YASKAWA

Permanent-Magnet Synchronous Motor
SS7-Series Eco PM Motor

Constant Torque Type

Certified for
ISO9001 and
ISO14001

JQA-QM8097 JQA-EM0202

Protecting the Future with Technology

In 1997, Yaskawa released the SS5 Series which featured the world's first PM motors with permanent magnets built directly into the rotors. The overwhelmingly high efficiency of these motors made machine downsizing and saving energy possible. Over the years, the need to reduce CO_2 emissions has continued to increase, and in response, Yaskawa Motor Corporation has undertaken a new challenge to develop original technologies that will help protect the future of our planet. In response to the introduction of high efficiency standards for industrial motors in 2015 to help reduce CO_2 emissions, Yaskawa Motor Corporation has released the SS7 Series, which improves on the efficient and compact SS5 Series.
The SS7 Series of Eco PM Motors promises to meet all your needs in a wide range of applications.

Main Features

1 Extensive Lineup of 2.2 kW to 300 kW Motors p8
- 200 V: 2.2 kW to 110 kW (for 1,750 min^{-1})
- 400 V: 2.2 kW to 300 kW (for 1,750 min^{-1})
- Rated speed: 1,150 min^{-1}, 1,450 min^{-1}, or 1,750 min^{-1}

2 High Efficiency p4
Complies* with premium efficiency (IE3) and super premium efficiency (IE4) standards.
Higher efficiency than the SS5 Series.
*: Inquire for estimates.

3 Compact and Lightweight p5
In comparison to induction motors, frames are 1 to 4 frame sizes smaller. Mass has been reduced by 10% to 64%.
This creates more compact machines and saves motor installation space.

4 Resolvers Used as Sensors (Encoders) p6
Resolvers are offered as a standard feature for their high reliability under vibration and heat.
(Optical encoders are optional.)

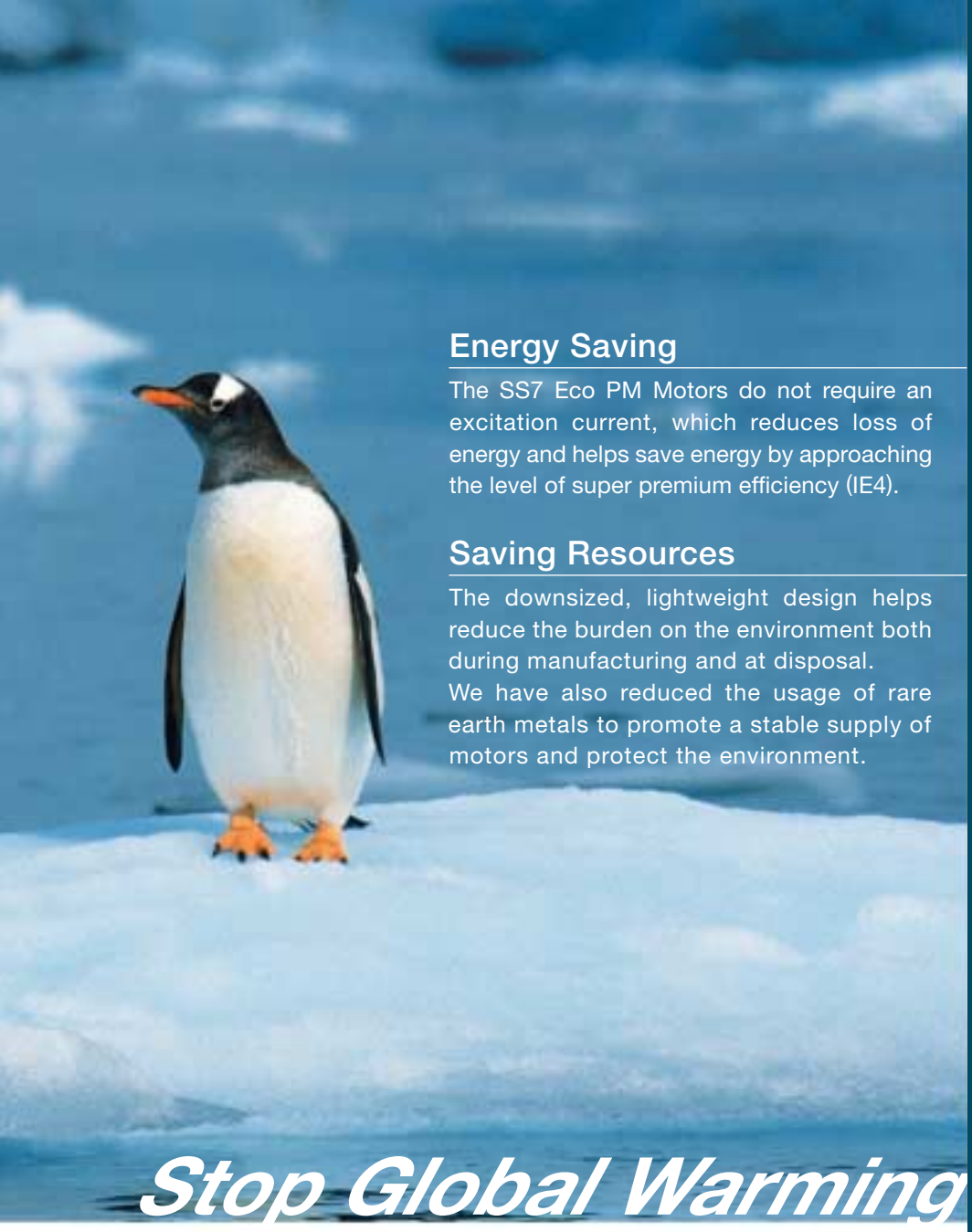
5 Advanced Machine Control p7
- Combine the SS7 Series with Yaskawa's A1000 AC drives for quick responses to speed references and load disturbances.
- These sensorless drives offer a speed control range of 1:20. You can reduce wiring and increase reliability.
- The rated output range can extend up to 150%* of the rated speed to make alignment with the machine's rated speed easier.

