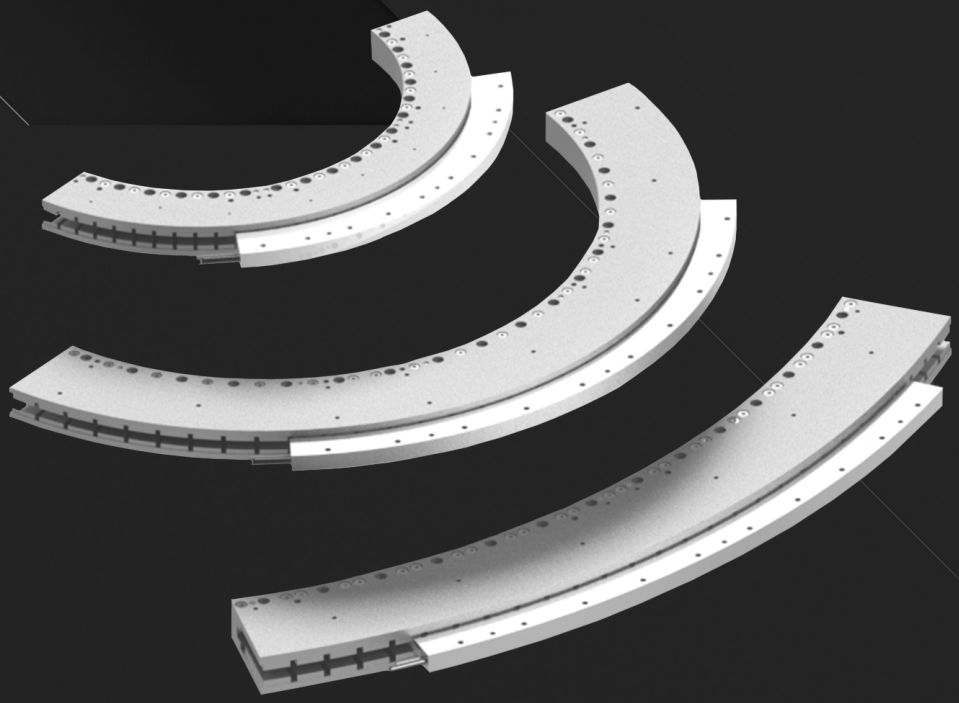
pba

SYSTEMS

DIRECT DRIVE TECHNOLOGY

Product Catalogue

VERSION 4.1.1



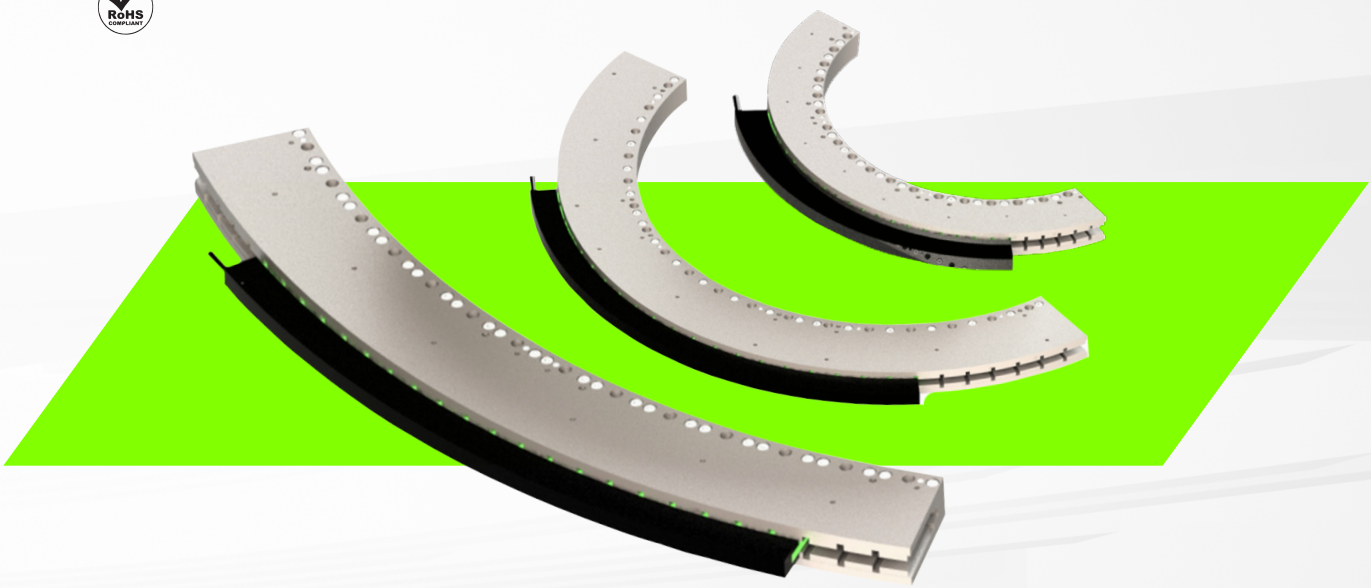
ARC SERIES

HIGH-PERFORMANCE IRONLESS ARC MOTOR

- PLAY VIDEO -

ARC SERIES

IRONLESS ARC MOTOR



Optimally designed for low profile high precise arc applications.

PBA ARC Series is specifically designed for angular motion with constrained Arc motion, 360 degrees or multi-turn rotation motion.

Powered by high-torque low-profile Ironless arc motors, the PBA ARC Series Motor can be arranged in a large centre hole of up to 1504 mm wide.

Coupled with large-diameter circular encoder scale and arc or angular bearings PBA ACR Series motor can achieve exceptionally smooth, precise motion with higher accuracy & repeatability.

- Higher Torque Direct-Drive Ironless Motor
- Low-Profile Form Factor with Low Mass
- Large Clear Aperture
- Arc Motion, 360 Degree or Multi-Turn Rotation Motion
- Zero Cogging and Exceptionally Smooth, Precise Motion
- Fast Dynamic Response
- High Positional Repeatability and Accuracy
- High Speed and Acceleration
- Zero Backlash
- Integrated Hall Sensor and Temperature Sensor
- Flexible Configuration with Multiple Coils And Multiple Tracks
- Easy Assembly

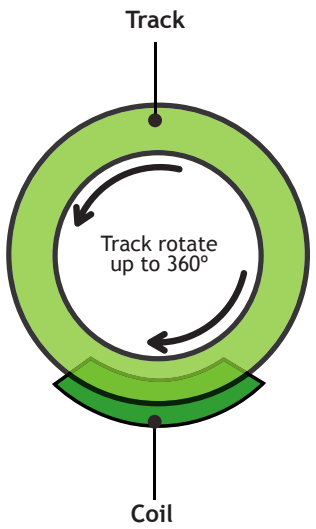
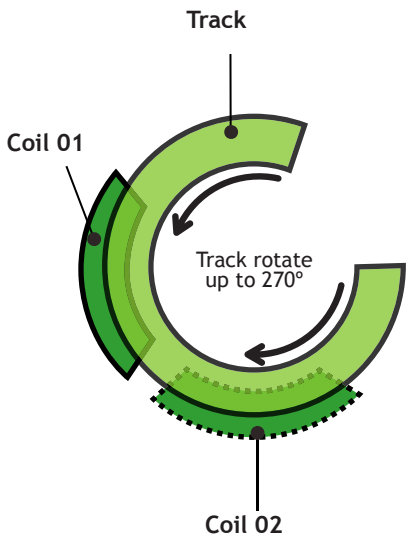
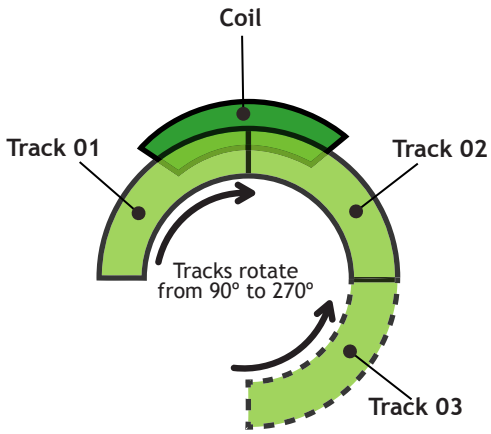
APPLICATION

