.7		13.7	
				8.3		8.3	
				35.0		41.0	
					16.0	16.0	16.0
					8.8	8.8	8.8
					35.0	46.2	48.0
	3.9						
	2.7						
	11.7						
			7.4	7.4			
			5.0	5.0			
			17.4	22.2			

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

142 E3

Drive part number				DST1203 3Ph	DST1204 1Ph	DST1204 3Ph		M700-03200050 A	M700-03200066A		M700-03200080 A	M700-03200106A				M700-04200137A	
Drive switching frequency				12	12	12	6	12	12	8	12	12	8	6	3	12	6
Rated drive current				5.4	4.7	7.6	7.6	5.0	6.6	6.6	8.0	8.8	10.6	10.6	10.6	13.7	13.7
Drive output maximal current				13.5	7.8	19.0	19.0	10.0	13.2	13.2	16.0	21.2	21.2	21.2	21.2	27.4	27.4
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**														
2,000	6.2	142 E3 A 20	Mo	6.2	6.2			6.2	6.2		6.2						
			Mn	5.9	5.9			5.9	5.9		5.9						
			Mmax	18.6	10.9			14.0	18.5		18.6						
	11.0	142 E3 B 20	Mo				10.3				11.0	11.0				11.0	
			Mn				9.8				10.4	10.4				10.4	
			Mmax				26.6				22.4	29.7				33.0	
	15.7	142 E3 C 20	Mo											14.8		15.7	
			Mn											13.8		14.7	
			Mmax											29.7		38.4	
	20.5	142 E3 D 20	Mo														18.2
			Mn														16.5
			Mmax														38.4
	25.0	142 E3 E 20	Mo														
			Mn														
			Mmax														
3,000	6.2	142 E3 A 30	Mo			6.2				6.0	6.2	6.2					
			Mn			5.5				5.3	5.5	5.5					
			Mmax			17.7				12.3	14.9	18.6					
	11.0	142 E3 B 30	Mo												9.6	11.0	
			Mn												8.3	9.5	
			Mmax												19.7	25.5	
	15.7	142 E3 C 30	Mo														
			Mn														
			Mmax														
	20.5	142 E3 D 30	Mo														
			Mn														
			Mmax														
	25.0	142 E3 E 30	Mo														
			Mn														
			Mmax														
4,000	6.2	142 E3 A 40	Mo										6.2			6.2	
			Mn										4.1			4.1	
			Mmax										14.8			18.6	
	11.0	142 E3 B 40	Mo														
			Mn														
			Mmax														
	15.7	142 E3 C 40	Mo														
			Mn														
			Mmax														
	20.5	142 E3 D 40	Mo														
			Mn														
			Mmax														
	25.0	142 E3 E 40	Mo														
			Mn														
			Mmax														

	M700-04200185A			M700-05200250 A			M700-06200330 A	M700-06200440 A		M700-07200610 A
	12	8	3	12	8	6	12	12	8	12
	17.6	18.5	18.5	21.5	24.8	25.0	32.0	33.0	40.0	61.0
	37.0	37.0	37.0	50.0	50.0	50.0	66.0	88.0	88.0	122.0
	15.7									
	14.7									
	47.1									
	20.5			20.5						
	18.5			18.5						
	51.8			61.5						
		24.0		25.0			25.0			
		20.6		21.5			21.5			
		51.8		70.0			75.0			
	11.0									
	9.5									
	33.0									
	15.7			15.7			15.7			
	12.8			12.8			12.8			
	34.4			46.5			47.1			
			16.6		19.7		20.5	20.5		
			13.0		15.4		16.0	16.0		
			34.4		46.5		61.4	61.5		
						22.3	25.0	25.0		
						16.2	18.2	18.2		
						46.5	61.4	75.0		
	11.0			11.0						
	8.1			8.1						
	25.9			33.0						
					15.7		15.7	15.7		
					10.2		10.2	10.2		
					35.0		46.2	47.1		
							20.5	20.5		
							12.2	12.2		
							46.2	61.5		
									25.0	25.0
									14.0	14.0
									61.6	75.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

190 E3

Drive part number				M700-03200080 A	M700-03200106A	M700-04200137A	M700-04200185A		M700-05200250 A		M700-06200330 A		M700-06200440 A		M700-07200610 A	M700-07200750 A
Drive switching frequency				6	12	12	12	6	12	8	12	8	12	8	12	12
Rated drive current				8.0	8.8	13.7	17.6	18.5	21.5	24.8	32.0	33.0	33.0	40.0	61.0	65.3
Drive output maximal current				16.0	21.2	27.4	37.0	37.0	50.0	50.0	66.0	66.0	88.0	88.0	122.0	150.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**													
2,000	11.3	190 E3 A 20	Mo	11.2	11.3	11.3										
			Mn	10.7	10.8	10.8										
			Mmax	22.4	29.7	33.8										
	22.5	190 E3 B 20	Mo				22.5		22.5							
			Mn				20.6		20.6							
			Mmax				51.8		67.5							
	33.5	190 E3 C 20	Mo					25.8		30.2	33.5		33.5			
			Mn					22.6		26.5	29.4		29.4			
			Mmax					51.8		70.0	92.4		101.0			
3,000	11.3	190 E3 A 30	Mo			11.3	11.3									
			Mn			10.3	10.3									
			Mmax			25.5	33.8									
	22.5	190 E3 B 30	Mo							22.5	22.5		22.5			
			Mn							19.4	19.4		19.4			
			Mmax							46.5	61.4		67.5			
	33.5	190 E3 C 30	Mo									30.2		30.2	33.5	
			Mn									23.9		23.9	26.5	
			Mmax									61.4		81.8	101.0	
4,000	11.3	190 E3 A 40	Mo				11.3		11.3							
			Mn				8.2		8.2							
			Mmax				25.9		33.8							
	22.5	190 E3 B 40	Mo									22.5	22.5		22.5	
			Mn									18.2	18.2		18.2	
			Mmax									46.2	61.6		67.5	
	33.5	190 E3 C 40	Mo												33.5	33.5
			Mn												23.0	23.0
			Mmax												85.4	101.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