*: 2.2 kW to 75 kW (with sensor)

6 Use Either a Coupling or Belt Drive p12
Design work is simplified because the external dimensions and installation dimensions do not depend on the drive method.

7 Compliance with the EU's CE Marking Safety Standard and the EU's Restriction of Hazardous Substances Directive (RoHS) (Estimates provided on an individual basis.)

ECO PM MOTOR



Energy Saving

The SS7 Eco PM Motors do not require an excitation current, which reduces loss of energy and helps save energy by approaching the level of super premium efficiency (IE4).

Saving Resources

The downsized, lightweight design helps reduce the burden on the environment both during manufacturing and at disposal.
We have also reduced the usage of rare earth metals to promote a stable supply of motors and protect the environment.

Stop Global Warming

Main Applications

- Resin or rubber molding machines (extruders, mulling machines, drawing machines, etc.)
- Cranes
- Compressors
- Metalworking Machines
- Printing Machines

SS7

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Energy Savings

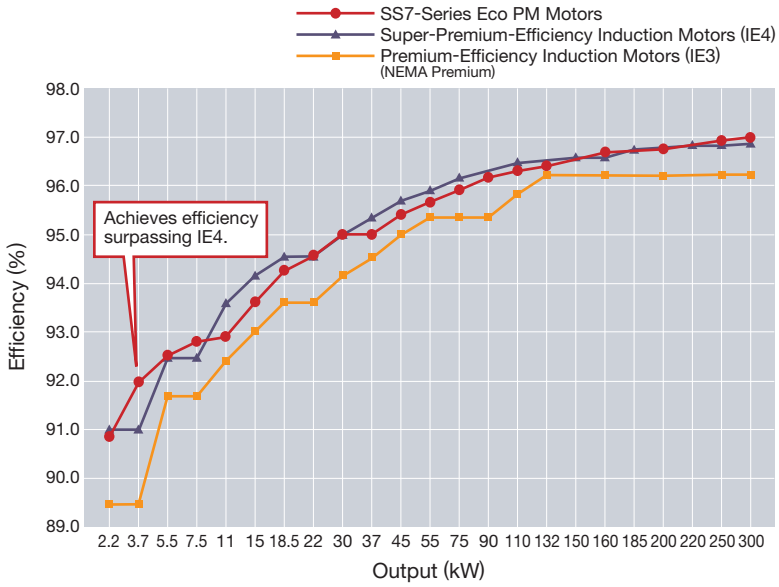
Saving energy to reduce environmental impacts (CO_2) and greatly reduce costs

The high efficiency of the SS7 Series surpasses premium efficiency (IE3) standards and approaches super premium efficiency (IE4) standards.
You can take even greater advantage of the benefits of Eco PM Motors with variable-speed control applications.

High Efficiency

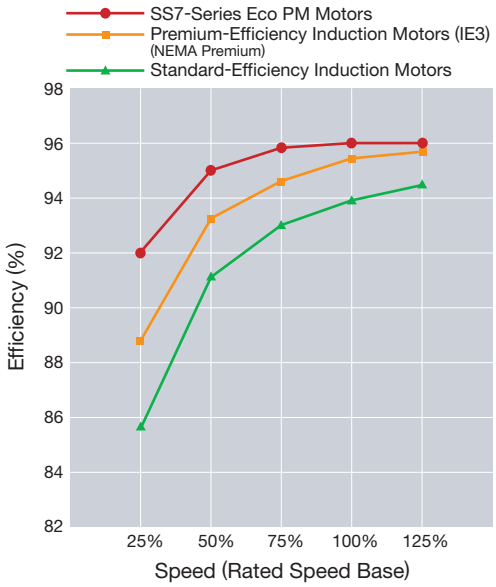
Motor Efficiency

High Efficiency Approaching IE4



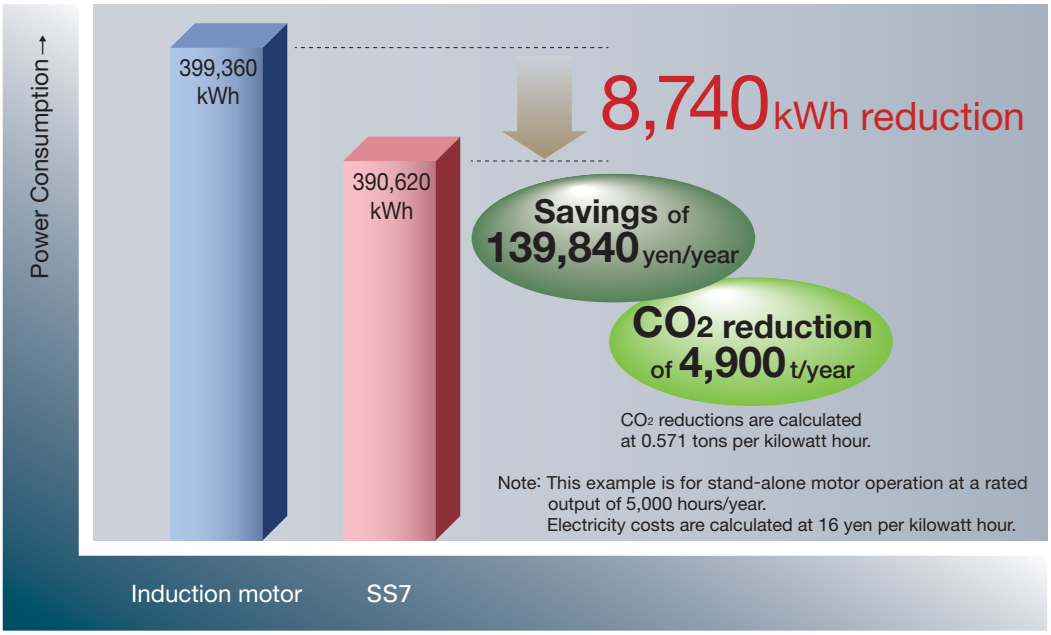
Motor Efficiency for Variable-Speed Control (Example for 75 kW, 1,750 min^{-1})

Take Advantage of Benefits with Variable-Speed Control



Reduced Running Costs

Power Consumption and Power Cost Comparison (Example for 75 kW)



Space Saving

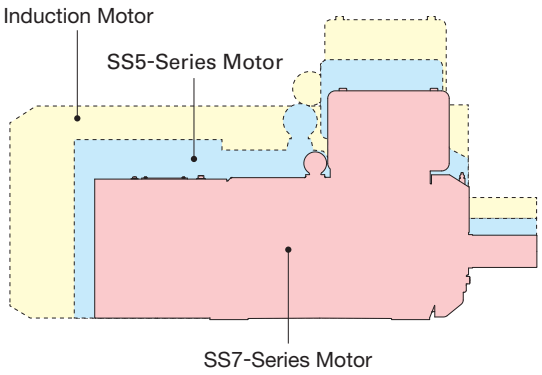
Makes machines more compact and saves resources

You can use the many compact and lightweight models in the SS7 Series to easily convert your machines to environmentally friendly machines.

