

# PAN MOTOR

## F-Series Frameless Motor

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### Datasheet

- Frameless Design
- Wide Range of Customization Options
- Brushless Inner Rotor with Permanent Magnet
- State-of-the-art Torque Density



# F-Series

## ➤ **Frameless Design**

F series is the frameless setting of our inner rotor permanent magnet brushless motor. We have broken conventions and thoroughly rethought the design logic of small electric motor, which gives this bold new product state-of-the-art torque density, i. e. most torque at minimal weight.

## ➤ **Brushless Inner Rotor with Permanent Magnet**

F series motor is brushless motor with permanent magnet inner rotor. Inner rotor is in contrast to outrunner motor: as the name suggests, the rotating rotor is physically positioned inside the stator. Inner rotor motor is preferred choice in vast majority of industrial applications due to its lower inertia and easier mechanical connection interface. Moreover, the inner rotor motor exhibits superior heat dissipation and cooling performance due to the absence of physical barriers for heat exchange between stator, housing and surrounding environment.

## ➤ **Compared to Outer Rotors**

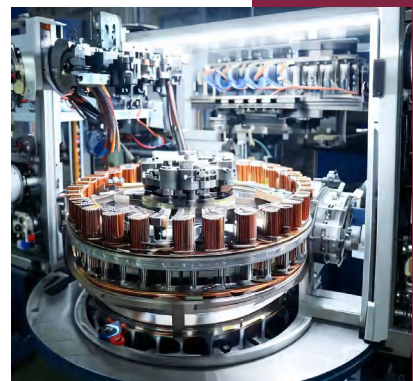
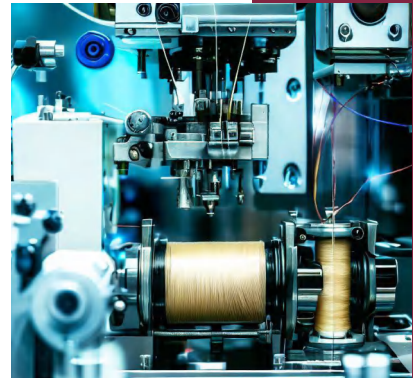
In many applications such as robotics and drones, outer rotors are favoured for a number of reasons: 1. larger radius of air gap (the gap between stator and rotor) and therefore a higher torque; 2. lower difficulty and cost of manufacturing. However, outrunner motor has some inherent disadvantages: 1. difficult to seal, resulting in either vulnerability to ingestion or need for extra protection; 2. difficult to cool; 3. limited mechanical connection options.

## ➤ **No Compromise, Push to Limit**

Our motor has overcome all cons of inner rotor-particularly low torque, while retaining all pros. Therefore, F series is the ideal choice for high torque, weight or volume sensitive applications.

## ➤ **Excellent Compatibility**

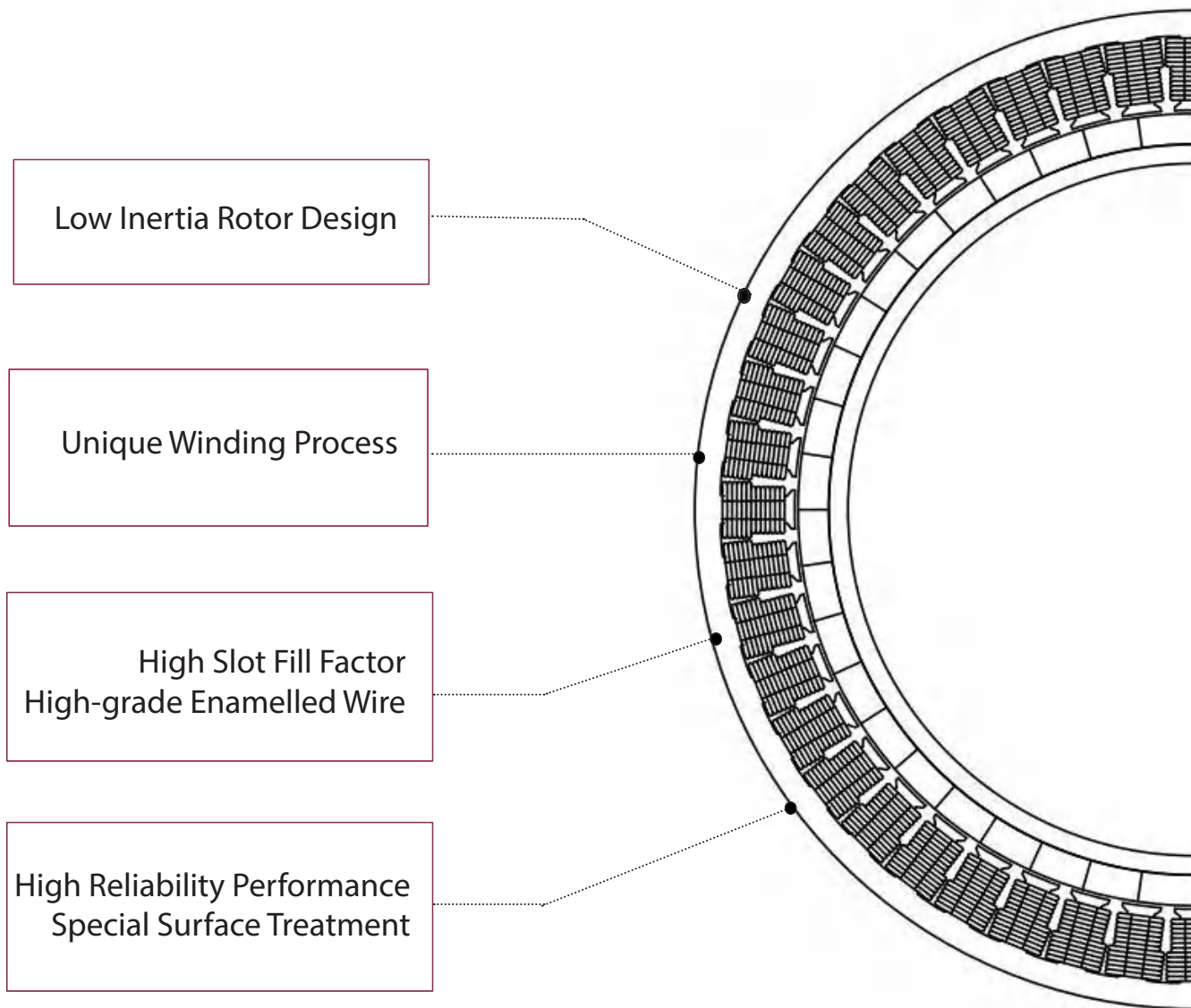
This product falls into the category of 3-phase permanent magnet brushless motors. Permanent magnet gives unparalleled energy density. Three-phase means the motor has 3 phases and 3 wire terminals of UVW and is compatible with the most motor drivers in the market, such as FOC driver and 6-step driver.



# Table of Contents

1. Introduction to F-Series	
1.1 Product Features	1
1.2 Applications	4
2. Glossary	
3. Specifications	
3.1 F-Series vs K-Series Performance	8
3.2 Nomenclature	9
3.3 F50	
3.3.1 Specification	10
3.3.2 Torque Range and Performance Curve	11
3.4 F60	
3.4.1 Specification	13
3.4.2 Torque Range and Performance Curve	16
3.5 F69	
3.5.1 Specification	21
3.5.2 Torque Range and Performance Curve	23
3.6 F76	
3.6.1 Specification	26
3.6.2 Torque Range and Performance Curve	29
3.7 F85	
3.7.1 Specification	34
3.7.2 Torque Range and Performance Curve	36
3.8 F104	
3.8.1 Specification	39
3.8.2 Torque Range and Performance Curve	42
3.9 F115	
3.9.1 Specification	47
3.9.2 Torque Range and Performance Curve	50
3.10 F130	
3.10.1 Specification	55
3.10.2 Torque Range and Performance Curve	56
4. Sizes and Tolerances	58

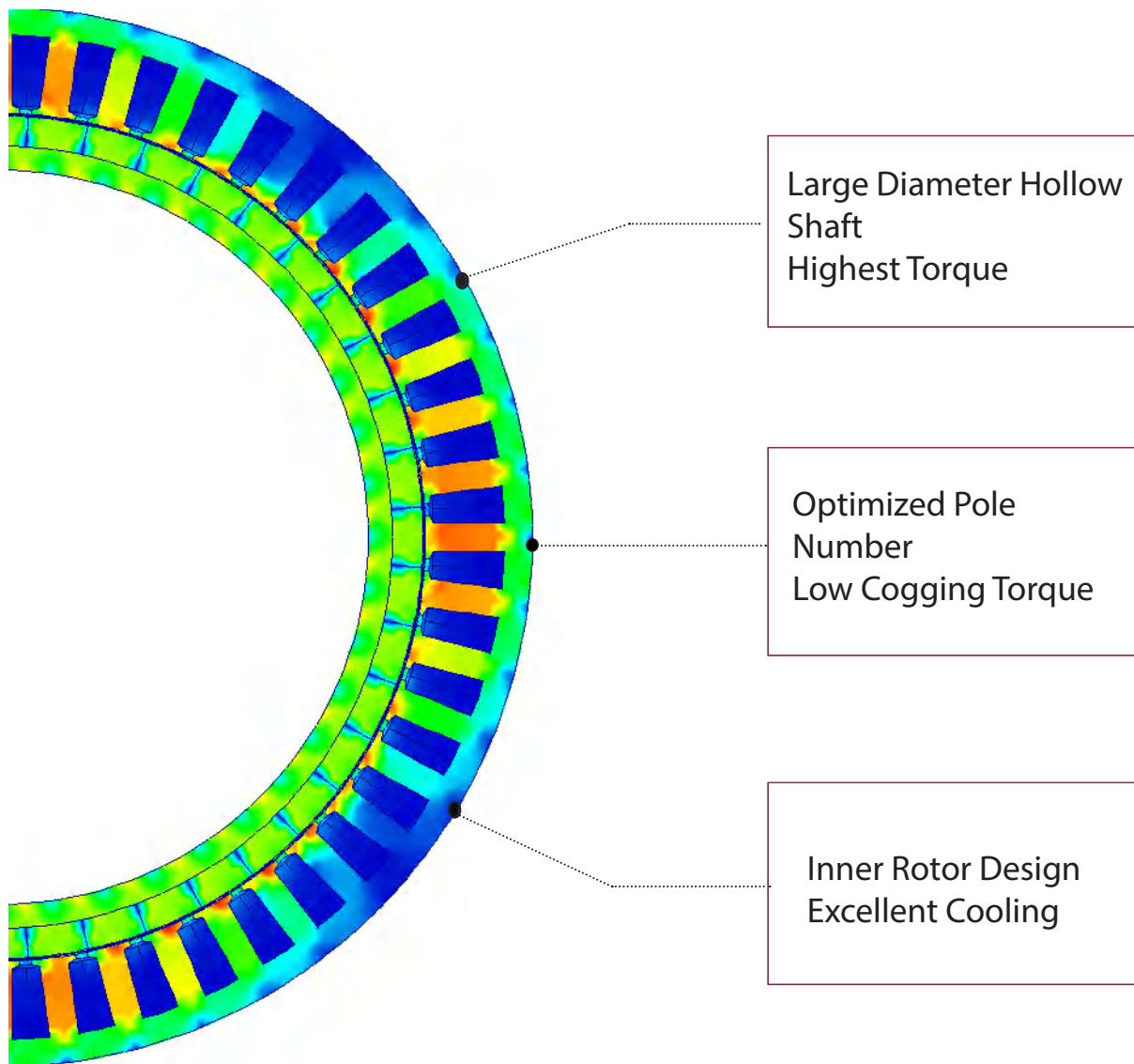
## Product Features



## Introduction

The F-Series motors are specifically designed for robotic applications where high torque capability is required.

You can seamlessly integrate the F-Series frameless inner rotor into your design, creating infinite possibilities for your design with the unprecedented torque capability.

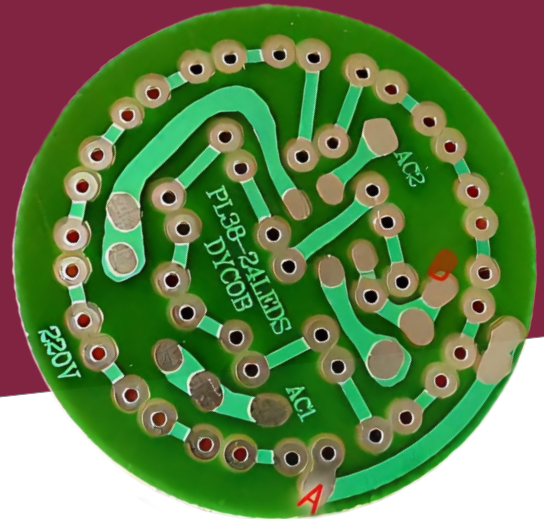
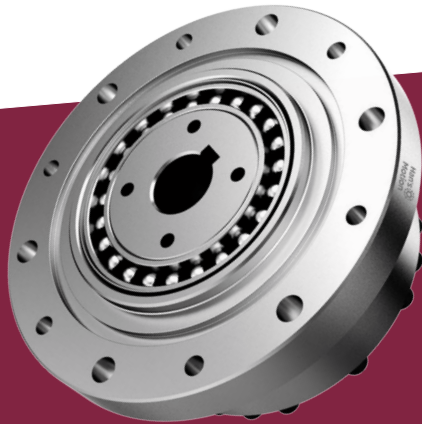


## Customization

Due to diversity of applications of the motor, we offer a wide range of customisation options to meet your various needs.

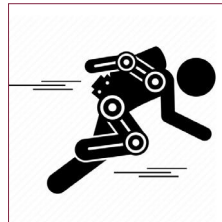
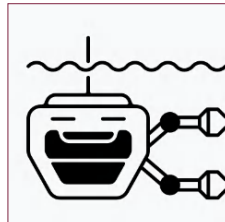
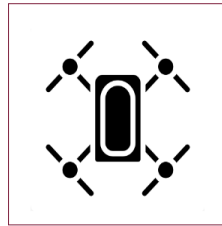
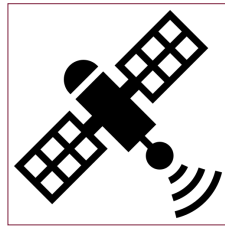
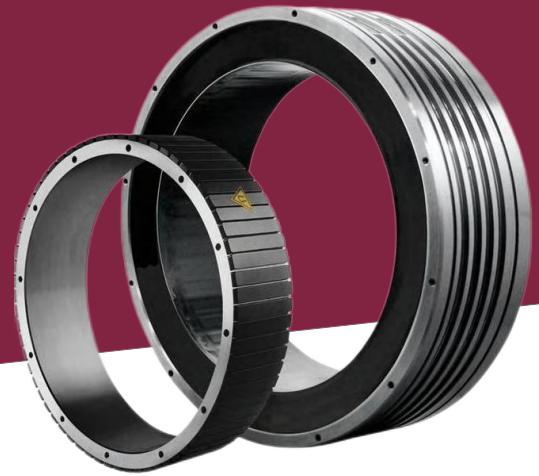
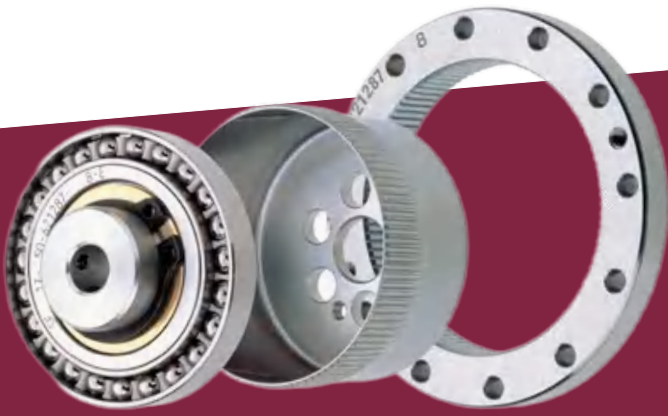
It includes, but are not limited to:

- Motor Size
- Mechanical Connection Interface
- KV Value or Peak Motor Speed
- Rated Current
- Special Insulation, Corrosion Protection Requirements
- Special Operating Environments
- Special Lifetime Requirements



## Product Features

- Frameless Design
- Inner Rotor Permanent Magnet Brushless Motor
- Highest Torque Density Ever
- Outstanding Power Density
- Minimal Weight
- High Reliability and Long Service Life
- Excellent Heat Dissipation
- Stator Diameters from 30mm to 150mm
- Applicable Voltage: 12V to 72V
- Torque Coverage: 0. 1Nm to 50Nm
- Optimised Cogging Torque
- Wide Range of Customization Options



## Applications

- Aerospace
- AGV and AGR
- Direct Drive without Gearbox
- Unmanned Aerial Vehicle (UAV)
- Exoskeleton Robot
- Gimbal Stabilizer
- Legged Robot
- Medical Device
- Robot Joint Actuator
- Underwater Robot

# Glossary

## 1 Stator Diameter [mm]

Nominal outer diameter of the stator of frameless motor.

## 2 Stator Axial Length (Excl. Cable) [mm]

Nominal axial length of the stator of frameless motor. The winding endings are included, and the dimensions occupied by the cables are not included.

## 3 Rotor Inner Diameter [mm]

Nominal inner rotor diameter of the frameless motor rotor. The inner diameter of the rotor can be reduced according to the customer's requirements, and it can be equipped with a mounting flange or other mechanical fixation; but it is generally difficult to expand.

## 4 Weight [g]

Frameless motor stator and rotor weight.

## 5 Stator Weight (Excl. Cable) [g]

The weight of the frameless motor stator. Stator weight includes standard cable.

## 6 Rotor Weight [g]

The weight of the frameless motor rotor. If the inner diameter of the rotor is be customized, the weight of the rotor will increase in general.

## 7 Rotor Inertia [kg mm<sup>2</sup>]

The moment of inertia of the frameless motor rotor. If the inner diameter of the rotor is customized, the moment of inertia will increase in general.

## 8 DC Drive Voltage (Typical) [V]

The DC drive voltage (Vdc) range permitted for the frameless motor. The drive voltage determines the no-load speed of the motor, and they are linear to each other. Too low voltage may cause the motor to fail to start or too low a running speed, but it will not affect the life and safety of the motor. Excessive voltage will affect the life of the motor and may lead to premature

failure of the motor. The size of the driving voltage has no effect on the rated torque and the permitted continuous mechanical speed.

## 9 Rated Output Power @ Typical Voltage [W]

The frameless motor can output power for a long time under the typical driving voltage and the specified ambient temperature. Exceeding the specified ambient temperature will result in a drop in output power.

## 10 No Load Speed @ Typical Voltage [rpm]

The maximum speed that the frameless motor can reach without load at the typical driving voltage and the specified ambient temperature. When the driving voltage increases, the no-load speed also increases. In general, the no-load speed is proportional to the driving voltage.

## 11 Load Speed @ Typical Voltage [rpm]

The maximum speed that the frameless motor can reach when the output load is the rated torque under the typical driving voltage and the specified ambient temperature. When the driving voltage increases, the load speed also increases.

## 12 Continuous Mechanical Speed Limit [rpm]

Under the specified ambient temperature, when the motor outputs the rated torque, the permitted speed at which motor can run for the whole life span. The factors for limiting the permitted continuous mechanical speed are the mechanical strength of the rotor and the heat generation of the motor itself. The permitted continuous mechanical speed is an inherent characteristic of the motor and is independent of the drive voltage.

## 13 Rated Torque (105°C Temp. Rise) [Nm]

When the environment of the motor is at room temperature of 25 °C and under typical natural heat dissipation conditions, the temperature of the motor stator rises by 105 °C, that is, the torque that the motor can continuously output when it reaches 130 °C. The rated torque is an inherent characteristic of the motor, which has nothing to do with the driving voltage, but it is dependent of



the heat dissipation conditions. Poor heat dissipation conditions will reduce the rated torque.

#### **14 Rated Torque (55°C Temp. Rise) [Nm]**

When the environment of the motor is at room temperature of 25 °C, the temperature of the motor stator rises by 55 °C, that is, the torque that the motor can continuously output when it reaches 80 °C. The rated torque is an inherent characteristic of the motor, which has nothing to do with the driving voltage, but it is dependent of the heat dissipation conditions. Poor heat dissipation conditions will reduce the rated torque.

#### **15 Rated Torque (Lasting 10s) [Nm]**

The motor stator can output torque within 55 °C within 10 seconds.

#### **16 Rated Torque (Lasting 2s) [Nm]**

The motor stator can output torque within 55 °C within 2 seconds.

#### **17 Rated RMS Current (105°C Temp. Rise) [A]**

When the environment of the motor is at room temperature of 25 °C, the motor stator temperature rises by 105 °C, that is, the RMS line current that can be continuously fed when the motor reaches 130 °C.

#### **18 Rated RMS Current (55°C Temp. Rise) [A]**

When the environment of the motor is at room temperature of 25 °C, the temperature of the motor stator rises by 55 °C, that is, the RMS line current that can be continuously fed when the motor reaches 80 °C.

#### **19 Peak RMS Current (Lasting 10s) [A]**

The RMS line current that the motor stator can input within 55 °C instantaneously within 10 seconds.

#### **20 Peak RMS Current (Lasting 2s) [A]**

The RMS line current that the motor stator can input within 55 °C instantaneously within 2 seconds.

#### **21 KV Constant [rpm/V]**

The ratio of the no-load speed of the motor to the DC drive voltage of the bus. It should be noted that

the speed coefficient will increase with the increase of temperature. It will increase linearly by about 0.5-1.5% for every 10 °C.

#### **22 Back EMF Constant [Vs/rad]**

The ratio of the motor's bus DC drive voltage to the back electromotive force. The back electromotive force (back EMF or BEMF) constant and the KV constant satisfy such relation: back EMF constant × KV constant =  $60/2\pi$ . It should be noted that the back EMF constant will decrease as the temperature rises. It will decrease linearly by about 0.5-1.5% for every 10 °C.

#### **23 Torque Constant [Nm/A]**

When the three phases of the motor are driven by sinusoidal current, the ratio of the motor torque to the peak value (amplitude) of any wire current. For example, when any line current is  $I\sin(\omega t)$ , the torque constant is the corresponding torque  $T/I$ . It should be noted that the torque constant of the motor is usually non-linear, which means that in different current ranges, the relationship between the torque output by the motor and the current tends to saturate (the current increases by 2.0x times, the torque less than 2.0x), see  $T_i$  curve for details. Torque constant will also decrease with the increase of temperature, which will decrease linearly by about 0.5-1.5% per 10 °C. The relationship between RMS rated current and rated torque is: rated torque = torque coefficient × RMS rated current ×  $\sqrt{2}$

#### **24 Line Resistance [Ohm]**

Resistance reading when connect any two among the three leads of the motor. It is important to note that line resistance increases as temperature rises. It will increase linearly by about 4% for every 10 °C.

#### **25 Line Inductance [H]**

Inductance reading when connect any two among the three leads of the motor.

**26 d Axis Inductance [mH]**

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The d-axis inductance of the motor.

**27 q Axis Inductance [mH]**

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The q-axis inductance of the motor. Our motor adopts non-salient pole design, that is: q-axis inductance = d-axis inductance. For a delta-connected non-salient pole motor, q-axis inductance = d-axis inductance = line inductance  $\times 1.5$ ; for a star-connected non-salient pole motor: q-axis inductance = d-axis inductance = line inductance  $\times 0.5$ .

**28 Time Constant [ms]**

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The electrical time constant indicates the current rise characteristic with respect to the input voltage. That is, when the motor is applied with voltage, the current needs time to rise due to the inductance, and the electrical time constant has unit of time, which is the time required for the current to reach  $I=0.632V/R$  (that is, 63.2% of the steady-state current) starting from the moment of applying DC voltage  $V$ , where  $R$  is the DC resistance.

**29 Winding Connection**

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Whether the winding is delta or star connection. The winding connection method has no effect on the efficiency or harmonic characteristics of the motor.

**30 Poles [Stator N Rotor P]**

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The number of teeth of the motor stator and the number of poles of the rotor. Pay attention to distinguish between the number of poles and the number of pole pairs, and the two satisfy the relationship: number of poles = number of pole pairs  $\times 2$ .

**31 Motor Constant [Nm/sqrt (W) ]**

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The motor constant is the ratio of the torque of the motor to the square root of the ohmic losses. The motor constant is the key indicator to measure the torque performance and efficiency of the motor. The higher the motor constant, the lower the heat generated by the motor to produce the same torque.

**32 Max. Winding Temperature [°C]**

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The maximum permitted temperature at which the motor can run for a long time. Exceeding this temperature will reduce the life expectancy of the motor.

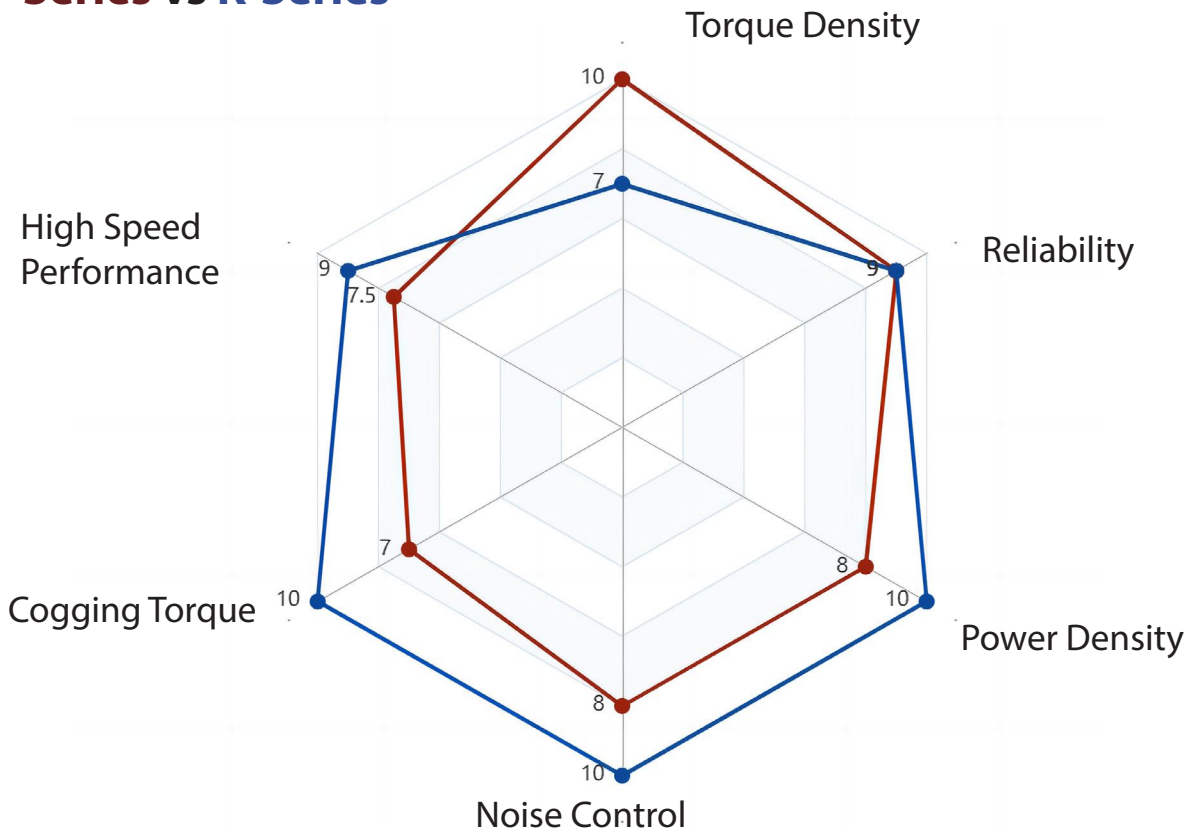
**33 Operating Ambient Temperature [°C]**

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Under one atmosphere pressure, the maximum permitted ambient temperature at which the motor can run for a long time. When the ambient temperature is high, motor shall be used at reduced power and torque.