- **Semiconductor machine**
- **Wafer processing and inspection equipment**
- **Photonics**
- **Biomedical equipment**
- **Precision positioning stages**
- **Lithium battery production**
- **Laser processing machines**
- **Printing machines**

**Technical specifications subject to change without prior notice*

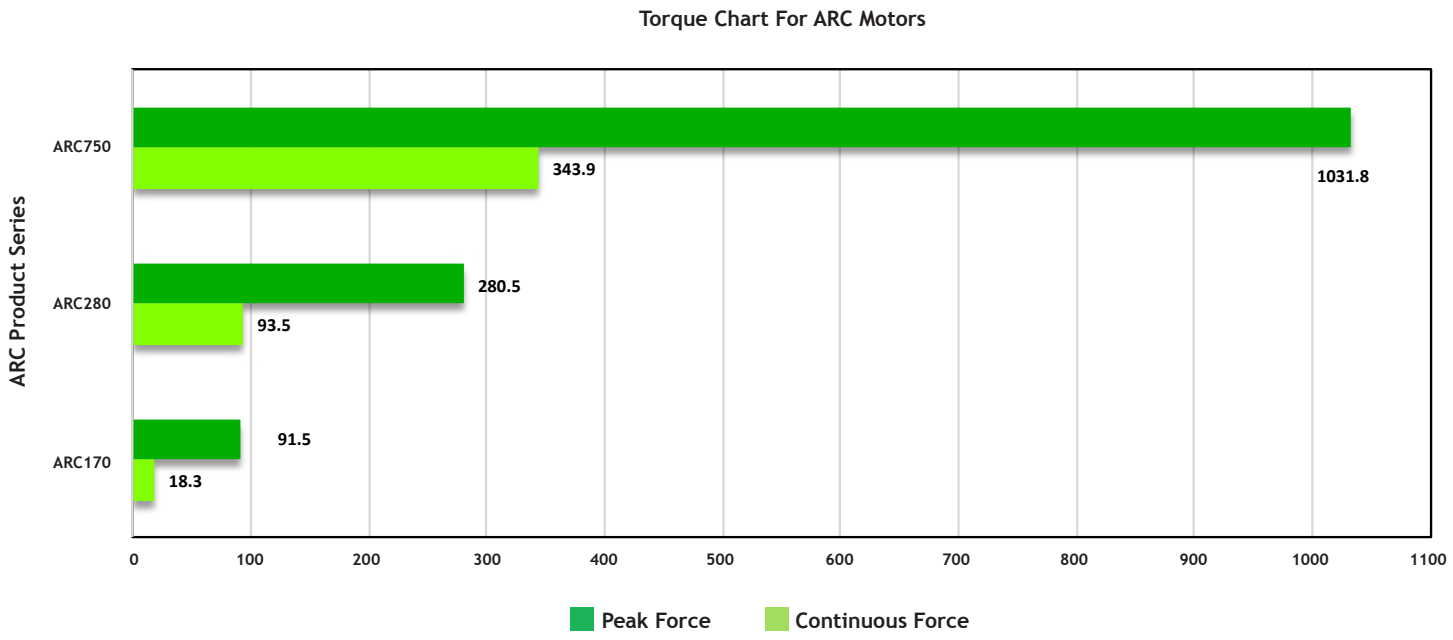
Configurations

PBA ARC motors allow customers to configure the setup based on their needs. From multiple coils to increase torque output, or multiple tracks to increase range of motion. PBA ARC motors can accomplish up to 360 degrees of rotation.

360 Degree Configuration	Multi-Coil Configuration	Multi-Track Configuration
		

Motor Model	Coil Size	Continuous Torque (N.m)	Peak Torque (N.m)	Continuous Current (A)	Peak Current (A)	Coil Weight (Kg)	Coil Angle (degrees)
ARC170	C5	18.3	91.5	2.37	11.84	0.85	90.4
ARC280	C5	93.5	280.5	2.3	6.91	1.5	90.4
ARC750	C5	343.9	1031.8	3.18	9.55	2.3	40.4

Torque Chart for ARC Motors



PART NUMBERING SYSTEM

COIL ASSEMBLY

ARC170 – C5 – TM – 0.5 – NF – HC – 00

MOTOR MODEL
ARC170
ARC280
ARC750

MOTOR SIZE
C5

THERMAL PROTECTION	
TC*	Thermostat
TM**	PT100 Sensor

CABLE LENGTH	
0.5	Power and Hall sensor cable

* TC-Sensor output to temperature controller
** TM-On/Off switch, trigger at 100˚C

DESIGN VERSIONS	
00	Standard
01	Customised Version

HALL SENSOR AND CONNECTOR OPTIONS	
H	Hall Sensor With Flying Leads
HC	Hall Sensor with 9 D sub Male Connector
CHC	Hall Sensor with 5 pins Circular Quick Lock Male Connector
HCL	9 pins D Sub Male Connector with Line Driver

POWER CABLE OPTIONS	
NF	No Ferrite Core (Flying Leads)
9NF	No Ferrite Core, D Sub 9 pins Female Connector
CNF	No Ferrite Core, Circular Quick Lock 6 pins Male Connector

MAGNET TRACK

ARCM170 – TA036 –

MOTOR MODEL
ARCM170
ARCM280
ARCMv750

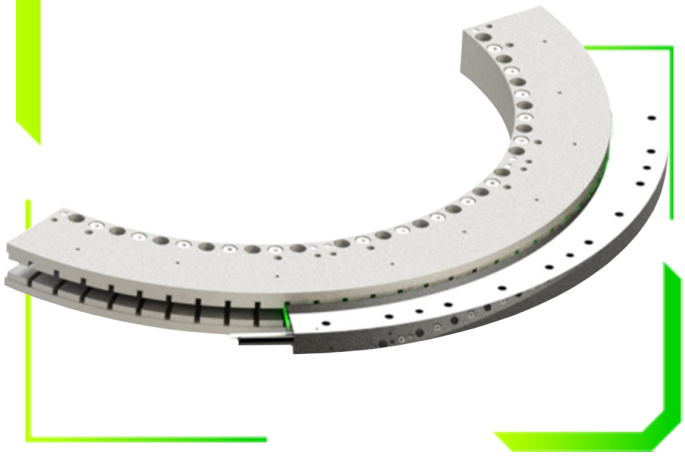
TRACK ARC ANGLE	
TA024	24 degress*
TA028	28 degress*
TA036	36 degress
TA054	54 degress