Compact

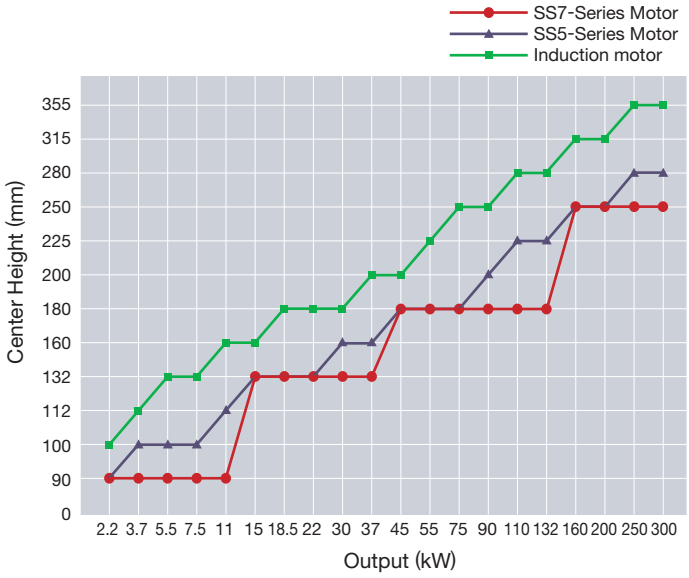
Exterior Comparison (Example for 132 kW/1750 min^{-1})

More Compact than SS5 Motors



Frame Number Comparison (1750 min^{-1} Model)

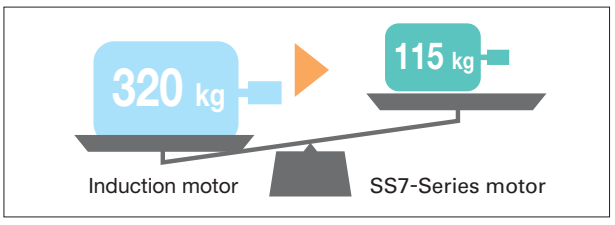
A Reduction of Up to Two Frame Sizes



Lightweight

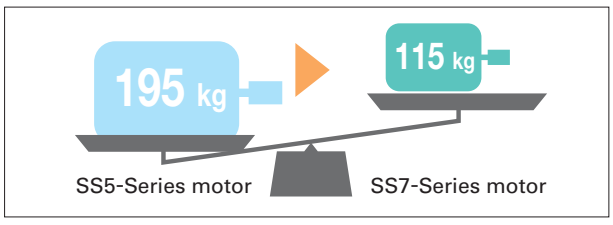
Mass Comparison with Induction Motors (Example for 37 kW/1750 min^{-1})

Reduced by Approximately 64%



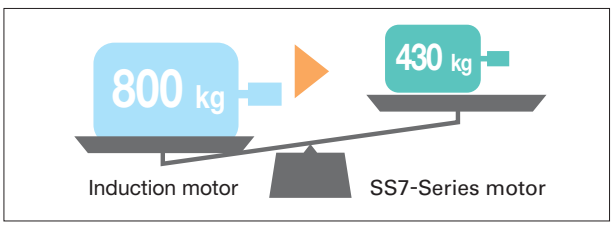
Mass Comparison with SS5-Series Motors (Example for 37 kW/1750 min^{-1})

Reduced by Approximately 41%



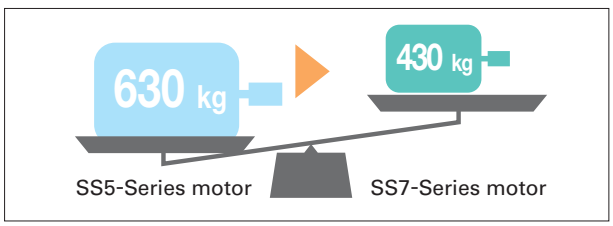
Mass Comparison with Induction Motors (Example for 132 kW/1750 min^{-1})

Reduced by Approximately 47%



Mass Comparison with SS5-Series Motors (Example for 132 kW/1750 min^{-1})

Reduced by Approximately 32%



Develop a High Performance Drive

SS7-Series Eco PM Motors

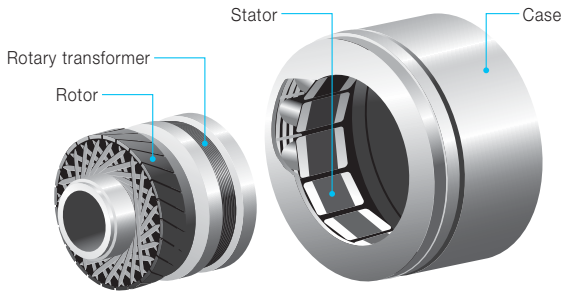
Designed for long-term, dependable operation.
Model selection and adjustments are simple, which reduces commissioning time.

Highly Reliable

Sensor (Encoder)

- Resolvers are offered as a standard feature because of their high reliability for environment and noise resistance.

Note: An optical encoder is offered as an option. Use an optical encoder for applications that require high-precision speed/torque control, such as testing machines and printing machines.



What Is a Resolver?