# Performance Comparison

## F-Series vs K-Series



### Torque Density:

The ability to produce torque per unit volume or weight. the F-Series has the highest torque density in the world.

### High Speed Performance:

The performance of the motor during high speed operation. The K-Series is designed for high speed applications.

### Cogging Torque:

The smoothness of the torque of the motor in different positions. Cogging torque affects the motor's positioning accuracy and speed fluctuations at low speeds.

The K-Series offers excellent cogging torque performance.

### Noise Control:

The electromagnetic noise of the motor at high speeds. The K series is quieter.

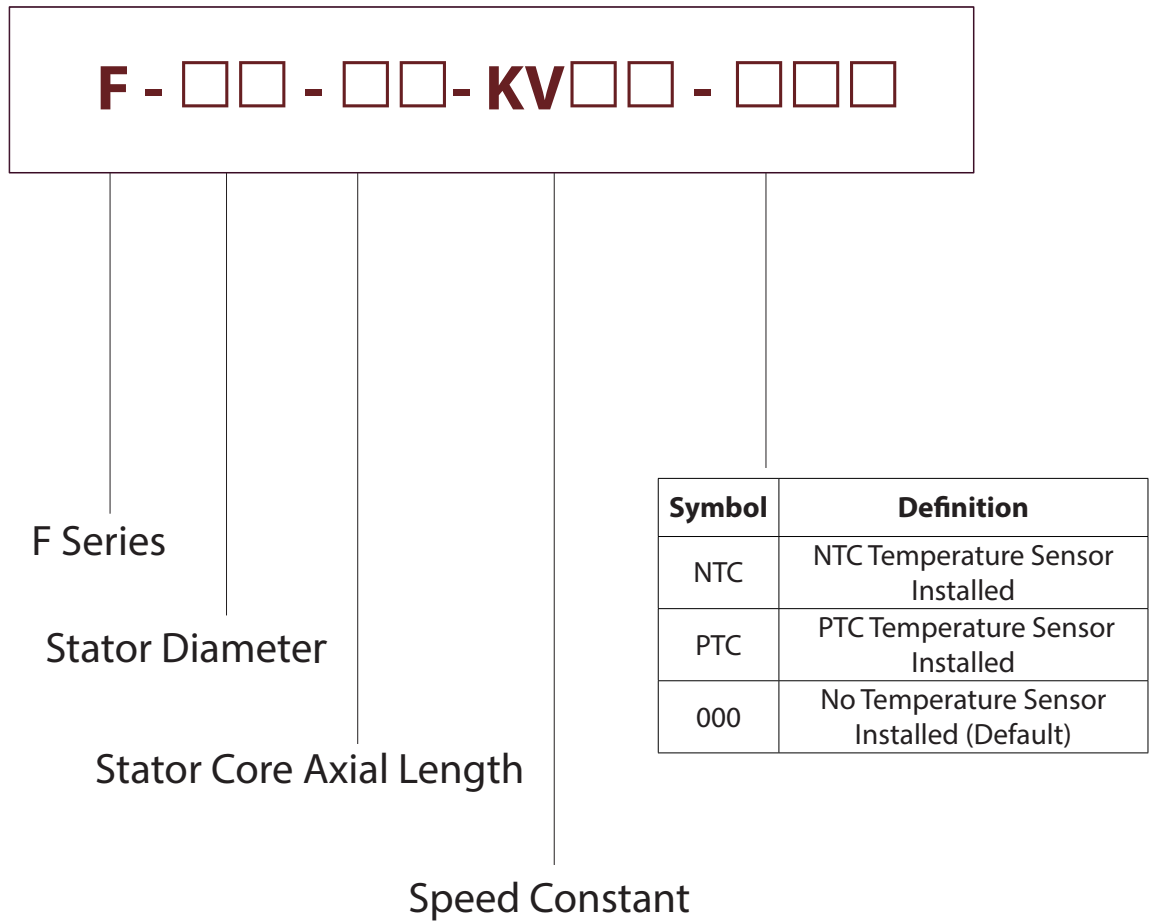
### Power Density:

The ability to output power per unit volume or weight.

### Reliability:

The ability of the motor to operate in harsh conditions. Both the F Series and K Series have excellent reliability.

# F Series-Nomenclature



Take F50-13-KV150-000 or F50-13-KV150 as an example:

This means that it is a product of the F series, that it has a nominal stator diameter of 50 mm, a Stator Core Axial Length of 13 mm, has a Kv (speed constant) of 15 rpm/V and is not installed with a temperature sensor.

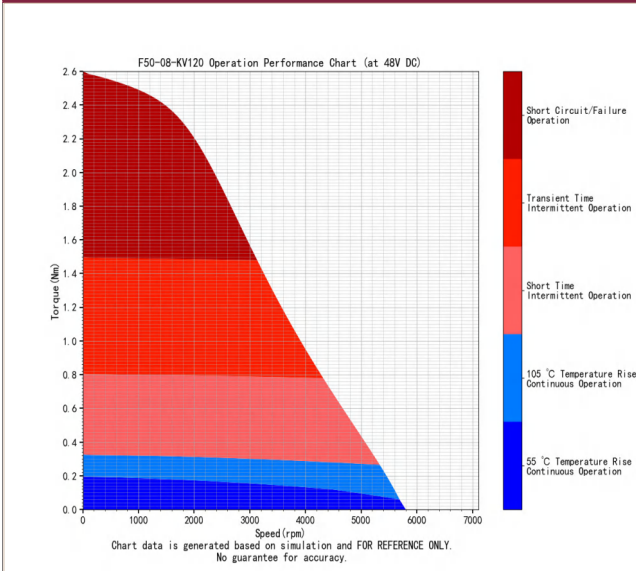
# F50 Specification

## F50-08 F50-13

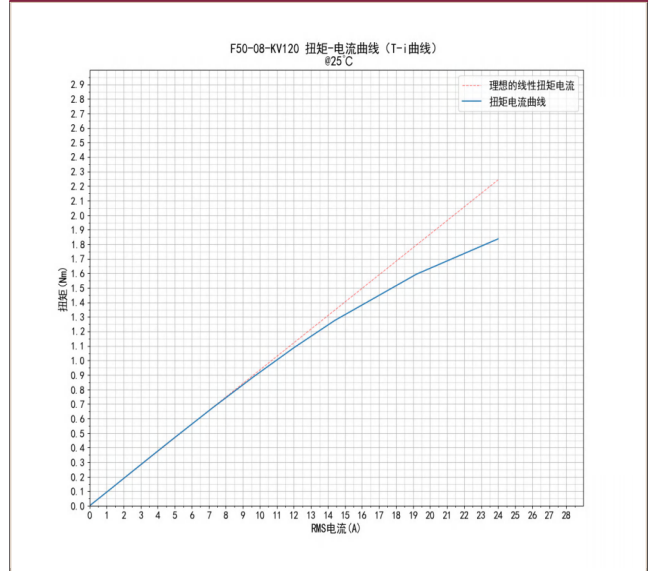
Type	F50-08		F50-13	
	KV120	KV250	KV75	KV150
Stator Diameter [mm]	50	50	50	50
Stator Axial Length (Excl. Cable) [mm]	16	16	21	21
Rotor Inner Diameter [mm]	28.5	28.5	28.5	28.5
Weight [g]	80	80	120	120
Stator Weight (Excl. Cable) [g]	66	66	97	97
Rotor Weight [g]	14	14	23	23
Rotor Inertia [kg mm <sup>2</sup> ]	3	3	5	5
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	130	130	170	220
No Load Speed @ Typical Voltage [rpm]	5900	11800	3600	7200
Load Speed @ Typical Voltage [rpm]	5400	11150	3260	6800
Continuous Mechanical Speed Limit [rpm]	4200	4200	4200	4200
Rated Torque (105°C Temp. Rise) [Nm]	0.32	0.32	0.51	0.51
Rated Torque (55°C Temp. Rise) [Nm]	0.19	0.19	0.31	0.31
Rated Torque (Lasting 10s) [Nm]	0.78	0.78	1.27	1.27
Rated Torque (Lasting 2s) [Nm]	1.44	1.44	2.3	2.3
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	3.4	6.7
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	2.02	4
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	8.4	16.8
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	16.8	33.6
KV Constant [rpm/V]	123	247	76	152
Back EMF Constant [Vs/rad]	0.0774	0.0387	0.126	0.0629
Torque Constant [Nm/A]	0.0666	0.0333	0.108	0.0541
Line Resistance [Ohm]	0.735	0.184	0.964	0.241
Line Inductance [H]	0.449	0.112	0.71	0.178
d Axis Inductance [mH]	0.668	0.167	1.06	0.264
q Axis Inductance [mH]	0.678	0.169	1.07	0.268
Time Constant [ms]	0.611	0.611	0.737	0.737
Winding Connection	△	△	△	△
Poles [Stator N Rotor P]	18N20P	18N20P	18N20P	18N20P
Motor Constant [Nm/sqrt (W) ]	0.0898	0.0898	0.127	0.127
Max. Winding Temperature [°C]	130	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50	-20 to 50

# F50-08-KV120

F50-08-KV120 Operation Performance Chart (at 48V DC)

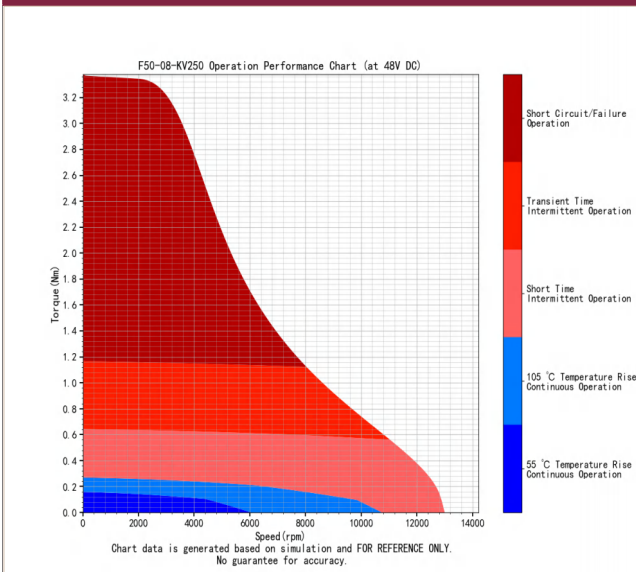


F50-08-KV120 Torque-Current Curve @25°C (T-i curve)

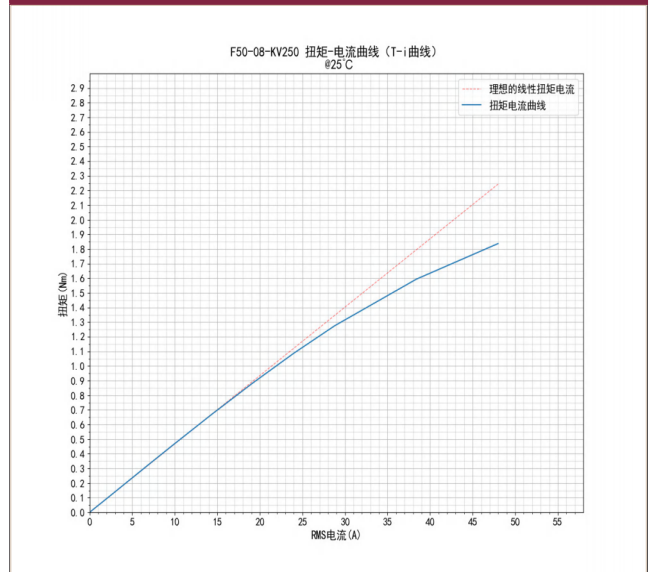


# F50-08-KV250

F50-08-KV250 Operation Performance Chart (at 48V DC)

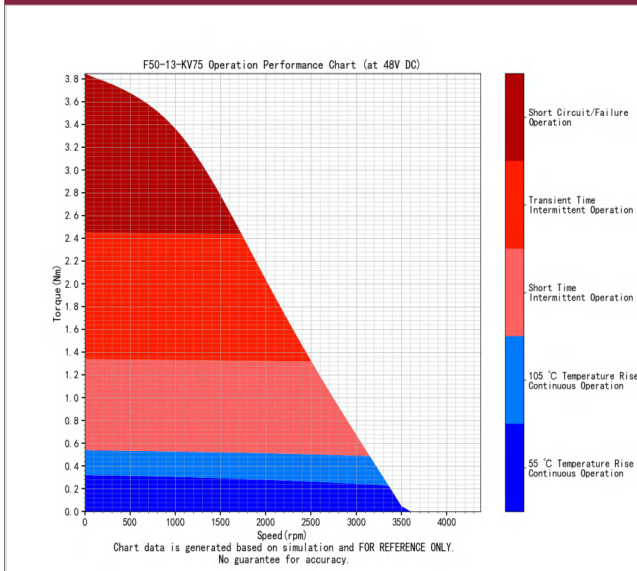


F50-08-KV250 Torque-Current Curve @25°C (T-i curve)

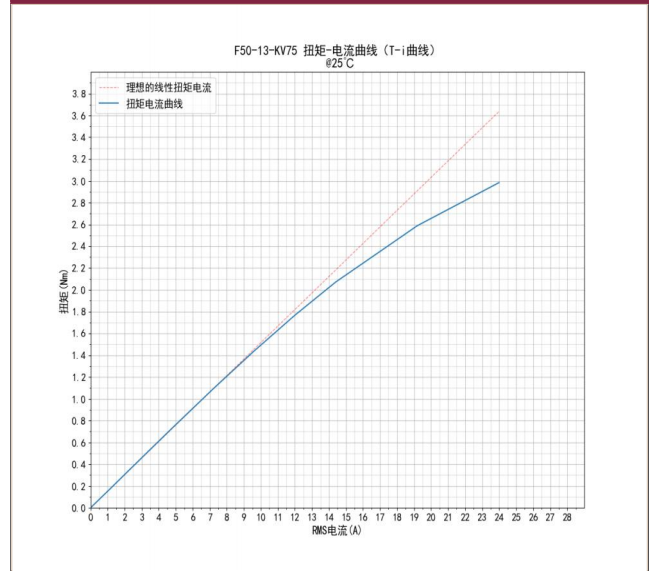


# F50-13-KV75

F50-13-KV75 Operation Performance Chart (at 48V DC)

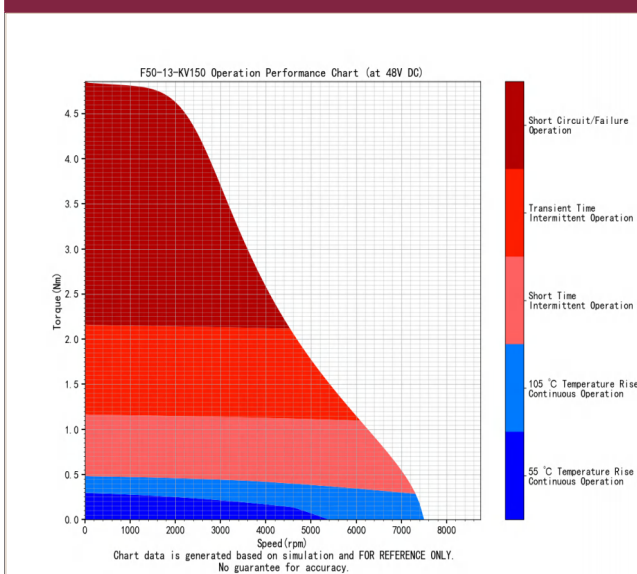


F50-13-KV75 Torque-Current Curve @25°C (T-i curve)

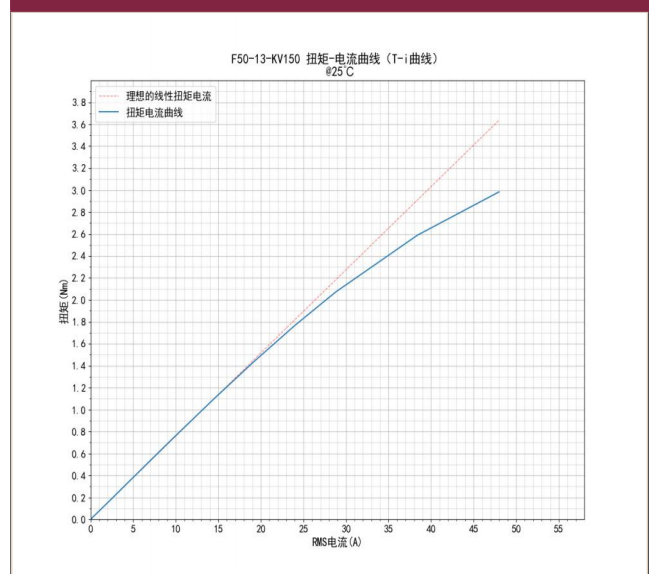


# F50-13-KV150

F50-13-KV150 Operation Performance Chart (at 48V DC)



F50-13-KV150 Torque-Current Curve @25°C (T-i curve)



# F60 Specification F60-08

Type	F60-08		
	KV80	KV160	KV330
Stator Diameter [mm]	60	60	60
Stator Axial Length (Excl. Cable) [mm]	16	16	16
Rotor Inner Diameter [mm]	36	36	36
Weight [g]	107	107	107
Stator Weight (Excl. Cable) [g]	84	84	84
Rotor Weight [g]	23	23	23
Rotor Inertia [kg mm <sup>2</sup> ]	9	9	9
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	170	200	200
No Load Speed @ Typical Voltage [rpm]	3900	7900	15800
Load Speed @ Typical Voltage [rpm]	3610	7520	15330
Continuous Mechanical Speed Limit [rpm]	4200	4200	4200
Rated Torque (105°C Temp. Rise) [Nm]	0.47	0.47	0.47
Rated Torque (55°C Temp. Rise) [Nm]	0.28	0.28	0.28
Rated Torque (Lasting 10s) [Nm]	1.15	1.15	1.15
Rated Torque (Lasting 2s) [Nm]	2.1	2.1	2.1
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	13.4
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	8.1
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	33.6
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	67.2
KV Constant [rpm/V]	82	165	330
Back EMF Constant [Vs/rad]	0.116	0.058	0.029
Torque Constant [Nm/A]	0.0991	0.0495	0.0248
Line Resistance [Ohm]	0.878	0.219	0.0549
Line Inductance [H]	0.385	0.0962	0.024
d Axis Inductance [mH]	0.495	0.124	0.0309
q Axis Inductance [mH]	0.659	0.165	0.0412
Time Constant [ms]	0.438	0.438	0.438
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N20P	24N20P	24N20P
Motor Constant [Nm/sqrt(W)]	0.122	0.122	0.122
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50



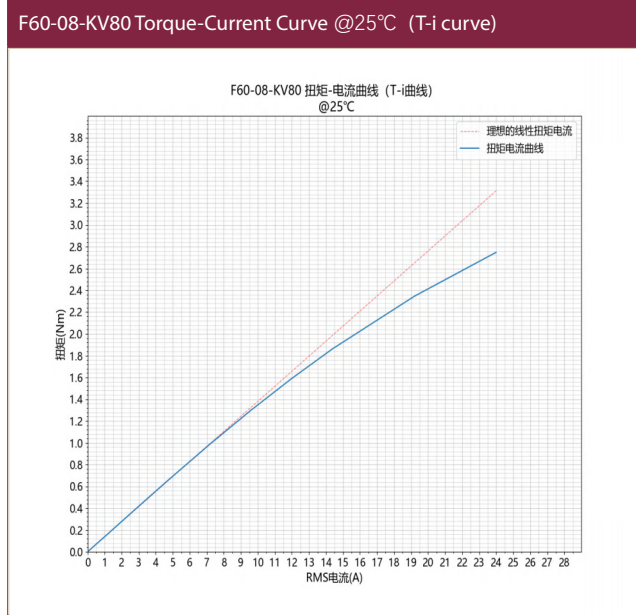
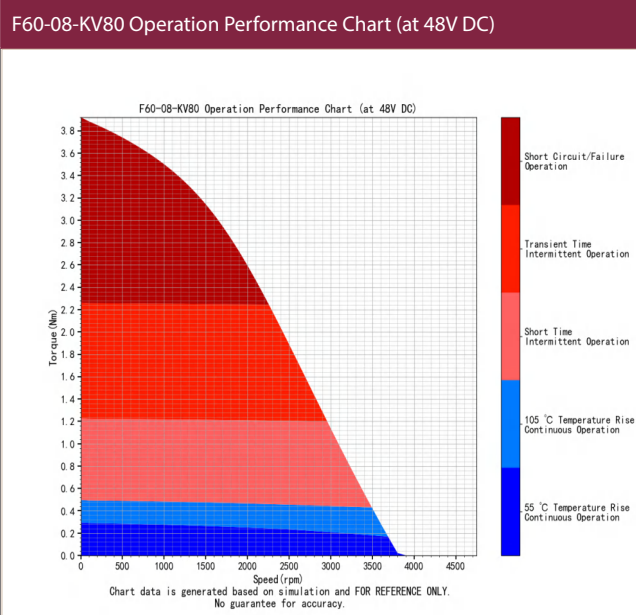
## F60 Specification F60-13

Type	F60-13		
	KV50	KV100	KV200
Stator Diameter [mm]	60	60	60
Stator Axial Length (Excl. Cable) [mm]	21	21	21
Rotor Inner Diameter [mm]	36	36	36
Weight [g]	162	162	162
Stator Weight (Excl. Cable) [g]	125	125	125
Rotor Weight [g]	37	37	37
Rotor Inertia [kg mm <sup>2</sup> ]	14	14	14
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	170	330	330
No Load Speed @ Typical Voltage [rpm]	2400	4800	9700
Load Speed @ Typical Voltage [rpm]	2160	4570	9380
Continuous Mechanical Speed Limit [rpm]	4200	4200	4200
Rated Torque (105°C Temp. Rise) [Nm]	0.76	0.76	0.76
Rated Torque (55°C Temp. Rise) [Nm]	0.46	0.46	0.46
Rated Torque (Lasting 10s) [Nm]	1.86	1.86	1.86
Rated Torque (Lasting 2s) [Nm]	3.4	3.4	3.4
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	13.4
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	8.1
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	33.6
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	67.2
KV Constant [rpm/V]	51	101	203
Back EMF Constant [Vs/rad]	0.188	0.0942	0.0471
Torque Constant [Nm/A]	0.161	0.0805	0.0402
Line Resistance [Ohm]	1.16	0.291	0.0727
Line Inductance [H]	0.607	0.152	0.0379
d Axis Inductance [mH]	0.776	0.194	0.0485
q Axis Inductance [mH]	1.04	0.261	0.0652
Time Constant [ms]	0.521	0.521	0.521
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N20P	24N20P	24N20P
Motor Constant [Nm/sqrt (W) ]	0.172	0.172	0.172
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

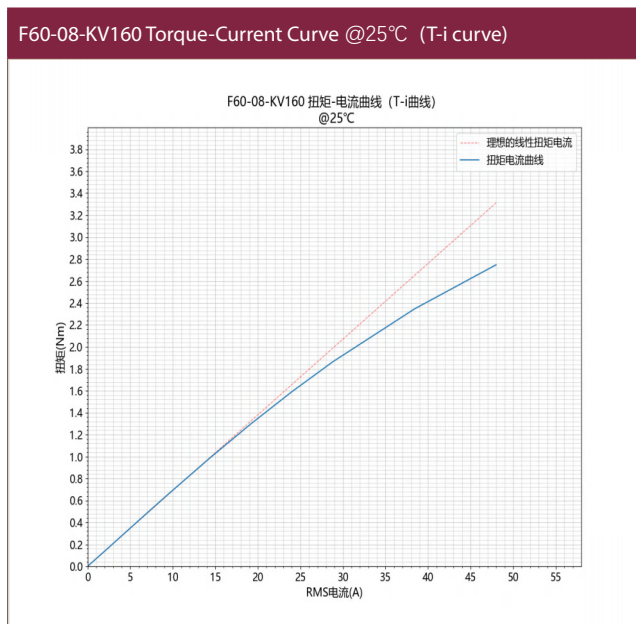
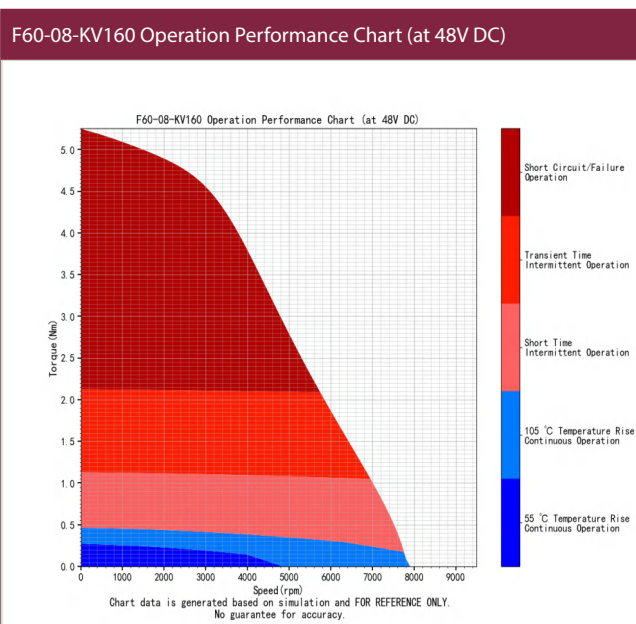
# F60 Specification F60-26

Type	F60-26		
	KV25	KV50	KV100
Stator Diameter [mm]	60	60	60
Stator Axial Length (Excl. Cable) [mm]	34	34	34
Rotor Inner Diameter [mm]	36	36	36
Weight [g]	306	306	306
Stator Weight (Excl. Cable) [g]	231	231	231
Rotor Weight [g]	75	75	75
Rotor Inertia [kg mm <sup>2</sup> ]	29	29	29
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	160	350	660
No Load Speed @ Typical Voltage [rpm]	1200	2400	4800
Load Speed @ Typical Voltage [rpm]	1000	2210	4610
Continuous Mechanical Speed Limit [rpm]	4200	4200	4200
Rated Torque (105°C Temp. Rise) [Nm]	1.52	1.52	1.52
Rated Torque (55°C Temp. Rise) [Nm]	0.91	0.91	0.91
Rated Torque (Lasting 10s) [Nm]	3.7	3.7	3.7
Rated Torque (Lasting 2s) [Nm]	6.9	6.9	6.9
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	13.4
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	8.1
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	33.6
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	67.2
KV Constant [rpm/V]	25	51	101
Back EMF Constant [Vs/rad]	0.377	0.188	0.0942
Torque Constant [Nm/A]	0.322	0.161	0.0804
Line Resistance [Ohm]	1.91	0.476	0.119
Line Inductance [H]	1.18	0.296	0.074
d Axis Inductance [mH]	1.51	0.377	0.0943
q Axis Inductance [mH]	2.04	0.511	0.128
Time Constant [ms]	0.621	0.621	0.621
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N20P	24N20P	24N20P
Motor Constant [Nm/sqrt(W)]	0.269	0.269	0.269
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F60-08-KV80

