United States
Regal Beloit Corporation
200 State Street - Beloit, WI3511
Phone: (608) 364-8800 (608) 364-8800
Fax: (608) 364-8816;

United Arab Emirates
Regal Beloit FZE
1810, JAFZA ONE Jebel Ali Free Zone - UAE
Phone: 971 4 8107444
Fax: 971 4 8812662;

Canada
Regal Beloit Canada
320 Superior Boulevard Mississauga, Ontario, Canada L5T 2N7
Phone: 1-905-670-4770 1-905-670-4770
Fax: 1-905-670-8971;

China
Regal Beloit China
6 Xiangge Rd, Hudai Town Wuxi, China 214161
Phone: (86) 510-8183-1600
Fax: (86) 510-8560-1389;

United Kingdom
Regal Beloit United Kingdom
Marshall Way Heapham Road Industrial Est
Gainsborough, Lincolnshire, UK DN21 1XU
Phone: (44) 1427-614141 (44) 1427-614141;

South Africa
Regal Beloit South Africa
268B Fleming Road Meadowdale Germiston, Johannesburg 1614
Phone: +27 (0)11 453 1930 +27 (0)11 453 1930
Fax: +27 (0)11 453 9560;

Singapore
Regal Beloit Singapore
12 Tuas Loop, Singapore 647346
Phone: +65 6863 3473 +65 6863 3473
Fax: +65 6863 3476;

South East Asia
Regal Beloit Thailand
Bangkrang, Muang Nonthaburi 11000, Thailand
Phone: (02) 447 3300 (02) 447 3300
Fax: (02) 926-2045;

Israel
Regal Beloit Israel
9 Bareket Street, Zone 23 North Industrial Park Caesarea 38900 Israel
Phone: +972 (0)4 627 0777 +972 (0)4 627 0777
Fax: +972 (0)4 627 0779;

New Zealand
CMG Electric Motors (NZ) Ltd.
18 Jomac Place Avondale, Auckland
Phone: +64 (0)9 820 3550 +64 (0)9 820 3550 Fax: +64 (0)9 828 9288;

Australia
Regal Beloit Australia
19 Corporate Avenue Rowville, Victoria, Australia 3178
Phone: +61 (0) 3 9237 4000 +61 (0) 3 9237 4000
Fax: +61 (0)3 9237 4010

Europe
Regal Beloit Europe
Mors 2-4 & 1-5a Eibergen, Gelderland, Netherlands 7151
Phone: (31) 0545-464640
Fax: (31) 0545-475065;

India
Regal Beloit India
Marathon Electric India Private Ltd. Regd. Office & Works
Sector 11, Model Town Faridabad 121006
Phone: (91) 129-228-6421
Fax: (91) 129-228-6423;

Central America
Regal Beloit de Centroamerica y el Caribe
Avenida Ferrocarril 19-97, Zona 12,
Empresarial Cortijo I, Of.413
GUATEMALA CITY - GUATEMALA
Phones: +502 24730100 +502 24730100 / +502 24730101 +502 24730101;

Mexico and Latin America
Regal Beloit de Mexico S de RL de CV
Calle Jose Timoteo Rosales # 4616
Colonia Niño Artillero
Monterrey, Nuevo Leon, Mexico 64280
Phone: +52 (81) 50 00 79 00 +52 (81) 50 00 79 00
Fax: +52(81) 50 00 79 01;

Version No.TCA-201812E

Hotline: 400 828 9878

Regal Beloit (Wuxi) Co., Ltd.
www.regalbeloit.com.cn

6 Xiangge Rd, Hudai Town, Wuxi,
China 214161
Tel: (86510) 8183 1600
Fax: (86510) 8560 1389

marathon® Motors

TerraMAX TCA Series Motors
IE3 Premium Efficiency Motors for Indust

CONTENTS

REGAL®

marathon®
Motors

REGAL - Across the world

Regal Beloit Corporation has locations in

27 countries

70 manufacturing bases

16 technical centers

more than 23,000 employees

over 100,000 customers

About Marathon Motors

Marathon motors, founded in 1913, is the famous industrial motor brand of Regal Beloit Corporation. Marathon motors has been a widely used manufacturer in the world of commercial and industrial motor design and high technology products. Marathon motors joined Regal Beloit Corporation in 1997. The main products include high effciency low voltage motor, low voltage variable frequency motor, high voltage motor, explosion-proof motor and custom-made motor, which are widely used in compressor,pump, petrochemical, paper making and water treatment and other industries.

Regal Beloit (Wuxi) Co., Ltd founded in 1958, focusing on motor R & D and manufacturing, is a national large industrial enterprise, national key high-tech enterprise.Regal Wuxi joined Regal Beloit Corporation in 2008, and is one of the major industrialmotor manufacturing enterprises in Regal Beloit Corporation. Regal Wuxi has a totalasset of 80 million US dollars, more than 700 employees, over 400 sets of mainequipments, annual output of 6 million kW, has the test capacity up to 5000kW.

REGAL®

Product Overview

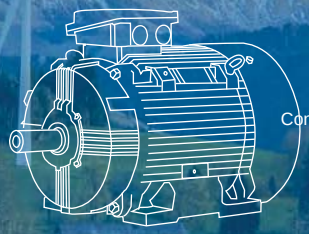
TerraMAX TCA Series is the low votlage premium efficiency (IE3 Efficiency), 3 phase induction motor. The motor is built in TEFC cast iron construction with integral foot and IP55 protection as standard to meet the demands of the general industry. The product confirms to IEC stanards and its global equivalent standards. The TCA Series motors are suitable for operation on various supply condition including supply from variable frequency drive for defined speed ranges to suit the various application load like pumps, fans and compressor to name a few.

Protection: IP55

continuous working system (S1)

constant speed or (25-50Hz) variable frequency

In compliance with ISO/IEC/GB standards, UL certificate



Frame material	grey cast iron
Rated voltage	220V/380V 380V/660V 50Hz
Power range	0.75-375KW
Insulation/Temp rise	class F/B
Service factor	SF 1.0
Efficiency	IE3
Protection	IP55
Cooling	IC411
Greasing system	N/A for fr. 80~180 of shielded bearings; available for fr. 200~355 of open bearings
Terminals	6
Conduit box material	grey cast iron
Shaft material	45# steel
Shaft key	A
Vibration	A
Balancing	half-key
Paint	RAL 5014
Nameplate	SS steel
Rotor	cast alum
Winding RTD's	PTC150℃(standard); PT100(optional)
Bearing RTD's	PT100(optional)
Bearings	Rollway SKF FAG

marathon® Motors

Environment

Protection IP55

≤1000M

Altitude

Relative humidity
-20℃≤T≤20℃: 100%
20℃<T≤30℃: 95%
30℃<T+B46≤40℃: 55%

Ambient temp
-20℃ ~ 40℃(IEC 60034-1)

Altitude(M) / Ambient temp (°C)	1000	1500	2000	2500	3000	3500	4000
<30	1.06	1.04	1.00	0.96	0.92	0.88	0.82
30~40	1.00	0.97	0.94	0.90	0.86	0.82	0.76
45	0.96	0.93	0.90	0.86	0.82	0.79	0.74
50	0.92	0.89	0.86	0.83	0.79	0.75	0.71
55	0.86	0.83	0.81	0.78	0.75	0.71	0.67
60	0.81	0.78	0.76	0.73	0.70	0.67	0.62

Higher ambient temp. and altitude higher than 1000m – refer to this table.