A resolver consists of a stator and rotor. Similar to transformers, an output voltage is generated (the rotation of the rotor creates a sine-wave output), which is read to detect the angle or speed. The main configurational components are the coil and core. There are no electronic components, so the influences of temperature, noise, and vibration are limited.

Note: An option board is required to operate the Eco PM motor with a resolver.

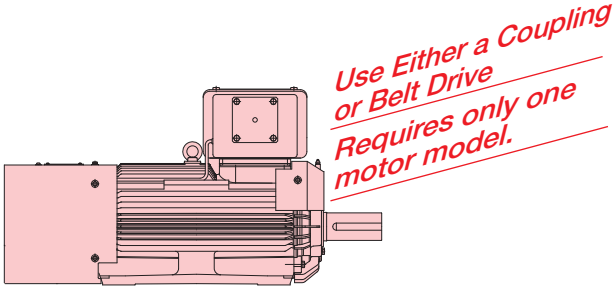
Fan Cover

- In response to wide-spread demand, the size of the air holes in the fan cover have been reduced to increase safety.

Simple Selection and Adjustment

Simple Model Selection

- Cylindrical roller bearings have been used for all bearings on the coupling side.*
- You can use a coupling or belt drive with the same motor to simplify model selection.

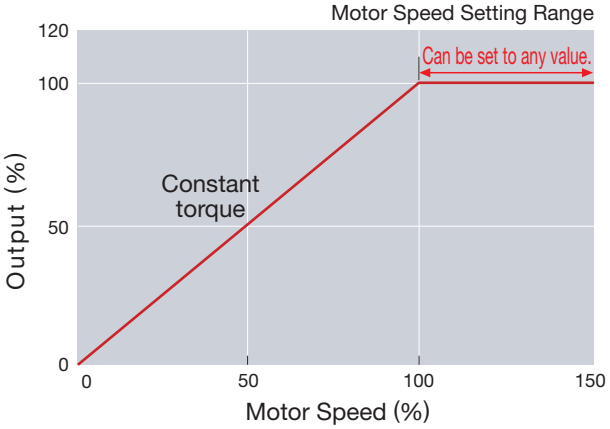


*: Frame number 180SA (45 kW 1750 min^{-1}) or larger

Simple Motor Speed Adjustment

- The constant output range can be set from 100% to 150% of the rated speed* to make alignment with the machine's rated speed exceptionally easy.

*: 2.2 kW to 75 kW (with sensor)



Recommended Drives: A1000

The highly efficient performance of the SS7-Series Eco PM Motors combines with the drive control performance of the A1000 to achieve extraordinary energy-saving results and exceptional drive performance through high precision and high response characteristics.

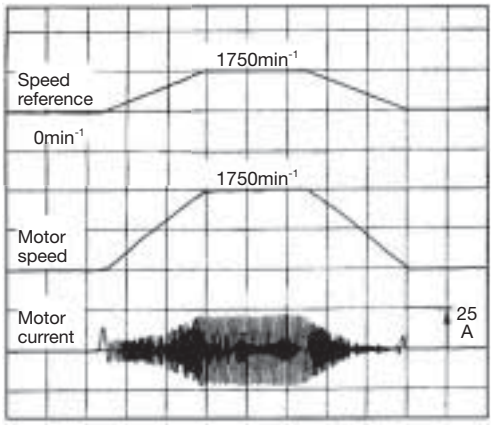
High Precision

Combine the A1000 with a Sensorless Motor to Achieve High-Precision Drive Performance

You can build a distinctive machine control system with the control functions of a drive that takes advantage of the features of the Eco PM Motors.

Smooth Acceleration and Deceleration

- Acceleration and deceleration are smooth even without a sensor.

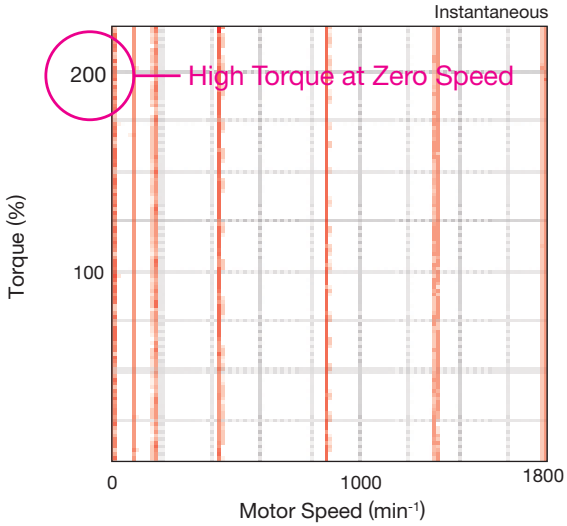


→ Time [1 s/division]

High-Torque Output at Zero Speed

- Even without a sensor, a high torque of 200% or higher can be output at a zero speed.

Note: A larger motor and drive capacity is required to achieve this torque.



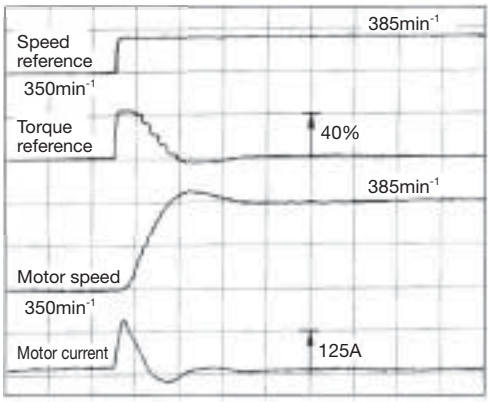
Fast Response

Combine the A1000 with a Sensor-equipped Motor to Achieve High-Speed-Response Drive Performance

Current vector control provides a high-speed response to changes in the speed reference or load conditions which help further improve machine performance.