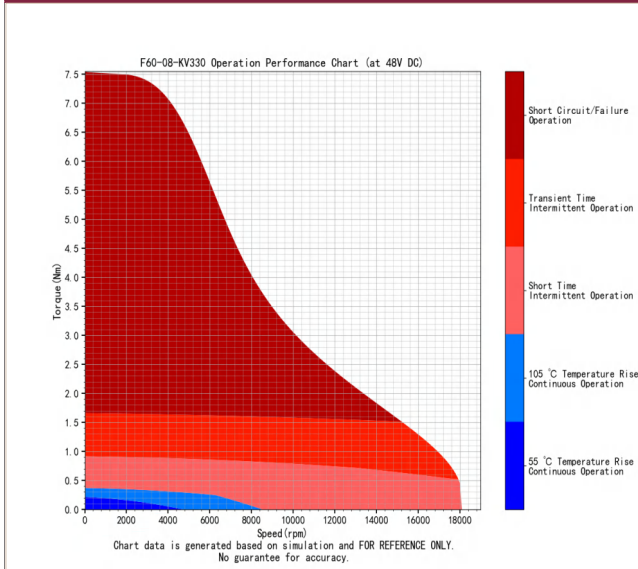


# F60-08-KV160

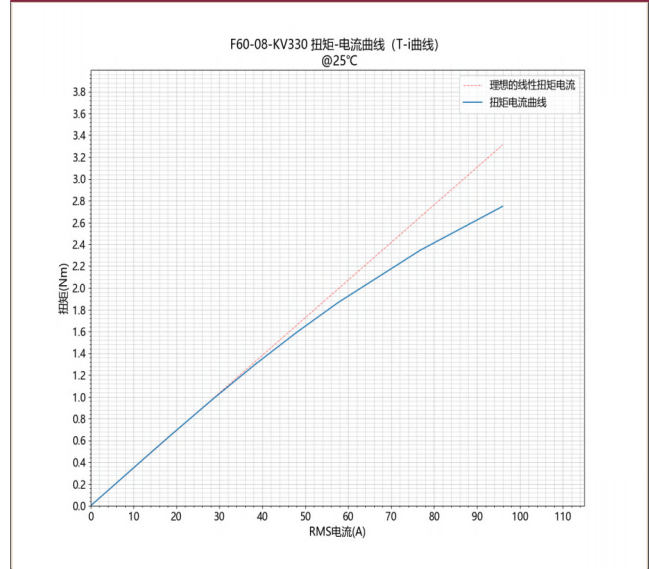


# F60-08-KV330

F60-08-KV330 Operation Performance Chart (at 48V DC)

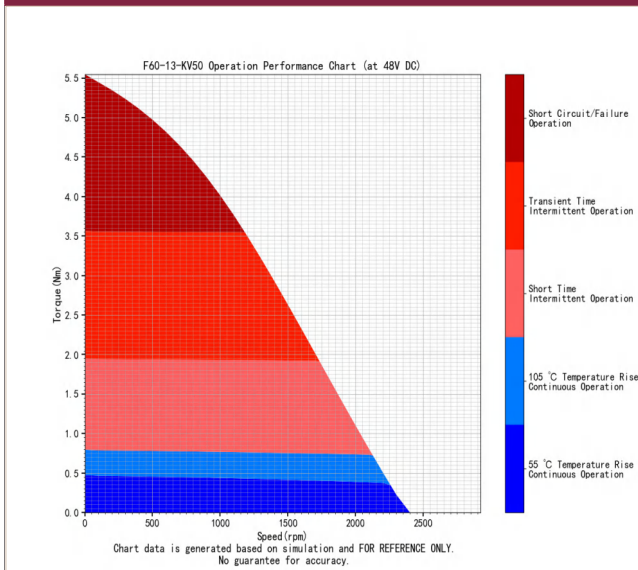


F60-08-KV330 Torque-Current Curve @25°C (T-i curve)

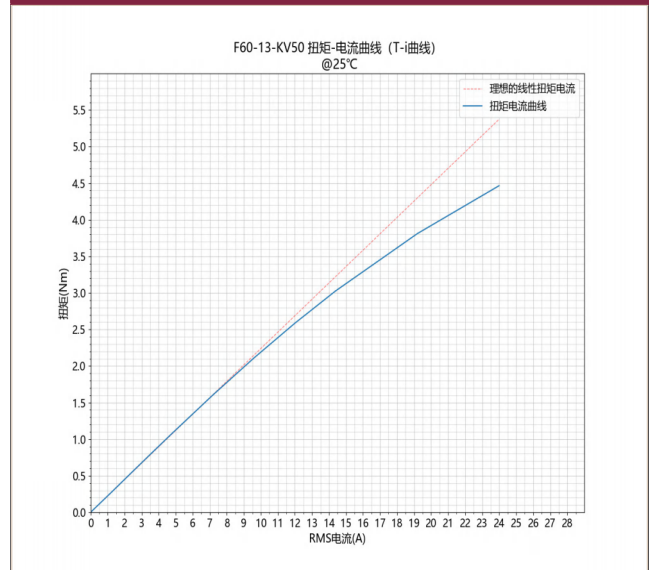


# F60-13-KV50

F60-13-KV50 Operation Performance Chart (at 48V DC)

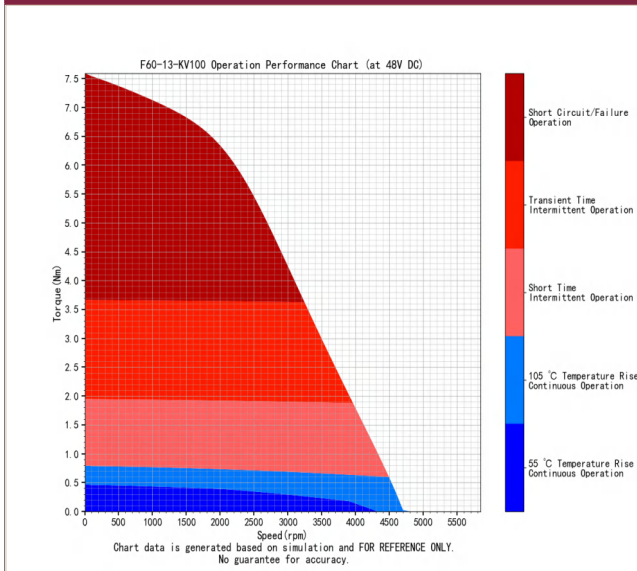


F60-13-KV50 Torque-Current Curve @25°C (T-i curve)

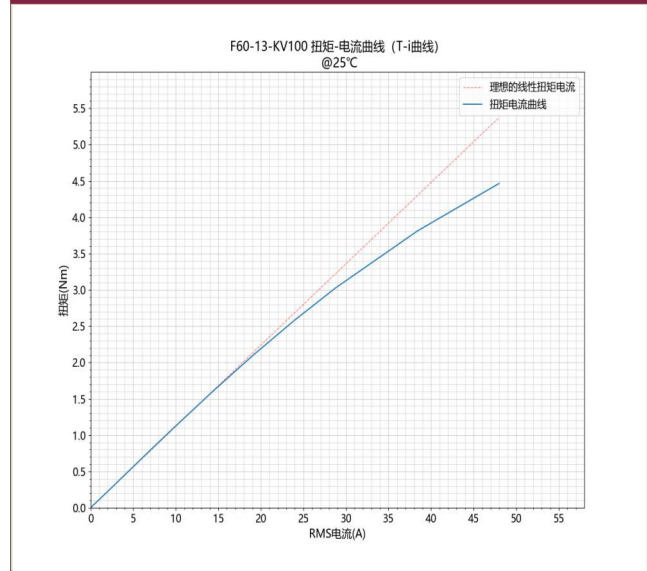


# F60-13-KV100

F60-13-KV100 Operation Performance Chart (at 48V DC)

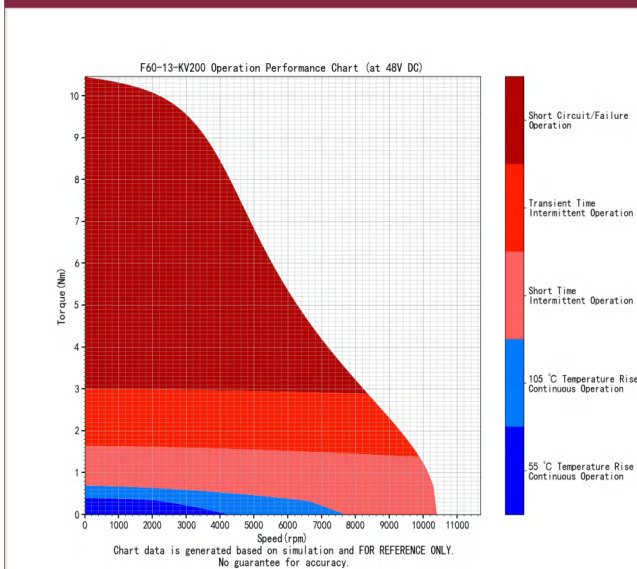


F60-13-KV100 Torque-Current Curve @25°C (T-i curve)

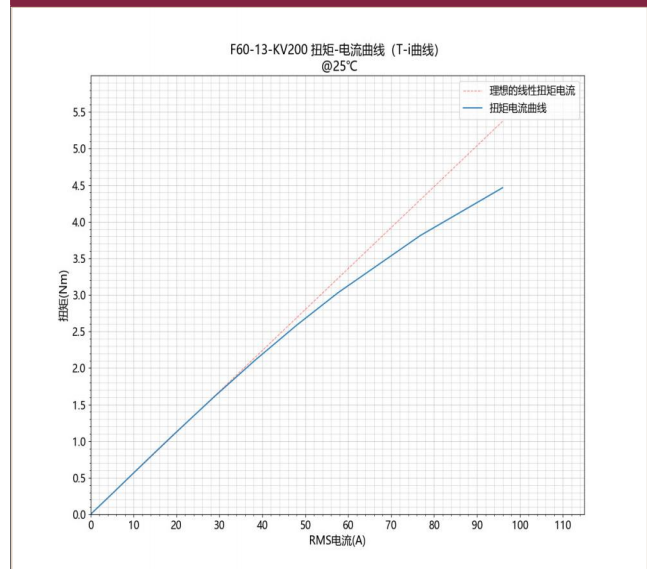


# F60-13-KV200

F60-13-KV200 Operation Performance Chart (at 48V DC)

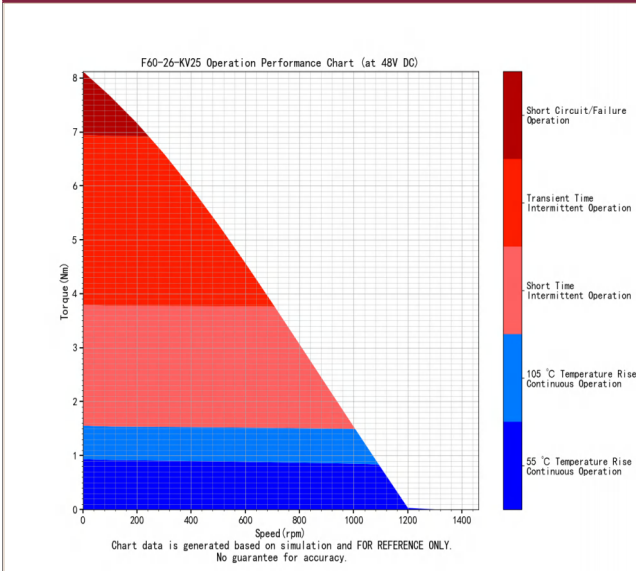


F60-13-KV200 Torque-Current Curve @25°C (T-i curve)

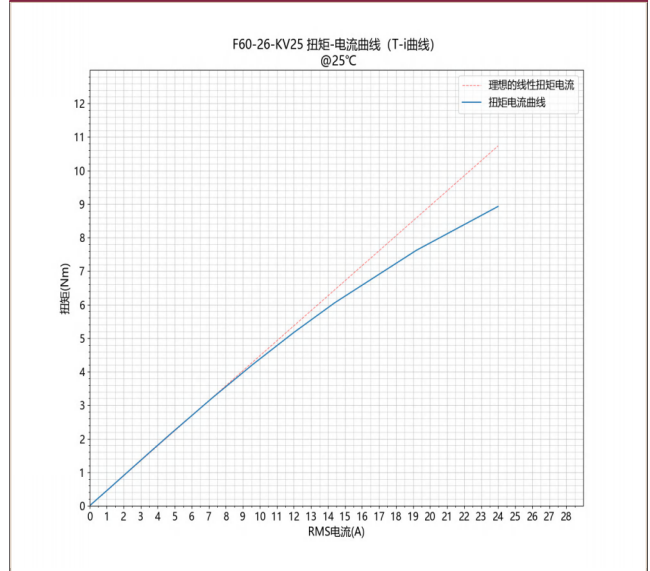


# F60-26-KV25

F60-26-KV25 Operation Performance Chart (at 48V DC)

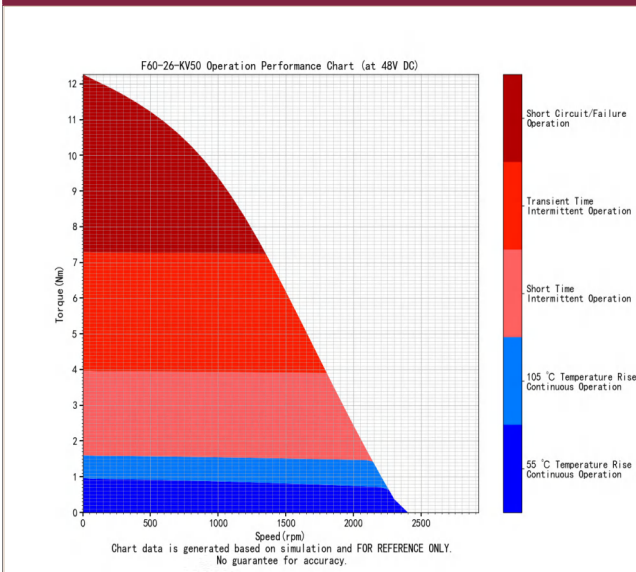


F60-26-KV25 Torque-Current Curve @25°C (T-i curve)

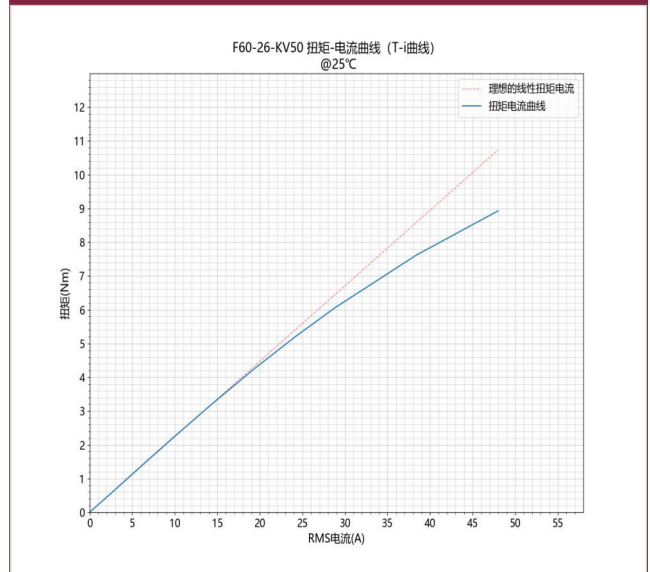


# F60-26-KV50

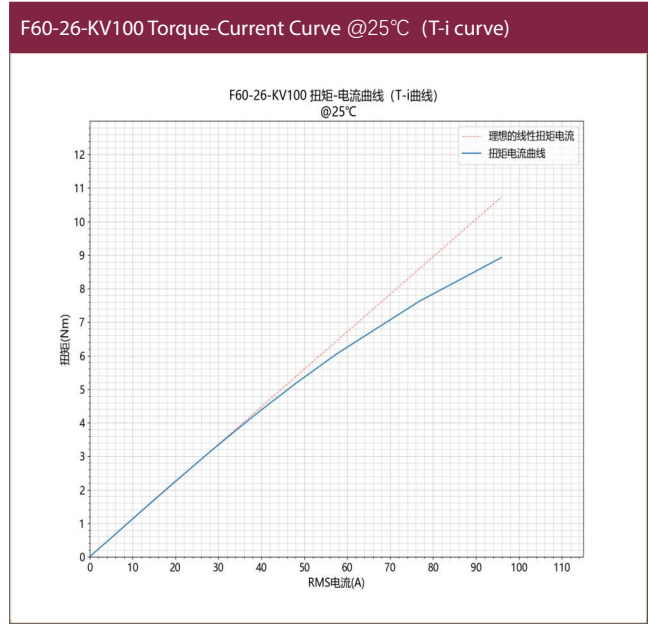
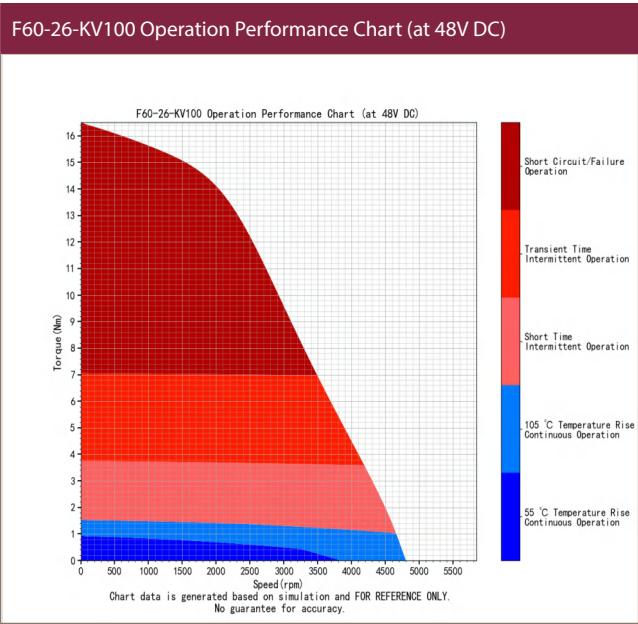
F60-26-KV50 Operation Performance Chart (at 48V DC)



F60-26-KV50 Torque-Current Curve @25°C (T-i curve)



# F60-26-KV100



## F69 Specification F69-10

Type	F69-10		
	KV45	KV95	KV190
Stator Diameter [mm]	69	69	69
Stator Axial Length (Excl. Cable) [mm]	18	18	18
Rotor Inner Diameter [mm]	42	42	42
Weight [g]	175	175	175
Stator Weight (Excl. Cable) [g]	143	143	143
Rotor Weight [g]	32	32	32
Rotor Inertia [kg mm <sup>2</sup> ]	16	16	16
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	200	320	320
No Load Speed @ Typical Voltage [rpm]	2200	4400	8900
Load Speed @ Typical Voltage [rpm]	1910	4040	8300
Continuous Mechanical Speed Limit [rpm]	3000	3000	3000
Rated Torque (105°C Temp. Rise) [Nm]	1.04	1.04	1.04
Rated Torque (55°C Temp. Rise) [Nm]	0.63	0.63	0.63
Rated Torque (Lasting 10s) [Nm]	2.5	2.5	2.5
Rated Torque (Lasting 2s) [Nm]	4.3	4.3	4.3
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	47	93	186
Back EMF Constant [Vs/rad]	0.205	0.103	0.0513
Torque Constant [Nm/A]	0.176	0.0879	0.0439
Line Resistance [Ohm]	0.999	0.25	0.0625
Line Inductance [H]	0.872	0.218	0.0545
d Axis Inductance [mH]	1.28	0.32	0.08
q Axis Inductance [mH]	1.33	0.334	0.0834
Time Constant [ms]	0.873	0.873	0.873
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N28P	24N28P	24N28P
Motor Constant [Nm/sqrt (W) ]	0.203	0.203	0.203
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

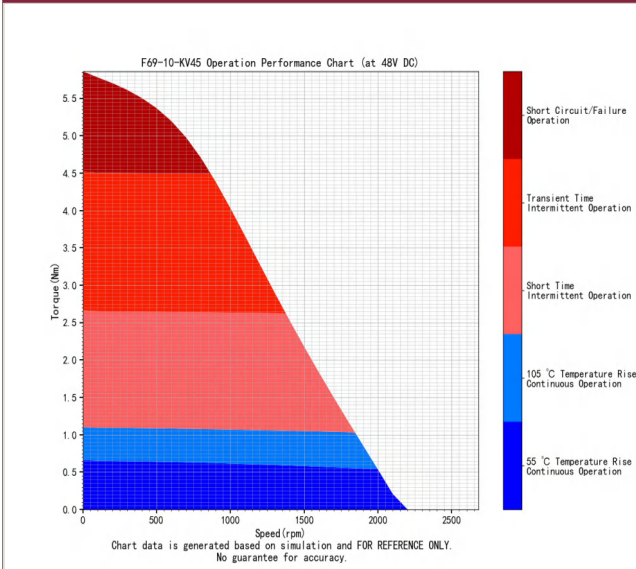


# F69 Specification F69-18

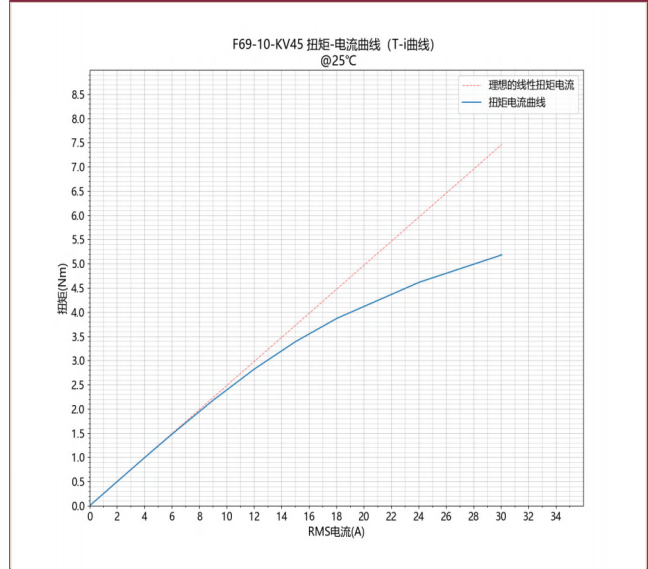
Type	F69-18		
	KV25	KV50	KV100
Stator Diameter [mm]	69	69	69
Stator Axial Length (Excl. Cable) [mm]	26	26	26
Rotor Inner Diameter [mm]	42	42	42
Weight [g]	289	289	289
Stator Weight (Excl. Cable) [g]	231	231	231
Rotor Weight [g]	58	58	58
Rotor Inertia [kg mm <sup>2</sup> ]	30	30	30
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	190	430	580
No Load Speed @ Typical Voltage [rpm]	1200	2400	4900
Load Speed @ Typical Voltage [rpm]	1010	2190	4570
Continuous Mechanical Speed Limit [rpm]	3000	3000	3000
Rated Torque (105°C Temp. Rise) [Nm]	1.87	1.87	1.87
Rated Torque (55°C Temp. Rise) [Nm]	1.12	1.12	1.12
Rated Torque (Lasting 10s) [Nm]	4.5	4.5	4.5
Rated Torque (Lasting 2s) [Nm]	7.7	7.7	7.7
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	26	52	103
Back EMF Constant [Vs/rad]	0.369	0.185	0.0924
Torque Constant [Nm/A]	0.316	0.158	0.0791
Line Resistance [Ohm]	1.43	0.358	0.0895
Line Inductance [H]	1.53	0.383	0.0958
d Axis Inductance [mH]	2.25	0.563	0.141
q Axis Inductance [mH]	2.35	0.587	0.147
Time Constant [ms]	1.07	1.07	1.07
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N28P	24N28P	24N28P
Motor Constant [Nm/sqrt (W) ]	0.305	0.305	0.305
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F69-10-KV45

F69-10-KV45 Operation Performance Chart (at 48V DC)

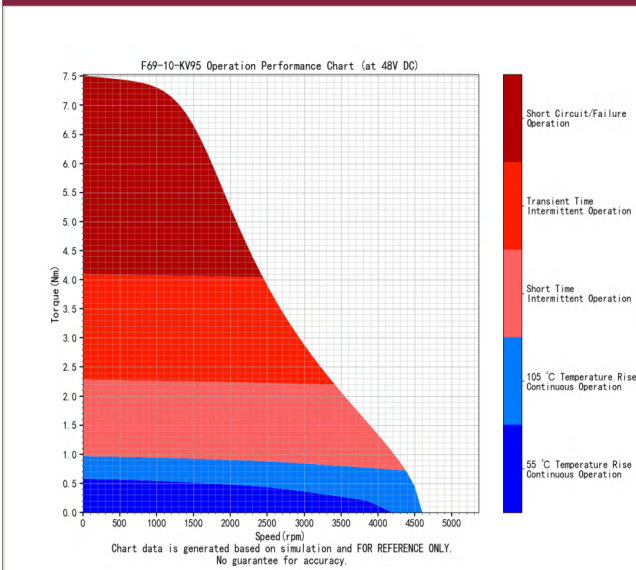


F69-10-KV45 Torque-Current Curve @25°C (T-i curve)