Standard Reference

IEC Standards & GB Standards

Standard Name	IEC Standards	GB Standards
Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code)	IEC 60034-30	GB 18613
Rotating electrical machines – Part 1: Rating and performance	IEC 60034-1	GB755
Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)	IEC 60034-2-1	GB/T 1032
Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification	IEC 60034-5	GB/T 4942.1
Rotating electrical machines - Part 7: Classification of types of constructions and mounting arrangements (IM Code)	IEC 60034-7	GB/T 997
Rotating electrical machines - Part 6: Methods of cooling (IC Code)	IEC 60034-6	GB/T 1993
Rotating electrical machines - Part 9: Noise limits	IEC 60034-9	GB 10069.3
Rotating electrical machines - Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity	IEC 60034-14	GB 10068
Rotating electrical machines – Safety requirements	IEC 60034-1	GB 14711
Electrical insulation - Thermal evaluation and designation	IEC 60085	GB/T 11021
Classification of environmental conditions - Part 2-1: Environmental conditions appearing in nature - Temperature and humidity	IEC 60721-2-1	GB/T 4797.1
IEC standard voltages	IEC 60038	GB/T 156

***

Vibration

Vibration lin its of different shaft heights H (mm) -exp ressed in displacement, vebcity and leration (in RMS values)										
Vibration classes	Shaft heights/mm	80~132			132~280			280 above		
	Mounting	Displacement	Velocity	Acceleration	Displacement	Velocity	Acceleration	Displacement	Velocity	Acceleration
A	Free suspension	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
	Rigid mounting	21	1.3	2.0	29	1.8	2.8	37	2.3	3.6
B	Free suspension	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8
	Rigid mounting	-	-	-	14	0.9	1.4	24	1.5	2.4

Note
1: Class A applies to motors that have no specific vibration requirement.
2: Class B applies to motors that have special vibration requirement. 132mm below, no rigid mounting.
3: The interface frequency of displacement/velocity and velocity/acceleration is 10HZ and 250HZ respectively.

Noise

No-load noise at ratsdout put 50HZ (db A) Lp				
Frame size (H)	3000 (2 poles)	1500 (4 poles)	1000 (6 poles)	750 (8 poles)
	Lp	Lp	Lp	Lp
80	53	51	-	-
90	56	52	47	-
100	62	56	51	-
112	63	58	55	-
132	65	61	56	-
160	71	63	62	61
180	72	63	62	61
200	72	63	62	62
225	73	64	63	63
250	74	68	65	64
280	76	68	66	64
315	84	70	65	64
355	92	82	72	70

The noise values are tested in noise room in compliance with ISO 1680.
The surface sound pressure level Lpfa, in unit dB(A).
The volume average of sound pressure level is measured on the surface.
The measurement surface is 1cbm away from the motor surface.
The sound power level is expressed in LWA, in unit dB(A).
The above noise values only apply to motors running at no-load with 50HZ power supply, with tolerance +3dB. If at 60HZ, there will be a deviation of +4dB.

Nameplate

Stainless steel nameplates, lasered nameplate data, including serial #, output, voltage, frequency, rated current, IP, power factor, insulation class, bearings, etc.

1. Motor serial #
2. Motor type
3. IP Rating
4. Insulation class
5. Cooling method
6. Service factor
7. Duty Cycle
8. Rated voltage
9. Connection Type
10. Frequency
11. Rated output
12. Rated current
13. Rated speed
14. Power factor
15. % Efficiency
16. Efficiency class
17. Mounting
18. DE Bearing
19. NDE Bearing
20. Production date
21. Motor weight

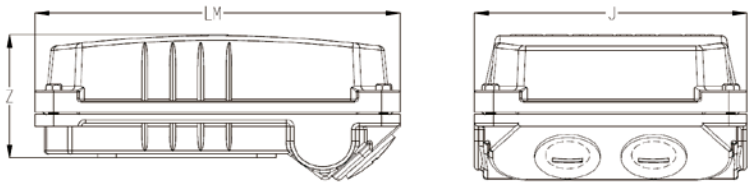
marathon® Motors

Mechanical Design

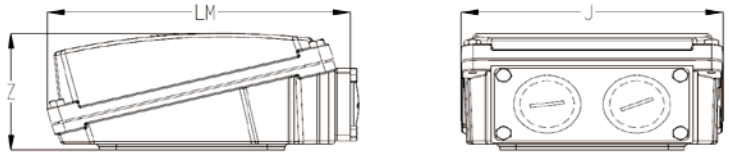
Junction box

Top mounted junction box as standard, LHS and RHS both optional.
Grey cast ironconstruction
IEC 80-132: 2 x 180° rotatable for flexible cable entryas per customer requirement
IEC 160-355: 2 x 90° rotatable for flexible cable entry as per customer requirement
2 cable entries, one sealed with gland and the other with plug.

80~132



160~355



Technical parameters of Junction box

Frame size	Cable entry(mm)	Dimension (L/W/H)
80-100	2-M20x1.5	157x122x68
112	2-M25x1.5	157x122x68
132	2-M25x1.5	195x146x77
160-180	2-M32x1.5	195x177x84
200-225	2-M40x1.5	240x203x104
250-280	2-M50x1.5	271x233x121
315	2-M63x1.5	435x352x190
355	4-M63x1.5	535x423x253

Note: The main conduit box can only accommodate power cables. Auxiliary boxes are required for RTD's.

Cooling and ventilation

Axial cooling fan for all rotations (IC411 IEC60034-6)
For some applications listed below, independent ventilation systems can be used:
VSD, motors running at low speed;
Motors running at higher speed than rated synchronous speed.
Please note the motor overall length increases when the independent ventilation system is added.

marathon® Motors

Bearing System

Deep groove ball bearings as standard and roller bearings as optional. Shielded or regreasable and locked at drive end. Alternate locking options based on application requirements.

Frame size		Ball bearing (standard)		Roller bearing (optional)
		DE	NDE	DE
80		6204ZZ	6204ZZ	-
90	2-4P	6205ZZ/C3	6205ZZ/C3	-
	6P	6205ZZ	6205ZZ	-
100		6206ZZ/C3	6206ZZ/C3	-
112		6306ZZ/C3	6206ZZ/C3	-
132		6308ZZ/C3	6208ZZ/C3	-
160		6309ZZ/C3	6209ZZ/C3	NU309
180		6311ZZ/C3	6211ZZ/C3	NU311
200		6312 C3	6212 C3	NU312
225		6313 C3	6213 C3	NU313
250		6314 C3	6314 C3	NU314
280	2P	6314 C3	6314 C3	-
	4-8P	6317 C3	6317 C3	NU317
315	2P	6316 C3	6316 C3	-
	4-8P	6319 C3	6319 C3	NU319
355	2P	6317 C3	6317 C3	-
	4-8P	6322 C3	6322 C3	NU322

Electrical Design

Rated power

The rated power of TCA motors is the power when the motor runs on duty S1 at ambient temperature -20℃~40℃,altitude no more than 4000m.

Voltage/Frequency

IEC 60034-1 separate voltage and frequency to two classes: Class A (voltage +-5%,frequency +-2%) Class B (voltage +-10%,frequency +3%/-5%)
Motors can generate rated torque in both scenarios. For class A, the motor temperature is about 10℃ higher than in normal case.