075 U3

Drive part number				DST1401 3Ph		DST1402 3Ph	DST1403 3Ph		DST1404 3Ph		DST1405 3Ph	M700-03400025A	M700-03400031A	M700-03400045A	M700-03400062A			M700-03400078A		M700-03400100 A
Drive switching frequency				12	6	12	12	8	8	6	6	12	12	12	12	8	6	12	8	8
Rated drive current				1.5	1.5	2.7	3.8	4.0	5.0	5.9	6.0	2.5	3.1	4.5	4.5	5.8	6.2	5.7	7.6	7.7
Drive output maximal current				3.8	3.8	6.8	10.0	10.0	14.8	14.8	20.0	5.0	6.2	9.0	12.4	12.4	12.4	15.6	15.6	20.0
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																	
2,000	1.4	075 U3 A 20	Mo	1.4								1.4								
			Mn	1.3								1.3								
			Mmax	4.3								4.3								
	2.7	075 U3 B 20	Mo	2.7								2.7								
			Mn	2.5								2.5								
			Mmax	8.0								8.0								
	3.7	075 U3 C 20	Mo		3.5	3.7						3.7								
			Mn		3.3	3.5						3.5								
			Mmax		9.1	11.2						11.2								
	4.7	075 U3 D 20	Mo			4.7						4.7	4.7							
			Mn			4.5						4.5	4.5							
			Mmax			14.0						12.0	14.0							
3,000	1.4	075 U3 A 30	Mo	1.4								1.4								
			Mn	1.3								1.3								
			Mmax	4.3								4.3								
	2.7	075 U3 B 30	Mo			2.7						2.7								
			Mn			2.3						2.3								
			Mmax			8.0						8.0								
	3.7	075 U3 C 30	Mo			3.7	3.7					3.7	3.7	3.7						
			Mn			3.3	3.3					3.3	3.3	3.3						
			Mmax			10.9	11.2					8.0	9.9	11.2						
	4.7	075 U3 D 30	Mo				4.7						4.7	4.7						
			Mn				4.2						4.2	4.2						
			Mmax				14.0						9.9	14.0						
4,000	1.4	075 U3 A 40	Mo	1.4								1.4								
			Mn	1.2								1.2								
			Mmax	4.3								4.3								
	2.7	075 U3 B 40	Mo			2.7						2.7	2.7	2.7						
			Mn			2.1						2.1	2.1	2.1						
			Mmax			8.0						6.0	7.4	8.0						
	3.7	075 U3 C 40	Mo				3.7						3.7	3.7	3.7					
			Mn				2.8						2.8	2.8	2.8					
			Mmax				11.2						7.4	10.8	11.2					
	4.7	075 U3 D 40	Mo					4.7	4.7					4.7	4.7					
			Mn					3.8	3.8					3.8	3.8					
			Mmax					12.0	14.0					10.8	14.0					
6,000	1.4	075 U3 A 60	Mo			1.4						1.4	1.4							
			Mn			1.1						1.1	1.1							
			Mmax			4.3						4.0	4.3							
	2.7	075 U3 B 60	Mo				2.7							2.7	2.7					
			Mn				1.9							1.9	1.9					
			Mmax				8.0							7.2	8.0					
	3.7	075 U3 C 60	Mo						3.7							3.7		3.7		
			Mn						2.8							2.8		2.8		
			Mmax						11.2							9.9		11.2		
	4.7	075 U3 D 60	Mo							4.7	4.7						4.7		4.7	4.7
			Mn							3.4	3.4						3.4		3.4	3.4
			Mmax							11.8	14.0						9.9		12.5	14.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