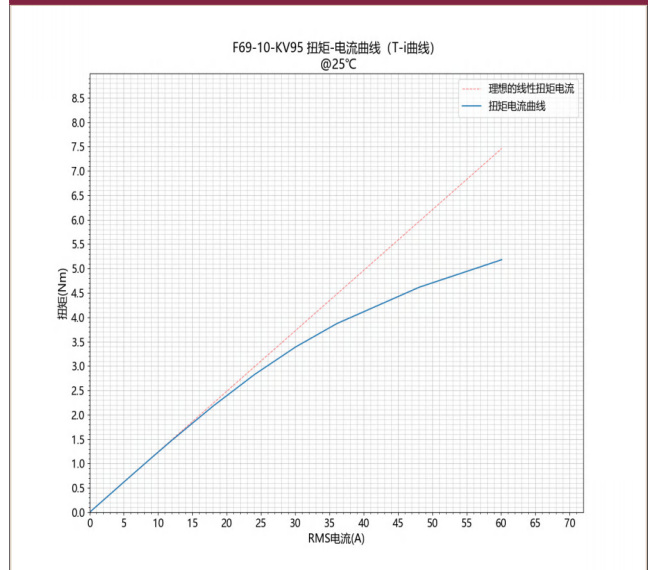


# F69-10-KV95

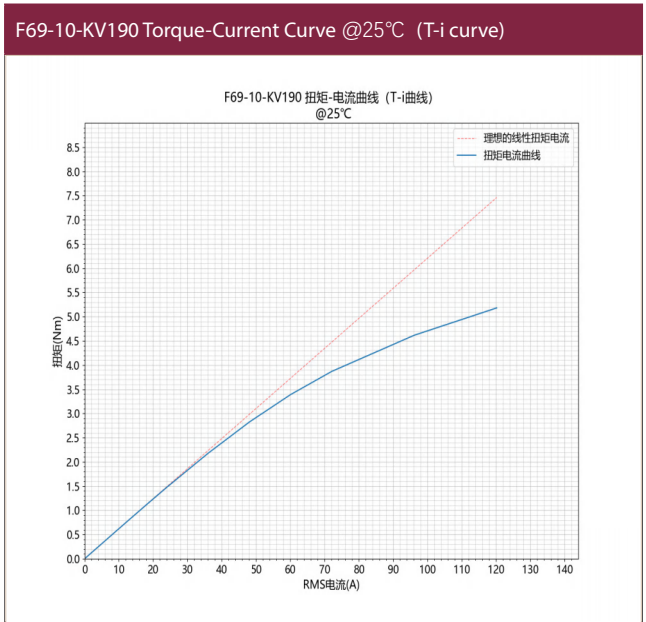
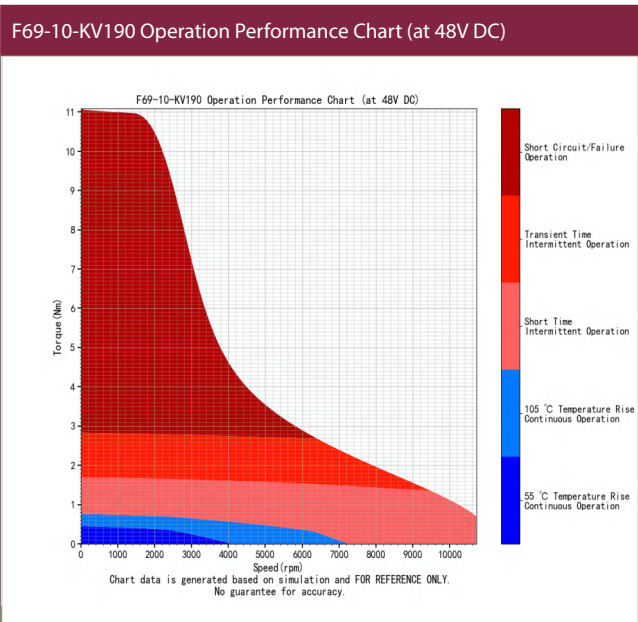
F69-10-KV95 Operation Performance Chart (at 48V DC)



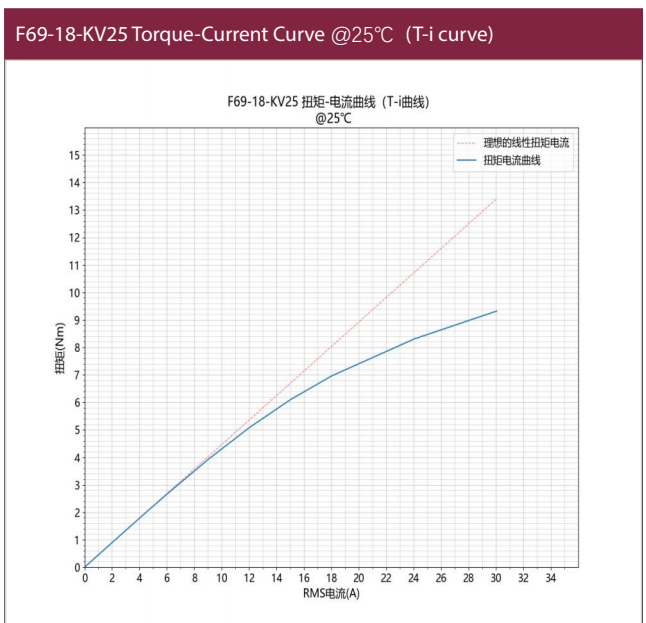
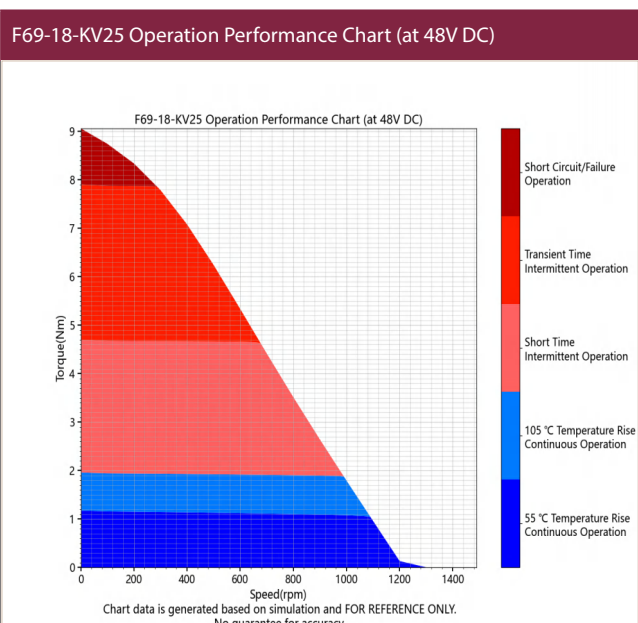
F69-10-KV95 Torque-Current Curve @25°C (T-i curve)



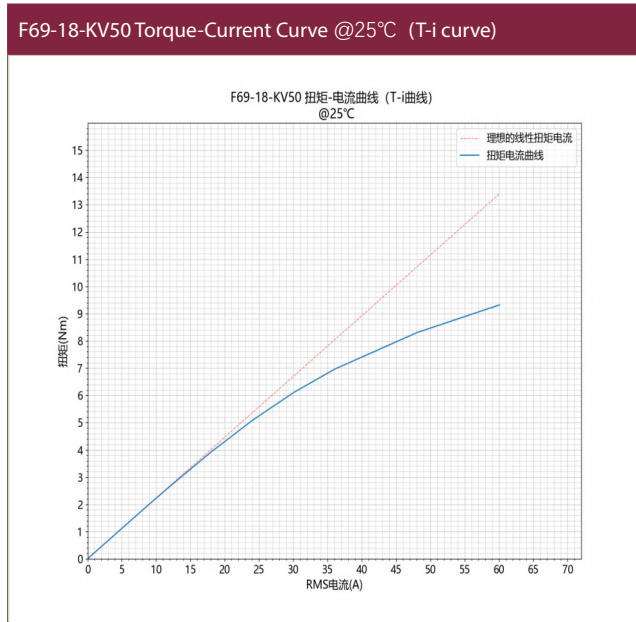
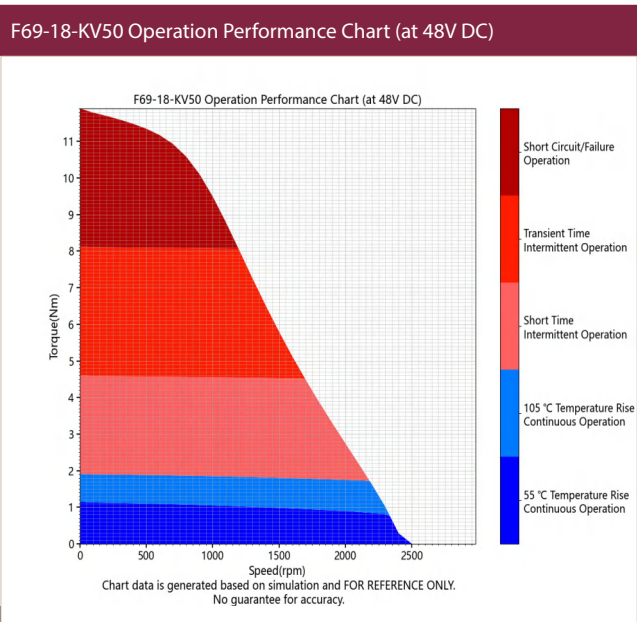
## F69-10-KV190



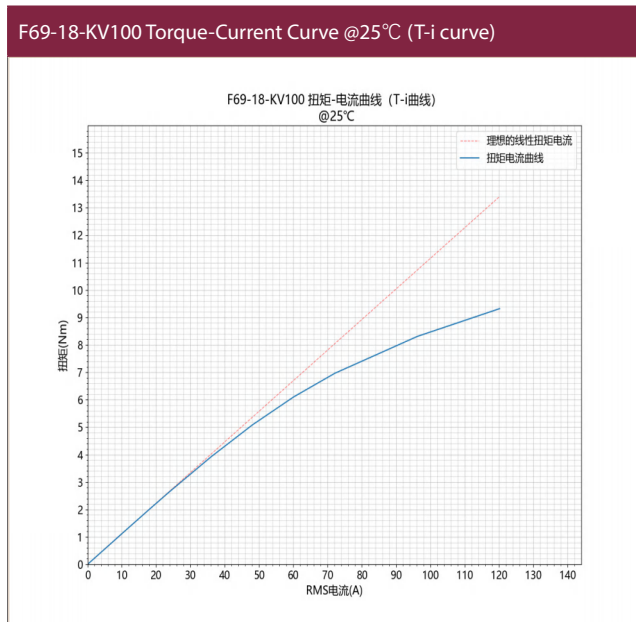
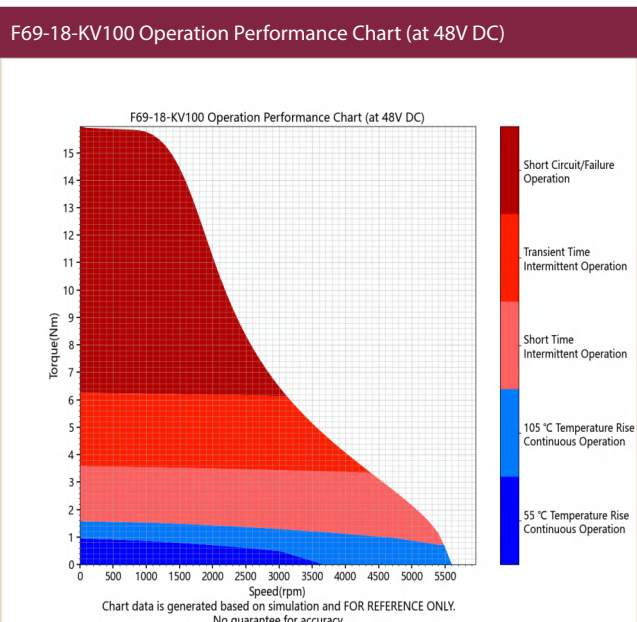
## F69-18-KV25



# F69-18-KV50



# F69-18-KV100



# F76 Specification F76-10

Type	F76-10		
	KV40	KV75	KV150
Stator Diameter [mm]	76	76	76
Stator Axial Length (Excl. Cable) [mm]	18	18	18
Rotor Inner Diameter [mm]	48	48	48
Weight [g]	205	205	205
Stator Weight (Excl. Cable) [g]	169	169	169
Rotor Weight [g]	36	36	36
Rotor Inertia [kg mm <sup>2</sup> ]	24	24	24
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	200	400	400
No Load Speed @ Typical Voltage [rpm]	1800	3600	7200
Load Speed @ Typical Voltage [rpm]	1530	3270	6740
Continuous Mechanical Speed Limit [rpm]	3000	3000	3000
Rated Torque (105°C Temp. Rise) [Nm]	1.29	1.29	1.29
Rated Torque (55°C Temp. Rise) [Nm]	0.77	0.77	0.77
Rated Torque (Lasting 10s) [Nm]	3.1	3.1	3.1
Rated Torque (Lasting 2s) [Nm]	5.4	5.4	5.4
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	38	76	151
Back EMF Constant [Vs/rad]	0.252	0.126	0.0631
Torque Constant [Nm/A]	0.217	0.108	0.0542
Line Resistance [Ohm]	1.11	0.278	0.0694
Line Inductance [H]	1.08	0.269	0.0673
d Axis Inductance [mH]	1.59	0.398	0.0995
q Axis Inductance [mH]	1.64	0.409	0.102
Time Constant [ms]	0.969	0.969	0.969
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N28P	24N28P	24N28P
Motor Constant [Nm/sqrt (W) ]	0.238	0.238	0.238
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F76 Specification F76-17

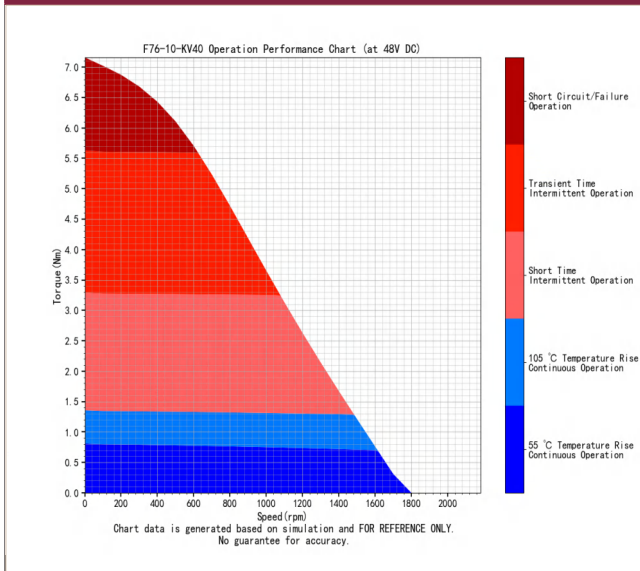
Type	F76-17		
	KV20	KV45	KV90
Stator Diameter [mm]	76	76	76
Stator Axial Length (Excl. Cable) [mm]	25	25	25
Rotor Inner Diameter [mm]	48	48	48
Weight [g]	322	322	322
Stator Weight (Excl. Cable) [g]	260	260	260
Rotor Weight [g]	62	62	62
Rotor Inertia [kg mm <sup>2</sup> ]	41	41	41
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	190	430	680
No Load Speed @ Typical Voltage [rpm]	1000	2100	4200
Load Speed @ Typical Voltage [rpm]	860	1880	3930
Continuous Mechanical Speed Limit [rpm]	3000	3000	3000
Rated Torque (105°C Temp. Rise) [Nm]	2.2	2.2	2.2
Rated Torque (55°C Temp. Rise) [Nm]	1.31	1.31	1.31
Rated Torque (Lasting 10s) [Nm]	5.3	5.3	5.3
Rated Torque (Lasting 2s) [Nm]	9.2	9.2	9.2
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	22	45	89
Back EMF Constant [Vs/rad]	0.429	0.214	0.107
Torque Constant [Nm/A]	0.368	0.184	0.0921
Line Resistance [Ohm]	1.51	0.378	0.0945
Line Inductance [H]	1.78	0.446	0.112
d Axis Inductance [mH]	2.64	0.66	0.165
q Axis Inductance [mH]	2.72	0.679	0.17
Time Constant [ms]	1.18	1.18	1.18
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N28P	24N28P	24N28P
Motor Constant [Nm/sqrt (W) ]	0.346	0.346	0.346
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F76 Specification F76-20

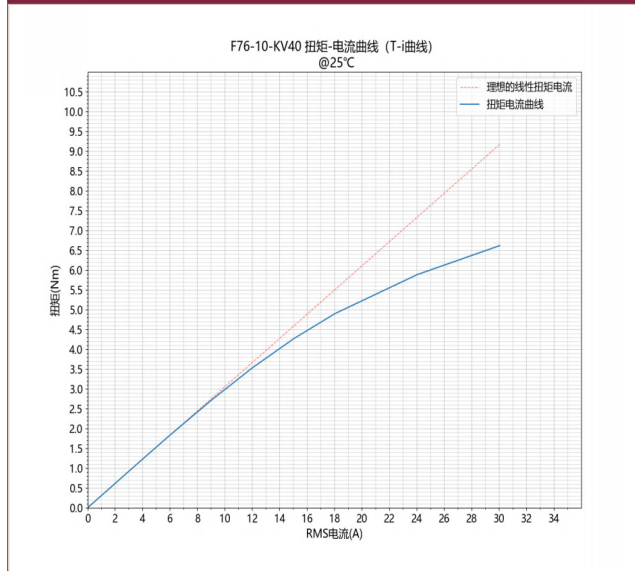
Type	F76-20		
	KV20	KV40	KV75
Stator Diameter [mm]	76	76	76
Stator Axial Length (Excl. Cable) [mm]	28	28	28
Rotor Inner Diameter [mm]	48	48	48
Weight [g]	373	373	373
Stator Weight (Excl. Cable) [g]	300	300	300
Rotor Weight [g]	73	73	73
Rotor Inertia [kg mm <sup>2</sup> ]	48	48	48
DC Drive Voltage (Typical) [V]	12-48 (48)	12-48 (48)	12-48 (48)
Rated Output Power @ Typical Voltage [W]	190	420	800
No Load Speed @ Typical Voltage [rpm]	900	1800	3600
Load Speed @ Typical Voltage [rpm]	710	1580	3320
Continuous Mechanical Speed Limit [rpm]	3000	3000	3000
Rated Torque (105°C Temp. Rise) [Nm]	2.6	2.6	2.6
Rated Torque (55°C Temp. Rise) [Nm]	1.54	1.54	1.54
Rated Torque (Lasting 10s) [Nm]	6.3	6.3	6.3
Rated Torque (Lasting 2s) [Nm]	10.9	10.9	10.9
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	19	38	76
Back EMF Constant [Vs/rad]	0.505	0.252	0.126
Torque Constant [Nm/A]	0.433	0.217	0.108
Line Resistance [Ohm]	1.68	0.421	0.105
Line Inductance [H]	2.09	0.522	0.131
d Axis Inductance [mH]	3.09	0.772	0.193
q Axis Inductance [mH]	3.18	0.795	0.199
Time Constant [ms]	1.24	1.24	1.24
Winding Connection	△	△	△
Poles [Stator N Rotor P]	24N28P	24N28P	24N28P
Motor Constant [Nm/sqrt (W) ]	0.386	0.386	0.386
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F76-10-KV40

F76-10-KV40 Operation Performance Chart (at 48V DC)

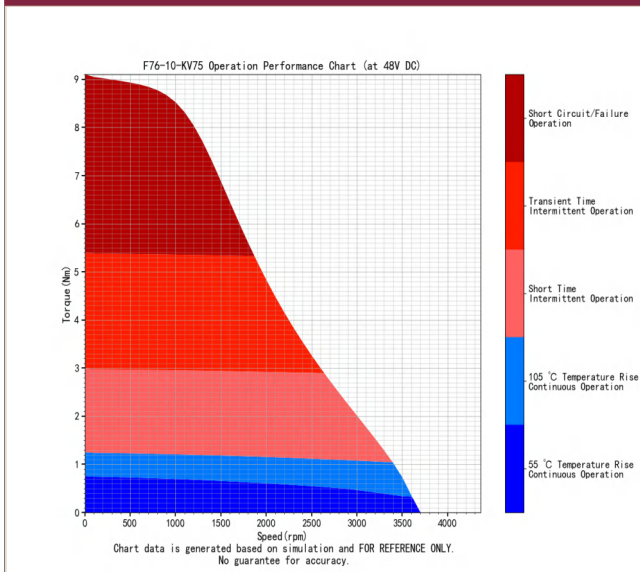


F76-10-KV40 Torque-Current Curve @25°C (T-i curve)

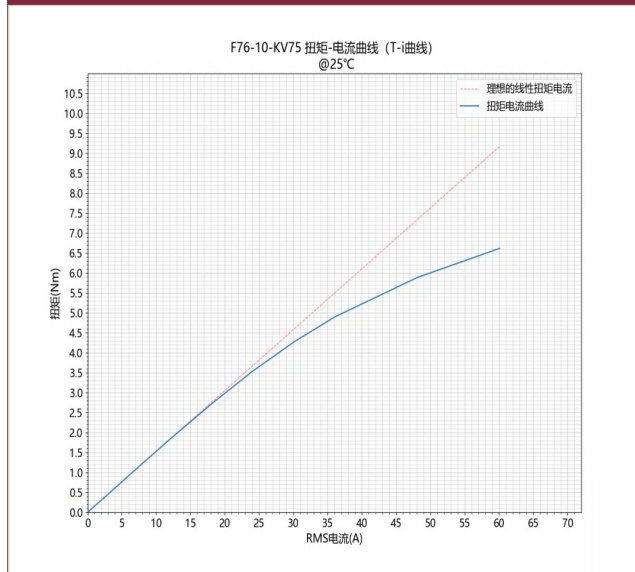


# F76-10-KV75

F76-10-KV75 Operation Performance Chart (at 48V DC)



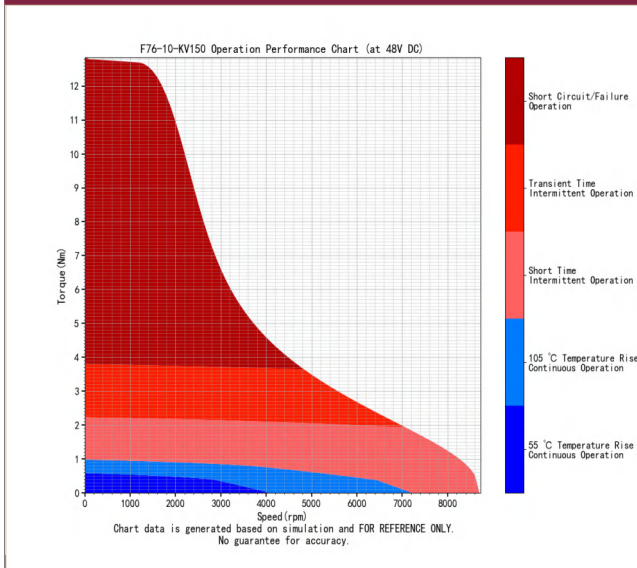
F76-10-KV75 Torque-Current Curve @25°C (T-i curve)



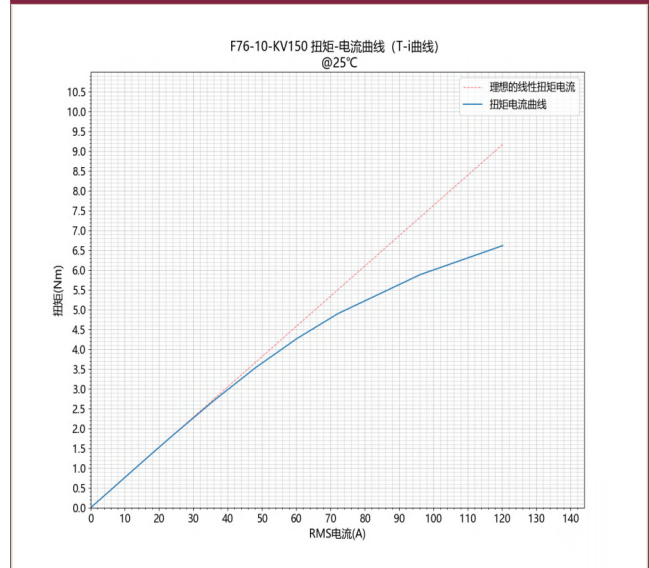


# F76-10-KV150

F76-10-KV150 Operation Performance Chart (at 48V DC)

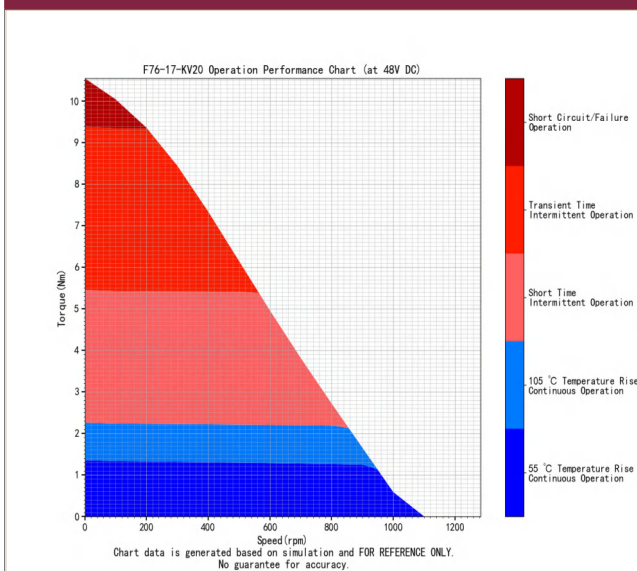


F76-10-KV150 Torque-Current Curve @25°C (T-i curve)

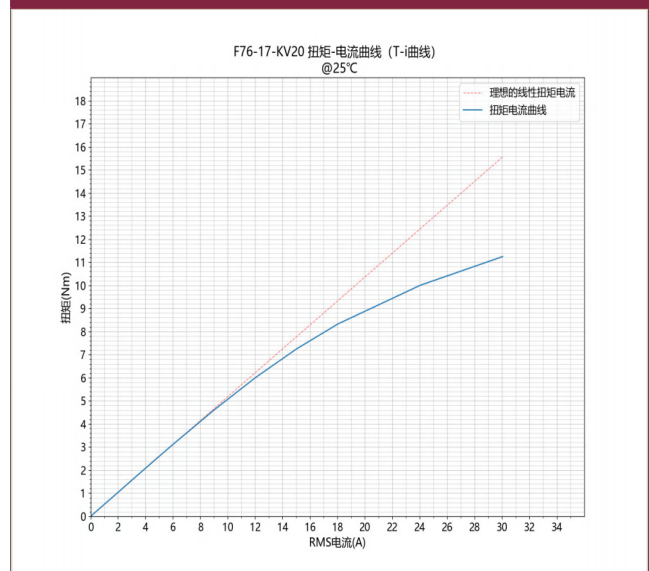


# F76-17-KV20

F76-17-KV20 Operation Performance Chart (at 48V DC)

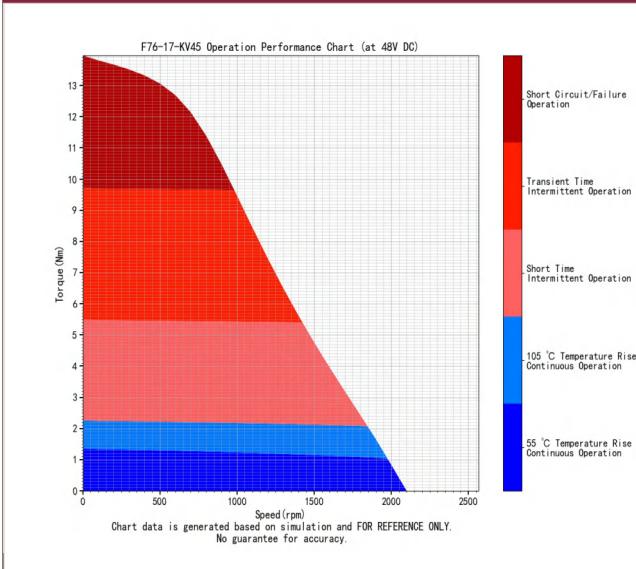


F76-17-KV20 Torque-Current Curve @25°C (T-i curve)