Criteria	Class A	Class B
Voltage difference	±5%	±10%
Frequency difference	±2%	±3%/ - 5%
As per standard, running motors at Class B scenario for long time is not recommended.		

Overload multiple

According to IEC60034, TCA motors can stand 160% rated current for 2 minutes at rated voltage and frequency.

Insulation system

High reliability, long lifetime
Temperature rise: class F (155)； class B (130) if the motor runs at rated power supply and outputs rated power.

Motor Protection

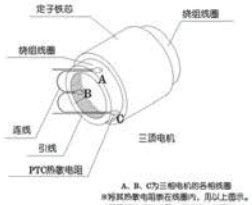
Overhear protection

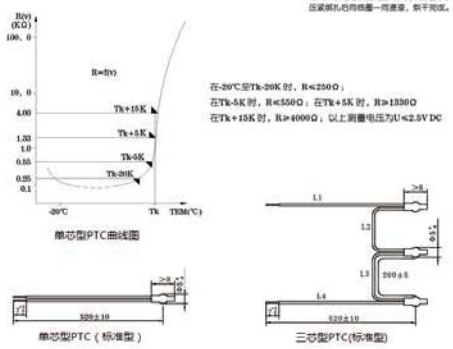
Protect the motors from breakdown due to overheating by embedding thermal sensors or RTD's into the winding or other appropriate location of the motors.

Winding Protection

PTC thermistor （standard accessory）

Presently, the most common protection is mounting thermistors (PTC) onto the winding. When up to limited temperature (e.g. PTC 150℃), the thermistor reads a great jump of resistance value which once caught by the protection module, the secondary circuit cuts off. The thermistor itself cannot bear high current or high voltage, otherwise, its semi-conductive elements can damage the winding.
This kind of protection is recommended if the motors operate in high ambient temp, with heavy-load starting or variable loading/power supply.

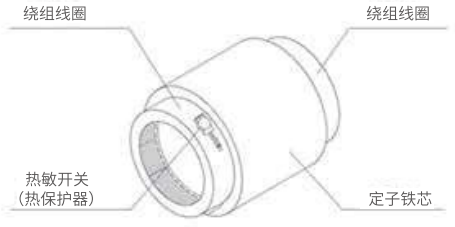




Winding Protection

PTO Thermoswitch (Optional)

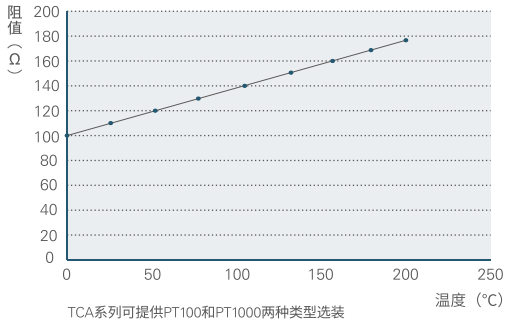
Featured with small size, high sensibility and reliability but low investment cost, it can be applied to controlling circuit directly to protect the motors except the motors run hot overloaded.



PT100 RTD's (Optional)

PT00 platinum resistance is a kind of sensors of high anti-vibration, accuracy, sensibility and anti-pressure. Its linear temperature resistance is superior to other sensors of resistance type. See its performance curve below.

PT100铂热电阻在不同温度下的阻值



TCA系列可提供PT100和PT1000两种类型选装

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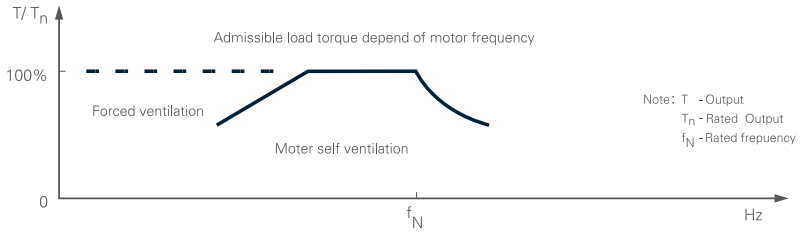
Moisture-proof heating protection (Optional)

When the motor is used in severe circumstances, for instance, high humidity or big day-night temperature difference, it is very likely to generate condensation dews to the winding, which might cause burndown of the motor. Given this, moisture-proof heating protection is advised to use to protect the motor. Heaters work when the motor stops but not when the motor is in operation.

Frame size	Space heater
100	20W
112	30W
132	40W
160	40W
180	50W
200	50W
225	60W
250	60W
280	60W
315	160W
355	220W

Inverter duty

When driven by the inverter, the inverter type, wiring, distance and application requirement all together decide the electro-magnetic disturbance to the motor, so the electromagnetic compatibility of the motor and the inverter must be taken into consideration during engineering and operation.



Model nomenclature of TerraMAX products

订货号 Order No.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
T	C	A					A		1		1	G					

Efficiency: F=IE1 S=IE2 T=IE3 Q=IE4

Enclosure: C=cast iron L=cast alum R=rolled steel F=fabricated steel

Environment:

A=industrial	J=Exd e	P =specified purpose
E=Ex e	S=smoke spill	L=slip ring
N=Non-sparking	M=mining	R=roller table
T=Dust	D=Ex d	F=fire pump

功率等级:

0.75=P75	5.5=5P5	30=030	110=110	250=250
1.1=1P1	7.5=7P5	37=037	132=132	280=280
1.5=1P5	11=011	45=045	160=160	315=315
2.2=2P2	15=015	55=055	185=185	355=355
3=003	18.5=18P	75=075	200=200	375=375
4=004	22=022	90=090	220=220	

Poles: 2 pole=1 4 pole=2 6 pole=3 8 pole=4

Frame standard: IEC=A NEMA=C

Voltage grade:

400V=1	230/400V=5	550V=9	460V=D	200V=H
400/690V=2	500V=6	660V=A	230/460V=E	
415V=3	525V=7	690V=B	380V=F	
380/660V=4	440V=8	480V=C	220/380V=G	

Frequency: 50Hz=1 60Hz=2 50/60Hz=3 others=4

Mounting: B3=1 B5=2 B35=3 V1=4 B34A=5 B34B=6 B14A=7 B14B=8 special=9

Terminal box: top=1 LHS=2 RHS=3

Accessaries:

Brake=B	Blower +encoder =D	Independent blower=F	high output=H	hybrid=X
Brake + encoder =C	Encoder=E	General purpose=G	Inverter duty= V	

Electrical change version number
Mechanical change version number

Serial number

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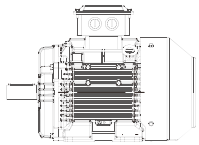
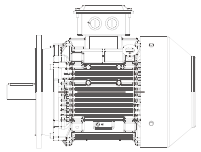
Mounting method