* only applicable to ARC750 only

DESIGN VERSIONS	
	Standard
01	Customised Version

ARC SERIES

IRONLESS ARC MOTOR



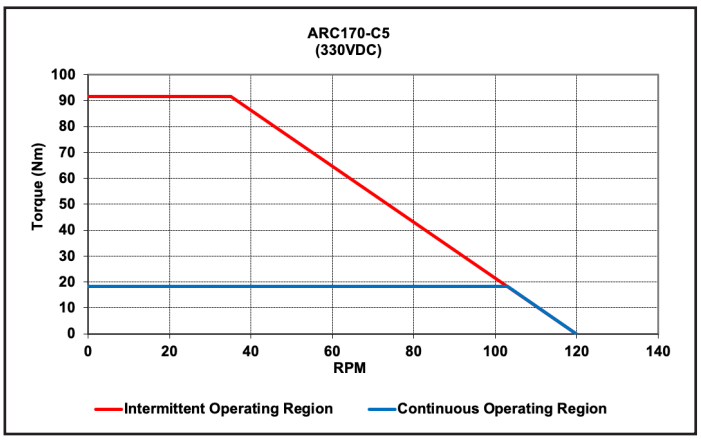
ARC170

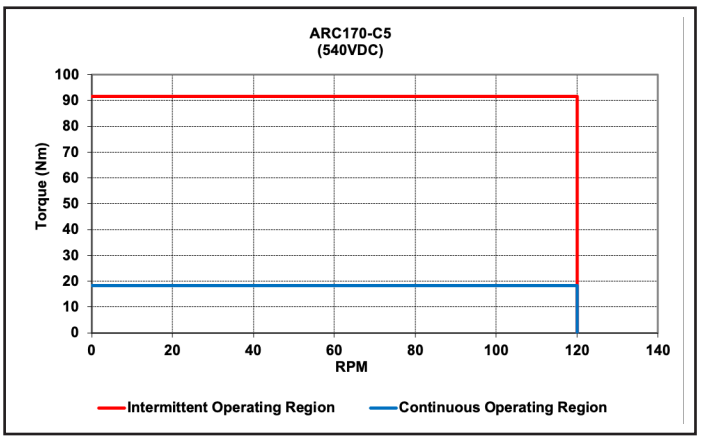
- Higher Torque Direct-Drive Ironless Motor
- Low-Profile Form Factor with Low Mass
- Large Clear Aperture
- Fast Dynamic Response

SPECIFICATION		MODEL	
		ARC170-C5	
Performance	**Unit**		
Peak Torque	N.m	91.5	
Continuous Torque @ 100°C	N.m	18.3	
Peak Power @ 100°C	W	2876.9	
Continuous Power @ 100°C	W	115.1	
Electrical			
Peak Current	Apk	11.84	
Continuous Current @ 100˚C	Apk	2.37	
Continuous Stall Current @ 100˚C	Arms	1.45	
Torque Constant	N.m/Apk	7.7	
Back EMF Constant L-L	Vpk/rad/s	8.9	
Resistance L-L @ 25˚C	Ohm	21.0	
Resistance L-L @ 100˚C	Ohm	27.4	
Inductance L-L @ 1kHz (fully ourside)	mH	6.5	
Motor Constant @ 100˚C	N.m/√W	1.6	
Max. Terminal Voltage	Vdc	330.0	
Thermal			
Thermal Resistance @ 100°C	°C/W	0.65	
Max. Winding Temperature	°C	105	
Motor Coil			
Motor Coil Weight	kg	0.85	
Electrical Time Constant	ms	0.3	
Magnet Track		ARCM170-TA36	ARCM170-TA54
Mass of Magnet Track	kg	1.07	1.61
Magnet Track Inertia	kg.m^2	0.0413	0.0621
Magnetic Period	deg	9.0	9.0

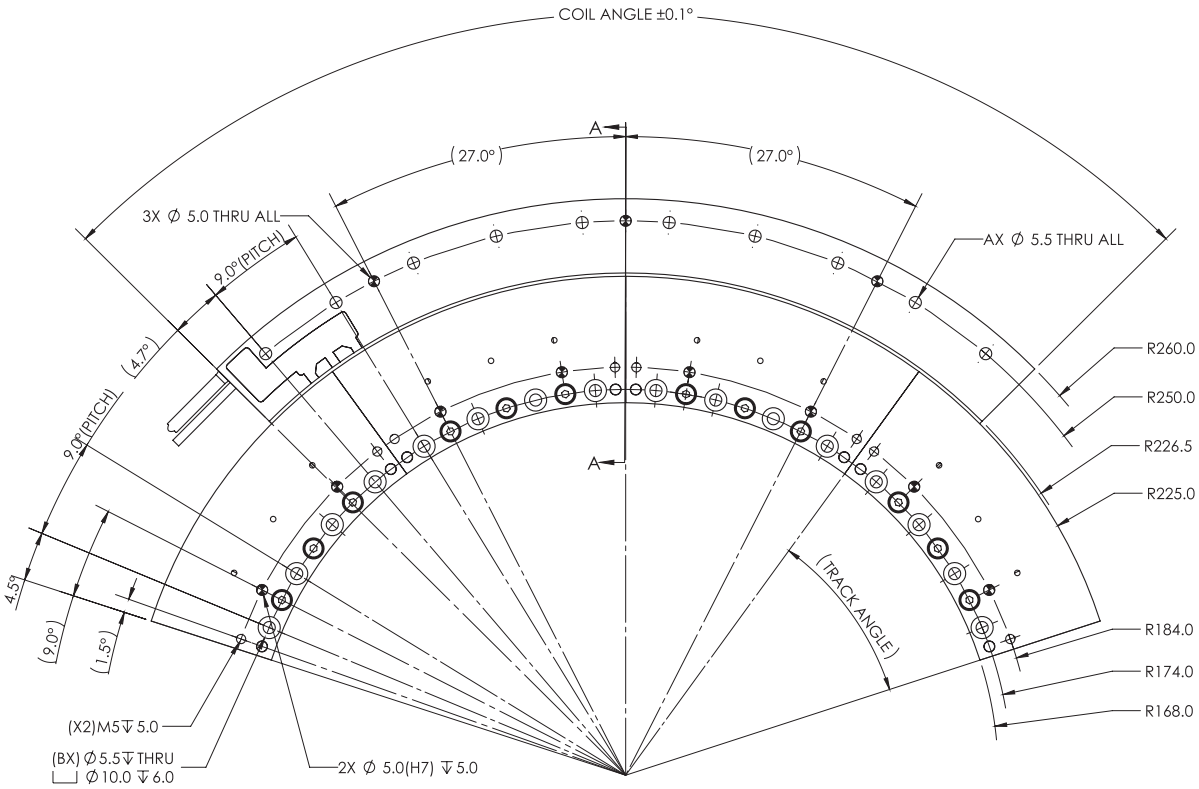
Notes:
1. Apk = 1.414* Arms; Vpk = 1.414 *Vrms.
2. *Ambient temperature 25ºC, nation convection, with coil mounted on arc assembly structure.
3. Specification tolerance: inductance ±30%, all others ±10%.
4. Peak force and current: 4% duty ratio and 1 second duration.
5. Specifications are subject to change without prior notice.