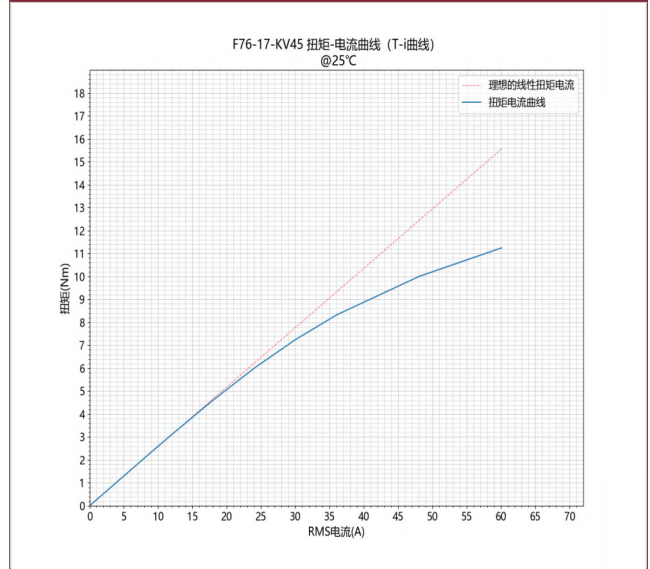


# F76-17-KV45

F76-17-KV45 Operation Performance Chart (at 48V DC)

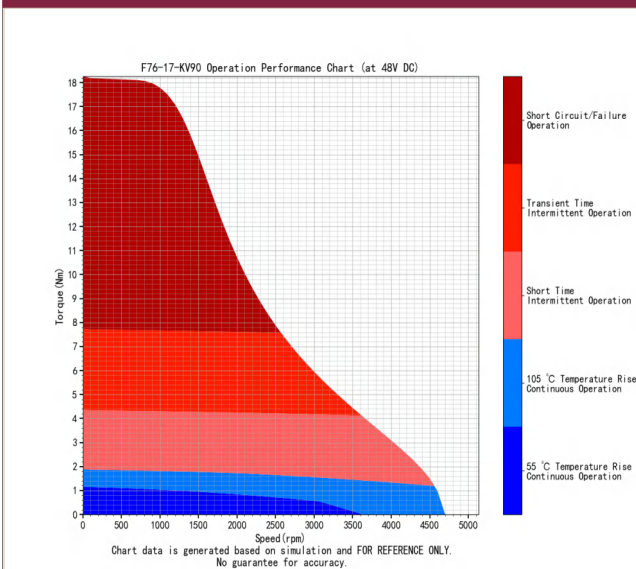


F76-17-KV45 Torque-Current Curve @25°C (T-i curve)

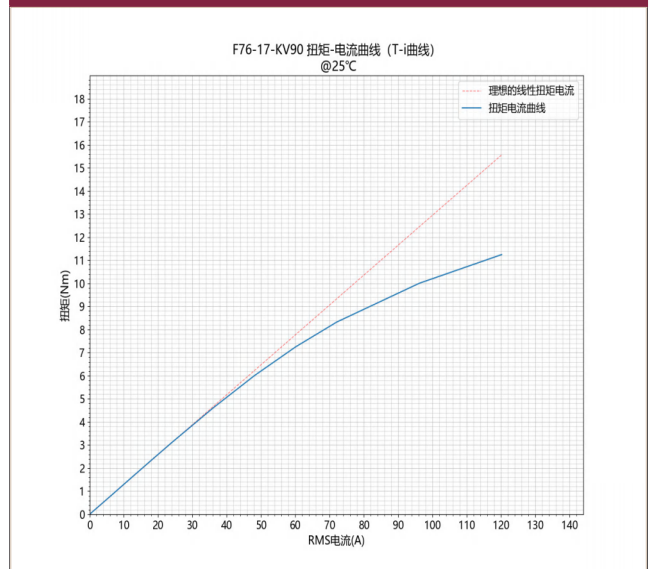


# F76-17-KV90

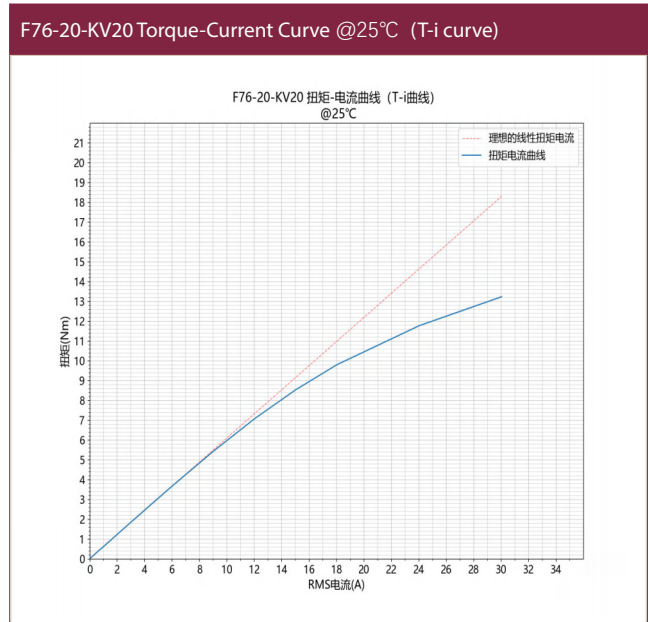
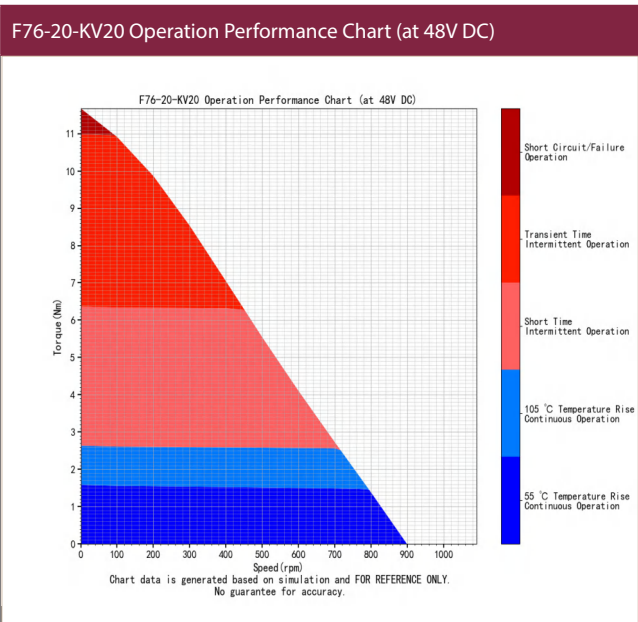
F76-17-KV90 Operation Performance Chart (at 48V DC)



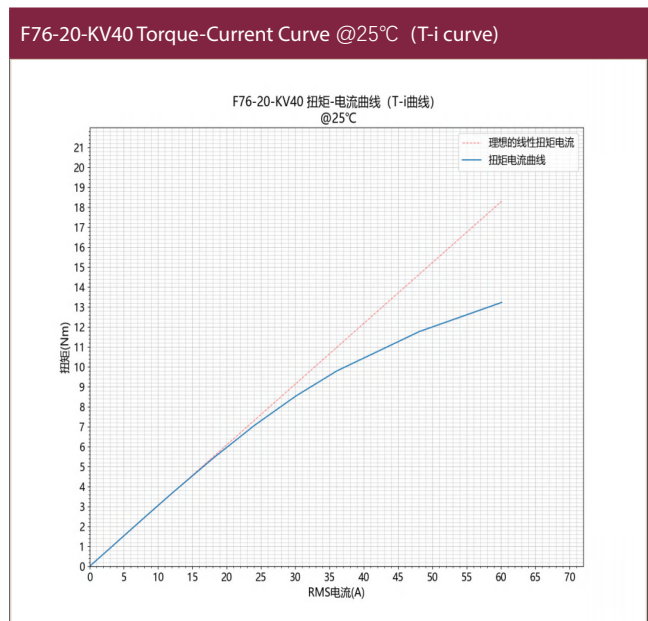
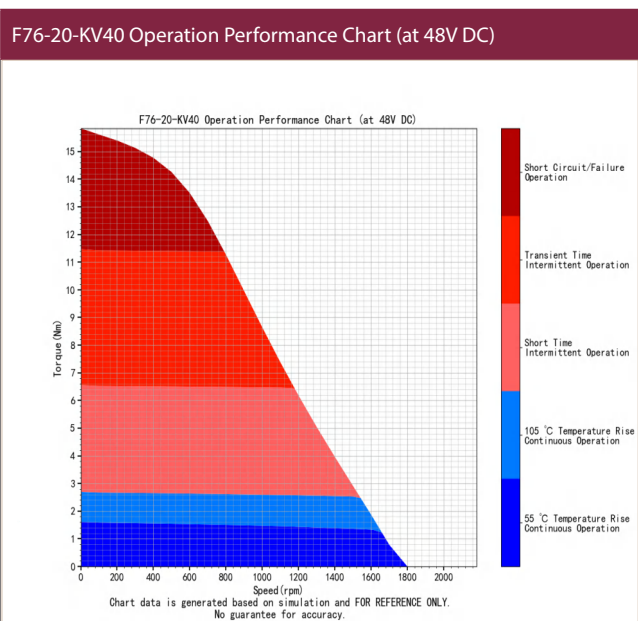
F76-17-KV90 Torque-Current Curve @25°C (T-i curve)



# F76-20-KV20

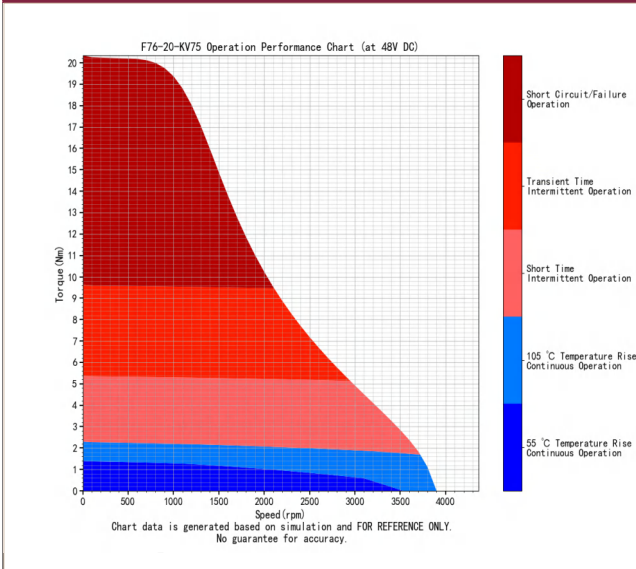


# F76-20-KV40

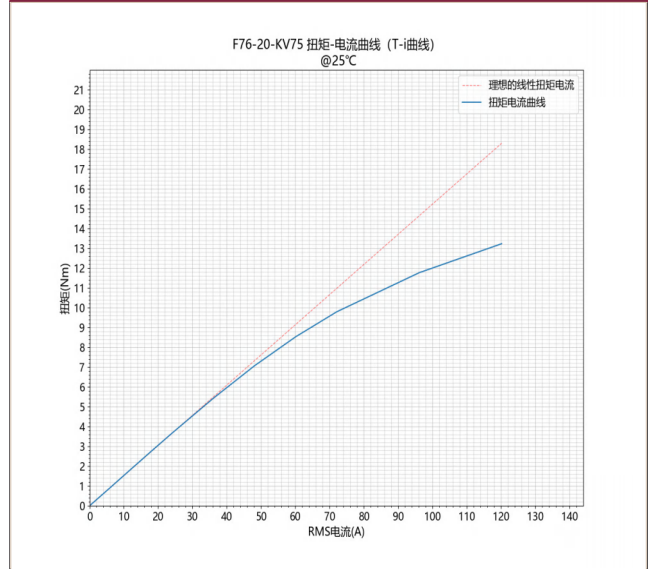


# F76-20-KV75

F76-20-KV75 Operation Performance Chart (at 48V DC)



F76-20-KV75 Torque-Current Curve @25°C (T-i curve)



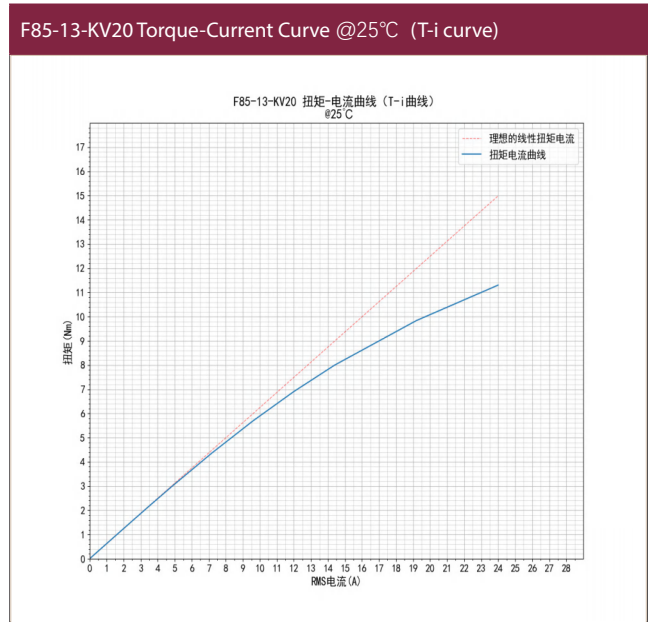
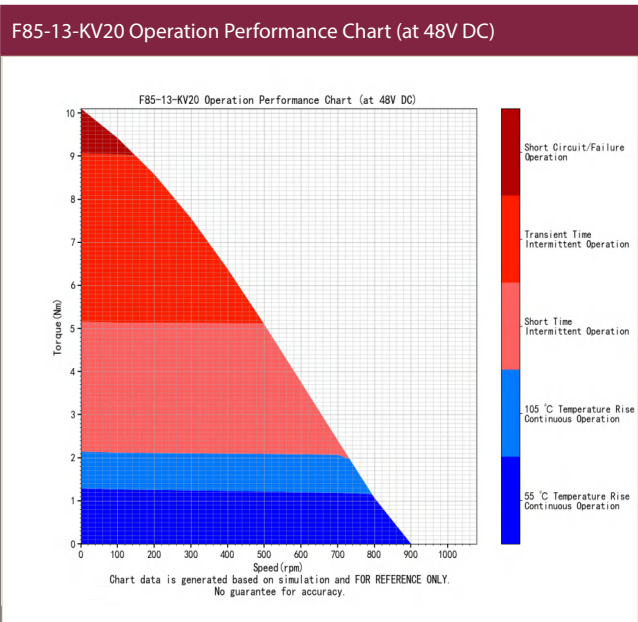
## F85 Specification F85-13

Type	F85-13		
	KV20	KV35	KV75
Stator Diameter [mm]	85	85	85
Stator Axial Length (Excl. Cable) [mm]	21	21	21
Rotor Inner Diameter [mm]	58.5	58.5	58.5
Weight [g]	270	270	270
Stator Weight (Excl. Cable) [g]	210	210	210
Rotor Weight [g]	60	60	60
Rotor Inertia [kg mm <sup>2</sup> ]	57	57	57
DC Drive Voltage (Typical) [V]	12-60 (48)	12-60 (48)	12-60 (48)
Rated Output Power @ Typical Voltage [W]	160	350	570
No Load Speed @ Typical Voltage [rpm]	890	1700	3500
Load Speed @ Typical Voltage [rpm]	730	1610	3380
Continuous Mechanical Speed Limit [rpm]	2620	2620	2620
Rated Torque (105°C Temp. Rise) [Nm]	2.1	2.1	2.1
Rated Torque (55°C Temp. Rise) [Nm]	1.25	1.25	1.25
Rated Torque (Lasting 10s) [Nm]	5	5	5
Rated Torque (Lasting 2s) [Nm]	9	9	9
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	13.4
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	8.1
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	33.6
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	67.2
KV Constant [rpm/V]	19	37	75
Back EMF Constant [Vs/rad]	0.51	0.255	0.128
Torque Constant [Nm/A]	0.439	0.22	0.11
Line Resistance [Ohm]	1.98	0.495	0.124
Line Inductance [H]	1.27	0.317	0.0792
d Axis Inductance [mH]	1.58	0.394	0.0986
q Axis Inductance [mH]	2.22	0.556	0.139
Time Constant [ms]	0.64	0.64	0.64
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N32P	36N32P	36N32P
Motor Constant [Nm/sqrt (W) ]	0.361	0.361	0.361
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

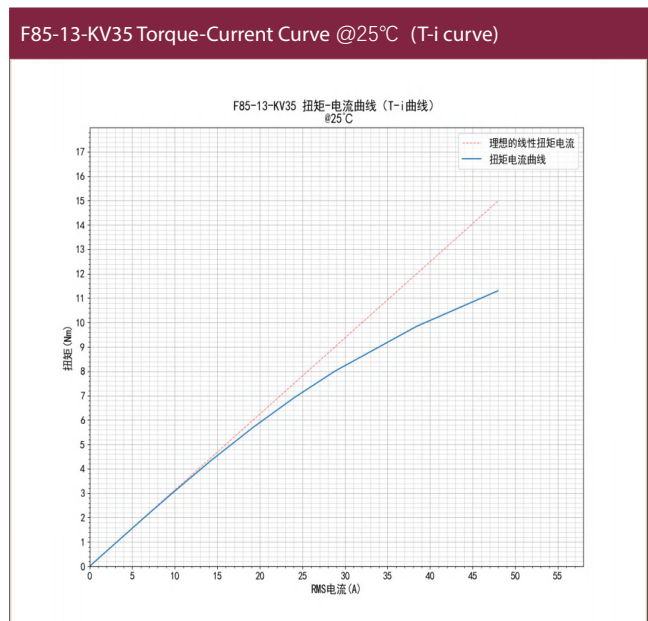
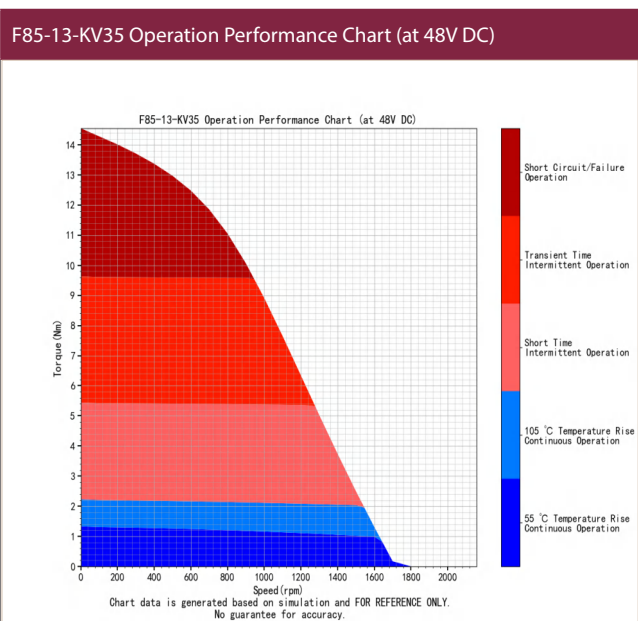
## F85 Specification F85-18

Type	F85-18		
	KV14	KV25	KV55
Stator Diameter [mm]	85	85	85
Stator Axial Length (Excl. Cable) [mm]	26	26	26
Rotor Inner Diameter [mm]	58.5	58.5	58.5
Weight [g]	362	362	362
Stator Weight (Excl. Cable) [g]	279	279	279
Rotor Weight [g]	83	83	83
Rotor Inertia [kg mm <sup>2</sup> ]	79	79	79
DC Drive Voltage (Typical) [V]	12-60 (48)	12-60 (48)	12-60 (48)
Rated Output Power @ Typical Voltage [W]	150	340	730
No Load Speed @ Typical Voltage [rpm]	640	1200	2500
Load Speed @ Typical Voltage [rpm]	500	1140	2410
Continuous Mechanical Speed Limit [rpm]	2620	2620	2620
Rated Torque (105°C Temp. Rise) [Nm]	2.9	2.9	2.9
Rated Torque (55°C Temp. Rise) [Nm]	1.73	1.73	1.73
Rated Torque (Lasting 10s) [Nm]	7	7	7
Rated Torque (Lasting 2s) [Nm]	12.4	12.4	12.4
Rated RMS Current (105°C Temp. Rise) [A]	3.4	6.7	13.4
Rated RMS Current (55°C Temp. Rise) [A]	2.02	4	8.1
Peak RMS Current (Lasting 10s) [A]	8.4	16.8	33.6
Peak RMS Current (Lasting 2s) [A]	16.8	33.6	67.2
KV Constant [rpm/V]	14	27	54
Back EMF Constant [Vs/rad]	0.706	0.353	0.177
Torque Constant [Nm/A]	0.608	0.304	0.152
Line Resistance [Ohm]	2.47	0.617	0.154
Line Inductance [H]	1.73	0.433	0.108
d Axis Inductance [mH]	2.15	0.538	0.135
q Axis Inductance [mH]	3.05	0.761	0.19
Time Constant [ms]	0.702	0.702	0.702
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N32P	36N32P	36N32P
Motor Constant [Nm/sqrt (W) ]	0.447	0.447	0.447
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F85-13-KV20

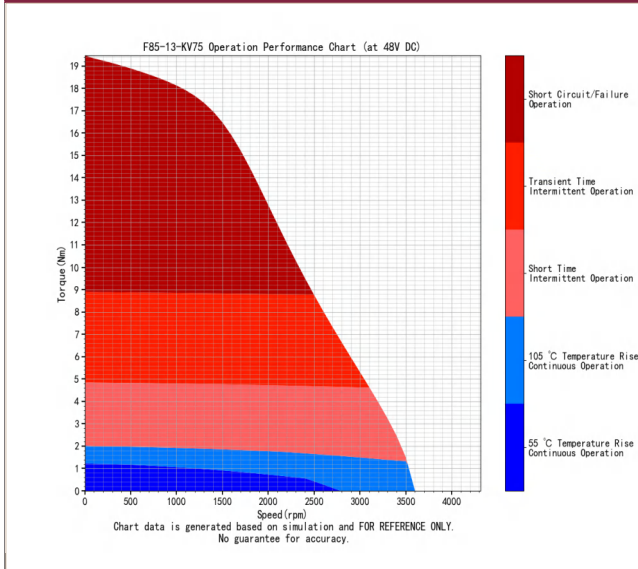


# F85-13-KV35

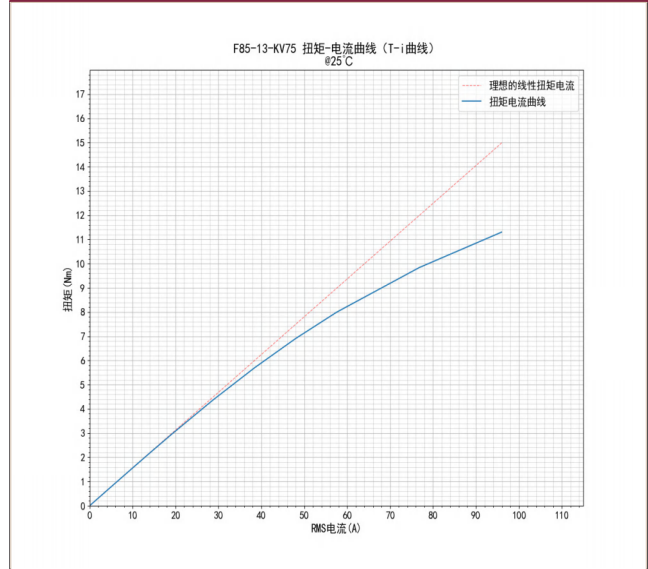


# F85-13-KV75

F85-13-KV75 Operation Performance Chart (at 48V DC)

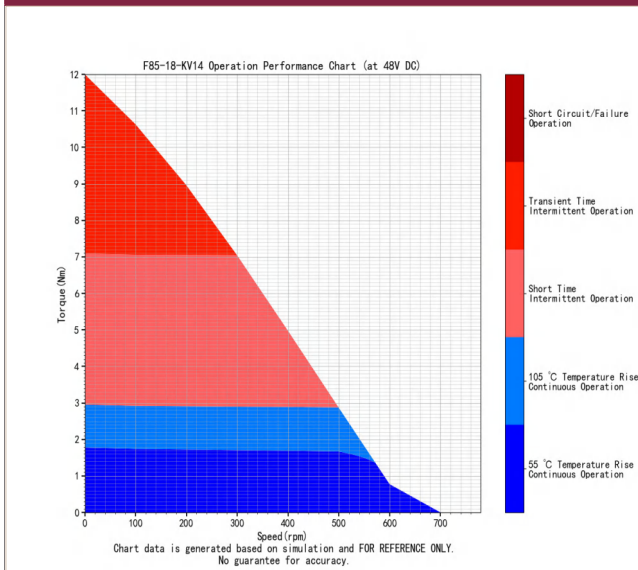


F85-13-KV75 Torque-Current Curve @25°C (T-i curve)

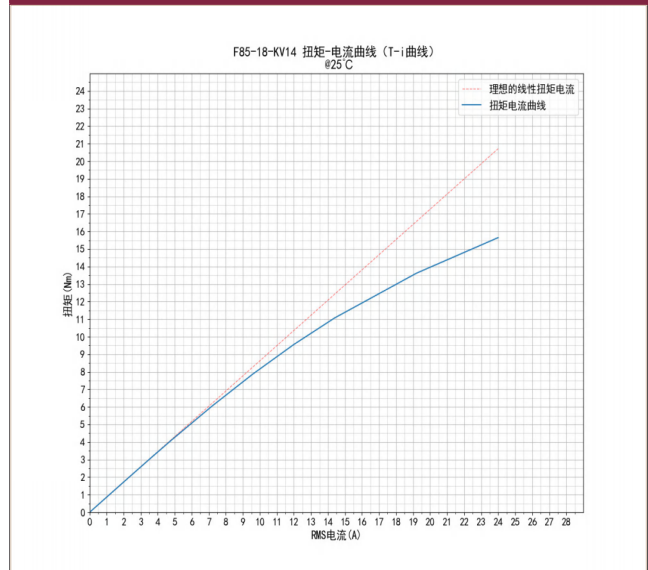


# F85-18-KV14

F85-18-KV14 Operation Performance Chart (at 48V DC)



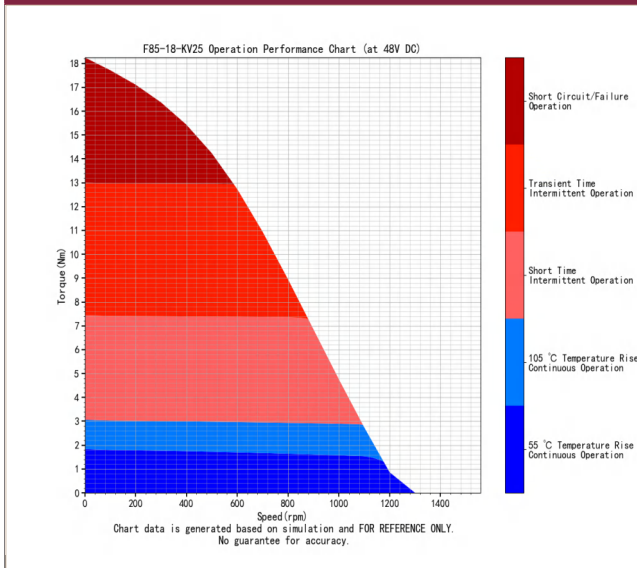
F85-18-KV14 Torque-Current Curve @25°C (T-i curve)