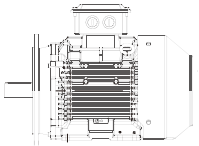
B3



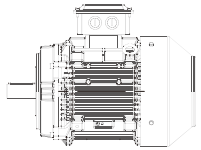
B5



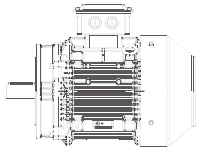
B35



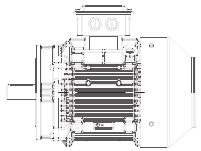
B14A



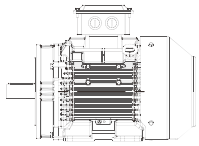
B14B



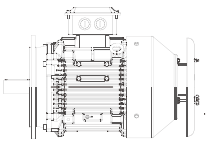
B34A



B34B



V1



Model Selections

Model#	Rating	Power (KW)	Frame size	Rated speed (RPM)	Current	Effi-cien-cy	power-factor	Rated tor que	Locked current	Locked tor que	Maximum torque	Inertia	Weig ht
									Rated current	Rated tor que	Rated torque		
TCAP751AF111GAC010	TCA 80MA02	0.75	80M	2865	1.70	80.7	0.83	2.50	6.9	2.4	3.1	0.0013	16.8
TCA1P11AF111GAC010	TCA 80MB02	1.1	80M	2861	2.43	82.7	0.83	3.67	6.9	2.6	3.2	0.0016	18.2
TCA1P51AF111GAC010	TCA 90S02	1.5	90S	2870	3.22	84.2	0.84	4.99	7.2	2.2	3.1	0.0021	21.9
TCA2P21AF111GAC010	TCA 90L02	2.2	90L	2866	4.58	85.9	0.85	7.33	7.7	2.5	3.3	0.0028	25.6
TCA0031AF111GAC010	TCA100LA02	3	100L	2879	6.02	87.1	0.87	9.95	7.2	2.9	3.2	0.0042	35.0
TCA0041AF111GAC010	TCA 112M02	4	112M	2903	7.66	88.1	0.9	13.2	7.4	2.2	3.1	0.0100	41.7
TCA5P51AF111GAC010	TCA 132SA02	5.5	132S	2924	10.8	89.2	0.87	18.0	7.2	2.1	3.1	0.0183	61.4
TCA7P51AF111GAC010	TCA 132SB02	7.5	132S	2920	14.2	90.1	0.89	24.5	7.2	2.3	3.1	0.0244	66.7
TCA0111AF111GAC010	TCA 160MB02	11	160M	2951	21.1	91.2	0.87	35.6	8.1	2.3	3.2	0.0626	122
TCA0151AF111GAC010	TCA 160MC02	15	160M	2944	27.9	91.9	0.89	48.7	8.1	2.5	3.2	0.0754	136
TCA18P1AF111GAC010	TCA 160LA02	18.5	160L	2944	33.8	92.4	0.90	60.0	8.2	2.4	3.2	0.0928	153
TCA0221AF111GAC010	TCA 180M02	22	180M	2963	41.0	92.7	0.88	70.9	7.5	2.4	3.2	0.1399	193
TCA0301AF111GAC010	TCA 200LA02	30	200L	2973	57.5	93.3	0.85	96.4	7.5	2.2	3.1	0.2429	249
TCA0371AF111GAC010	TCA 200LB02	37	200L	2973	69.0	93.7	0.87	119	7.4	2.6	3.2	0.2934	275
TCA0451AF111GAC010	TCA 225MA02	45	225M	2976	81.7	94.0	0.89	144	7.2	2.6	3.1	0.4263	357
TCA0551AF111GAC010	TCA 250MA02	55	250M	2981	98.5	94.3	0.90	176	7.5	2.2	3.4	0.6213	477
TCA0751AF111GAC010	TCA 280S02	75	280S	2982	134	94.7	0.90	240	7.5	2.4	3.2	1.0792	640
TCA0901AF111GAC010	TCA 280MA02	90	280M	2981	160	95.0	0.90	288	7.3	2.4	3.1	1.1810	714
TCA1101AF111GAC010	TCA 315S02	110	315S	2983	197	95.2	0.89	352	7.1	2.2	3.2	2.2273	882
TCA1321AF111GAC010	TCA 315MB02	132	315M	2983	236	95.4	0.89	423	7.1	2.3	3.2	2.4890	913
TCA1601AF111GAC010	TCA 315LA02	160	315L	2983	286	95.6	0.89	512	7.2	2.4	3.3	2.7640	960
TCA1801AF111GAC010	TCA 315LB02	180	315L	2980	321	95.7	0.89	577	7.2	2.4	3.3	3.0910	1063
TCA2001AF111GAC010	TCA 315LC02	200	315L	2980	356	95.8	0.89	641	7.2	2.4	3.3	3.0910	1063
TCA2251AF111GAC010	TCA 355MA02	225	355M	2983	398	95.8	0.90	720	7.5	2.4	3.2	4.0728	1590
TCA2501AF111GAC010	TCA 355M02	250	355M	2983	443	95.8	0.90	800	7.5	2.6	3.3	4.0728	1590
TCA2801AF111GAC010	TCA 355LA02	280	355L	2984	493	95.8	0.90	896	7.5	2.5	3.3	4.4557	1650
TCA3151AF111GAC010	TCA 355LB02	315	355L	2984	554	95.8	0.90	1008	7.5	2.5	3.3	4.7428	1749
TCA3551AF111GAC010	TCA 355LC02	355	355L	2981	626	95.8	0.90	1137	7.8	2.5	3.3	5.7955	1733

3000rpm/minute, 2 poles, 50Hz, IP55

marathon® Motors

Model Selections

Model#	Rating	Power (KW)	Frame size	Rated speed (RPM)	Current	Effi-cien-cy	power-factor	Rated tor que	Locked current	Locked tor que	Maximum torque	Inertia	Weig ht
									Rated current	Rated tor que	Rated torque		
TCAP752AF111GAC010	TCA 80MB04	0.75	80M	1428	1.79	82.5	0.77	5.02	6.7	2.9	3.2	0.0031	20.2
TCA1P12AF111GAC010	TCA 90S04	1.1	90S	1444	2.55	84.1	0.78	7.27	6.7	2.8	3.1	0.0044	23.5
TCA1P52AF111GAC010	TCA 90L04	1.5	90L	1441	3.43	85.3	0.78	9.94	6.8	2.8	3.1	0.0052	26.5
TCA2P22AF111GAC010	TCA 100LA04	2.2	100L	1457	4.76	86.7	0.81	14.4	7.0	2.3	3.0	0.0115	35.7
TCA0032AF111GAC010	TCA 100LB04	3	100L	1455	6.26	87.7	0.83	19.7	7.0	2.6	3	0.0144	38.7
TCA0042AF111GAC010	TCA 112MB04	4	112M	1451	8.37	88.6	0.82	26.3	7.0	2.0	3	0.0206	48.3
TCA5P52AF111GAC010	TCA 132S04	5.5	132S	1463	11.4	89.6	0.82	35.9	6.9	2.0	2.9	0.0446	69.7
TCA7P52AF111GAC010	TCA 132M04	7.5	132M	1462	15.2	90.4	0.83	49.0	6.8	2.1	3.1	0.0551	79.8
TCA0112AF111GAC010	TCA 160MB04	11	160M	1476	21.8	91.4	0.84	71.2	7.3	2.5	3.0	0.1200	137
TCA0152AF111GAC010	TCA 160LA04	15	160L	1472	29.1	92.1	0.85	97.3	7.5	2.5	3.1	0.1592	160
TCA18P2AF111GAC010	TCA 180M04	18.5	180M	1477	36.6	92.6	0.83	120	7.1	2.3	3.0	0.2208	187
TCA0222AF111GAC010	TCA 180LA04	22	180L	1474	43.8	93.0	0.82	143	7.5	2.5	3.2	0.2415	206
TCA0302AF111GAB003	TCA 200LA04	30	200L	1482	57.3	93.6	0.85	193	7.2	2.2	3.0	0.4487	263
TCA0372AF111GAC010	TCA 225S04	37	225S	1483	70.4	93.9	0.85	238	7.1	2.3	3.0	0.6683	340
TCA0452AF111GAC010	TCA 225MA04	45	225M	1484	85.4	94.2	0.85	290	7.4	2.3	3.0	0.7129	369
TCA0552AF111GAC010	TCA 250MA04	55	250M	1488	103	94.6	0.86	353	7.1	2.4	3.0	1.3974	504
TCA0752AF111GAC010	TCA 280S04	75	280S	1489	138	95.0	0.87	481	6.8	2.2	3.0	2.2302	679
TCA0902AF111GAC010	TCA 280MA04	90	280M	1489	163	95.2	0.88	577	6.8	2.2	3.0	2.3805	747
TCA1102AF111GAC010	TCA 315S04	110	315S	1489	204	95.4	0.86	706	7.0	2.3	3.1	3.3448	846
TCA1322AF111GAC010	TCA 315MB04	132	315M	1489	244	95.6	0.86	847	7.0	2.3	3.0	3.7065	902
TCA1602AF111GAC010	TCA 315LA04	160	315L	1489	288	95.8	0.88	1026	7.1	2.4	3.1	4.3389	1034
TCA1802AF111GAC010	TCA 315LB04	180	315L	1489	328	95.9	0.87	1154	7.1	2.2	2.8	3.9566	1102
TCA2002AF111GAC010	TCA 315LC04	200	315L	1489	364	96.0	0.87	1283	7.1	2.5	3	5.0622	1102
TCA2252AF111GAC010	TCA 355MA04	225	355M	1491	401	96.0	0.89	1441	7.1	2.0	3.0	8.2509	1572
TCA2502AF111GAC010	TCA 355M04	250	355M	1491	446	96.0	0.89	1601	7.1	2.0	3.0	8.2509	1572
TCA2802AF111GAC010	TCA 355LA04	280	355L	1491	498	96.0	0.89	1793	7.1	2.0	2.8	9.5039	1690
TCA3152AF111GAC010	TCA 355LB04	315	355L	1491	557	96.0	0.90	2018	7.1	2.0	2.8	9.5981	1755
TCA3552AF111GAC010	TCA 355LC04	355	355L	1491	629	96.0	0.89	2274	7.0	2.2	2.9	10.9452	1809