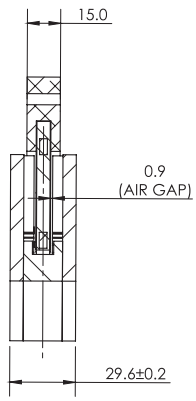
GRAPH: TORQUE VS SPEED





ARC170





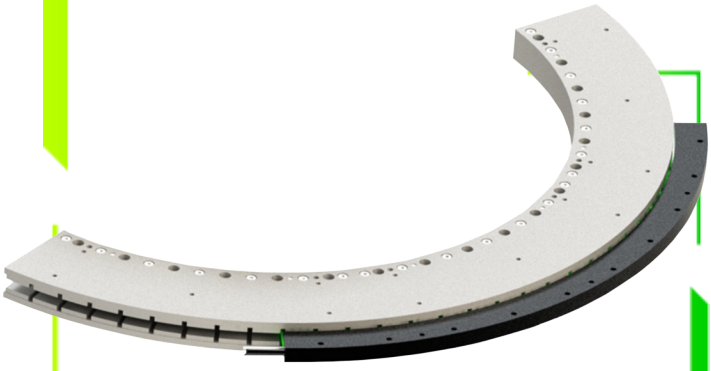
SECTION A

MAGNET TRACK	B	TRACK ANGLE
ARCM170-TA036	4	36°
ARCM170-TA054	6	54°

MOTOR COIL	A	COIL ANGLE
ARC170-S-C5	10	90.4°

ARC SERIES

IRONLESS ARC MOTOR



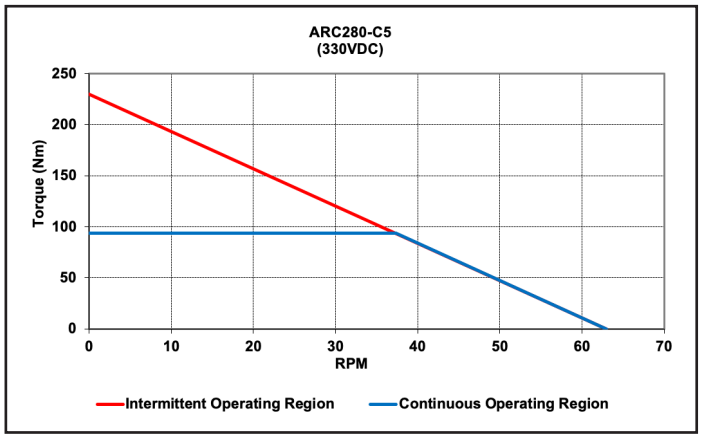
ARC280

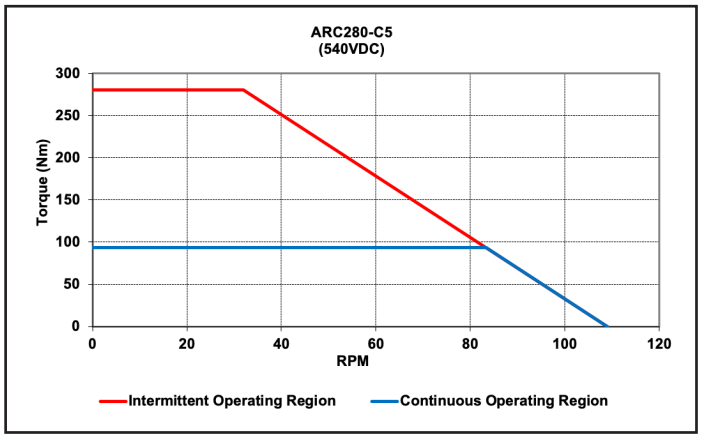
- Higher Torque Direct-Drive Ironless Motor
- Low-Profile Form Factor with Low Mass
- Large Clear Aperture
- Fast Dynamic Response

SPECIFICATION		MODEL	
		ARC280-C5	
Performance	**Unit**		
Peak Torque	N.m	280.5	
Continuous Torque @ 100°C	N.m	93.5	
Peak Power @ 100°C	W	2560.2	
Continuous Power @ 100°C	W	284.5	
Electrical			
Peak Current	A_{pk}	6.91	
Continuous Current @ 100˚C	A_{pk}	2.30	
Continuous Stall Current @ 100˚C	Arms	1.41	
Torque Constant	N.m/A_{pk}	40.6	
Back EMF Constant L-L	Vpk/rad/s	46.9	
Resistance L-L @ 25˚C	Ohm	54.9	
Resistance L-L @ 100˚C	Ohm	71.5	
Inductance L-L @ 1kHz (fully ourside)	mH	24.9	
Motor Constant @ 100˚C	N.m/√W	5.5	
Max. Terminal Voltage	Vdc	400.0	
Thermal			
Thermal Resistance @ 100°C	°C/W	0.26	
Max. Winding Temperature	°C	105	
Motor Coil			
Motor Coil Weight	kg	1.5	
Electrical Time Constant	ms	0.5	
Magnet Track		ARCM280-TA36	ARCM280-TA54
Mass of Magnet Track	kg	2.8	4.2
Magnet of Track Interia	kg.m^2	0.28	0.42
Magnetic Period	deg	9.0	9.0

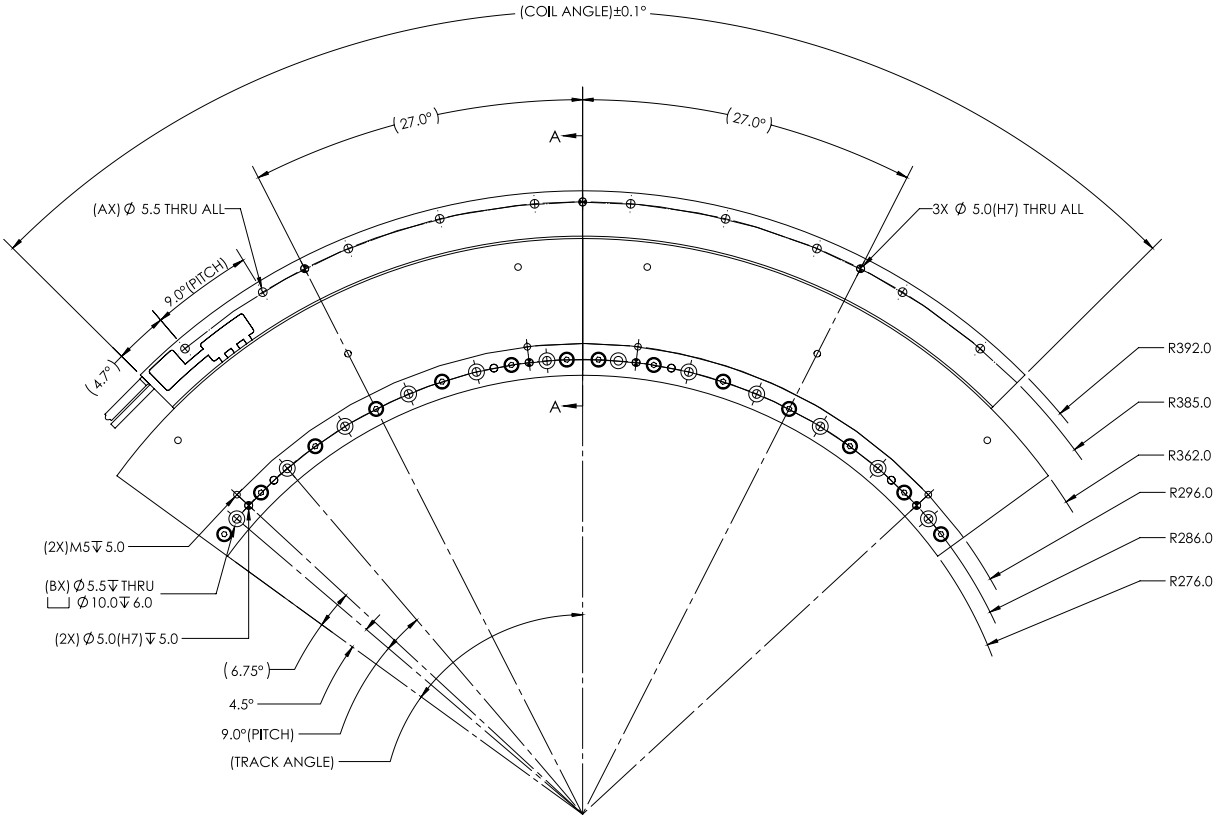
Notes:
1. Apk = 1.414* Arms; Vpk = 1.414 *Vrms.
2. *Ambient temperature 25°C, nation convection, with coil mounted on arc assembly structure.
3. Specification tolerance: inductance ±30%, all others ±10%.
4. Peak force and current: 4% duty ratio and 1 second duration.
5. Specifications are subject to change without prior notice.