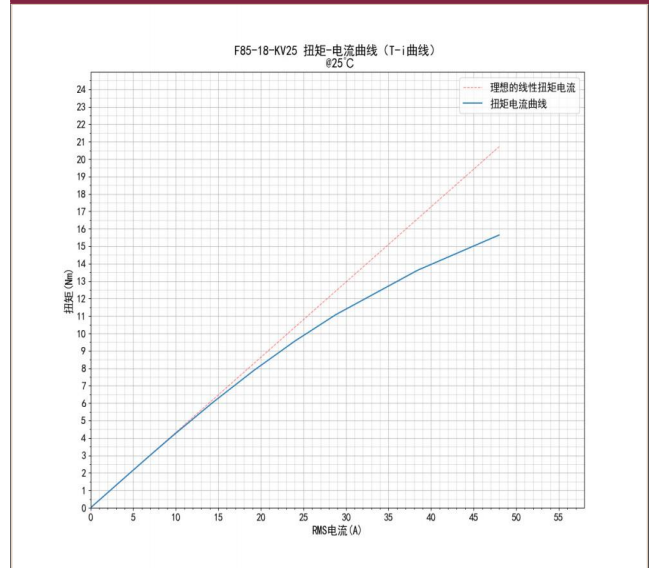


## F85-18-KV25

F85-18-KV25 Operation Performance Chart (at 48V DC)

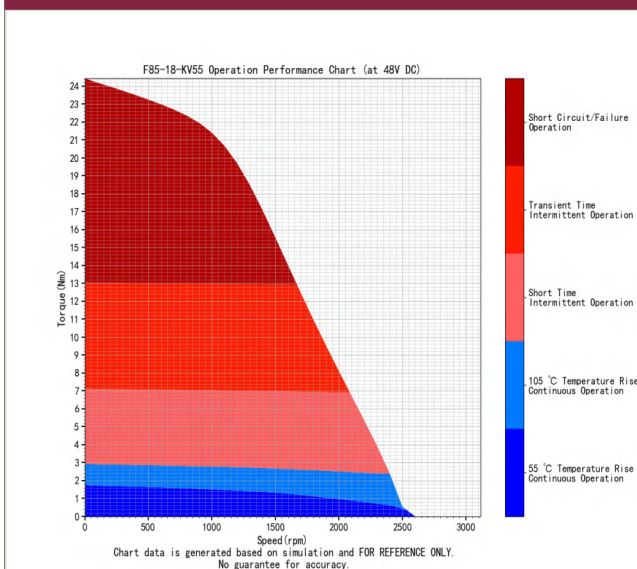


F85-18-KV25 Torque-Current Curve @25°C (T-i curve)

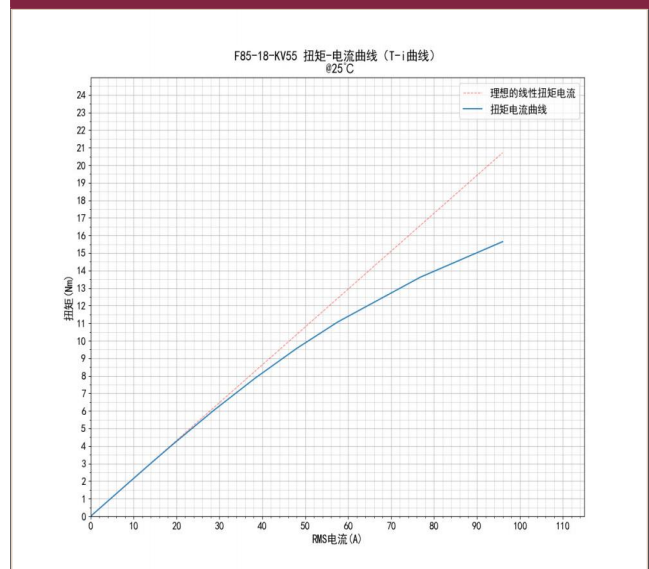


## F85-18-KV55

F85-18-KV55 Operation Performance Chart (at 48V DC)



F85-18-KV55 Torque-Current Curve @25°C (T-i curve)



# F104 Specification F104-08

Type	F104-08		
	KV20	KV40	KV80
Stator Diameter [mm]	104	104	104
Stator Axial Length (Excl. Cable) [mm]	16	16	16
Rotor Inner Diameter [mm]	73	73	73
Weight [g]	274	274	274
Stator Weight (Excl. Cable) [g]	220	220	220
Rotor Weight [g]	54	54	54
Rotor Inertia [kg mm <sup>2</sup> ]	82	82	82
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	190	430	640
No Load Speed @ Typical Voltage [rpm]	980	1900	3900
Load Speed @ Typical Voltage [rpm]	800	1760	3680
Continuous Mechanical Speed Limit [rpm]	2620	2620	2620
Rated Torque (105°C Temp. Rise) [Nm]	2.4	2.4	2.4
Rated Torque (55°C Temp. Rise) [Nm]	1.41	1.41	1.41
Rated Torque (Lasting 10s) [Nm]	5.7	5.7	5.7
Rated Torque (Lasting 2s) [Nm]	9.9	9.9	9.9
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	21	41	82
Back EMF Constant [Vs/rad]	0.465	0.233	0.116
Torque Constant [Nm/A]	0.398	0.199	0.0995
Line Resistance [Ohm]	1.54	0.385	0.0961
Line Inductance [H]	1.16	0.29	0.0724
d Axis Inductance [mH]	1.5	0.375	0.0938
q Axis Inductance [mH]	1.98	0.494	0.123
Time Constant [ms]	0.753	0.753	0.753
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N32P	36N32P	36N32P
Motor Constant [Nm/sqrt (W) ]	0.37	0.37	0.37
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

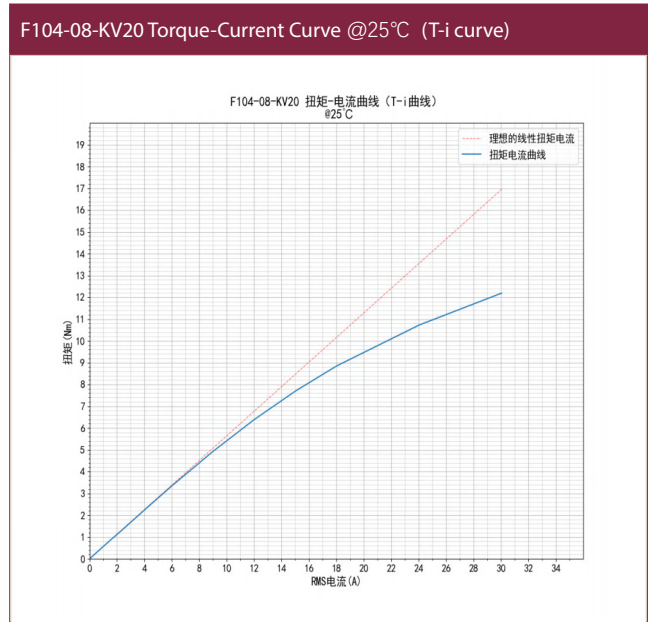
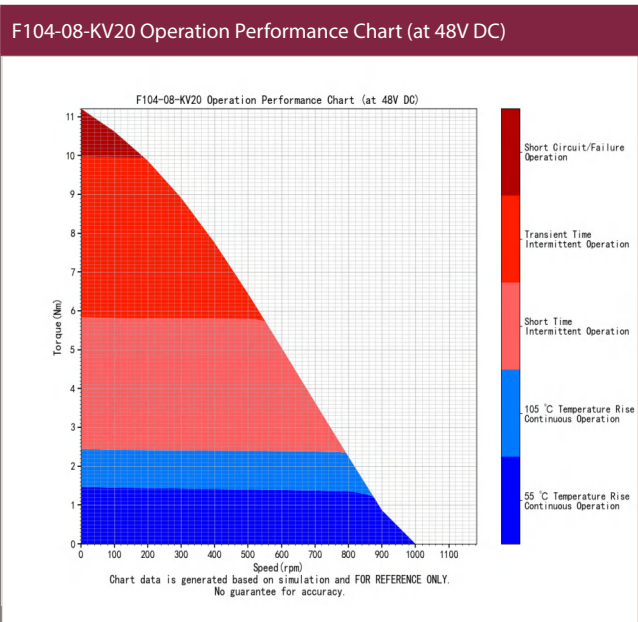
# F104 Specification F104-13

Type	F104-13		
	KV13	KV25	KV50
Stator Diameter [mm]	104	104	104
Stator Axial Length (Excl. Cable) [mm]	21	21	21
Rotor Inner Diameter [mm]	73	73	73
Weight [g]	410	410	410
Stator Weight (Excl. Cable) [g]	321	321	321
Rotor Weight [g]	89	89	89
Rotor Inertia [kg mm <sup>2</sup> ]	132	132	132
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	180	420	890
No Load Speed @ Typical Voltage [rpm]	600	1200	2400
Load Speed @ Typical Voltage [rpm]	460	1050	2240
Continuous Mechanical Speed Limit [rpm]	2620	2620	2620
Rated Torque (105°C Temp. Rise) [Nm]	3.8	3.8	3.8
Rated Torque (55°C Temp. Rise) [Nm]	2.3	2.3	2.3
Rated Torque (Lasting 10s) [Nm]	9.2	9.2	9.2
Rated Torque (Lasting 2s) [Nm]	16	16	16
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	13	25	51
Back EMF Constant [Vs/rad]	0.756	0.378	0.189
Torque Constant [Nm/A]	0.645	0.322	0.161
Line Resistance [Ohm]	1.99	0.498	0.124
Line Inductance [H]	1.83	0.457	0.114
d Axis Inductance [mH]	2.36	0.589	0.147
q Axis Inductance [mH]	3.13	0.782	0.196
Time Constant [ms]	0.918	0.918	0.918
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N32P	36N32P	36N32P
Motor Constant [Nm/sqrt (W) ]	0.527	0.527	0.527
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

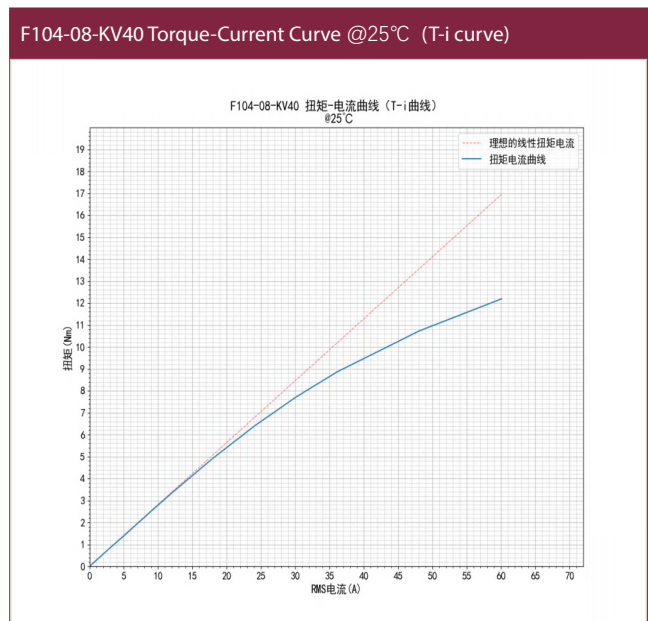
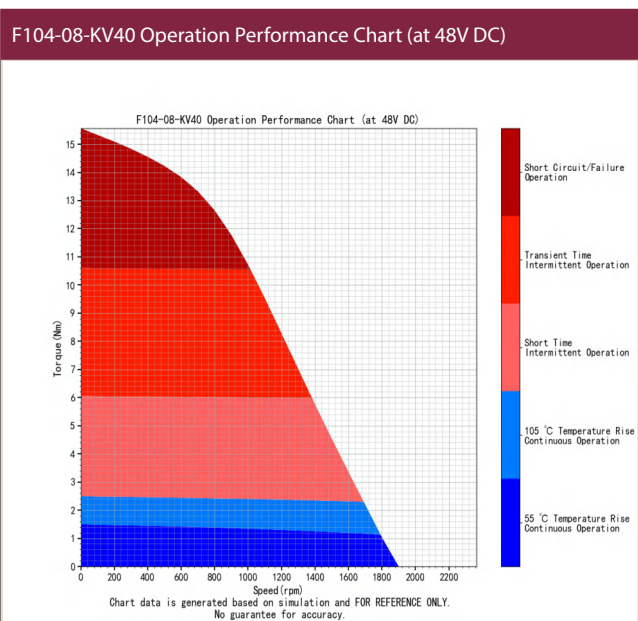
# F104 Specification F104-26

Type	F104-26		
	KV6	KV13	KV25
Stator Diameter [mm]	104	104	104
Stator Axial Length (Excl. Cable) [mm]	34	34	34
Rotor Inner Diameter [mm]	73	73	73
Weight [g]	764	764	764
Stator Weight (Excl. Cable) [g]	585	585	585
Rotor Weight [g]	179	179	179
Rotor Inertia [kg mm <sup>2</sup> ]	265	265	265
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	150	390	860
No Load Speed @ Typical Voltage [rpm]	300	600	1200
Load Speed @ Typical Voltage [rpm]	190	490	1080
Continuous Mechanical Speed Limit [rpm]	2620	2620	2620
Rated Torque (105°C Temp. Rise) [Nm]	7.6	7.6	7.6
Rated Torque (55°C Temp. Rise) [Nm]	4.6	4.6	4.6
Rated Torque (Lasting 10s) [Nm]	18.4	18.4	18.4
Rated Torque (Lasting 2s) [Nm]	32	32	32
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.4	16.8
Rated RMS Current (55°C Temp. Rise) [A]	2.52	5	10.1
Peak RMS Current (Lasting 10s) [A]	10.5	21	42.1
Peak RMS Current (Lasting 2s) [A]	21	42.1	84.1
KV Constant [rpm/V]	6	13	25
Back EMF Constant [Vs/rad]	1.51	0.756	0.378
Torque Constant [Nm/A]	1.29	0.643	0.322
Line Resistance [Ohm]	3.17	0.792	0.198
Line Inductance [H]	3.57	0.892	0.223
d Axis Inductance [mH]	4.58	1.15	0.286
q Axis Inductance [mH]	6.12	1.53	0.383
Time Constant [ms]	1.13	1.13	1.13
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N32P	36N32P	36N32P
Motor Constant [Nm/sqrt (W) ]	0.834	0.834	0.834
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F104-08-KV20

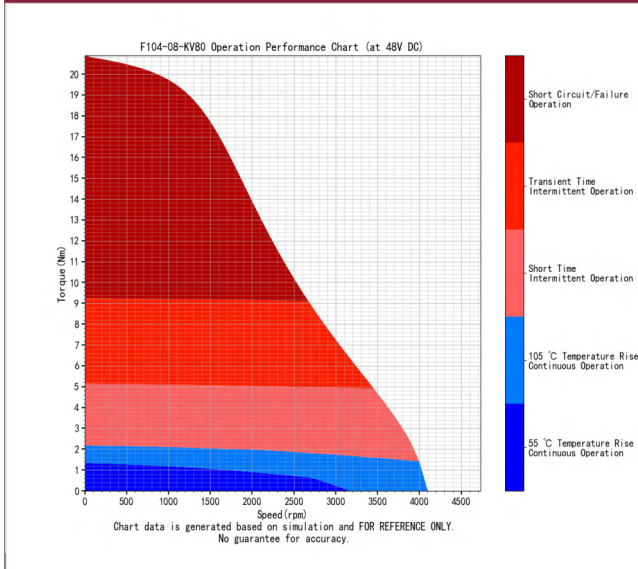


# F104-08-KV40

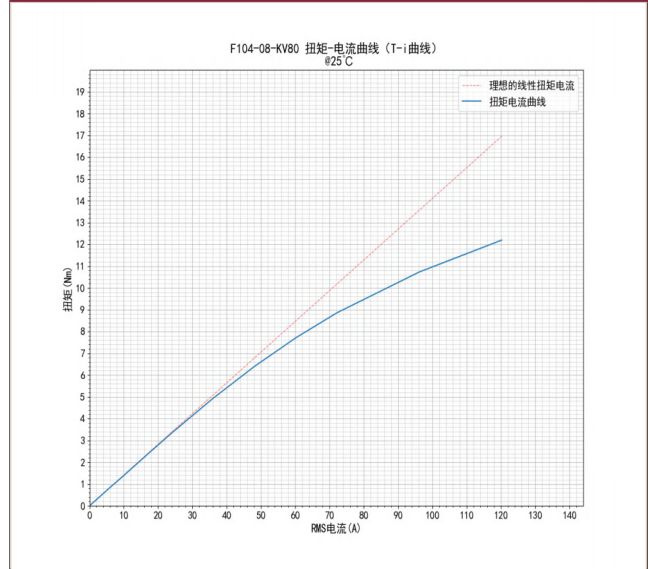


# F104-08-KV80

F104-08-KV80 Operation Performance Chart (at 48V DC)

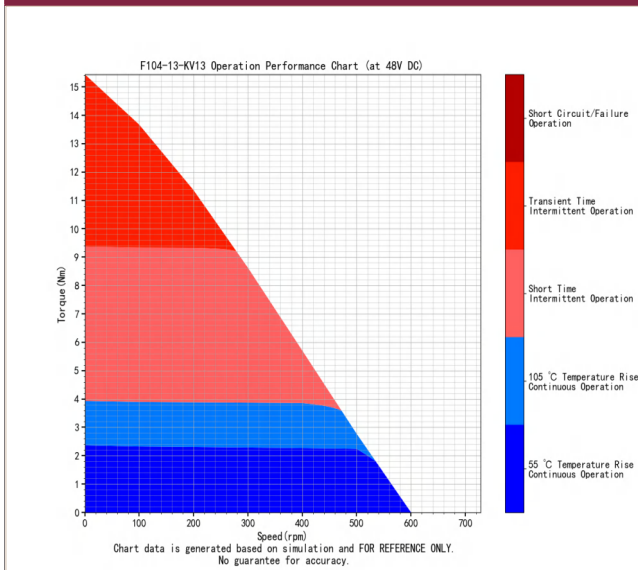


F104-08-KV80 Torque-Current Curve @25°C (T-i curve)

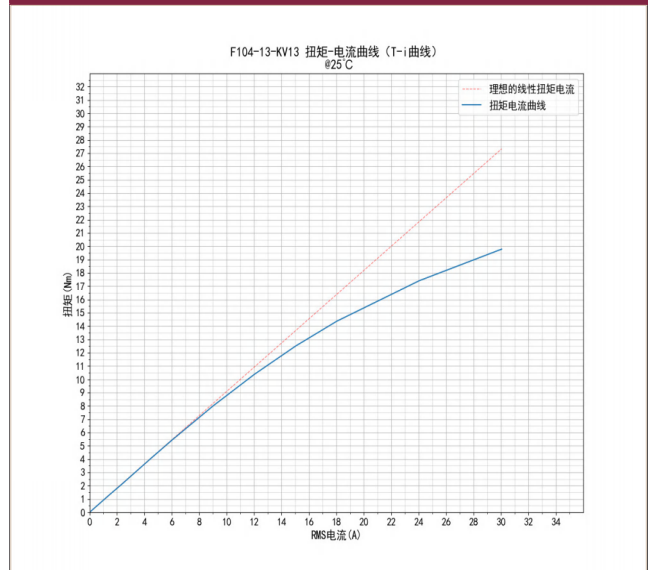


# F104-13-KV13

F104-13-KV13 Operation Performance Chart (at 48V DC)

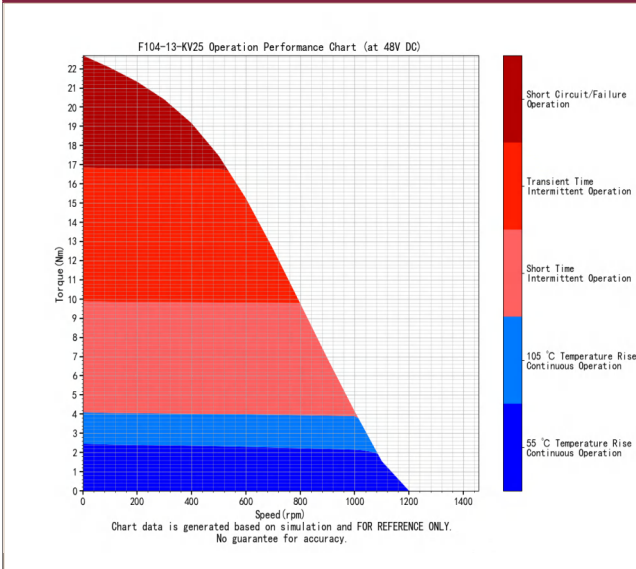


F104-13-KV13 Torque-Current Curve @25°C (T-i curve)

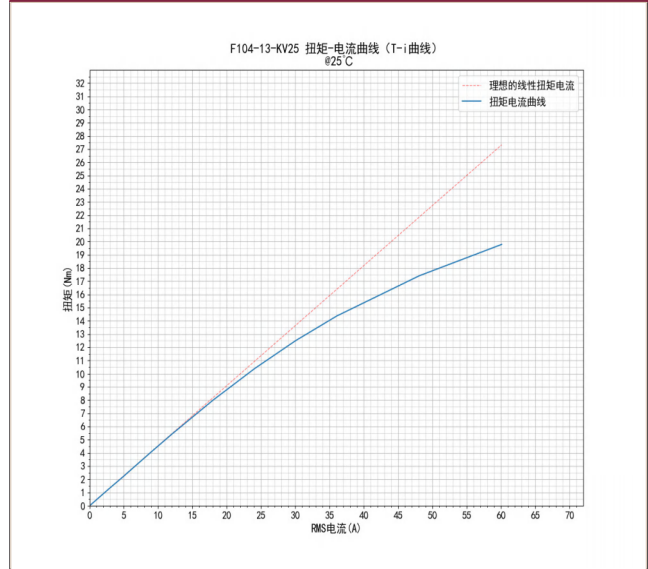


# F104-13-KV25

F104-13-KV25 Operation Performance Chart (at 48V DC)

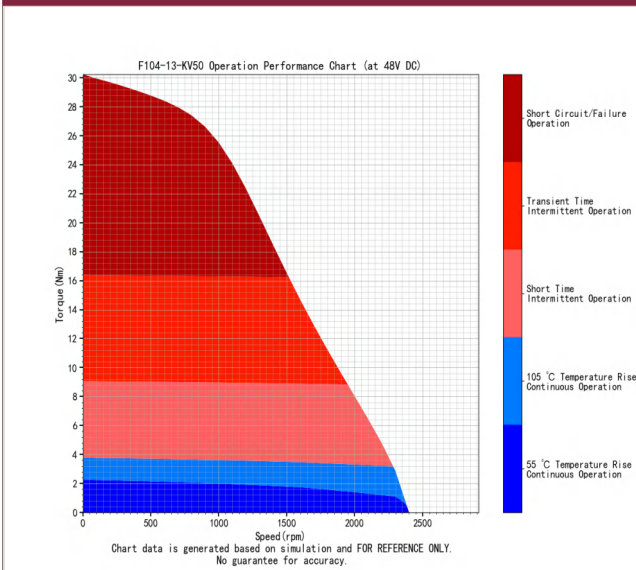


F104-13-KV25 Torque-Current Curve @25°C (T-i curve)

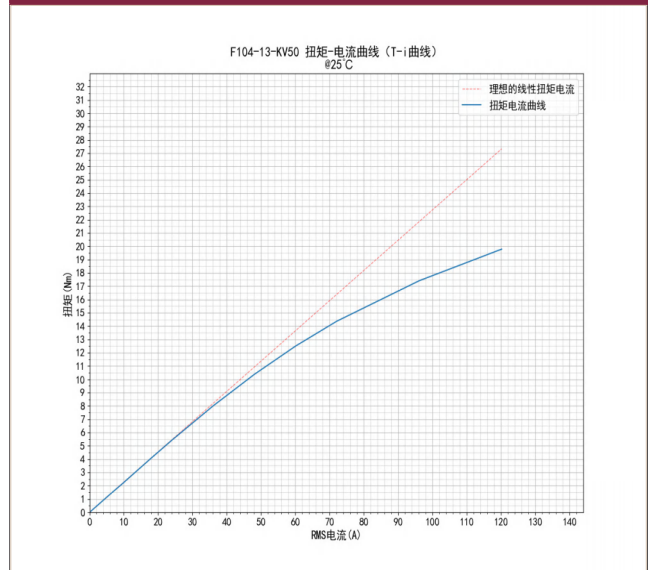


# F104-13-KV50

F104-13-KV50 Operation Performance Chart (at 48V DC)

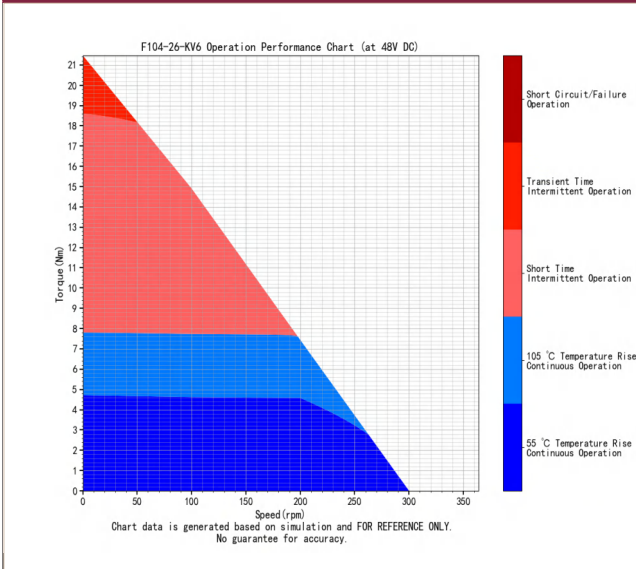


F104-13-KV50 Torque-Current Curve @25°C (T-i curve)

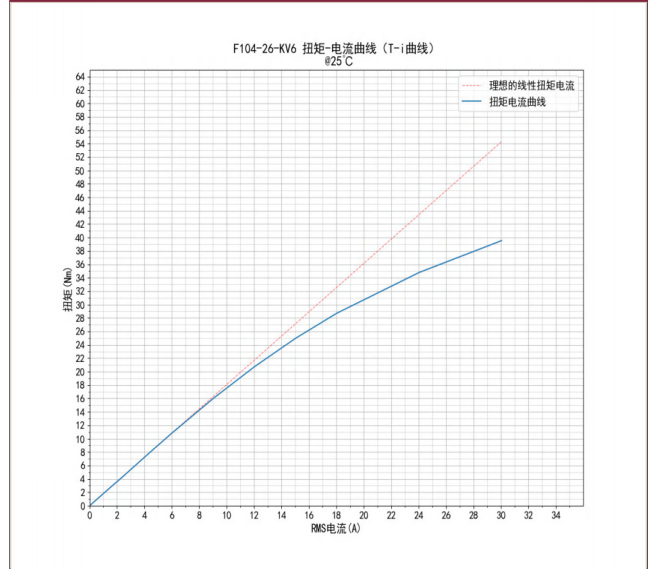


# F104-26-KV6

F104-26-KV6 Operation Performance Chart (at 48V DC)