1500rpm/minute, 4 poles, 50Hz, IP55,class F/B

Model Selections

Model#	Rating	Power (KW)	Frame size	Rated speed (RPM)	Current	Effi-cien-cy	power-factor	Rated tor que	Locked current	Locked tor que	Maximum torque	Inertia	Weig ht
									Rated current	Rated tor que	Rated torque		
TCAP753AF111GAC010	TCA 90S06	0.75	90S	946	2.09	78.9	0.69	7.57	5.6	2.5	3.4	0.0036	22.7
TCA1P13AF111GAC010	TCA 90L06	1.1	90L	941	2.99	81.0	0.69	11.2	5.6	3.3	2.8	0.0046	26.8
TCA1P53AF111GAB002	TCA 100L06	1.5	100L	966	3.84	82.5	0.72	14.8	6.6	2.1	2.5	0.0142	33.7
TCA2P23AF111GAB002	TCA 112M06	2.2	112M	958	5.29	84.3	0.75	21.9	6.5	2.4	2.7	0.0180	44.2
TCA0033AF111GAB006	TCA 132SA06	3	132S	970	6.92	85.6	0.77	29.5	6.5	1.8	2.5	0.0390	57.8
TCA0043AF111GAB002	TCA 132MA06	4	132M	973	9.09	86.8	0.77	39.3	6.5	1.8	2.5	0.0495	67.6
TCA5P53AF111GAB002	TCA 132MB06	5.5	132M	973	12.3	88.0	0.77	54.0	6.5	1.8	2.5	0.0662	78.5
TCA7P53AF111GAB006	TCA 160M06	7.5	160M	976	15.6	89.1	0.82	73.4	6.5	1.9	2.5	0.1355	125
TCA0113AF111GAB002	TCA 160LB06	11	160L	977	23.1	90.3	0.80	108	6.5	1.9	2.5	0.1811	152
TCA0153AF111GAB002	TCA 180LA06	15	180L	982	32.0	91.2	0.78	146	6.9	1.9	2.8	0.2961	208
TCA18P3AF111GAC010	TCA 200LA06	18.5	200L	984	38.3	91.7	0.80	180	6.3	1.9	2.3	0.5178	250
TCA0223AF111GAC010	TCA 200LB06	22	200L	985	45.3	92.2	0.80	213	6.1	2.2	2.4	0.6069	255
TCA0303AF111GAC010	TCA 225MA06	30	225M	987	59.1	92.9	0.83	290	6.8	2.3	3.2	0.9206	342
TCA0373AF111GAC010	TCA 250MA06	37	250M	987	71.7	93.3	0.84	358	6.6	2.1	3.1	1.6081	448
TCA0453AF111GAB006	TCA 280S06	45	280S	989	89.0	93.7	0.82	435	6.5	2.0	3.1	2.2380	561
TCA0553AF111GAB002	TCA 280MA06	55	280M	989	106	94.1	0.84	531	6.5	2.1	3.0	2.6733	644
TCA0753AF111GAB003	TCA 315S06	75	315S	989	147	94.6	0.82	724	6.5	2.1	2.9	3.3733	753
TCA0903AF111GAB002	TCA 315MA06	90	315M	990	176	94.9	0.82	868	6.5	1.7	2.6	3.9281	808
TCA1103AF111GAB002	TCA 315LA06	110	315L	990	214	95.1	0.82	1061	6.5	1.8	2.6	4.7676	883
TCA1323AF111GAB002	TCA 315LC06	132	315L	990	256	95.4	0.82	1273	6.6	1.8	2.6	5.4801	1003
TCA1603AF111GAC010	TCA 355MA06	160	355M	992	303	95.6	0.84	1540	6.6	1.7	2.8	8.5699	1483
TCA1803AF111GAC010	TCA 355M06	180	355M	992	340	95.7	0.84	1733	6.6	1.7	2.8	9.9148	1573
TCA2003AF111GAC010	TCA 355MB06	200	355M	992	378	95.8	0.84	1925	6.8	1.8	2.8	9.9148	1573
TCA2253AF111GAC010	TCA 355LA06	225	355L	992	423	95.8	0.84	2166	6.8	1.8	2.8	11.7079	1713
TCA2503AF111GAC010	TCA 355LB06	250	355L	992	470	95.8	0.84	2407	6.9	1.8	2.8	11.7079	1713
TCA2803AF111GAC010	TCA 355LC06	280	355L	991	529	95.8	0.84	2698	6.9	1.8	2.8	12.6224	1770