095 U3

Drive part number				DST1401 3Ph		DST1402 3Ph		DST1403 3Ph		DST1404 3Ph		DST1405 3Ph	M700-03400025A			M700-03400031A		
Drive switching frequency				12	8	12	6	12	8	8	6	6	12	6	3	12	6	
Rated drive current				1.5	1.5	2.7	2.7	3.8	4.0	5.0	5.9	6.0	2.5	2.5	2.5	3.1	3.1	
Drive output maximal current				3.8	3.8	6.8	6.8	10.0	10.0	14.8	14.8	20.0	5.0	5.0	5.0	6.2	6.2	
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**															
2,000	2.5	095 U3 A 20	Mo	2.5									2.5					
			Mn	2.4									2.4					
			Mmax	7.4									7.4					
	4.5	095 U3 B 20	Mo			4.5							4.5			4.5		
			Mn			4.3							4.3			4.3		
			Mmax			13.5							12.0			13.5		
	6.3	095 U3 C 20	Mo			6.3		6.3						5.9		6.3		
			Mn			5.9		5.9						5.4		5.9		
			Mmax			16.3		18.9						12.0		14.9		
	7.9	095 U3 D 20	Mo					7.9									7.4	
			Mn					7.3									6.8	
			Mmax					23.7									14.9	
	9.3	095 U3 E 20	Mo						9.0	9.0								
			Mn						8.2	8.2								
			Mmax						24.0	27.8								
3,000	2.5	095 U3 A 30	Mo		2.4	2.5							2.5					
			Mn		2.3	2.3							2.3					
			Mmax		6.1	7.4							7.4					
	4.5	095 U3 B 30	Mo				4.2	4.5							4.0	4.5		
			Mn				3.8	4.1							3.6	4.1		
			Mmax				10.9	13.5							8.0	9.9		
	6.3	095 U3 C 30	Mo						6.1	6.1								
			Mn						5.4	5.4								
			Mmax						16.0	18.9								
	7.9	095 U3 D 30	Mo							7.7								
			Mn							6.7								
			Mmax							23.7								
	9.3	095 U3 E 30	Mo								8.6	8.6						
			Mn								7.6	7.6						
			Mmax								23.7	27.8						
4,000	2.5	095 U3 A 40	Mo			2.5							2.5			2.5		
			Mn			2.3							2.3			2.3		
			Mmax			7.4							6.0			7.4		
	4.5	095 U3 B 40	Mo					4.5		4.5								
			Mn					3.8		3.8								
			Mmax					12.0		13.5								
	6.3	095 U3 C 40	Mo								6.3	6.3						
			Mn								5.3	5.3						
			Mmax								17.8	18.9						
	7.9	095 U3 D 40	Mo															
			Mn															
			Mmax															
	9.3	095 U3 E 40	Mo															
			Mn															
			Mmax															
6,000	2.5	095 U3 A 60	Mo					2.5								2.5		
			Mn					2.0								2.0		
			Mmax					7.4								5.0		
	4.5	095 U3 B 60	Mo								4.5	4.5						
			Mn								3.2	3.2						
			Mmax								11.8	13.5						
	6.3	095 U3 C 60	Mo															
			Mn															
			Mmax															

	M700-03400045A		M700-03400062A		M700-03400078A			M700-03400100 A			M700-04400150 A
	12	4	12	8	12	8	6	12	8	6	12
	4.5	4.5	4.5	5.8	5.7	7.6	7.8	5.7	7.7	9.2	11.5
	9.0	9.0	12.4	12.4	15.6	15.6	15.6	20.0	20.0	20.0	30.0
	6.3										
	5.9										
	18.9										
	7.9		7.9								
	7.3		7.3								
	21.6		23.7								
	9.3		9.3								
	8.5		8.5								
	21.6		27.8								
	4.5										
	4.1										
	13.5										
	6.3		6.3								
	5.6		5.6								
	14.4		18.9								
		7.2		7.7	7.9						
		6.3		6.7	6.9						
		14.4		19.8	23.7						
				9.0		9.0			9.0		9.3
				7.9		7.9			7.9		8.2
				19.8		25.0			27.8		27.8
	4.5		4.5								
	3.8		3.8								
	10.8		13.5								
				6.3	6.3			6.3			
				5.3	5.3			5.3			
				14.9	18.7			18.9			
						7.9			7.9		
						6.4			6.4		
						18.7			23.7		
							9.3			9.3	9.3
							7.4			7.4	7.4
							18.7			24.0	27.8
	2.5		2.5								
	2.0		2.0								
	7.2		7.4								
				4.5	4.5			4.5			
				3.2	3.2			3.2			
				9.9	12.5			13.5			
										6.3	6.3
										4.2	4.2
										16.0	18.9

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

115 U3

Drive part number				DST1402 3Ph	DST1403 3Ph	DST1404 3Ph		DST1405 3Ph	M700-03400025A	M700-03400031A	M700-03400045A		M700-03400062A				M700-03400078A		
Drive switching frequency				12	12	8	6	6	12	12	12	8	12	8	6	4	12	8	6
Rated drive current				2.7	3.8	5.0	5.9	6.0	2.5	3.1	4.5	4.5	4.5	5.8	6.2	6.2	5.7	7.6	7.8
Drive output maximal current				6.8	10.0	14.8	14.8	20.0	5.0	6.2	9.0	9.0	12.4	12.4	12.4	12.4	15.6	15.6	15.6
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																
2,000	3.9	115 U3 A 20	Mo	3.9					3.9										
			Mn	3.7					3.7										
			Mmax	11.7					11.7										
	7.4	115 U3 B 20	Mo		7.4					7.4	7.4		7.4						
			Mn		7.3					7.3	7.3		7.3						
			Mmax		22.2					14.9	21.6		22.2						
	10.8	115 U3 C 20	Mo			10.5						10.5		10.5			10.8		
			Mn			9.8						9.8		9.8			10.1		
			Mmax			32.4						21.6		29.8			32.4		
	13.7	115 U3 D 20	Mo				12.3	12.3						13.0			13.7		
			Mn				10.7	10.7						11.3			11.9		
			Mmax				35.5	41.0						29.8			37.4		
	16.0	115 U3 E 20	Mo					14.4							14.4			15.2	
			Mn					12.7							12.7			13.4	
			Mmax					48.0							29.8			37.4	
3,000	3.9	115 U3 A 30	Mo	3.9	3.9				3.9	3.9	3.9								
			Mn	3.5	3.5				3.5	3.5	3.5								
			Mmax	10.9	11.7				8.0	9.9	11.7								
	7.4	115 U3 B 30	Mo			7.2						7.2		7.2			7.4		
			Mn			6.5						6.5		6.5			6.7		
			Mmax			22.2						14.4		19.8			22.2		
	10.8	115 U3 C 30	Mo													9.8		10.5	
			Mn													8.6		9.2	
			Mmax													19.8		25.0	
	13.7	115 U3 D 30	Mo																12.3
			Mn																10.1
			Mmax																25.0
	16.0	115 U3 E 30	Mo																
			Mn																
			Mmax																
4,000	3.9	115 U3 A 40	Mo		3.9						3.9		3.9						
			Mn		3.0						3.0		3.0						
			Mmax		11.7						10.8		11.7						
	7.4	115 U3 B 40	Mo												7.4			7.4	
			Mn												5.8			5.8	
			Mmax												14.9			18.7	
	10.8	115 U3 C 40	Mo																
			Mn																
			Mmax																
	13.7	115 U3 D 40	Mo																
			Mn																
			Mmax																
	16.0	115 U3 E 40	Mo																
			Mn																
			Mmax																
6,000	3.9	115 U3 A 60	Mo			3.9								3.9			3.9		
			Mn			2.7								2.7			2.7		
			Mmax			11.7								9.9			11.7		
	7.4	115 U3 B 60	Mo																
			Mn																
			Mmax																