Response Characteristics for Speed Reference

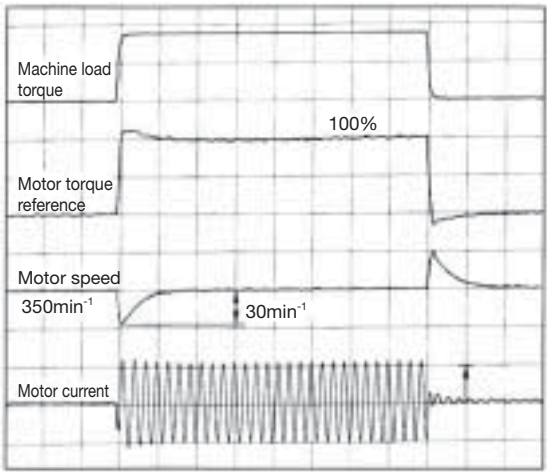
- Quick compliance with reference changes.



→ Time [10 ms/division]

Response Characteristics for Load Disturbances

- Fast speed recovery of the drive load and stable operation even with load changes.



→ Time [200 ms/division]

Production Range

Model		With sensor (EST4)						Sensorless (EST2)					
Protection and Cooling		Totally Enclosed*, Forced Fan Cooling						Totally Enclosed*, Forced Fan Cooling					
Voltage Class		200 V Class			400 V Class			200 V Class			400 V Class		
Motor Speed mm^{-1}		1750	1450	1150	1750	1450	1150	1750	1450	1150	1750	1450	1150
Frame Number : 90	90SA*	2.2	1.5	0.75	2.2	1.5	0.75	2.2	1.5	0.75	2.2	1.5	0.75
	90SB*	3.7	2.2	1.5	3.7	2.2	1.5	3.7	2.2	1.5	3.7	2.2	1.5
	90MA*	5.5	3.7	2.2	5.5	3.7	2.2	5.5	3.7	2.2	5.5	3.7	2.2
	90MB*	7.5	5.5	3.7	7.5	5.5	3.7	7.5	5.5	3.7	7.5	5.5	3.7
	90MB	11	7.5	5.5	11	7.5	5.5	11	7.5	5.5	11	7.5	5.5
Frame Number : 132	132SA	15	11	7.5	15	11	7.5	15	11	7.5	15	11	7.5
	132SB	18.5	15	11	18.5	15	11	18.5	15	11	18.5	15	11
	132SC	22	18.5	15	22	18.5	15	22	18.5	15	22	18.5	15
	132MA	30	22	18.5	30	22	18.5	30	22	18.5	30	22	18.5
	132MB	37	30	22	37	30	22	37	30	22	37	30	22
Frame Number : 180	180SA	45	37	30	45	37	30	45	37	30	45	37	30
	180SB	55	45	37	55	45	37	55	45	37	55	45	37
	180MA	75	55	45	75	55	45	75	55	45	75	55	45
	180MB	90	75	55	90	75	55	90	75	55	90	75	55
	180LA	110	90	75	110	90	75	110	90	75	110	90	75
	180LB	–	110	90	132	110	90	–	110	90	132	110	90
Frame Number : 250	250SA	–	–	110	160	132	110	–	–	110	160	132	110
	250SB	–	–	–	200	160	132	–	–	–	200	160	132
	250MA	–	–	–	250	200	160	–	–	–	250	200	160
	250LA	–	–	–	300	250	200	–	–	–	300	250	200

Model Designations

Basic Model Codes: **E S T 4 – 4 3 0 0 A K R**

Application Codes: **S A B A N**

Product Series
ES : SS7 Series

Torque Characteristic
T : Constant torque

Speed Control Range
2 : 1 : 20
4 : 1 : 1500

Voltage Class
2 : 200 V Class
4 : 400 V Class

Motor Output
2P2 : 2.2 kW
to to
300 : 300 kW

Rated Speed
A : 1750 min^{-1}
B : 1450 min^{-1}
C : 1150 min^{-1}

Protection and Cooling
E : Totally Enclosed
K : Totally Enclosed, Forced Fan Cooling

Sensor (Encoder) Specification
R : Resolver [4,096 P/R] (standard)
A : Optical [1,024 P/R]
N : No encoder

Thermostat Specification
N: No thermostat (standard)
S: Thermostat for stator (1)

Terminal Box Position and Cable Entrance Direction (See the following table.)

Drive Method
B: Either coupling or belt drive (standard)

Environment
A: Indoor (standard)

Mounting Method
S: Foot-mounted with horizontal shaft (standard)
L: Flange-mounted with horizontal shaft (frame numbers 90SA to 132MB)

Terminal Box Position and Cable Entrance Direction

Terminal Box Position: Top

Possible for all models.
Positions and directions are viewed from the coupling side.

Code	Terminal Box Position	Cable Entrance Direction	Grease Discharge Outlet*2
A*1	Top	Left	Right
B	Top	Right	Left

*1: Code A is standard for frame numbers 180 to 250.
*2: A grease outlet is applicable to 180SA to 250LA.

Terminal box position: Side

Applicable only to 90SA to 180MB (Terminal box must be on the left for 180SA to 180MB.)
Positions and directions are viewed from the coupling side.

Code	Terminal Box Position	Cable Entrance Direction	Grease Discharge Outlet*2
1	Left	Bottom	Right
2	Right	Bottom	Left
5*1	Left	Opposite from coupling side	Right
6	Right		Left

*1: Code 5 is standard for frame numbers 90 to 132.
*2: A grease outlet is applicable to 180SA to 180MB.