1000rpm/minute, 6 poles, 50Hz, IP55,class F/B

marathon® Motors

Model Selections

Model#	Rating	Power (KW)	Frame size	Rated speed (RPM)	Current	Effi-cien-cy	power-factor	Rated tor que	Locked current	Locked tor que	Maximum torque	Inertia	Weig ht
									Rated current	Rated tor que	Rated torque		
TCA0044AF111GAB002	TCA 160MB08	4	160M	730	9.94	85.0	0.72	52.3	5.3	1.7	2.3	0.1312	127
TCA5P54AF111GAB002	TCA 160MC08	5.5	160M	730	13.2	86.5	0.73	72.0	5.3	1.7	2.3	0.1673	142
TCA7P54AF111GAB002	TCA 160L08	7.5	160L	728	17.5	87.8	0.74	98.4	5.4	1.8	2.2	0.2040	160
TCA0114AF111GAB002	TCA 180LA08	11	180L	730	25.0	89.3	0.74	144	6.4	1.7	2.6	0.3337	213
TCA0154AF111GAB002	TCA 200LA08	15	200L	739	34.7	90.4	0.73	194	5.5	1.9	2.5	0.7327	294
TCA18P4AF111GAB002	TCA 225S08	18.5	225S	738	39.1	91.1	0.79	239	5.2	1.7	2.2	0.8780	336
TCA0224AF111GAB002	TCA 225MA08	22	225M	738	45.7	91.5	0.80	285	5.2	1.7	2.2	1.0453	369
TCA0304AF111GAB002	TCA 250MA08	30	250M	739	61.1	92.4	0.81	388	5.3	1.8	2.2	2.1616	529
TCA0374AF111GAB002	TCA 280S08	37	280S	742	75.7	92.9	0.80	476	5.8	1.8	2.2	3.2583	690
TCA0454AF111GAB002	TCA 280M08	45	280M	742	92.0	93.5	0.80	579	5.6	1.8	2.2	3.5326	725
TCA0554AF111GAB002	TCA 315S08	55	315S	742	121	92.5	0.75	708	5.2	1.7	2.2	3.6517	853
TCA0754AF111GAB002	TCA 315M08	75	315M	743	163	93.1	0.75	964	5.3	1.8	2.2	4.6636	952
TCA0904AF111GAB002	TCA 315LA08	90	315L	743	194	93.4	0.76	1157	5.4	1.9	2.2	5.4687	1038
TCA1104AF111GAB002	TCA 315LB08	110	315L	742	230	93.7	0.78	1416	5.3	1.8	2.2	6.6163	1160
TCA1324AF111GAB002	TCA 355MB08	132	355M	742	254	94.0	0.83	1699	5.9	1.4	2.3	8.9257	1516
TCA1504AF111GAB002	TCA 355MC08	150	355M	742	288	94.2	0.83	1931	5.9	1.4	2.3	9.9098	1605
TCA1604AF111GAB002	TCA 355MD08	160	355M	742	308	94.3	0.83	2059	6.2	1.5	2.3	10.5659	1658
TCA1854AF111GAB002	TCA 355ME08	185	355M	742	352	94.5	0.83	2381	6.1	1.5	2.3	12.0967	1787
TCA2004AF111GAB002	TCA 355LA08	200	355L	742	380	94.6	0.84	2574	6.3	1.6	2.4	13.1901	1873
TCA2204AF111GAB002	TCA 355LB08	220	355L	743	418	94.6	0.84	2828	6.5	1.6	2.4	14.7210	1998

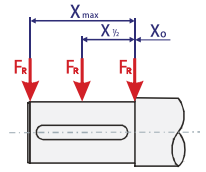
750rpm/minute, 8 poles, 50Hz, IP55,class F/B

Radial force

Standard ball bearing				
Max.radial force				
Frame	Pole	Xo	X1/2	Xmax
80	2	709	629	575
	4	664	598	544
90	2	705	633	571
	4	655	589	531
	6	829	745	673
100	2	1084	963	865
	4	1003	892	803
	6	1182	1052	945
112	2	1579	1409	1271
	4	1467	1311	1186
	6	1735	1552	1400
132	2	2314	2060	1855
	4	2149	1908	1721
	6	2488	2212	1989
160	2	2903	2568	2305
	4	2675	2377	2127
	6	3059	2711	2435
180	2	4018	3630	3304
	4	3714	3358	3059
	6	4272	3857	3514

Standard ball bearing				
Max.radial force				
Frame	Pole	Xo	X1/2	Xmax
200	2	4147	3755	3411
	4	4423	4000	3656
	6	4664	4223	3853
225	2	4941	4499	4125
	4	4477	3973	3572
	6	5222	4646	4174
250	2	5427	4869	4410
	4	4655	4169	3763
	6	5560	4976	4504
280	2	5226	4780	4397
	4	6047	5525	5083
	6	7112	6506	5975
315	2	6042	5601	5226
	4	6078	5850	5610
	6	7955	7286	6720
355	2	5877	5507	5168
	4	8490	7879	7366
	6	9302	8642	8062

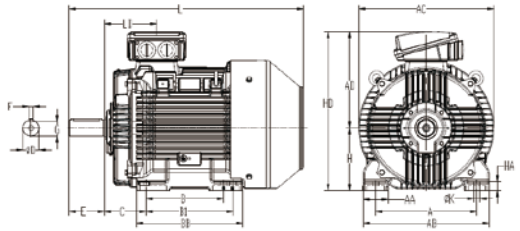
The above table gives the max. allowable radial force at shaft extension. (With absence of axial force, the bearing life of 2 pole motor @ 50HZ is 20,000hrs and 40,000hrs for 4/6 pole motors.)



marathon® Motors

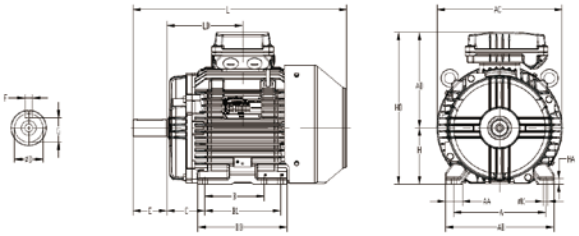
Dimensional outline and chart

Frame size 80~132



Frame size	Series	Poles	Mounting dimensions (mm)									
			A	B	B1	C	D	E	F	G	H	K
80M	TCA	2 4	125	100	-	50	19	40	6	15.5	80	10
90S	TCA	2 4 6	140	100	-	56	24	50	8	20	90	10
90S/L	TCA	2 4 6	140	100	125	56	24	50	8	20	90	10
100L	TCA	2 4 6	160	140	-	63	28	60	8	24	100	12
112M	TCA	2 4 6	190	140	-	70	28	60	8	24	112	12
132S	TCA	2 4 6	216	140	-	89	38	80	10	33	132	12
132S/M	TCA	2 4 6	216	140	178	89	38	80	10	33	132	12
160M	TCA	2 4 6 8	254	210	-	108	42	110	12	37	160	14.5
160M/L	TCA	2 4 6 8	254	210	254	108	42	110	12	37	160	14.5
180M	TCA	2 4	279	241	-	121	48	110	14	42.5	180	14.5
180M/L	TCA	4 6 8	279	241	279	121	48	110	14	42.5	180	14.5
200L	TCA	2 4 6 8	318	305	-	133	55	110	16	49	200	18.5
225S	TCA	4 6	356	286	-	149	60	140	18	53	225	18.5
225S/M	TCA	2	356	286	311	149	55	110	16	49	225	18.5
225S/M	TCA	4 6 8	356	286	311	149	60	140	18	53	225	18.5
250M	TCA	2	406	349	-	168	60	140	18	53	250	24
250M	TCA	4 6 8	406	349	-	168	65	140	18	58	250	24
280S	TCA	2	457	368	-	190	65	140	18	58	280	24
280S	TCA	4 6 8	457	368	-	190	75	140	20	67.5	280	24
280S/M	TCA	2	457	368	419	190	65	140	18	58	280	24
280S/M	TCA	4 6 8	457	368	419	190	75	140	20	67.5	280	24
315S/M	TCA	2	508	406	457	216	65	140	18	58	315	28
315S/M	TCA	4 6 8	508	406	457	216	80	170	22	71	315	28
315L	TCA	2	508	457	508	216	65	140	18	58	315	28
315L	TCA	4 6 8	508	457	508	216	80	170	22	71	315	28
355M/L	TCA	2	610	560	630	254	75	140	20	67.5	355	28
355M/L	TCA	4 6 8	610	560	630	254	95	170	25	86	355	28