	M700-03400100 A				M700-04400150 A		M700-04400172A		M700-05400270 A	
	12	8	6	4	12	8	12	8	12	
	5.7	7.7	9.2	10.0	11.5	14.4	11.5	14.4	13.8	
	20.0	20.0	20.0	20.0	30.0	30.0	34.4	34.4	54.0	
	13.7									
	11.9									
	41.0									
		15.2			16.0					
		13.4			14.1					
		48.0			48.0					
		10.5			10.8					
		9.2			9.5					
		32.0			32.4					
			12.3		13.7					
			10.1		11.2					
			32.0		41.0					
			14.4		16.0					
			11.4		12.7					
			32.0		48.0					
		7.4								
		5.8								
		22.2								
			10.8		10.8					
			7.5		7.5					
			24.0		32.4					
					13.7		13.7			
					8.3		8.3			
					36.0		41.0			
						16.0		16.0	16.0	
						8.8		8.8	8.8	
						36.0		41.3	48.0	
				7.4	7.4					
				5.0	5.0					
				16.0	22.2					

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

142 U3

Drive part number				DST1402 3Ph	DST1403 3Ph		DST1404 3Ph		DST1405 3Ph	M700-03400025A	M700-03400031A	M700-03400045A		M700-03400062A			
Drive switching frequency				12	12	8	8	6	6	6	12	12	8	12	8	6	3
Rated drive current				2.7	3.8	4.0	5.0	5.9	6.0	2.5	3.1	4.5	4.5	4.5	5.8	6.2	6.2
Drive output maximal current				6.8	10.0	10.0	14.8	14.8	20.0	5.0	6.2	9.0	9.0	12.4	12.4	12.4	12.4
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**														
2,000	6.2	142 U3 A 20	Mo	6.2	6.2					5.8	6.2	6.2					
			Mn	5.9	5.9					5.5	5.9	5.9					
			Mmax	16.3	18.6					12.0	14.9	18.6					
	11.0	142 U3 B 20	Mo				10.7						10.7		10.7		
			Mn				10.1						10.1		10.1		
			Mmax				33.0						21.6		29.8		
	15.7	142 U3 C 20	Mo													14.8	
			Mn													13.8	
			Mmax													29.8	
	20.5	142 U3 D 20	Mo														
			Mn														
			Mmax														
	25.0	142 U3 E 20	Mo														
			Mn														
			Mmax														
3,000	6.2	142 U3 A 30	Mo			6.0	6.0					6.2		6.2			
			Mn			5.3	5.3					5.5		5.5			
			Mmax			16.0	18.6					14.4		18.6			
	11.0	142 U3 B 30	Mo														9.6
			Mn														8.3
			Mmax														19.8
	15.7	142 U3 C 30	Mo														
			Mn														
			Mmax														
	20.5	142 U3 D 30	Mo														
			Mn														
			Mmax														
	25.0	142 U3 E 30	Mo														
			Mn														
			Mmax														
4,000	6.2	142 U3 A 40	Mo					6.2	6.2						6.2		
			Mn					4.1	4.1						4.1		
			Mmax					17.8	18.6						14.9		
	11.0	142 U3 B 40	Mo														
			Mn														
			Mmax														
	15.7	142 U3 C 40	Mo														
			Mn														
			Mmax														
	20.5	142 U3 D 40	Mo														
			Mn														
			Mmax														
	25.0	142 U3 E 40	Mo														
			Mn														
			Mmax														
6,000	6.2	142 U3 A 60	Mo														
			Mn														
			Mmax														
	11.0	142 U3 B 60	Mo														
			Mn														
			Mmax														

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

	M700-03400078A			M700-03400100 A			M700-04400150 A			M700-04400172A				M700-05400270 A			M700-05400300 A	M700-06400350 A
	12	8	6	8	6	4	12	8	6	12	8	6	4	12	8	4	8	12
	5.7	7.6	7.8	7.7	9.2	10.0	11.5	14.4	15.0	11.5	14.4	16.1	17.2	13.8	17.6	23.7	21.0	23.0
	15.6	15.6	15.6	20.0	20.0	20.0	30.0	30.0	30.0	34.4	34.4	34.4	34.4	54.0	54.0	54.0	66.0	70.0
	11.0																	
	10.4																	
	33.0																	
		15.2		15.2			15.7											
		14.3		14.3			14.7											
		37.4		47.1			47.1											
			18.2		18.2		20.5											
			16.5		16.5		18.5											
			37.4		48.0		61.5											
						21.5	25.0			25.0								
						18.5	21.5			21.5								
						48.0	72.0			75.0								
		10.7		10.7			11.0											
		9.2		9.2			9.5											
		25.0		32.0			33.0											
						14.3	15.7											
						11.6	12.8											
						32.0	47.1											
								19.7			19.7			20.5				
								15.4			15.4			16.0				
								48.0			55.0			61.5				
									22.3			22.3			24.0			25.0
									16.2			16.2			17.5			18.2
									48.0			55.0			75.0			75.0
	6.2																	
	4.1																	
	18.6																	
					11.0		11.0											
					8.1		8.1											
					24.0		33.0											
								15.7			15.7			15.7				
								10.2			10.2			10.2				
								36.0			41.3			47.1				
													20.5		20.5			
													12.2		12.2			
													41.3		61.5			
																25.0	25.0	
																14.0	14.0	
																64.8	75.0	
			6.2		6.2		6.2											
			3.2		3.2		3.2											
			12.5		16.0		18.6											
								11.0			11.0			11.0				
								5.2			5.2			5.2				
								24.0			27.5			33.0				