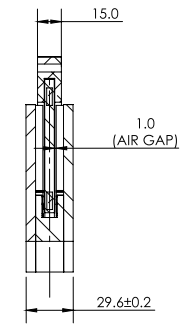
GRAPH: TORQUE VS SPEED





ARC280





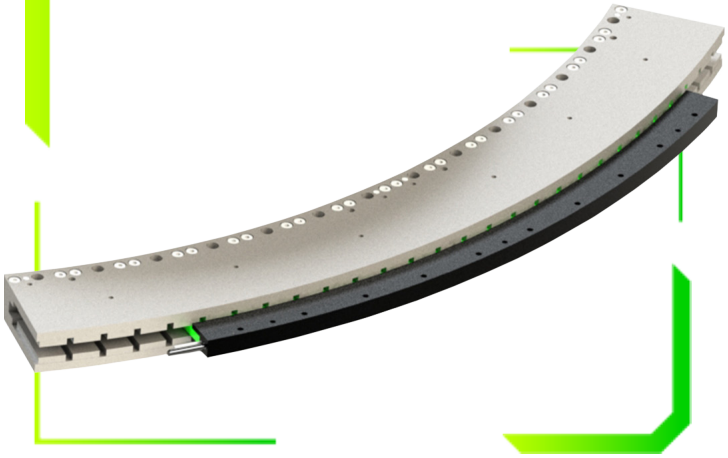
SECTION A

MAGNET TRACK	B	TRACK ANGLE
ARCM280-TA036	4	36°
ARCM280-TA054	6	54°

MOTOR COIL	A	COIL ANGLE
ARC280-S-C5	10	90.4°

ARC SERIES

IRONLESS ARC MOTOR



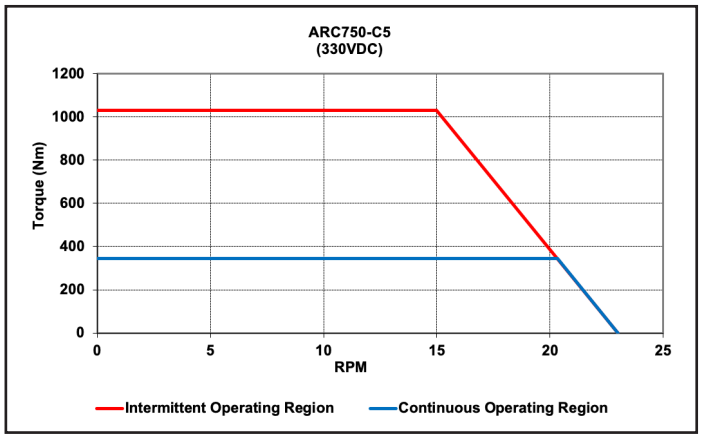
ARC750

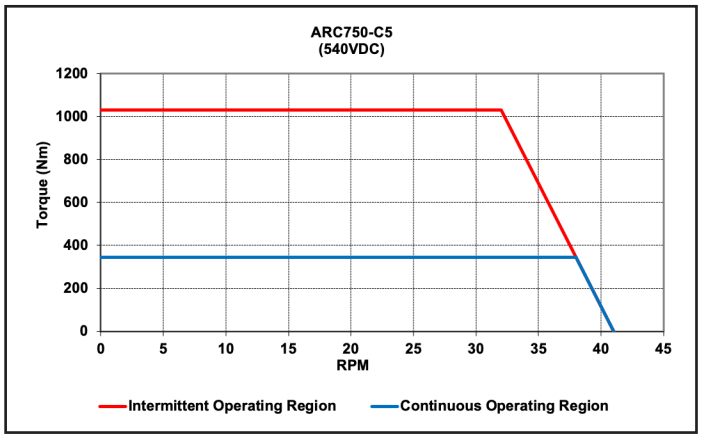
- Higher Torque Direct-Drive Ironless Motor
- Low-Profile Form Factor with Low Mass
- Large Clear Aperture
- Fast Dynamic Response

SPECIFICATION		MODEL	
		ARC750-C5	
Performance	**Unit**		
Peak Torque	N.m	1031.8	
Continuous Torque @ 100°C	N.m	343.9	
Peak Power @ 100°C	W	1070.3	
Continuous Power @ 100°C	W	118.9	
Electrical			
Peak Current	A_{pk}	9.55	
Continuous Current @ 100˚C	A_{pk}	3.18	
Continuous Stall Current @ 100˚C	Arms	1.95	
Torque Constant	N.m/A_{pk}	108.0	
Back EMF Constant L-L	Vpk/rad/s	124.7	
Resistance L-L @ 25˚C	Ohm	12.0	
Resistance L-L @ 100˚C	Ohm	15.6	
Inductance L-L @ 1kHz (fully ourside)	mH	16.0	
Motor Constant @ 100˚C	N.m/√W	31.5	
Max. Terminal Voltage	Vdc	600.0	
Thermal			
Thermal Resistance @ 100°C	°C/W	0.63	
Max. Winding Temperature	°C	105	
Motor Coil			
Motor Coil Weight	kg	2.3	
Electrical Time Constant	ms	1.3	
Magnet Track		ARCM750-TA24	ARCM750-TA28
Mass of Magnet Track	kg	6.8	7.9
Magnet of Track Interia	kg.m^2	4.4	5.2
Magnetic Period	deg	4.0	4.0

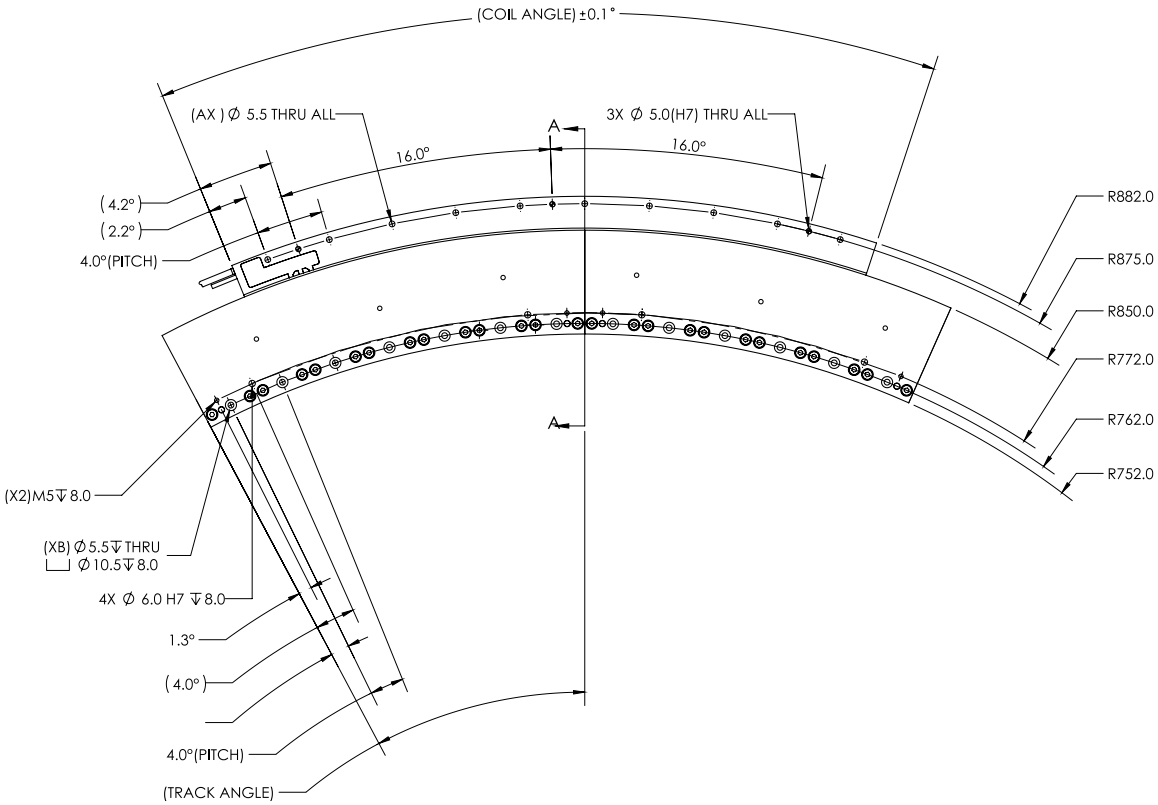
Notes:
1. Apk = 1.414* Arms; Vpk = 1.414 *Vrms.
2. *Ambient temperature 25ºC, nation convection, with coil mounted on arc assembly structure.
3. Specification tolerance: inductance ±30%, all others ±10%.
4. Peak force and current: 4% duty ratio and 1 second duration.
5. Specifications are subject to change without prior notice.