Combination with Recommended Drive A1000

Output	Motor Speed	Frame Number 90SA to 132MB	Recommended Drive	
		Motor Model*1 EST□-	Model CIMR-	Carrier Frequency*2
kW	min-1			
200 V Class				
2.2	1750	22P2AE✻	A□2A0012	5 kHz (4 kHz)
3.7		23P7AE✻	A□2A0021	
5.5		25P5AE✻	A□2A0030	
7.5		27P5AE✻	A□2A0040	
11		2011AK✻	A□2A0056	
15		2015AK✻	A□2A0069	
18.5		2018AK✻	A□2A0081	
22		2022AK✻	A□2A0110	
30		2030AK✻	A□2A0138	
37		2037AK✻	A□2A0169	
1.5	1450	21P5BE✻	A□2A0010	
2.2		22P2BE✻	A□2A0012	
3.7		23P7BE✻	A□2A0021	
5.5		25P5BE✻	A□2A0030	
7.5		27P5BK✻	A□2A0040	
11		2011BK✻	A□2A0056	
15		2015BK✻	A□2A0069	
18.5		2018BK✻	A□2A0081	
22		2022BK✻	A□2A0110	
30		2030BK✻	A□2A0138	
0.75	1150	20P7CE✻	A□2A0006	
1.5		21P5CE✻	A□2A0010	
2.2		22P2CE✻	A□2A0012	
3.7		23P7CE✻	A□2A0021	
5.5		25P5CK✻	A□2A0030	
7.5		27P5CK✻	A□2A0040	
11		2011CK✻	A□2A0056	
15		2015CK✻	A□2A0069	
18.5		2018CK✻	A□2A0081	
22		2022CK✻	A□2A0110	
400 V Class				
2.2	1750	42P2AE✻	A□4A0007	5 kHz (4 kHz)
3.7		43P7AE✻	A□4A0011	
5.5		45P5AE✻	A□4A0018	
7.5		47P5AE✻	A□4A0023	
11		4011AK✻	A□4A0031	
15		4015AK✻	A□4A0038	
18.5		4018AK✻	A□4A0044	
22		4022AK✻	A□4A0058	
30		4030AK✻	A□4A0072	
37		4037AK✻	A□4A0088	
1.5	1450	41P5BE✻	A□4A0005	
2.2		42P2BE✻	A□4A0007	
3.7		43P7BE✻	A□4A0011	
5.5		45P5BE✻	A□4A0018	
7.5		47P5BK✻	A□4A0023	
11		4011BK✻	A□4A0031	
15		4015BK✻	A□4A0038	
18.5		4018BK✻	A□4A0044	
22		4022BK✻	A□4A0058	
30		4030BK✻	A□4A0072	
0.75	1150	40P7CE✻	A□4A0004	
1.5		41P5CE✻	A□4A0005	
2.2		42P2CE✻	A□4A0007	
3.7		43P7CE✻	A□4A0011	
5.5		45P5CK✻	A□4A0018	
7.5		47P5CK✻	A□4A0023	
11		4011CK✻	A□4A0031	
15		4015CK✻	A□4A0038	
18.5		4018CK✻	A□4A0044	
22		4022CK✻	A□4A0058	

Output	Motor Speed	Frame Number 180SA to 250LA	Recommended Drive	
		Motor Model*1 EST□-	Model CIMR-	Carrier Frequency*2
kW	min-1			
200 V Class				
45	1750	2045AK✻	A□2A0211	5 kHz (4 kHz)
55		2055AK✻	A□2A0250	
75		2075AK✻	A□2A0312	
90		2090AK✻	A□2A0360	
110		2110AK✻	A□2A0415*3	
37	1450	2037BK✻	A□2A0169	
45		2045BK✻	A□2A0211	
55		2055BK✻	A□2A0250	
75		2075BK✻	A□2A0312	
90		2090BK✻	A□2A0360	
110		2110BK✻	A□2A0415*3	
30	1150	2030CK✻	A□2A0138	
37		2037CK✻	A□2A0169	
45		2045CK✻	A□2A0211	
55		2055CK✻	A□2A0250	
75		2075CK✻	A□2A0312	
90		2090CK✻	A□2A0360	
110		2110CK✻	A□2A0415*3	
400 V Class				
45	1750	4045AK✻	A□4A0103	5 kHz (4 kHz)
55		4055AK✻	A□4A0139	
75		4075AK✻	A□4A0165	
90		4090AK✻	A□4A0208	
110		4110AK✻	A□4A0250	
132		4132AK✻	A□4A0296	
160		4160AK✻	A□4A0362	2 kHz (2 kHz)
200		4200AK✻	A□4A0414	
250		4250AK✻	A□4A0515	
300		4300AK✻	A□4A0675	
37	1450	4037BK✻	A□4A0088	5 kHz (4 kHz)
45		4045BK✻	A□4A0103	
55		4055BK✻	A□4A0139	
75		4075BK✻	A□4A0165	
90		4090BK✻	A□4A0208	
110		4110BK✻	A□4A0250	
132		4132BK✻	A□4A0296	2 kHz (2 kHz)
160		4160BK✻	A□4A0362	
200		4200BK✻	A□4A0414	
250		4250BK✻	A□4A0515	
30	1150	4030CK✻	A□4A0072	5 kHz (4 kHz)
37		4037CK✻	A□4A0088	
45		4045CK✻	A□4A0103	
55		4055CK✻	A□4A0139	
75		4075CK✻	A□4A0165	
90		4090CK✻	A□4A0208	
110		4110CK✻	A□4A0250	2 kHz (2 kHz)
132		4132CK✻	A□4A0296	
160		4160CK✻	A□4A0362	
200		4200CK✻	A□4A0414	

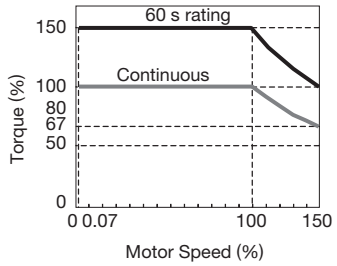
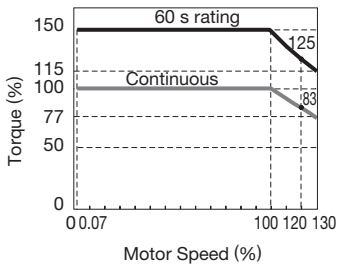
✻1: Refer to the Model Designations (page 8) for the alphanumerics that replace □ and ✻ in the motor model numbers.

✻2: The values in parentheses for the carrier frequency are for sensorless motors. Changes in the carrier frequency for different applications are possible. Ask your Yaskawa representative for details.

✻3: The CIMR-A□2A0415 AC Drive (200 V and 110 kW) has a default carrier frequency setting of 2 kHz.