190 U3

Drive part number				DST1404 3Ph	M700-03400062A	M700-03400078A		M700-03400100 A		M700-04400150 A		M700-04400172A	M700-05400270 A		M700-05400300 A	M700-06400350 A		M700-06400420 A	
Drive switching frequency				8	8	12	8	8	4	12	8	8	8	6	8	12	8	8	
Rated drive current				5.0	5.8	5.7	7.6	7.7	10.0	11.5	14.4	14.4	17.6	20.3	21.0	23.0	30.0	30.0	
Drive output maximal current				14.8	12.4	15.6	15.6	20.0	20.0	30.0	30.0	34.4	54.0	54.0	66.0	70.0	70.0	84.0	
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**																
2,000	11.3	190 U3 A 20	Mo	11.3	11.3	11.3													
			Mn	10.8	10.8	10.8													
			Mmax	33.8	29.8	33.8													
	22.5	190 U3 B 20	Mo						22.3	22.5									
			Mn						20.4	20.6									
			Mmax						48.0	67.5									
	33.5	190 U3 C 20	Mo								30.2	30.2	30.2			33.5			
			Mn								26.5	26.5	26.5			29.4			
			Mmax								72.0	82.6	101.0			101.0			
3,000	11.3	190 U3 A 30	Mo				11.3	11.3		11.3									
			Mn				10.3	10.3		10.3									
			Mmax				25.0	32.0		33.8									
	22.5	190 U3 B 30	Mo								22.5	22.5	22.5						
			Mn								19.4	19.4	19.4						
			Mmax								48.0	55.0	67.5						
	33.5	190 U3 C 30	Mo											25.8	30.2	33.5			
			Mn											20.4	23.9	26.5			
			Mmax											86.4	101.0	101.0			
4,000	11.3	190 U3 A 40	Mo						11.3	11.3									
			Mn						8.2	8.2									
			Mmax						24.0	33.8									
	22.5	190 U3 B 40	Mo											22.5	22.5				
			Mn											18.2	18.2				
			Mmax											64.8	67.5				
	33.5	190 U3 C 40	Mo														33.5	33.5	
			Mn														23.0	23.0	
			Mmax														84.0	101.0	

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

Case Study 4 - Emerson servo motors and drives at the heart of printing, converting and finishing machines from Rotary Logic Systems

Rotary Logic Systems creates bespoke systems for various high speed printing applications.

The challenge

Rotary Logic Systems supplies both stand-alone machines and modules to suit all applications in the converting and finishing industries. The company needed a servo solution for a six line, multi-stage anti-counterfeit machine for packaging, incorporating high precision application of a hot-foil hologram. Alan Chandler, the company's director, says: "We need drives that are flexible in operation, straight forward to program and with very fast response– that's why we use mainly Digitax ST Plus servo-drives from Control Techniques".

The solution

The lines each comprise unwind and in-feed, foiling, flying head die-cutting, flexographic printing, out-feed and rewind. Digitax ST Plus servo drives twinned with Unimotor fm servo motors control the feeds and various other processes.

The Benefits

- Flexible operation
- Straightforward programming
- Very fast response

250 U3

Drive part number				M700-04400172A	M700-05400270 A		M700-05400300 A			M700-06400350 A				M700-06400420 A			
Drive switching frequency				4	8	4	6	4	3	12	8	6	4	8	6	4	
Rated drive current				17.2	17.6	23.7	24.0	27.9	30.0	23.0	30.0	35.0	35.0	30.0	35.0	42.0	
Drive output maximal current				34.4	54.0	54.0	66.0	66.0	66.0	70.0	70.0	70.0	70.0	84.0	84.0	84.0	
Rated motor speed	**Motor stall torque**	**Motor type**	**Combined drive and motor performance**														
1,000	92.0	250 U3 D 10	Mo	82.8	90.2					92.0							
			Mn	67.5	73.5					75.0							
			Mmax	184.0	276.0					276.0							
	116.0	250 U3 E 10	Mo			104.0	109.0			116.0							
			Mn			82.8	86.5			92.0							
			Mmax			289.0	348.0			348.0							
	136.0	250 U3 F 10	Mo			122.0	128.0				133.0			133.0			
			Mn			95.4	99.6				103.9			103.9			
			Mmax			289.0	353.0				375.0			408.0			
1,500	92.0	250 U3 D 15	Mo			82.8		82.8			90.2			90.2			
			Mn			60.3		60.3			65.7			65.7			
			Mmax			193.0		236.0			250.0			276.0			
	116.0	250 U3 E 15	Mo						102.0			109.0			109.0		
			Mn						66.9			71.4			71.4		
			Mmax						236.0			250.0			300.0		
	136.0	250 U3 F 15	Mo										122.0			122.0	
			Mn										75.6			75.6	
			Mmax										250.0			300.0	
2,000	92.0	250 U3 D 20	Mo									86.5			86.5		
			Mn									61.1			61.1		
			Mmax									187.0			224.0		
	116.0	250 U3 E 20	Mo													104.0	
			Mn													65.7	
			Mmax													224.0	
	136.0	250 U3 F 20	Mo														
			Mn														
			Mmax														
2,500	92.0	250 U3 D 25	Mo													82.8	
			Mn													55.8	
			Mmax													180.0	
	116.0	250 U3 E 25	Mo														
			Mn														
			Mmax														
	136.0	250 U3 F 25	Mo														
			Mn														
			Mmax														