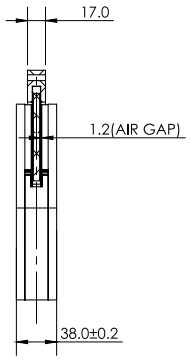
GRAPH: TORQUE VS SPEED





ARC750



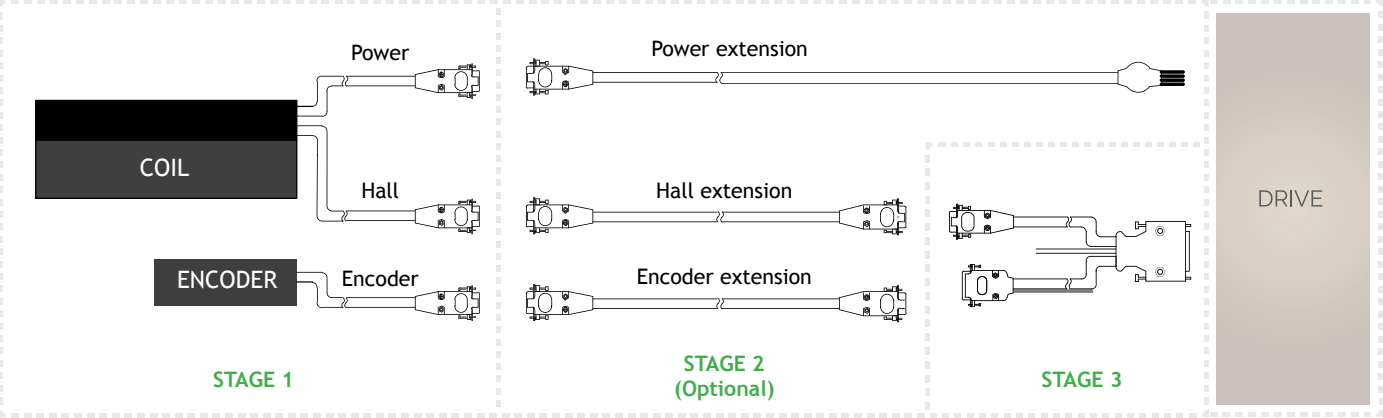


SECTION A
SCALE 1 : 4

MAGNET TRACK	B	TRACK ANGLE
ARCM750-TA024	6	24°
ARCM750-TA028	7	28°

MOTOR COIL	A	COIL ANGLE
ARC750-S-C5	10	40.4°

CABLE OPTION



THERMAL PROTECTION

The temperature in which the thermostat is active is shown as below:

MODEL	THERMAL DEVICE TYPE	THERMOSTAT (NC) OPENS AT
ARCXXX	PT100	TC: Refer to Note 1
ARCXXX	Thermostat	TM: (NC) Opens at 100ºC

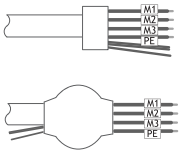
Note1:
- Programmable on temperature controller or analog inputs on motion controller.
- Recommended to set cut-off temperature to 100˚C (max) to prevent coil damage.
- User has to ensure that the thermal protection devices are wired to appropriate electronics to ensure that the motor power cutoff is active when temperature reaches its allowable limit.

STAGE 1 | POWER AND HALL CABLE OPTION

ARC280-C5-TM-0.5-9NF-HC-00

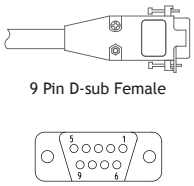
POWER CABLE OPTIONS

NF / FC



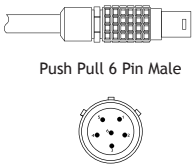
M1	Grey
M2	Brown
M3	Black
PE	Yellow
TS1	Black
TS2	Orange

9NF



P1	M1	Grey
P2	M1	Black (Jumper)
P3	M3	Black
P4	M3	Black (Jumper)
P5	M2	Brown
P6	M2	Black (Jumper)
P7	Temp senor 1	Black
P8	Temo senor 2	Orange
P9	PE	Yellow

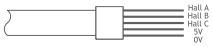
CNF



P1	M1	Grey
P2	M2	Brown
P3	M3	Black
P4	Temp Senor 1	Black
P5	Temp Senor 2	Orange
P6	PE	Yellow

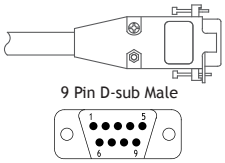
HALL SENSOR OPTIONS

H



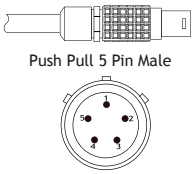
Hall A	White
Hall B	Green
Hall C	Blue
5V	Red
0V	Black

HC



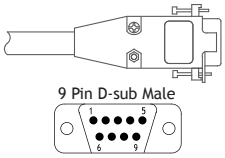
P1	Hall A	White
P2	Hall B	Green
P3	Hall C	Blue
P4	5V	Red
P5	0V	Black

CHC



P1	Hall A	White
P2	Hall B	Green
P3	Hall C	Blue
P4	5V	Red
P5	0V	Black

HCL

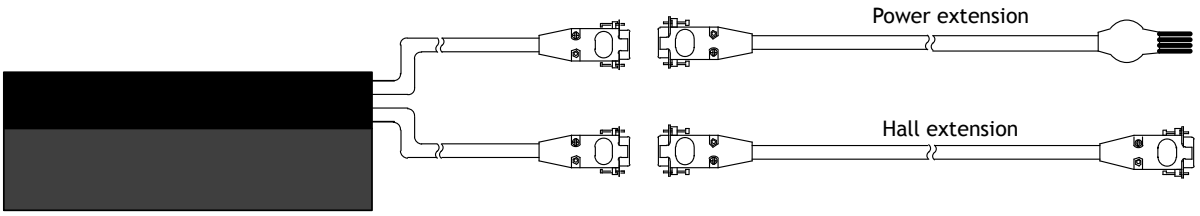


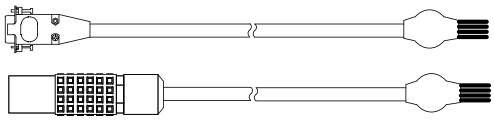
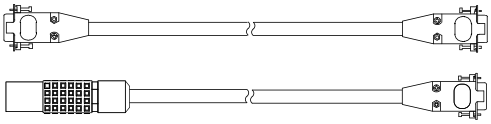
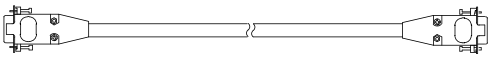
P1	Hall A+
P2	Hall A-
P3	Hall B+
P4	Hall B-
P5	Hall C+
P6	Hall C-
P7	5V
P8	0V

Notes: All connectors shown are front view

STAGE 2 | ARC SERIES EXTENSION CABLE

Connection example: ARC□□□-□-□-□-9NF-HC-00



Extension Cable		Part Number
Power Extension Cable		CBL_EXT_PIX1_X.X
		CBL_EXT_PIX1_CC_X.X
Hall Sensor Extension Cable		CBL_EXT_HALL0_X.X
		CBL_EXT_HALL0_CC_X.X
		CBL_EXT_HALL0_DIF_X.X
Encoder Extension Cable		CBL_EXT_REN00_X.X
		CBL_EXT_REN00A_X.X
		CBL_EXT_REN01_X.X
		CBL_EXT_REN01B_X.X
		CBL_EXT_REN05_X.X
		CBL_EXT_REN05A_X.X