Frame size 160~350



Frame size	Series	Poles	Mounting dimensions (mm)								
			AA	AB	AC	AD	HA	HD	BB	LD	L
80M	TCA	2 4	30	152	182	161	9	241	125	100	282
90S	TCA	2 4 6	35	165	199	169	9	259	125	106.5	307
90S/L	TCA	2 4 6	35	165	199	169	9	259	150	119	332
100L	TCA	2 4 6	32	192	229	183	13	283	170	133	398
112M	TCA	2 4 6	38	222	256	194	12	306	170	140	399
132S	TCA	2 4 6	40	255	295	227	13	359	172	159	465
132S/M	TCA	2 4 6	40	255	295	227	13	359	210	178	503
160M	TCA	2 4 6 8	65	315	352	260	22	420	244	213.5	622
160M/L	TCA	2 4 6 8	65	315	352	260	22	420	288	235.5	666
180M	TCA	2 4	75	354	399	281	28	461	322	188.5	712
180M/L	TCA	4 6 8	75	354	399	281	28	461	360	188.5	750
200L	TCA	2 4 6 8	80	398	446	330	26	530	361	186.5	769
225S	TCA	4 6	90	446	491	355	28	580	380	195.5	837
225S/M	TCA	2	90	446	491	355	28	580	405	195.5	832
225S/M	TCA	4 6 8	90	446	491	355	28	580	405	195.5	862
250M	TCA	2	100	506	542	398	35	648	428	211	941
250M	TCA	4 6 8	100	506	542	398	35	648	428	211	941
280S	TCA	2	100	557	595	421	37.5	701	519	211	1100
280S	TCA	4 6 8	100	557	595	421	37.5	701	519	226.5	1100
280S/M	TCA	2	100	557	595	421	37.5	701	570	226.5	1151
280S/M	TCA	4 6 8	100	557	595	421	37.5	701	570	226.5	1151
315S/M	TCA	2	120	628	652	519	48.5	834	607	236	1176
315S/M	TCA	4 6 8	120	628	652	519	48.5	834	607	236	1206
315L	TCA	2	120	628	652	519	48.5	834	718	236	1287
315L	TCA	4 6 8	120	628	652	519	48.5	834	718	236	1317
355M/L	TCA	2	120	730	762	642	48	997	770	291.5	1512
355M/L	TCA	4 6 8	120	730	762	642	48	997	770	291.5	1542

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Dimensional outline and chart

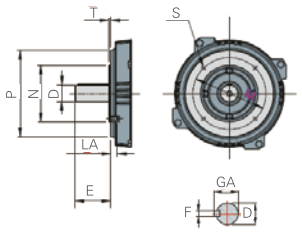
Shaft dimension

Frame size H	Diameter D		Length E	
80	19		40	
90	24		50	
100	28		60	
112	28		60	
132	38		80	
160	42		110	
180	48		110	
200	55		110	
Model selection	2P	4-8P	2P	4-8P
225	55	60	110	140
250	60	65	140	
280	65	75	140	
315	65	80	140	170
355	75	95	140	170

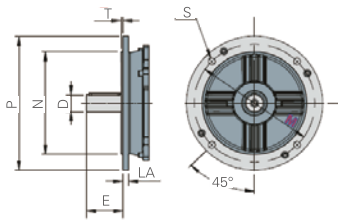
B5 flange endshield

Flange mounting hole distance dia M	Flange spigot dia N	Flange spigot dia P	Flange mounting hole dia S
165	130	200	12
165	130	200	12
215	180	250	14.5
215	180	250	14.5
265	230	300	14.5
305	250	350	18.5
305	250	350	18.5
355	300	400	18.5
405	350	450	18.5
505	450	550	18.5
505	450	550	18.5
605	550	660	24
745	680	800	24

B14 flange



B14A



B14B

B14A flange endshield

Flange mounting hole distance dia M	Flange spigot dia N	Flange spigot dia P	Flange mounting hole dia S
100	80	120	M6
115	95	140	M8
130	110	160	M8
130	110	160	M8
165	130	200	M10
215	180	250	M12

B14B flange endshield

Flange mounting hole distance dia M	Flange spigot dia N	Flange spigot dia P	Flange mounting hole dia S
130	110	160	M8
130	110	160	M8
165	130	200	M10
165	130	200	M10
215	180	215	M12
265	230	300	M12

B5 flange (D face)
Flange dia. > motor dia.
Through hole
Available for all frame sizes

B14A flange
Flange dia. < motor dia.
Thread hole
Available for fr.63~160

B14B flange
Flange dia. < B5 flange dia., but >B14A flange dia.
Thread hole
Available for fr.63~160

LV Product Family

Product name	HJA Standand eff Alum Motor	SCA Standand eff Motor	QCA Super high eff Motor	TCA High eff Motor
Picture				
Eff	IE2	IE2	IE4	IE3
Enclosure material	Alum	Cast iron		Cast iron
Rated power	0.75-11KW	0.75-375KW		0.75-375KW
Frame size	H80-132	H80-355		H80-355
Pole	2-6	2-6		2-8
Mounting	B3			
Rated voltage	220V/380V 380V/660V			
Protection level	IP55			
Construction standard	IEC			
Cooling method	IC411			
Insulation/temp rise	F/B			
VFD	Customize			
Target market	Generalpur pose machines			
Certification	CE,CCC	CE,CCC	CE,CCC, Energy saving certification	CE,CCC,UL,CSA, CC-code, Energy saving certification
Marine certification	Optional			
Encoder	Optional			
Brake	Availableup to fr255			
Independent blower	Optional			
RTD's & heaters	Optional			

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LV Product Family

Product name	LVF Inverter duty (Fan/pump)	LVF2 High-precision inverter duty	LVX LV high output inverter duty	SCA High speed inverter duty
Picture				
Eff	IE1	IE2 or IE3	IE2 or IE3	IE2
Enclosure material	Cast iron			
Rated power	0.75-500KW	0.75-500KW	132-1400KW	30-200KW
Frame size	H80-400	H80-400	H355-560	H200-315
Pole	2-8	2-6	2-12	2
Mounting	B3			
Rated voltage	380V/660V 400V/690V			
Protection level	IP55			
Construction standard	IEC			
Cooling method	IC411 or IC416			
Insulation/temp rise	F/B			
VFD	Customerize			
Target market	Generl purpose	Paper-making/textile	water pump	Blower/compressor
Certification	CE,CCC	CE,CCC	CE	CE
Marine certification	Optional			
Encoder	Optional			
Brake	Up to H200	Up to H200	-	
Independent blower	Optional			
RTD's & heaters	Optional			