	M700-06400470 A			M700-07400660 A				M700-07400770 A				M700-07401000 A		M700-08401340 A
6	4	3	12	8	6	4	12	8	6	4	8	6	12
35.0	42.0	46.0	41.0	48.0	57.0	66.0	44.0	51.0	59.0	70.0	61.0	73.0	72.0
94.0	94.0	94.0	132.0	132.0	132.0	132.0	154.0	154.0	154.0	154.0	200.0	200.0	268.0
			136.0										
			106.0										
			408.0										
			92.0										
			67.0										
			276.0										
109.0			116.0										
71.4			76.0										
336.0			348.0										
	122.0		136.0										
	75.6		84.0										
	336.0		408.0										
86.5			92.0										
61.1			65.0										
251.0			276.0										
	104.0			114.0			116.0						
	65.7			71.5			73.0						
	251.0			348.0			348.0						
		120.0			128.0			133.0					136.0
		71.3			76.1			79.4					81.0
		251.0			352.0			408.0					408.0
	82.8			90.2			92.0						
	55.8			60.8			62.0						
	201.0			276.0			276.0						
					109.0				109.0		114.0		116.0
					65.8				65.8		68.6		70.0
					282.0				330.0		348.0		348.0
						122.0				122.0		128.0	136.0
						69.3				69.3		72.4	77.0
						282.0				330.0		408.0	408.0

Key

Mo = stall torque

Mn = rated torque

Mmax = maximum torque

6 Motor and signal cables

Cables are an important part of a servo system installation. Not only must the noise immunity and integrity of the cabling and connectors be correct, but also SAFETY and EMC regulations must be complied with to ensure successful, reliable and fail safe operation. One of the most frequent problems experienced by motion systems engineers is incorrect connections of the motor to the drive.

Emerson Industrial Automation ready made cables mean system installers can avoid the intricate, time consuming assembly normally associated with connecting servo systems. Installation and set-up time are greatly reduced - there is no fiddling with wire connections and crimp tools, and no fault finding.

The cables are made to order in lengths from 1m to100 m.

Power cable variants

- Phase conductors 1.0 mm² (10 A) to 25 mm² (70 A)
- With and without brake wire pairs
- Motor end connector
- Motor end Ferrules for Hybrid box
- Drive end is tailored to suit the drive and can be ferrules or ring terminals

Cable features

- PUR outer sheath for oil resistance and dynamic performance. The PUR jacket has excellent abrasion, chemical and ozone resistance along with low smoke and low halogen flame retardant construction suitable for internal and external industrial environments.
- PVC outer sheath for oil resistance and static performance.
- Complies with DESINA coding - Orange for power, Green for signal
- Power cable and plugs UL recognized
- Optimum noise immunity
- Encoder cable has low volt drop for long cable lengths and separately screened thermistor wires.
- No need for crimp and insertion / removal tools
- Production build gives quality and price benefits
- Power cables with and without brake wires
- Cable assembly type identification label
- Brake wires are separately shielded within the power cable

6.1 General Cable Specifications

<table>
<tr><th></th><th colspan="2">POWER</th><th colspan="2">SIGNAL</th></tr>
<tr><th></th><th>PVC</th><th>PUR</th><th>PUR</th><th>PVC</th></tr>
<tr><td>Electrical</td><td colspan="2">➜ Nominal voltage : 1,000 V UL
Power cores Uo/U 0,6/1 kV
Control cores Uo/U 300/500 V
➜ Test voltage : 3 kV
➜ Conductor resistance (at 20 °C) : according to class 6 VDE 0295, EN 60228
➜ Insulation resistance (at 20 °C) : > 20 MΩ x km</td><td colspan="2">➜ Nominal voltage : 1,000 V UL
Maximum 350 V (VDE/DIN)
➜ Test voltage : maximum 3 kV
➜ Conductor resistance (at 20 °C) : according to class 6 VDE 0295, EN 60228
➜ Insulation resistance (at 20 °C) : > 20 MΩ x km
➜ Mutual capacitance :
core/core approx. 70 pF/m
core/screen approx. 110 pF/m
➜ Speed of propagation (Vp) : 5,05 ns/m (66 %)</td></tr>
<tr><td>Mechanical</td><td>➜ Minimum bending radius : 15 x outer diameter (fixed installation)</td><td>➜ Minimum bending radius : 5 x outer diameter (fixed installation)
➜ Minimum bending radius : 7,5 x outer diameter (dynamic installation)
➜ Installation : cable into drag-chain
➜ Maximum speed : 300 m/min
➜ Maximum acceleration : 40 m/s²
➜ Drag-chain length : maximum 15 m
➜ Number of cycle : 5,000,000</td><td colspan="2">➜ Minimum bending radius : 15 x outer diameter (fixed installation)</td></tr>
<tr><td>Thermal</td><td colspan="4">➜ Operating temperature range : -30 °C to +80 °C
➜ Maximum according to UL : +80 °C</td></tr>
<tr><td>Chemical</td><td>➜ Oil resistance : according to UL1581</td><td>➜ Oil resistance : according to EN 50363-10-2, OIL 80 °C UL758</td><td colspan="2">➜ Oil resistance : according to UL1581</td></tr>
<tr><td>Fire Behavior</td><td colspan="2">➜ Flame retardant : according to EN60332-1 ➜ Cable flame test : FT1 CSA C.22.2 n° 210</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>➜ Halogen-free : according to IEC 60754-1</td><td colspan="2"></td></tr>
<tr><td>Approvals</td><td colspan="4">➜ Desina standard ➜ UL/CSA AWM
➜ EC Low Voltage Directive 73/23/EEC and CE Marking Directive 93/68/EEC
➜ UE directive 2002/95/CE Restriction of the use of Hazardous Substance (RoHS)</td></tr>
</table>