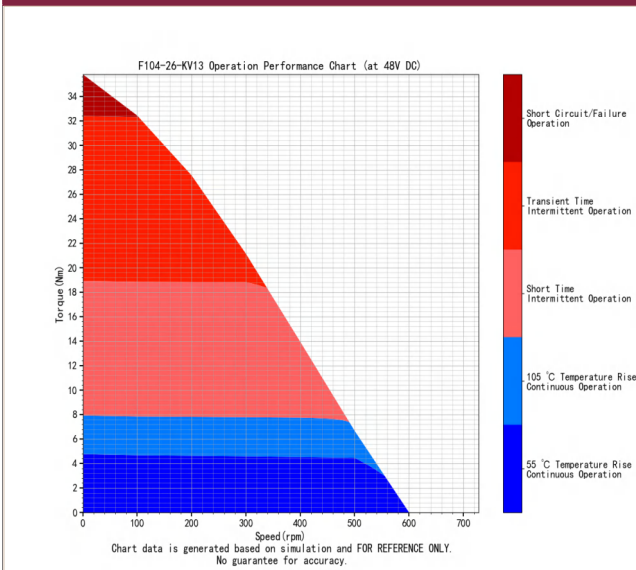


F104-26-KV6 Torque-Current Curve @25°C (T-i curve)

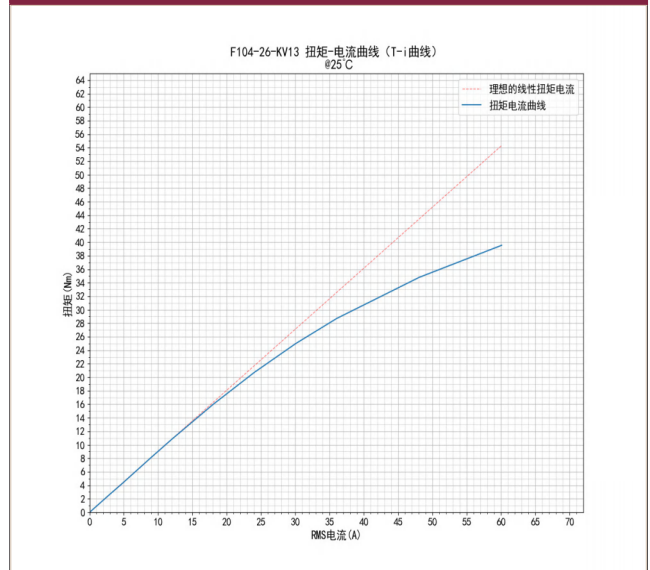


# F104-26-KV13

F104-26-KV13 Operation Performance Chart (at 48V DC)

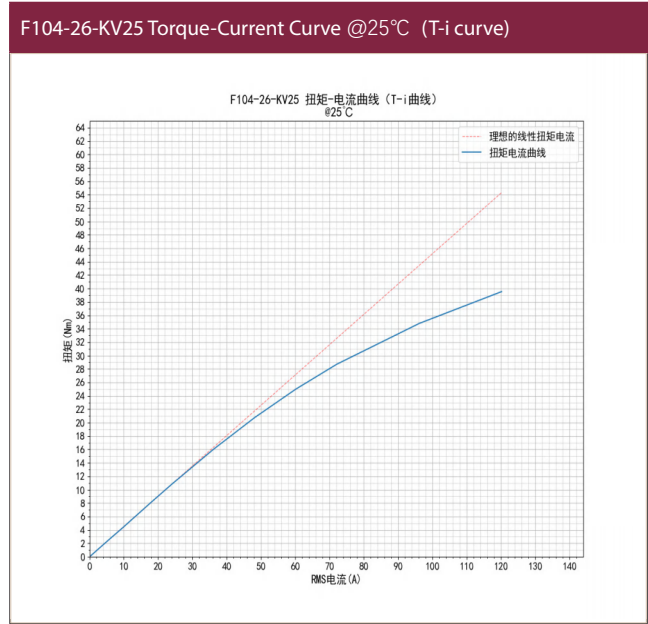
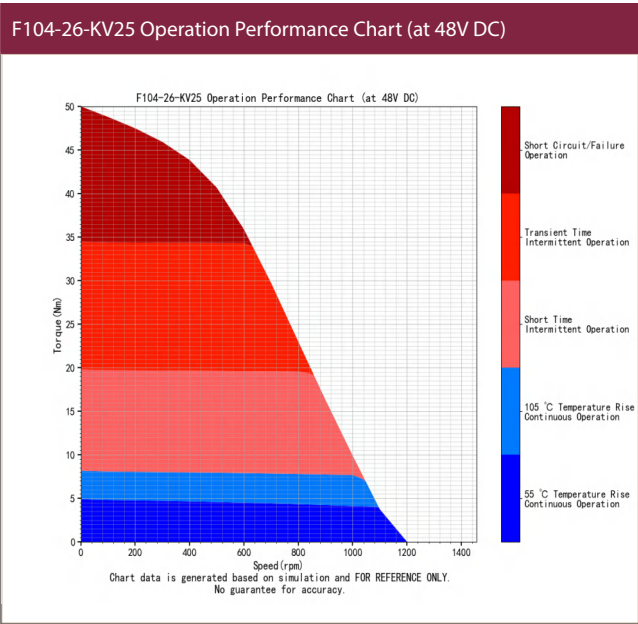


F104-26-KV13 Torque-Current Curve @25°C (T-i curve)





# F104-26-KV25



# F115 Specification F115-08

Type	F115-08		
	KV15	KV30	KV65
Stator Diameter [mm]	115	115	115
Stator Axial Length (Excl. Cable) [mm]	16	16	16
Rotor Inner Diameter [mm]	83.5	83.5	83.5
Weight [g]	309	309	309
Stator Weight (Excl. Cable) [g]	246	246	246
Rotor Weight [g]	63	63	63
Rotor Inertia [kg mm <sup>2</sup> ]	120	120	120
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	190	440	670
No Load Speed @ Typical Voltage [rpm]	760	1500	3000
Load Speed @ Typical Voltage [rpm]	620	1360	2860
Continuous Mechanical Speed Limit [rpm]	2100	2100	2100
Rated Torque (105°C Temp. Rise) [Nm]	3.1	3.1	3.1
Rated Torque (55°C Temp. Rise) [Nm]	1.84	1.84	1.84
Rated Torque (Lasting 10s) [Nm]	7.5	7.5	7.5
Rated Torque (Lasting 2s) [Nm]	13.5	13.5	13.5
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.5	17
Rated RMS Current (55°C Temp. Rise) [A]	2.55	5.1	10.2
Peak RMS Current (Lasting 10s) [A]	10.6	21.2	42.4
Peak RMS Current (Lasting 2s) [A]	21.2	42.4	84.9
KV Constant [rpm/V]	16	32	64
Back EMF Constant [Vs/rad]	0.596	0.298	0.149
Torque Constant [Nm/A]	0.513	0.257	0.128
Line Resistance [Ohm]	1.61	0.403	0.101
Line Inductance [H]	1.33	0.332	0.083
d Axis Inductance [mH]	1.93	0.482	0.121
q Axis Inductance [mH]	2.05	0.514	0.128
Time Constant [ms]	0.824	0.824	0.824
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N40P	36N40P	36N40P
Motor Constant [Nm/sqrt (W) ]	0.467	0.467	0.467
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

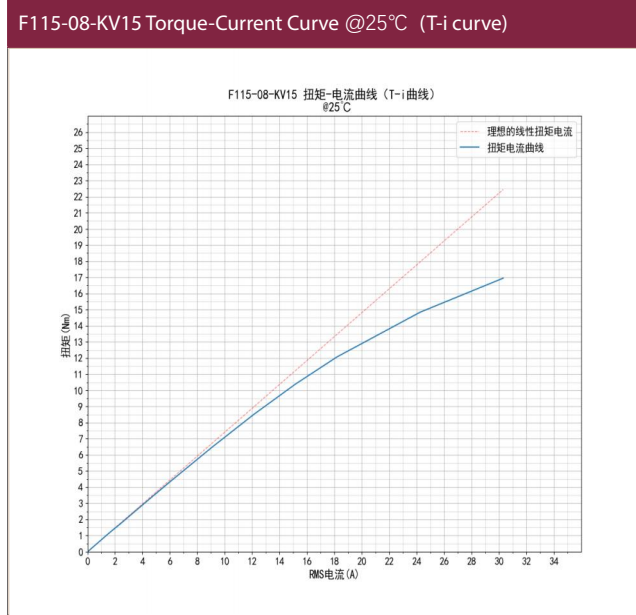
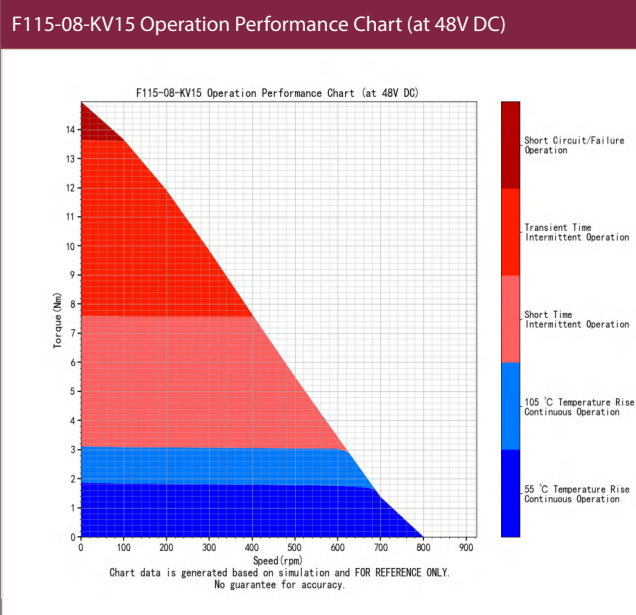
# F115 Specification F115-13

Type	F115-13		
	KV10	KV20	KV40
Stator Diameter [mm]	115	115	115
Stator Axial Length (Excl. Cable) [mm]	21	21	21
Rotor Inner Diameter [mm]	83.5	83.5	83.5
Weight [g]	463	463	463
Stator Weight (Excl. Cable) [g]	361	361	361
Rotor Weight [g]	102	102	102
Rotor Inertia [kg mm <sup>2</sup> ]	196	196	196
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	180	420	910
No Load Speed @ Typical Voltage [rpm]	470	940	1800
Load Speed @ Typical Voltage [rpm]	360	820	1740
Continuous Mechanical Speed Limit [rpm]	2100	2100	2100
Rated Torque (105°C Temp. Rise) [Nm]	5	5	5
Rated Torque (55°C Temp. Rise) [Nm]	3	3	3
Rated Torque (Lasting 10s) [Nm]	12.2	12.2	12.2
Rated Torque (Lasting 2s) [Nm]	22	22	22
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.5	17
Rated RMS Current (55°C Temp. Rise) [A]	2.55	5.1	10.2
Peak RMS Current (Lasting 10s) [A]	10.6	21.2	42.4
Peak RMS Current (Lasting 2s) [A]	21.2	42.4	84.9
KV Constant [rpm/V]	10	20	39
Back EMF Constant [Vs/rad]	0.968	0.484	0.242
Torque Constant [Nm/A]	0.834	0.417	0.208
Line Resistance [Ohm]	2.07	0.517	0.129
Line Inductance [H]	2.09	0.522	0.13
d Axis Inductance [mH]	3.03	0.758	0.189
q Axis Inductance [mH]	3.23	0.808	0.202
Time Constant [ms]	1.01	1.01	1.01
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N40P	36N40P	36N40P
Motor Constant [Nm/sqrt (W) ]	0.669	0.669	0.669
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

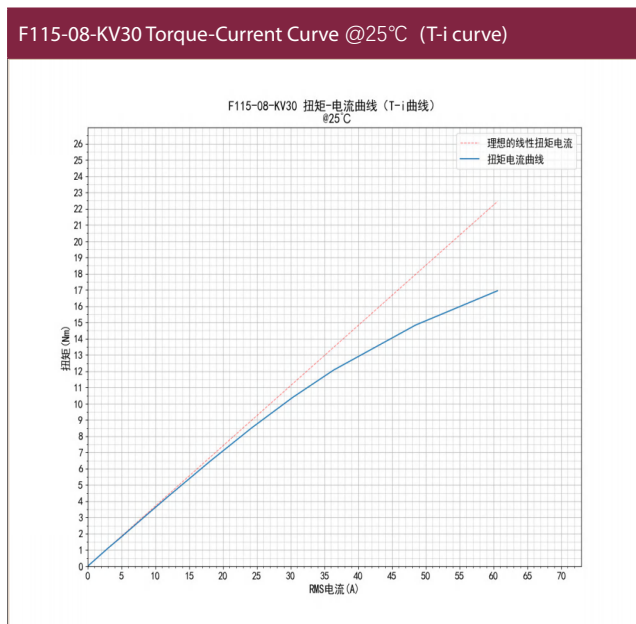
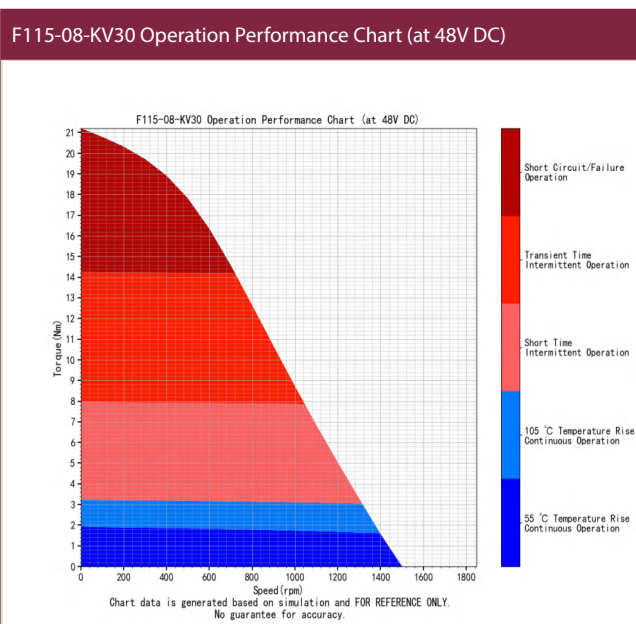
# F115 Specification F115-26

Type	F115-26		
	KV5	KV10	KV20
Stator Diameter [mm]	115	115	115
Stator Axial Length (Excl. Cable) [mm]	34	34	34
Rotor Inner Diameter [mm]	83.5	83.5	83.5
Weight [g]	863	863	863
Stator Weight (Excl. Cable) [g]	659	659	659
Rotor Weight [g]	204	204	204
Rotor Inertia [kg mm <sup>2</sup> ]	392	392	392
DC Drive Voltage (Typical) [V]	12-100 (48)	12-100 (48)	12-100 (48)
Rated Output Power @ Typical Voltage [W]	150	390	880
No Load Speed @ Typical Voltage [rpm]	230	470	940
Load Speed @ Typical Voltage [rpm]	150	380	840
Continuous Mechanical Speed Limit [rpm]	2100	2100	2100
Rated Torque (105°C Temp. Rise) [Nm]	10	10	10
Rated Torque (55°C Temp. Rise) [Nm]	6	6	6
Rated Torque (Lasting 10s) [Nm]	24.4	24.4	24.4
Rated Torque (Lasting 2s) [Nm]	44	44	44
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.5	17
Rated RMS Current (55°C Temp. Rise) [A]	2.55	5.1	10.2
Peak RMS Current (Lasting 10s) [A]	10.6	21.2	42.4
Peak RMS Current (Lasting 2s) [A]	21.2	42.4	84.9
KV Constant [rpm/V]	5	10	20
Back EMF Constant [Vs/rad]	1.94	0.968	0.484
Torque Constant [Nm/A]	1.67	0.834	0.417
Line Resistance [Ohm]	3.26	0.814	0.204
Line Inductance [H]	4.06	1.02	0.254
d Axis Inductance [mH]	5.89	1.47	0.368
q Axis Inductance [mH]	6.3	1.57	0.394
Time Constant [ms]	1.25	1.25	1.25
Winding Connection	△	△	△
Poles [Stator N Rotor P]	36N40P	36N40P	36N40P
Motor Constant [Nm/sqrt (W) ]	1.07	1.07	1.07
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

# F115-08-KV15

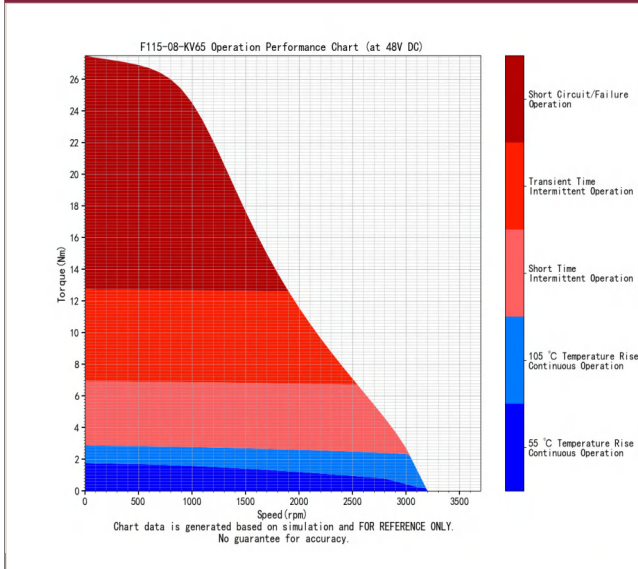


# F115-08-KV30

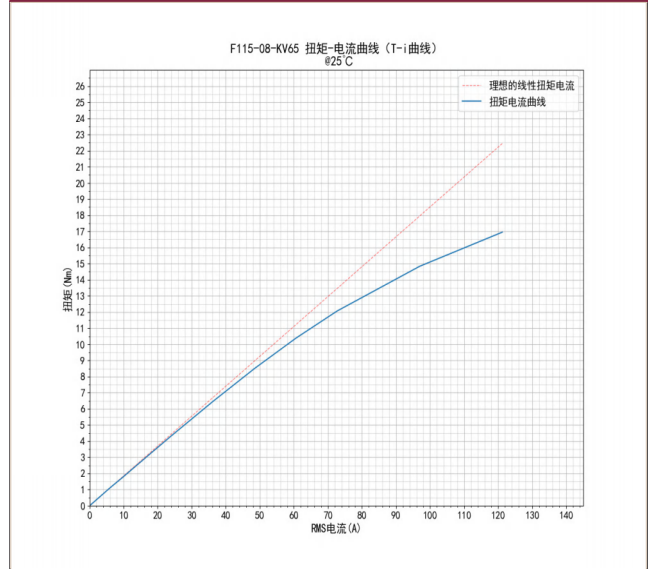


# F115-08-KV65

F115-08-KV65 Operation Performance Chart (at 48V DC)

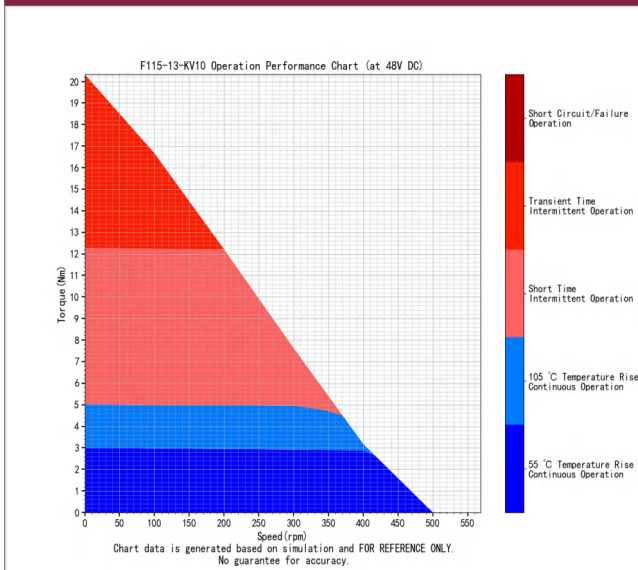


F115-08-KV65 Torque-Current Curve @25°C (T-i curve)

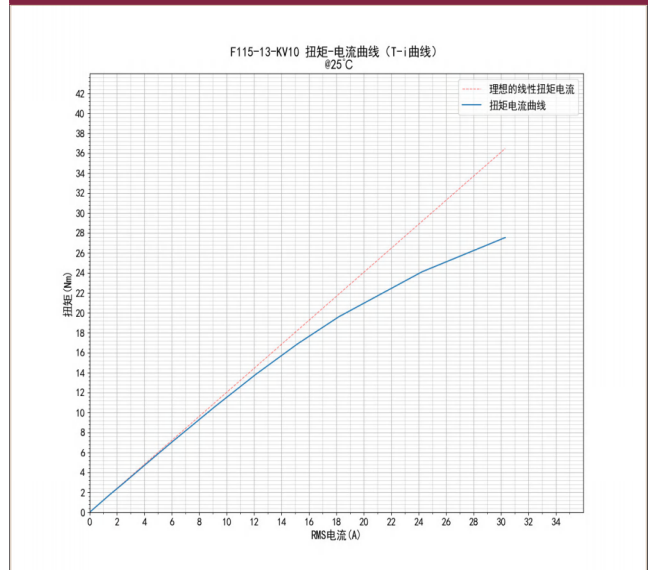


# F115-13-KV10

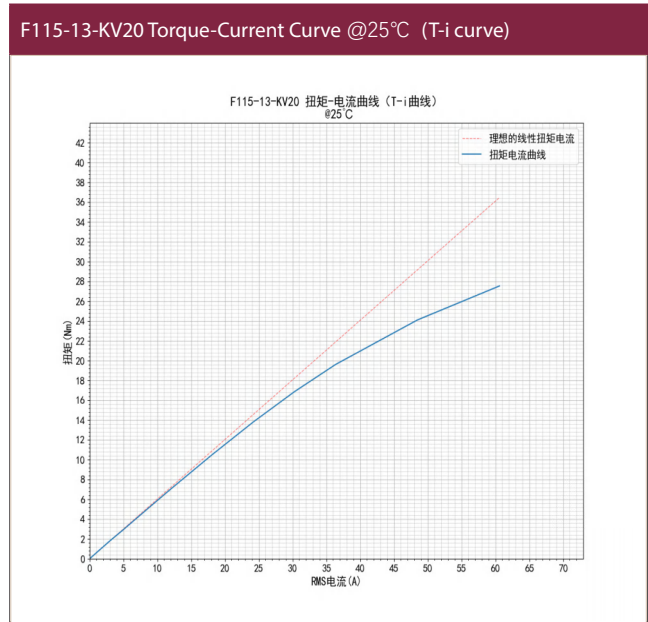
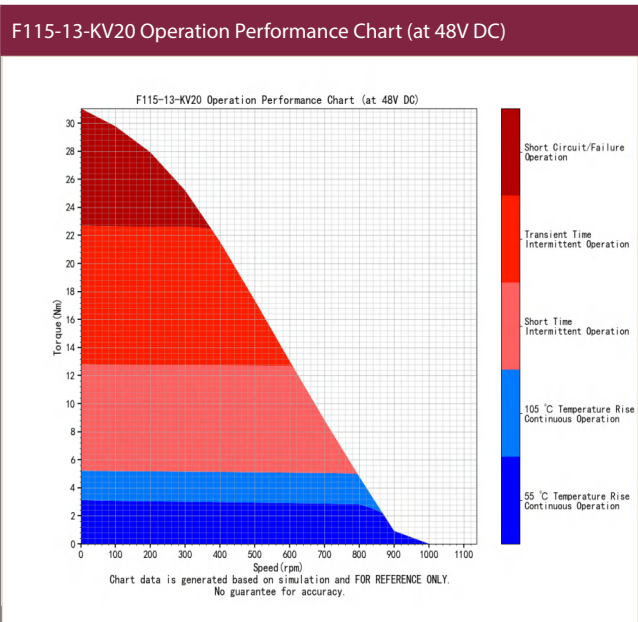
F115-13-KV10 Operation Performance Chart (at 48V DC)



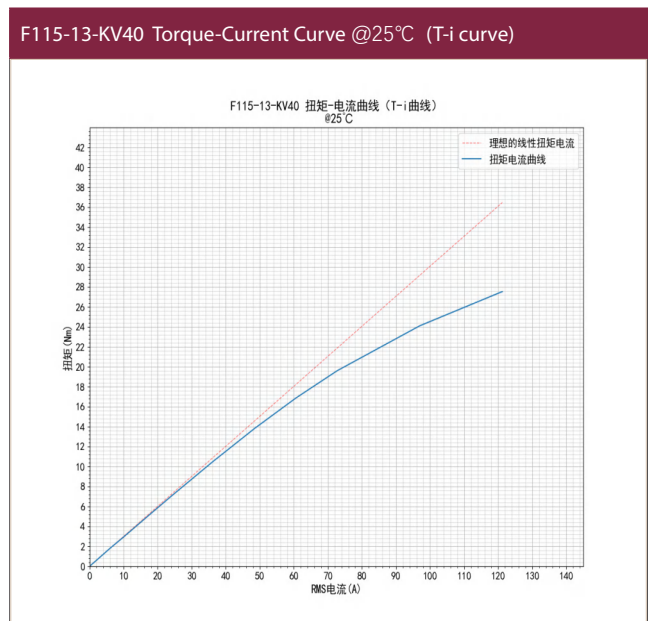
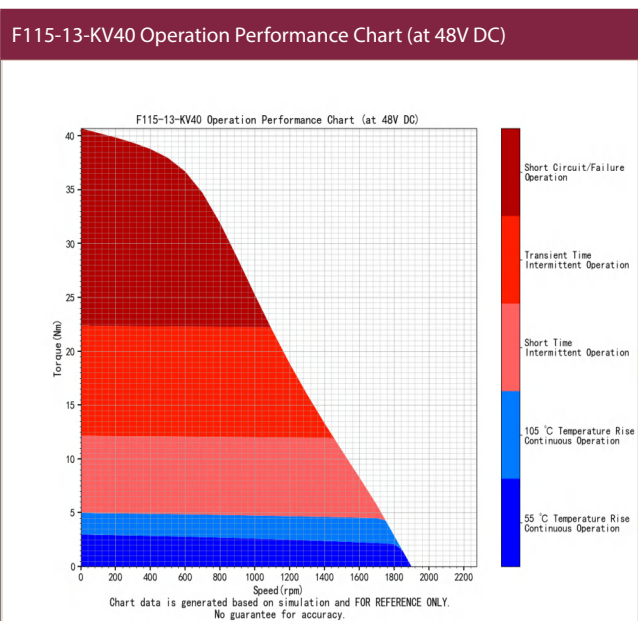
F115-13-KV10 Torque-Current Curve @25°C (T-i curve)