Product name	TCS Smoke Spill motors (high eff)	LEB Brake motors	LEX Exdexplosion proof motors	LCP Verical motors
Picture				
Eff	IE3	-	IE2	-
Enclosure material	Cast iron			
Rated power	0.75-375KW	0.18-45KW	0.55-355KW	80-300KW
Frame size	H80-355	H71-225	H80-355	H450-500
Pole	2-6	2-8	2-8	4-12
Mounting	B3	B3	B3	V1/V2
Rated voltage	220V/380V 380V/660V		380/660V	380-420V 660-690V
Protection level	IP55			IP23
Construction standard	IEC			
Cooling method	IC410	IC411 or IC416	IC411	IC01
Insulation/temp rise	H/B		F/B	
VFD	25~50Hz/specified range	25~50Hz/specified range	-	25~50Hz/specified range
Target market	Subway/tunnel	Wind power	Exd	Pharmacy and Biochemistry
Certification	"CE,CCC,GA211,EN12101-3	CE	Exd II BT4 Gb CNEx	CE
Marine certification	Optional			
Encoder	-	Optional	-	-
Brake	-	Up to H200	-	-
Independent blower	-	Optional	-	-
RTD's & heaters	Optional			

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HV Product Family

Product name	LOD ODP standard	NEMA-TEFC Totally enclosed NEMA standard	NEMA-ODP Open NEMA standard	NEMA-ODP Open NEMA fire pump
Picture				
Eff	-	Premium	Premium	EPACT
Enclosure material	Cast iron		180~360 Rolled steel 400~440 Cast iron	
Rated power	11-710KW	1-250HP	1-350HP	1-300HP
Frame size	H160-355	143T-449T	143T-449T	143T-449T
Pole	2-8	2-8	2-8	2-4
Mounting	B3	F1	F1	F1
Rated voltage	220V/380V 380V/660V	208-230/460V 575V	208-230/460V 575V	208-230/460V 575V
Protection level	IP23	IP55	IP22	IP22
Construction standard	IEC	NEMA	NEMA	NEMA
Cooling method	IC01	IC411	IC01	IC01
Insulation/temp rise	F/B			
VFD	25~50HZ/specified range	10:1 VT, 2:1 CT	10:1 VT, 2:1 CT	10:1 VT, 2:1 CT
Target market	Compressor marine	USA	USA	Fire pump UL1004-5
Certification	CE	UL,CSA,CE,CC-code	UL,CSA,CE,CC-code	UL,EX5190
Marine certification	Optional			
Encoder	Optional			
Brake	-		-	
Independent blower	Optional		-	
RTD's & heaters	Optional			

Product name	HKA HV 2 pole motors	HKO HV 2 pole motors	HAA HV air-to-air cooling motors
Picture			
Eff	-	-	-
Enclosure material	Fabricated steel		
Rated power	200-3150KW	220-4000KW	185-8000KW
Frame size	H355-560	H355-560	H355-900
Pole	2	2	2-16
Mounting	B3 or B35	B3 or B35	B3
Rated voltage	6KV 10KV	6KV 10KV	6KV 10KV
Protection level	IP55	IP24	IP55
Construction standard	IEC		
Cooling method	IC611	IC01	IC611
Insulation/temp rise	Class F/B		
VFD	-	-	-
Target market	Centrifugal comoressor/blower	Centrifugal comoressor/blower	General purpose
Certification	-		
Marine certification	Optional		
Encoder	-		
Brake	-		
Independent blower	-		
RTD's & heaters	Optional		

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HV Product Family

Product name	HAH Air-to-air motors (high eff.)	HDP Open type motors	HCM High-compact motors	Tiger High eff. high compact motors
Picture				
Eff	Grade II (GB)	-	-	Grade I (GB)
Enclosure material	Fabricated steel	Fabricated steel	cast irom	cast irom
Rated power	400-3150KW	185-8000KW	60-1800KW	200-1120KW
Frame size	H400-500	H355-900	H355-560	H315-450
Pole	4-6	2-16	2-8	2-8
Mounting	B3	B3	B3	B3
Rated voltage	6KV or 10KV	6KV or 10KV	6KV or 10KV	6KV or 10KV
Protection level		IP24	IP55	IP55
Construction standard	IEC			
Cooling method		IC01	IC411	IC411
Insulation/temp rise	Clss F/B			
VFD	-			
Target market	General purpose			
Certification	-			
Marine certification	Optional			
Encoder	-			
Brake	-			
Independent blower	-			
RTD's & heaters	Optional			

Maintenance Tips

Inspectio nsteps	Need to Know
Prestart	1) The motor perormance data ie rated speed, power, volt, curent, tc
	2) Check the application requirement ke speed, starting, etc
	3) Check the installation situation as well as the circumstance
	4) Make sure the supply ads conned suely ne he minal box and houding bolt n good coat on motor shell
	5) Check the status of the sup w h oa w mu u on m sang abnt and make sure they are in good condition
	6) Check the cooling system against its manual
	7) If necessary, also check the insulation resistance meets spec
	8) For motos with sleeve bearings.the DE clearacne cursor must be in the shaft groove when mounting for magnetic concentricity of the stator and rotor in operation
	9) Check the lubrication conduit connection staatus of the sleeve bearings for any potential leakage. First run the oil station if the motor has forced oil cooing system.
	10) Check the motor rotation if necessary
Afterstartup	1) Motor in correct rotation
	2) No noise or vibration at startup or acceleration.
	3) Noxmal starting cuon and ap te voltage roduction
	4) Starting time is normal
	5) Load cunent shal not exceed the rated cunent shown on the nameplate;balanced volt/current in three phases
	6) Starting system is oK
Inoperation	1) Check the motor sound . speed . temp . oprating current to judge whether the motor is runing well. If any one of the following phenomenons happens. stop the motor right away for inspection-election leakage.-electric leakage. sudden slow-down. severe vibration. abnormal sound. overheated. smoking. sparking at connection points.
	2) Listen to it when the motor is rnnnng. If abnomral mchical sound oocurs, it might be fiom the bearngs, or caused by stator touching w ih morand bosenng up ofparts, etc. FIselectmicalno se, it m ihtbe caused by open phase. voltage unbalance. etc. Do not run the motor until the noise issue is addressed
	3) Make sure the contD lsystem and the m otorconnectDns securel fastened, no abno m alte m p rise or spang,nonsultin agng No noise orvbratmn fimm the oontactor. n o sp arkng at the contact heads. A ddress night aw ay if any.
	4) Check the motor temp from time to time in case overheating. The abwabe max. temp rise of motors of inaultion class Fis 155℃. The actual winding temp of running motor way llower than this max. limit. The actual wnding temp shoul be the motor surface temp plus 15℃20℃ Measure its working cument when the motor temp rise is high.If the working cunent is relatiely high while the three phase voltage is normal is says the motor is over lbaded and shall inform the mantenance peope to check the applicaton machinery if above 20% overcurrent for a long time while the protection system no reaction, it says the thermal relay's calibration current was set too high and shall be reduced Make sure the motor current at each phase varies no mroe than 10% of the average value. No radial play or abnomal sound of the bearings no oil leakage Bearng temp no more than 95℃. Observe closely the motor runing status to see if any abnormal sound, vibration or odor generates.
Aftershutdown	Dust off the motor aurface in time after motor is shut down to keep the motor clean. Do not w ater down on the motor dinectly in case any contaminant entry into the motor. Regrease the bearings as per the relubrication plate says.Do not mix-lubrucate or oner-lub.Suggest daily check by listening. looking.touching and measuring and log dowe the operation shatus for easy tracibility. Any help .please call MARATHN Customer Care Center at 400 8289 878

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Certifications

TCA series is a world product developed for the global market. It complies with CE/CCC/UL and ISO9001:2012.





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