CABLE	
00	RGH41, VIONIC, QUANTIC Digital
00A	RGH41 Analog
01	RH200 Digital
01B	PH200 Analog
05	ATOM Ri Interface Digital
05A	ATOM Ri Interface Analog

CABLE LENGTH (X.X)	
0.5	0.5 meter
1.0	1.0meter
2.0	2.0 meter
3.0	3.0 meter (standard)

Notes: 1. X.X is the length of the cable in meters. 2. For customized cable length, contact PBA

Application Form - DDR Motor Selection

Customer Name:	Date (DD/MM/YY):
Contact Email:	

PBA DDR MOTOR SELECTION QUESTIONAIRE

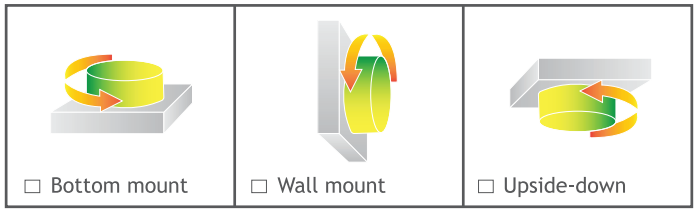
1. Application Description

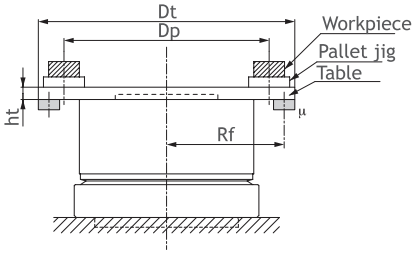
1a. Application Sketch With Approx Dimensions

2. Load Parameter (Please Circle Accordingly)

	a) Load moment of inertia	kg.m²	
	Frictional torque	N.m	
Table	b) Table top shape		Disk / Rectangular Plate
Table	Material		Steel / Aluminium
Table	Dimension	Dt (mm)	
Table	Plate thickness	ht (mm)	
Table	Weight	m1 (kg)	
Workpiece	c) Quantity	nw (pc.)	
Workpiece	Max. weight	mw (kg/pc.)	
Workpiece	Installation center	Dp (mm)	
Pallet Jig	d) Quantity	np (pc.)	
Pallet Jig	Max. weight	mp (kg/pc.)	

Mounting Requirements





3. Motion Parameter

		Profile 1	Profile 2	Profile 3
Rotational angle (θ)	°			
Moving time	s			
Moving speed	rps			
Dwell time	s			

4. Command/Bus (Please Circle Accordingly)

Pulse and direction / Analog / EtherCAT / IO trigger / Other : _____

5. Encoder (Please Circle Accordingly)

Incremental / Analog		
Resolution	cpr	327680 / 518400 / 655360 / 864000

6. Motion Precision

Accuracy	arcsec	
Repeatability	arcsec	

7. Mechanical Specification (Please Circle Accordingly)

Axial run-out	um	5 / 10 / 20
Radial run-out	um	5 / 10 / 20
Space constraints (H x W)	mm	

8. Working Environment

Room temperature	°C	
Clean room class		

9. Additional Requirements (Please Tick ( )Accordingly)

Motor extension cable length	Flexible cable	Amplifier	Controller	Other: _____
m				

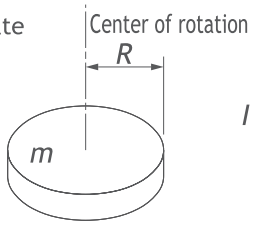
10. Remarks: If you have any special motion request for sizing procedure, please specify your requirement in below remarks.

Formula of moment of inertia

(m : Weight of object (kg))

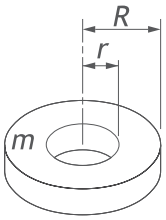
A When rotation center is own shaft

1. Circular plate (cylinder)



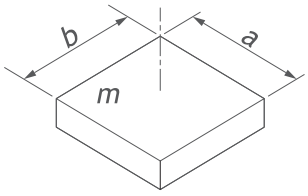
$$I = \frac{mR^2}{2}$$

2. Hollow circular plate (hollow cylinder)



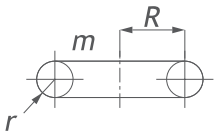
$$I = \frac{m(R^2 + r^2)}{2}$$

3. Direct hexagonal side finish body



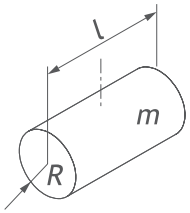
$$I = \frac{m(a^2 + b^2)}{12}$$

4. Ring



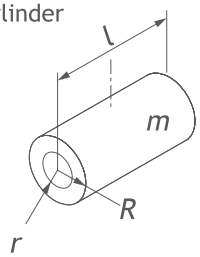
$$I = \frac{m(4R^2 + 3r^2)}{4}$$

5. Cylinder



$$I = \frac{m(3R^2 + l^2)}{12}$$

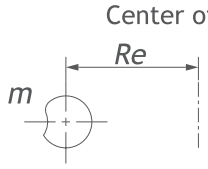
6. Hollow cylinder



$$I = \frac{m(R^2 + r^2 + l^2/3)}{4}$$

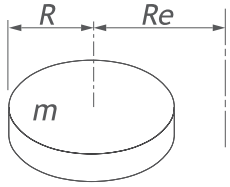
B When rotation center differs from own shaft

1. Any shape (if small very well)



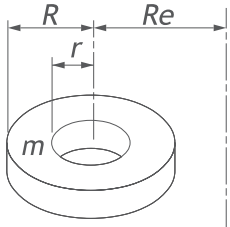
$$I = mRe^2$$

2. Circular plate (cylinder)



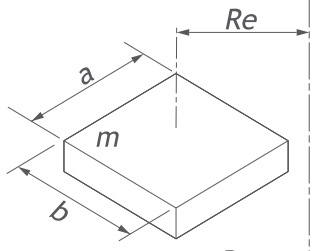
$$I = m\left(\frac{R^2}{2} + Re^2\right)$$

3. Hollow circular plate (hollow cylinder)



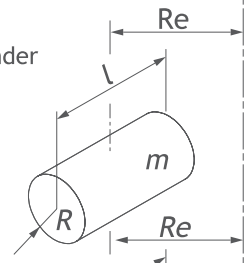
$$I = m\left(\frac{R^2 + r^2}{2} + Re^2\right)$$

4. Direct hexagonal side finish body



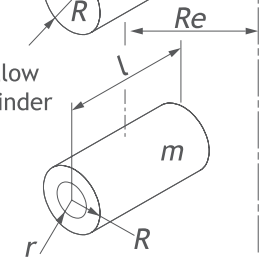
$$I = m\left(\frac{a^2 + b^2}{12} + Re^2\right)$$

5. Cylinder



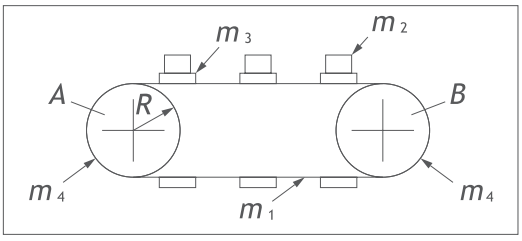
$$I = m\left(\frac{3R^2 + l^2}{12} + Re^2\right)$$