Specifications and Characteristics of EST4 (with sensor)

Specifications: Model EST4

Output Range			0.75 kW to 11 kW			7.5 kW to 37 kW			30 kW to 132 kW			110 kW to 300 kW	
Frame Number			90SA to 90MB			132SA to 132MB			180SA to 180LB			250SA to 250LA	
Mounting Method			Foot-mounted/Flange-mounted						Foot-mounted				
Protection and Cooling			Totally Enclosed, Forced Fan Cooling (IP44)			Forced Fan Cooling (IP44)			Forced Fan Cooling (IP44)				
Rated Speed (min^{-1})			1750	1450	1150	1750	1450	1150	1750	1450	1150	1750	1450	1150
Output Range (kW)		200 V Class	2.2 to 11	1.5 to 7.5	0.75 to 5.5	15 to 37	11 to 30	7.5 to 22	45 to 110	37 to 110	30 to 110	none		110
		400 V Class	2.2 to 11	1.5 to 7.5	0.75 to 5.5	15 to 37	11 to 30	7.5 to 22	45 to 132	37 to 110	30 to 90	160 to 300	132 to 250	110 to 200
Power Supply	Drive Input Power Supply*1	200 V Class	200 V to 240 V, 50/60 Hz											
		400 V Class	380 V to 480 V, 50/60 Hz											
	Motor Nominal Rated Voltage		200 V Class: 200 V, 400 V Class: 400 V											
Motor Poles			90SA to 180LB: 12-pole, 250SA to 250LA: 8-pole											
Speed Control Range			1 : 1,500 (constant torque), 1 : 1.5 (constant output)*2											
Number of Sensor (Encoder) Pulses			Resolver: 4,096 P/R, Optical encoder : 1,024 P/R											
Time Rating			S1 (continuous)											
Thermal Class			155 (F)											
Application Site			Indoor, non-explosion-proof location (Usage is not possible outdoors or in class-2 anti-corrosion environment.)											
Ambient Conditions	Temperature		−20˚C to 40˚C											
	Humidity		90% RH max. (with no condensation)											
	Altitude		1,000 m max.											
Rotation Direction			Counterclockwise when viewed from the coupling side. (Rotation in both directions is also possible.)											
Drive Method			Coupling or V-belt drive (Same model used for both.)											
Coating Color			Indoor usage: Munsell 6.0 PB 3.9/11.0											
Compliant Standards			JEC2100											
Recommended Drives			Yaskawa A1000 Series											
Allowable Load Characteristics*3 (Based on above applicable Drives.)			Frame number: 90SA to 180MA  Frame number: 180MB to 250LA*2 											

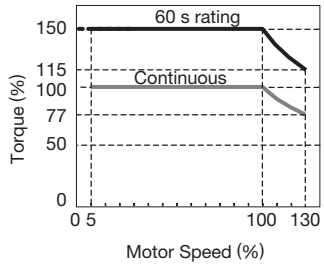
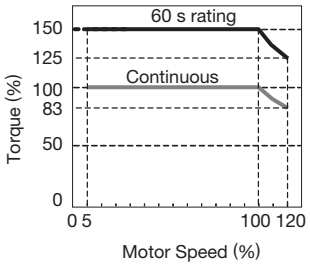
∗1 : If the drive input voltage is over 440 V or the wiring distance is long, you must consider the motor's insulation tolerance.
For details, contact your Yaskawa representative.
∗2: The speed control range (constant output) is 1 : 1.5 for frame sizes up to 180MA, 1 : 1.3 for frame sizes from 180MB to 250SA, and 1:1.2 for frame sizes 250SB and larger.
∗3: The region beyond the 1:1,500 speed control range is the momentary overtorque (150% max.) operation region.

Characteristics

Output	1750 min^{-1}					1450 min^{-1}					1150 min^{-1}				
	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)
kW		N·m	200 V Class	400 V Class	kg·m^2		N·m	200 V Class	400 V Class	kg·m^2		N·m	200 V Class	400 V Class	kg·m^2
0.75											90SA	6.2	3.6	1.8	0.00666
1.5						90SA	9.9	6.9	3.5	0.00666	90SB	12	6.9	3.5	0.00840
2.2	90SA	12	9.7	4.9	0.00666	90SB	14	10	5.0	0.00840	90MA	18	9.6	4.8	0.0104
3.7	90SB	20	16	8.0	0.00840	90MA	24	16	8.0	0.0104	90MB	31	15	7.5	0.0120
5.5	90MA	30	23	12	0.0104	90MB	36	24	12	0.0120	90MB	46	21	11	0.0122
7.5	90MB	41	30	15	0.0120	90MB	49	28	14	0.0122	132SA	62	27	14	0.0310
11	90MB	60	41	21	0.0122	132SA	72	41	21	0.0310	132SB	91	41	21	0.0377
15	132SA	82	56	28	0.0310	132SB	99	56	28	0.0377	132SC	125	56	28	0.0441
18.5	132SB	101	69	35	0.0377	132SC	122	67	34	0.0441	132MA	154	69	35	0.0603
22	132SC	120	80	40	0.0441	132MA	145	79	40	0.0603	132MB	183	79	40	0.0674
30	132MA	164	109	55	0.0603	132MB	198	110	55	0.0674	180SA	249	107	53	0.210
37	132MB	202	132	66	0.0674	180SA	244	138	68	0.210	180SB	307	131	65	0.253
45	180SA	246	153	78.5	0.210	180SB	296	163	81.5	0.253	180MA	374	160	79.5	0.303
55	180SB	300	200	98	0.253	180MA	362	198	99	0.303	180MB	457	190	98	0.342
75	180MA	409	263	129	0.303	180MB	494	253	125	0.342	180LA	623	259	128	0.439
90	180MB	491	296	155	0.342	180LA	593	320	150	0.439	180LB	747	300	157	0.517
110	180LA	600	368	184	0.439	180LB	724	368	184	0.517	250SA	913	384	192	1.14
132	180LB	720	–	230	0.517	250SA	869	–	230	1.14	250SB	1100	–	230	1.53
160	250SA	873	–	279	1.14	250SB	1050	–	280	1.53	250MA	1330	–	279	1.83
200	250SB	1090	–	349	1.53	250MA	1320	–	349	1.83	250LA	1660	–	349	2.15
250	250MA	1360	–	437	1.83	250LA	1650	–	436	2.15					
300	250LA	1640	–	524	2.15										

*: The full load currents of the motors are for the following motor input voltages.
200 V Class: 190 V, 400 V Class: 380 V
For other voltages, calculate the characteristics using the inverse proportion to the voltage.