6.2 Power Cables (PUR & PVC)

6.2.1 Power Cable Construction

Phase & conductor size (current rating CEI EN 60204-1:2006-09 at 40 °C – Installation Method B2)	Power Plug Size	Plug Current Rating	Power No brake - Number of cores x Cross section (mm²)	Power Braked - Number of cores x Cross section (mm²)	Nominal outer diameter (mm) No brake	Nominal outer diameter (mm) Braked	Tolerance (mm)
1 mm² (10,1 Amps)	Size 1	30 A	4G1	4G1+(2 X 0.5)	7,9	9,5	± 0,3
2,5 mm² (17,4 Amps)	Size 1	30 A	4G2.5	4G2.5+(2 X 0.5)	11	12	± 0,3
4 mm² (23 Amps)	Size 1	30 A	4G4	4G4+(2 X 1)	12,2	13,3	± 0,3
6 mm² (30 Amps)	Size 1,5	53 A	4G6	4G6+(2 X 1)	14,5	15,5	± 0,4
10 mm² (40 Amps)	Size 1,5	53 A	4G10	4G10+(2 X 1)	18,3	18,8	± 0,4
16 mm² (54 Amps)	Size 1,5	70 A	4G16	4G16+(2 X 1)	21,4	21,6	± 0,5
25 mm² (70 Amps)	n/a	n/a	4G25	4G25+(2 X 1)	26,5	26,9	± 0,5

6.2.2 Power Cable Codification

Field Number

1	2	3	4	5	6	7	8	9	10	11	12
M	B	B	A	A	A	0	0	2	5	S	S

Cable Type (Field N° 1 & 2)
MB = power braked
4 w + 2 w + screen
MS = power 4 w + screen

Length Metre (**) (Field N° 7, 8, & 9 + 10)
0010 = 1 Metre
0025 = 2.5 Metres
1,000 = 100 Metres max
5,000 = 500 Metres max cut end

Jacket Type(Field N° 3)
A = PVC fixed installation
B = PUR dynamic installation

Optional : Progressive alphanumeric code for custom special requests (Field N° 11 & 12)

Phase & conductor size (Field N° 4)		
MS = Power NO Brake	or	MB = Power Braked
A = 1 mm²	or	1 mm² + 0.5 mm²
B = 2.5 mm²	or	2.5 mm² + 0.5 mm²
C = 4 mm²	or	4 mm² + 1 mm²
D = 6 mm²	or	6 mm² + 1 mm²
E = 10 mm²	or	10 mm² + 1 mm²
F = 16 mm²	or	16 mm² + 1 mm²
G = 25 mm²	or	25 mm² + 1 mm²

Drive end connection (*) (Field N° 5)
A = Unidrive M size 3-4-5 / Unidrive SP size 0-1-2 / Digitax ULTRASONIC WELDING
B = Unidrive M size 6 / Unidrive SP size 3 Ring terminal M6
C = Unidrive M size 7 Ring terminal M8
D = Unidrive M size 8 Ring terminal TBA
G = Unidrive SP size 4-5-6 Ring terminal M10
P = 6 Way Male plug
S = Special
X = Cut end

Motor end Connection (Field N° 6)
A = 6 way power size 1 from 1 to 4 mm² (no Speedtec conn.)
B = 6 way power size 1.5 53 Amps 4 mm² (no Speedtec conn.)
C = 6 way power size 1.5 70 Amps from 6 to 16 mm² (no Speedtec conn.)
D = 75-250 Unimotor fm hybrid box ULTRASONIC WELDING
S = Special
X = Cut end
S = Special

(*) Terminal sizes by Unidrive M 700/701 User Guide issue number 7 / Unidrive SP User Guide issue number 13

(**) Length meter / Cable requiring (cm) lengths will be rounded up to the next highest half metre; Eg. 2.1 will be charged as a 2.5 metre cable

Maximum cable assembly length 100 meters

6.3 Signal Cables (PUR & PVC)

6.3.1 Signal Cable Construction

Code	Cable construction	Nominal outer diameter (mm)	Tolerance (mm)
Incremental Encoder (ABZ + UVW) & Sincos with EnDat	SI	[(2 x 0,34)E(St) + 6 x 2 x 0,25 + 1 x 2 x 0,50]ST mm²	10
Resolver	SR	[4 x (2 x 0,25) St]ST mm²	8,5
Sincos with Hiperface	SS	[4 x (2 x 0,15) St + 1 x 2 x 0,50] ST mm²	8,9

6.3.2 Signal Cable Codification

Field Number

1	2	3	4	5	6	7	8	9	10	11	12
S	I	B	A	A	A	0	0	2	5	S	S

Cable Type (Field N° 1 & 2)

- SI = Incremental encoder & EnDat
- SR = Resolver
- SS = Sincos encoder

Length Metre (**) (Field N° 7, 8, & 9 + 10)