6. Hollow cylinder



$$I = m\left(\frac{R^2 + r^2 + l^2/3}{4} + Re^2\right)$$

For conveyer



m_1: Chain weight
m_2: Workpiece total weight
m_3: Jig (pallet) total weight
m_4: Sprocket A (drive) + B total weight
R : Drive side sprocket radius

$$I = \left(m_1 + m_2 + m_3 + \frac{m_4}{2}\right) \cdot R^2$$

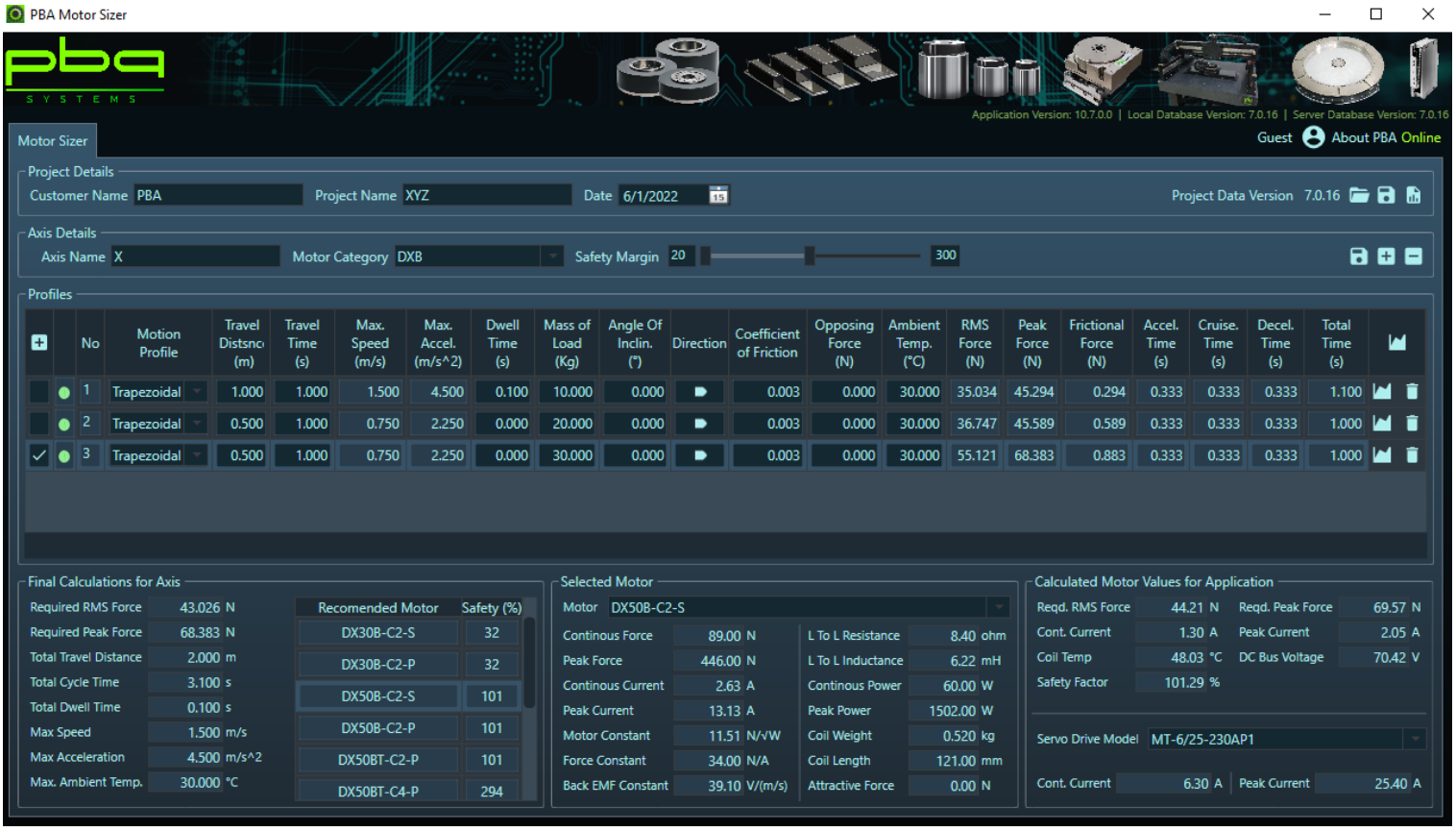
PBA SYSTEMS LINEAR MOTOR SIZER SOFTWARE

PBA SYSTEMS LINEAR MOTOR SIZER SOFTWARE

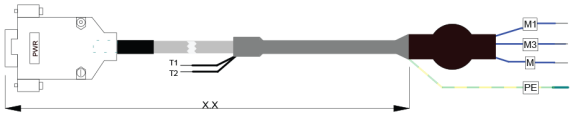
PBA Systems Motor Sizer Software is available to download from our website to assist in the calculation and selection.

Kindly visit us at www.pbasystems.com.sg or simply scan the QR CODE

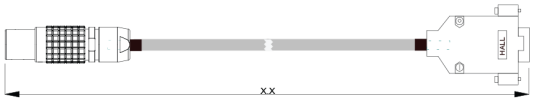
SIMULATED PERFORMANCE CHARTS



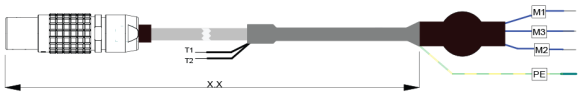
Power Extension Cable



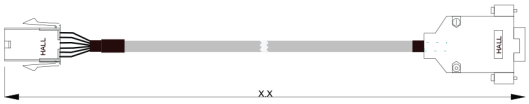
Hall Extension Cable



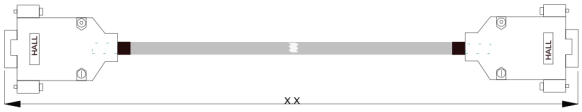
Power Extension Cable



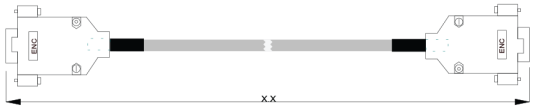
Hall Extension Cable



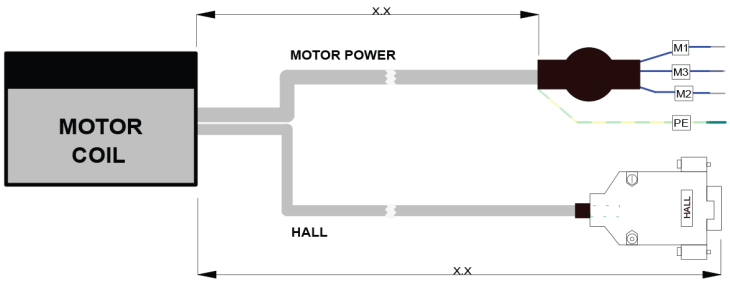
Hall Extension Cable



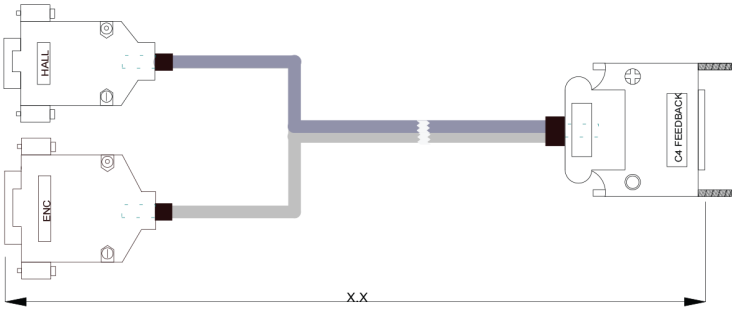
Encoder Extension Cable



MOTOR POWER HALL CABLE



MAXTUNE FEEDBACK CABLE



Notes:

1. X.X is the length of the cable in meter with a tolerance of $^{+0.10}_{-0}$
2. All measurements are in meters (m) unless stated