# F115-13-KV20

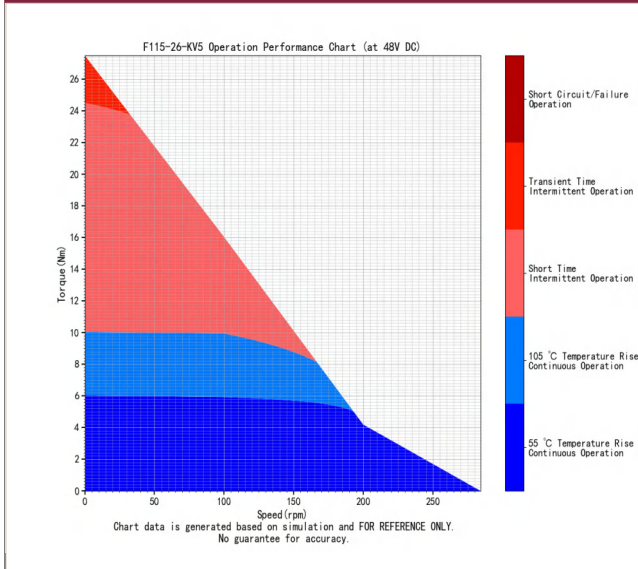


# F115-13-KV40

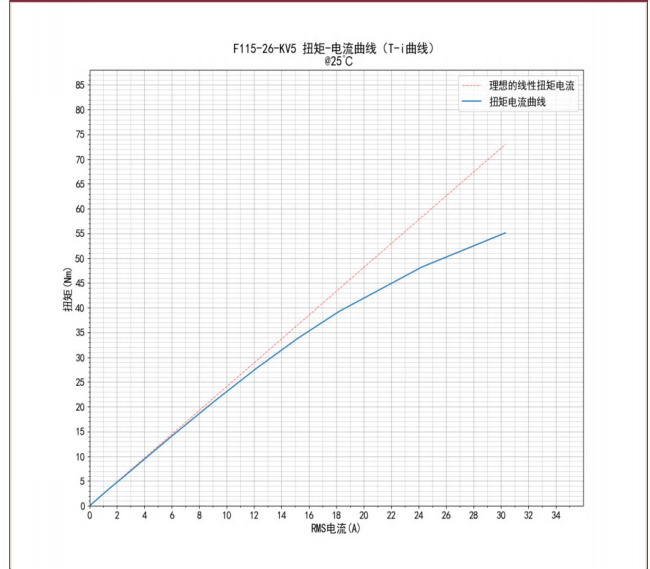


# F115-26-KV5

F115-26-KV5 Operation Performance Chart (at 48V DC)

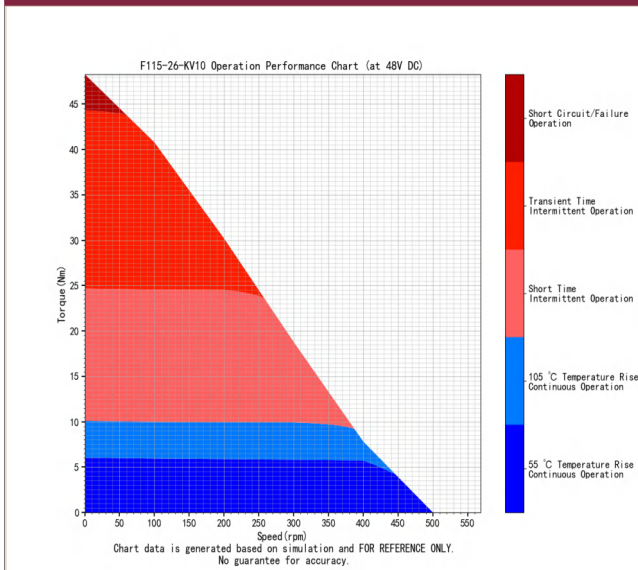


F115-26-KV5 Torque-Current Curve @25°C (T-i curve)

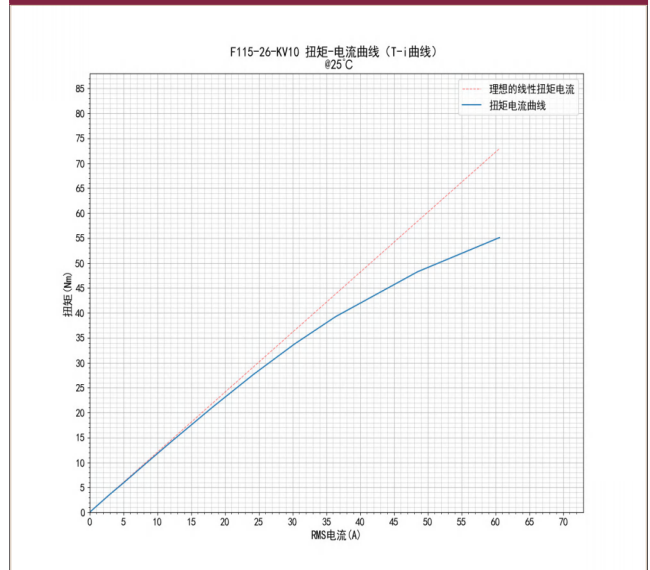


# F115-26-KV10

F115-26-KV10 Operation Performance Chart (at 48V DC)



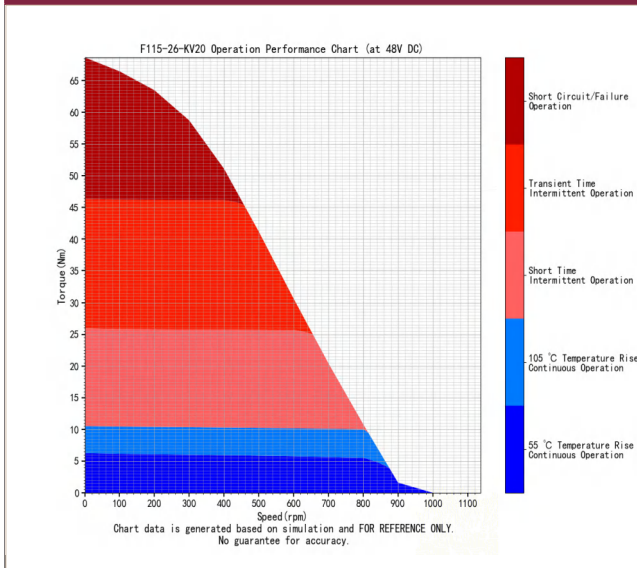
F115-26-KV10 Torque-Current Curve @25°C (T-i curve)



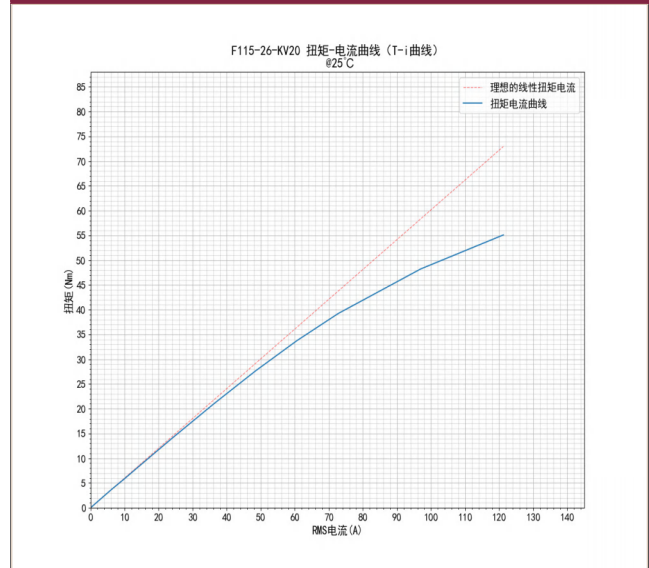


# F115-26-KV20

F115-26-KV20 Operation Performance Chart (at 48V DC)



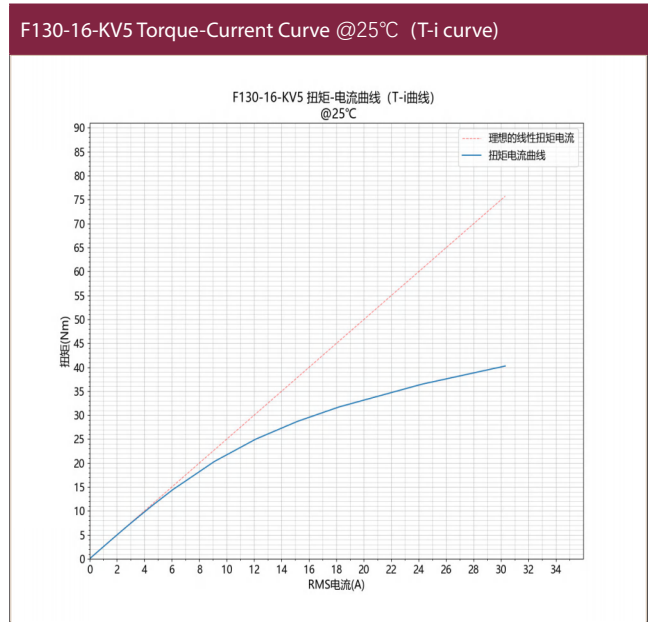
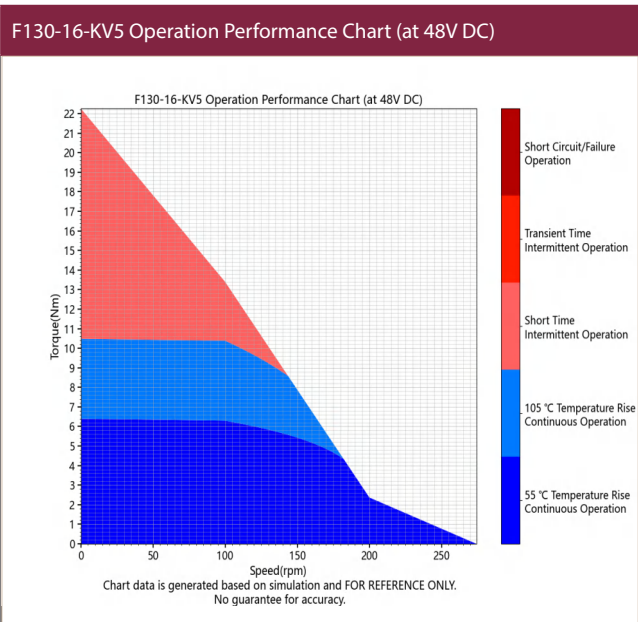
F115-26-20 Torque - current curve (T-i curve) (at 25°C)



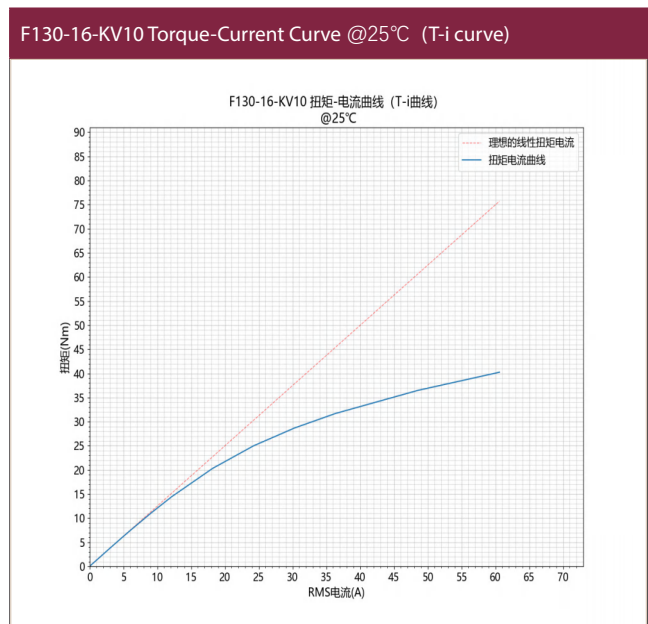
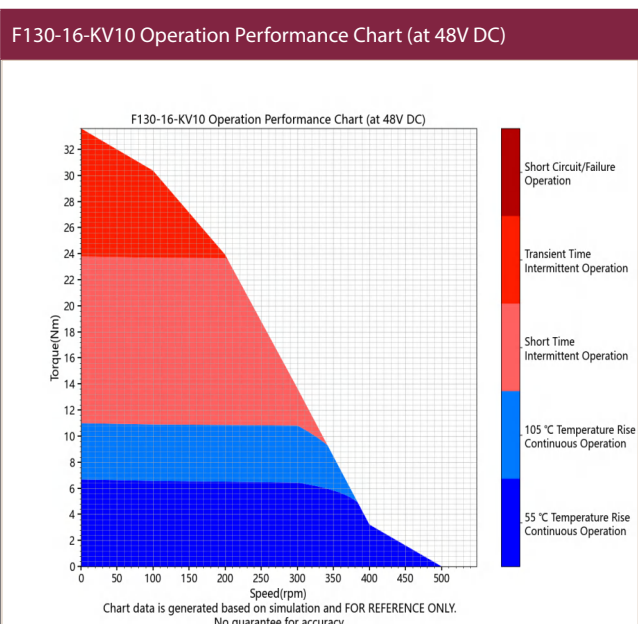
# F130 Specification F130-16

Type	F130-16		
	KV5	KV10	KV20
Stator Diameter [mm]	130	130	130
Stator Axial Length (Excl. Cable) [mm]	24.5	24.5	24.5
Rotor Inner Diameter [mm]	93	93	93
Weight [g]	745	745	745
Stator Weight (Excl. Cable) [g]	591	591	591
Rotor Weight [g]	154	154	154
Rotor Inertia [kg mm <sup>2</sup> ]	364	364	364
DC Drive Voltage (Typical) [V]	12-120 (48)	12-120 (48)	12-120 (48)
Rated Output Power @ Typical Voltage [W]	130	360	830
No Load Speed @ Typical Voltage [rpm]	220	450	910
Load Speed @ Typical Voltage [rpm]	120	340	760
Continuous Mechanical Speed Limit [rpm]	1610	1610	1610
Rated Torque (105°C Temp. Rise) [Nm]	10.4	10.4	10.4
Rated Torque (55°C Temp. Rise) [Nm]	6.2	6.2	6.2
Rated Torque (Lasting 10s) [Nm]	22.8	22.8	22.8
Rated Torque (Lasting 2s) [Nm]	34.2	34.2	34.2
Rated RMS Current (105°C Temp. Rise) [A]	4.2	8.5	17
Rated RMS Current (55°C Temp. Rise) [A]	2.55	5.1	10.2
Peak RMS Current (Lasting 10s) [A]	10.6	21.2	42.4
Peak RMS Current (Lasting 2s) [A]	21.2	42.4	84.9
KV Constant [rpm/V]	5	10	19
Back EMF Constant [Vs/rad]	2.01	1	0.502
Torque Constant [Nm/A]	1.73	0.864	0.432
Line Resistance [Ohm]	3.83	0.957	0.239
Line Inductance [H]	5.41	1.35	0.338
d Axis Inductance [mH]	7.28	1.82	0.455
q Axis Inductance [mH]	8.96	2.24	0.56
Time Constant [ms]	1.41	1.41	1.41
Winding Connection	△	△	△
Poles [Stator N Rotor P]	48N52P	48N52P	48N52P
Motor Constant [Nm/sqrt (W) ]	1.02	1.02	1.02
Max. Winding Temperature [°C]	130	130	130
Operating Ambient Temperature [°C]	-20 to 50	-20 to 50	-20 to 50

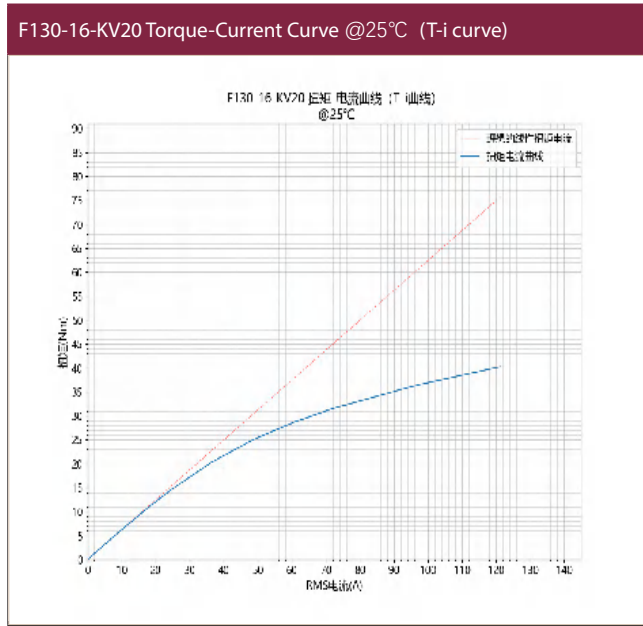
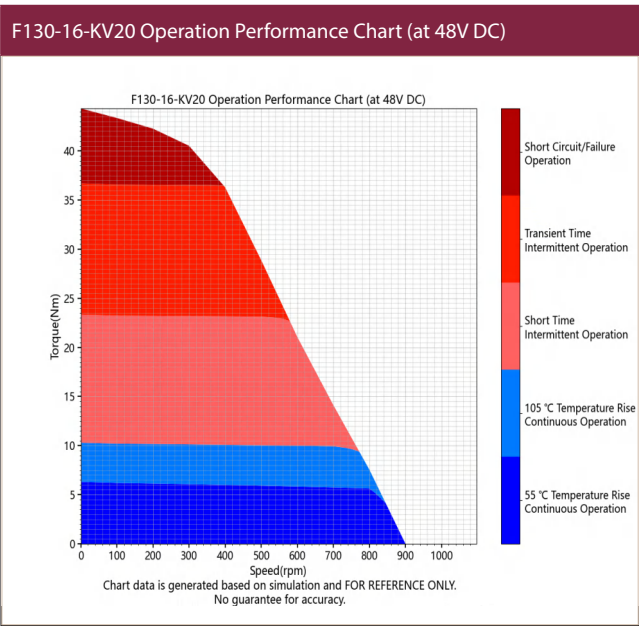
# F130-16-KV5



# F130-16-KV10

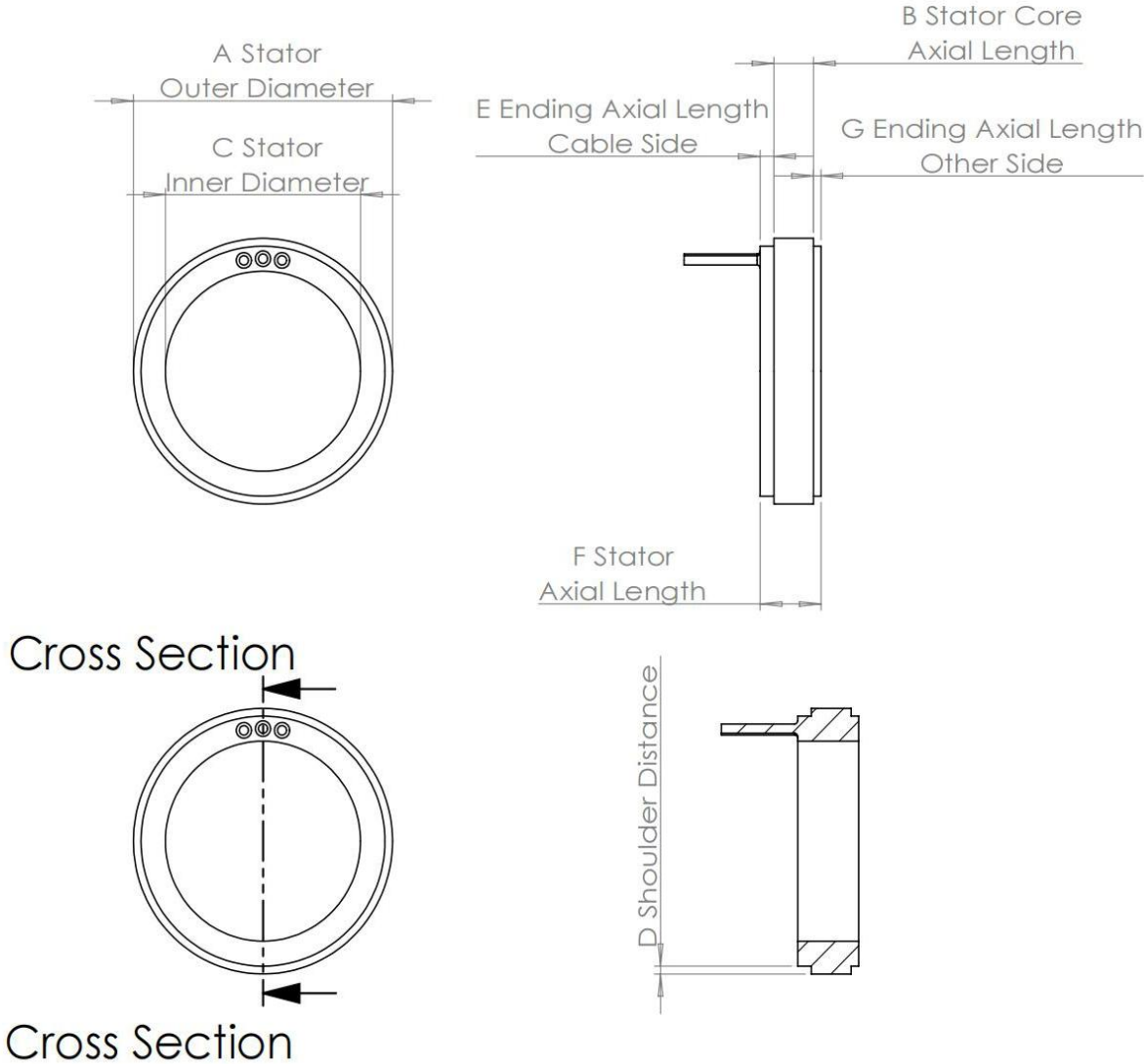


# F130-16-KV20

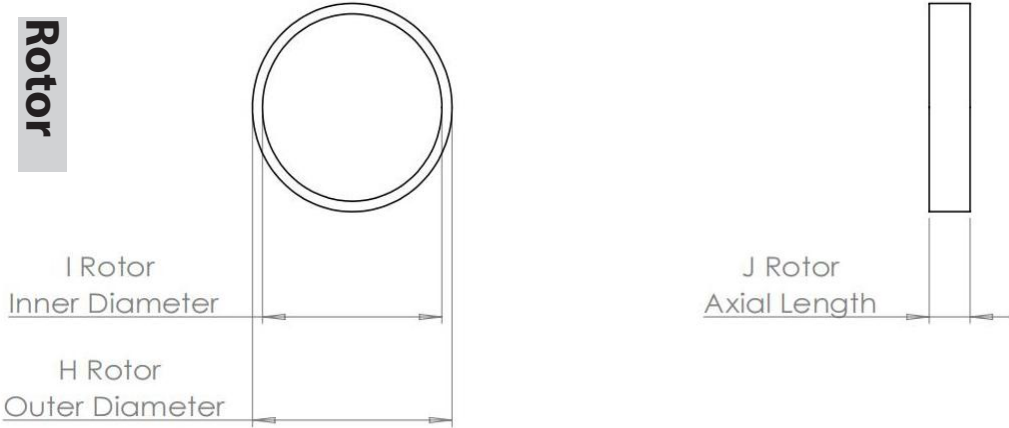


# Sizes and Tolerances

## Stator



## Rotor



## F50-08

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
50.00	8.00	34.00	1.20	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.039, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
16.50	3.00	33.50	28.50	8.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.021)	±0.05

## F50-13

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
50.00	13.00	34.00	1.20	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.039, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
21.50	3.00	33.50	28.50	13.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.021)	±0.05

## F60-08

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
60.00	8.00	43.00	1.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
16.50	3.00	42.50	36.00	8.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F60-13

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
60.00	13.00	43.00	1.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
21.50	3.00	42.50	36.00	13.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F60-26

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
60.00	26.00	43.00	1.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
34.50	3.00	42.50	36.00	26.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F69-10

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
69.00	10.00	48.60	2.00	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
18.50	3.00	48.10	42.00	10.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05



## F69-18

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
69.00	18.00	48.60	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
26.50	3.00	48.10	42.00	18.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F76-10

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
76.00	10.00	54.80	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
18.50	3.00	54.10	48.00	10.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F76-17

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
76.00	17.00	54.80	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
25.50	3.00	54.10	48.00	17.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F76-20

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
76.00	20.00	54.80	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.046, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
28.50	3.00	54.10	48.00	20.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.025)	±0.05

## F85-13

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
85.00	13.00	65.60	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.054, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
21.50	3.00	64.90	58.50	13.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.030)	±0.05

## F85-18

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
85.00	18.00	65.60	2.00	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.054, 0)	±0.20	±0.031	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
26.50	3.00	64.90	58.50	18.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.030)	±0.05

## F104-08

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
104.00	8.00	81.40	2.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
16.50	3.00	80.70	73.00	8.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.030)	±0.05

## F104-13

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
104.00	13.00	81.40	2.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
21.50	3.00	80.70	73.00	13.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.030)	±0.05

## F104-26

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
104.00	26.00	81.40	2.50	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
34.50	3.00	80.70	73.00	26.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.030)	±0.05

## F115-08

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
115.00	8.00	92.00	2.50	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
16.50	3.00	91.30	83.50	8.00
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.035)	±0.05

## F115-13

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
115.00	13.00	92.00	2.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
21.50	3.00	91.30	83.50	13.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.035)	±0.05

## F115-26

A Stator Outer Diameter	B Stator Core Axial Length	C Stator Inner Diameter	D Shoulder Distance	E Ending Axial Length Cable Side
115.00	26.00	92.00	2.50	5.50
a Tolerance	b Tolerance	c Tolerance	d Tolerance	e Tolerance
h8 (-0.054, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
F Stator Axial Length	G Ending Axial Length Other Side	H Rotor Outer Diameter	I Rotor Inner Diameter	J Rotor Axial Length
34.50	3.00	91.30	83.50	26.00
f Tolerance	g Tolerance	h Tolerance	i Tolerance	j Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.035)	±0.05

# F130-16

<b>A</b> Stator Outer Diameter	<b>B</b> Stator Core Axial Length	<b>C</b> Stator Inner Diameter	<b>D</b> Shoulder Distance	<b>E</b> Ending Axial Length Cable Side
130.00	16.30	102.20	2.50	5.50
<b>a</b> Tolerance	<b>b</b> Tolerance	<b>c</b> Tolerance	<b>d</b> Tolerance	<b>e</b> Tolerance
h8 (-0.063, 0)	±0.20	±0.037	±0.50	(-0.5, 0)
<b>F</b> Stator Axial Length	<b>G</b> Ending Axial Length Other Side	<b>H</b> Rotor Outer Diameter	<b>I</b> Rotor Inner Diameter	<b>J</b> Rotor Axial Length
24.80	3.00	101.50	93.00	16.30
<b>f</b> Tolerance	<b>g</b> Tolerance	<b>h</b> Tolerance	<b>i</b> Tolerance	<b>j</b> Tolerance
(-1, 0)	±0.50	±0.040	H7 (0, +0.035)	±0.05

# Update Log

## Data Update Date[2023-07-27]

FS-20230426 Updated: Creation of the Document.

FS-20230523 Updated: Addition of NTC/PTC/000 in the Nomenclature.

FS-20230607 updated: Compared to FS-20230523, addition of the type F115-26-KV5, F115-26-KV10 and F115-26-KV20 .

FS-20230707 updated: Compared to FS-20230607, the data for **H** rotor outer diameter type of F76,F85,F104,F115 and F130 have been adjusted.

FS-20230727 Updated: Compared to FS-20230707, the data for **d** Tolerance,**g** Tolerance,and **G** Ending Axial Length Other Side of F series have been adjusted.



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