- 0010 = 1 Metre
- 0025 = 2.5 Metres
- 1,000 = 100 Metres max
- 5,000 = 500 Metres max cut end

Jacket Type (Field N° 3)

- A = PVC fixed installation
- B = PUR dynamic installation

Optional : Progressive alphanumeric code for custom special requests (Field N° 11 & 12)

Cable construction (Field N° 4)

- A = [(2 x 0,34) E (St) + 6 x 2 x 0,25 + 1 x 2 x 0,50] ST mm² (SI = Incremental encoder & EnDat)
- B = [4 x (2 x 0,25) St] ST mm² (SR = Resolver)
- C = [4 x (2 x 0,15) St + 1 x 2 x 0,50] ST mm² (SS = Sincos encoder)

Drive end connection (*) (Field N° 5)

- A = Unidrive M / Unidrive SP / Digitax ST (encoder 15 pin D type connector hd)
- B = Unidrive M / Unidrive SP resolver/sincos / Digitax ST (flying leads)
- P = Signal Male plug
- S = Special

Motor end Connection (Field N° 6)

- A = Unimotor 17 way no Speedtec connector
- B = Unimotor 12 way no Speedtec connector
- C = Unimotor 90° 17 way no Speedtec connector
- D = Unimotor 90° 12 way no Speedtec connector
- S = Special

Note: (**) Length metre / Cable requiring (cm) lengths will be rounded up to the next highest half metre; Eg. 2.1 will be charged as a 2.5 metre cable

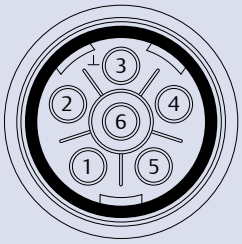
Maximum cable assembly length 100 meters

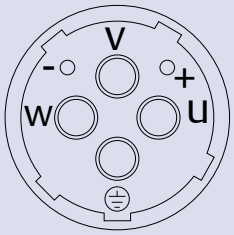
6.3.3 Signal Cable Construction

Application	Feedback	Drive end	Motor end	Code (xxxx = length)
Fixed	Incremental Encoder (ABZ + UVW) and/or SinCos EnDat	D type 15 pins	Flat	SIAAAAxxxx
			90°	SIAAACxxxx
		Flying leads	Flat	SIAABAxxxx
			90°	SIAABCxxxx
	Resolver	D type 15 pins	Flat	SR ABABxxxx
			90°	SRABADxxxx
		Flying leads	Flat	SRABBBxxxx
			90°	SRABBDxxxx
	SinCos with Hiperface	D type 15 pins	Flat	SSACABxxxx
			90°	SSACADxxxx
		Flying leads	Flat	SSACBBxxxx
			90°	SSACBDxxxx
Dynamic	Incremental encoder (ABZ + UVW) and/or SinCos EnDat	D type 15 pins	Flat	SIBAAAxxxx
			90°	SIBAACxxxx
		Flying leads	Flat	SIBABAxxxx
			90°	SIBABCxxxx
	Resolver	D type 15 pins	Flat	SR BBABxxxx
			90°	SR BBADxxxx
		Flying leads	Flat	SR BBxxxxBB
			90°	SR BBBDxxxx
	SinCos with Hiperface	D type 15 pins	Flat	SSBCABxxxx
			90°	SSBCADxxxx
		Flying leads	Flat	SSBCBBxxxx
			90°	SSBCBDxxxx

6.4 Motor connector details

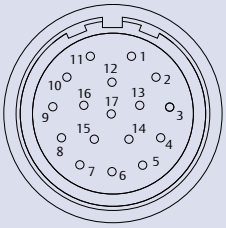
Power plug

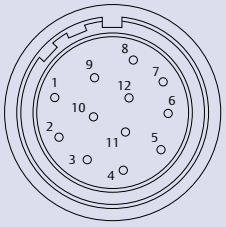




Size 1	With brake	Without brake	Size 1.5	With brake	Without brake
Pin	**Function**	**Function**	**Pin**	**Function**	**Function**
1	Phase U (R)	Phase U (R)	U	Phase U (R)	Phase U (R)
2	Phase V (S)	Phase V (S)	V	Phase V (S)	Phase V (S)
3	Ground	Ground	⏚	Ground	Ground
4	Phase W (T)	Phase W (T)	W	Phase W (T)	Phase W (T)
5	Brake		+	Brake	
6	Brake		-	Brake	
Shell	Screen	Screen	Shell	Screen	Screen

Signal plug





	Incremental encoder (CR, MR, CA, MA)	Heidenhain Absolute Encoders (EM, FM, EC, FC, EB, FB, LC, NC, LM, NM)	Resolver (AR, AE)	SICK Sin/Cos encoders (TL, UL, RA, SA)
Pin	**Function**	**Function**	**Function**	**Function**
1	Thermistor	Thermistor	Excitation High	REF Cos
2	Thermistor	Thermistor	Excitation Low	+ Data
3		Screen (Optical encoder only)	Cos High	- Data
4	S1		Cos Low	+ Cos
5	S1 Inverse		Sin High	+Sin
6	S2		Sin Low	REF Sin
7	S2 Inverse		Thermistor	Thermistor
8	S3	+ Clock	Thermistor	Thermistor
9	S3 Inverse	- Clock		Screen
10	Channel A	+ Cos		0 Volts
11	Index	+ Data		-
12	Index Inverse	- Data		+ V
13	Channel A Inverse	- Cos		
14	Channel B	+ Sin		
15	Channel B Inverse	- Sin		
16	+ V	+ V		
17	0 Volts	0 Volts		
Body	Screen	Screen		Screen

7 General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the guide, without notice.

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