Specifications: Model EST2

Output Range			0.75 kW to 11 kW			7.5 kW to 37 kW			30 kW to 132 kW			110 kW to 300 kW	
Frame Number			90SA to 90MA			132SA to 132MB			180SA to 180LB			250SA to 250LA	
Mounting Method			Foot-mounted/Flange-mounted						Foot-mounted				
Protection and Cooling			Totally Enclosed, Forced Fan Cooling (IP44)			Forced Fan Cooling (IP44)			Forced Fan Cooling (IP44)				
Rated Speed (min^{-1})			1750	1450	1150	1750	1450	1150	1750	1450	1150	1750	1450	1150
Output Range (kW)		200 V Class	2.2 to 11	1.5 to 7.5	0.75 to 5.5	15 to 37	11 to 30	7.5 to 22	45 to 110	37 to 110	30 to 110	none		110
		400 V Class	2.2 to 11	1.5 to 7.5	0.75 to 5.5	15 to 37	11 to 30	7.5 to 22	45 to 132	37 to 110	30 to 90	160 to 300	132 to 250	110 to 200
Power Supply	Drive Input Power Supply*1	200 V Class	200 V to 240 V, 50/60 Hz											
		400 V Class	380 V to 480 V, 50/60 Hz											
	Motor Nominal Rated Voltage		200 V Class: 200 V, 400 V Class: 400 V											
Motor Poles			90SA to 180LB: 12-pole, 250SA to 250LA: 8-pole											
Speed Control Range			1 : 20 (constant torque), 1 : 1.3 (constant output)*2											
Time Rating			S1 (continuous)											
Thermal Class			155 (F)											
Application Site			Indoor, non-explosion-proof location (Usage is not possible outdoors or in class-2 anti-corrosion environment.)											
Ambient Conditions	Temperature		−20°C to 40°C											
	Humidity		90% RH max. (with no condensation)											
	Altitude		1,000 m max.											
Rotation Direction			Counterclockwise when viewed from the coupling side. (Rotation in both directions is also possible.)											
Drive Method			Coupling or V-belt drive (Same model used for both.)											
Coating Color			Indoor usage: Munsell 6.0 PB 3.9/11.0											
Compliant Standards			JEC2100											
Recommended Drives			Yaskawa A1000 Series											
Allowable Load Characteristics*3 (Based on above applicable Drives.)			Frame number: 90SA to 180MA  Frame number: 180MB to 250LA 											

*1 : If the drive input voltage is over 440 V or the wiring distance is long, you must consider the motor's insulation tolerance. For details, contact your Yaskawa representative.
*2: The speed control range (constant output) for a frame size of 250SB or larger is 1:1.2.
*3: The bold lines in the allowable load characteristics indicate the momentary operation region.

Characteristics

Output	1750 min^{-1}					1450 min^{-1}					1150 min^{-1}				
	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)	Frame No.	Rated Torque	Full Load Current* A		Moment of Inertia J (GD^2/4)
kW		N·m	200 V Class	400 V Class	kg·m^2		N·m	200 V Class	400 V Class	kg·m^2		N·m	200 V Class	400 V Class	kg·m^2
0.75											90SA	6.2	3.6	1.8	0.00666
1.5						90SA	9.9	6.9	3.5	0.00666	90SB	12	6.9	3.5	0.00840
2.2	90SA	12	9.7	4.9	0.00666	90SB	14	10	5.0	0.00840	90MA	18	9.6	4.8	0.0104
3.7	90SB	20	16	8.0	0.00840	90MA	24	16	8.0	0.0104	90MB	31	15	7.5	0.0120
5.5	90MA	30	23	12	0.0104	90MB	36	24	12	0.0120	90MB	46	21	11	0.0122
7.5	90MB	41	30	15	0.0120	90MB	49	28	14	0.0122	132SA	62	27	14	0.0310
11	90MB	60	41	21	0.0122	132SA	72	41	21	0.0310	132SB	91	41	21	0.0377
15	132SA	82	56	28	0.0310	132SB	99	56	28	0.0377	132SC	125	56	28	0.0441
18.5	132SB	101	69	35	0.0377	132SC	122	67	34	0.0441	132MA	154	69	35	0.0603
22	132SC	120	80	40	0.0441	132MA	145	79	40	0.0603	132MB	183	79	40	0.0674
30	132MA	164	109	55	0.0603	132MB	198	110	55	0.0674	180SA	249	107	53	0.210
37	132MB	202	132	66	0.0674	180SA	244	138	68	0.210	180SB	307	131	65	0.253
45	180SA	246	153	78.5	0.210	180SB	296	163	81.5	0.253	180MA	374	160	79.5	0.303
55	180SB	300	200	98	0.253	180MA	362	198	99	0.303	180MB	457	190	98	0.342
75	180MA	409	263	129	0.303	180MB	494	253	125	0.342	180LA	623	259	128	0.439
90	180MB	491	296	155	0.342	180LA	593	320	150	0.439	180LB	747	300	157	0.517
110	180LA	600	368	184	0.439	180LB	725	368	184	0.517	250SA	913	384	192	1.14
132	180LB	720	–	230	0.517	250SA	869	–	230	1.14	250SB	1100	–	230	1.53
160	250SA	873	–	279	1.14	250SB	1050	–	280	1.53	250MA	1330	–	279	1.83
200	250SB	1090	–	349	1.53	250MA	1320	–	349	1.83	250LA	1660	–	349	2.15
250	250MA	1360	–	437	1.83	250LA	1650	–	436	2.15					
300	250LA	1640	–	524	2.15										

*: The full load currents of the motors are for the following motor input voltages.
200 V Class: 190 V, 400 V Class: 380 V
For other voltages, calculate the characteristics using the inverse proportion to the voltage.

Dimensions (unit: mm)

Frame Number: 90SA to 132MB Foot-mounted

Figure 1

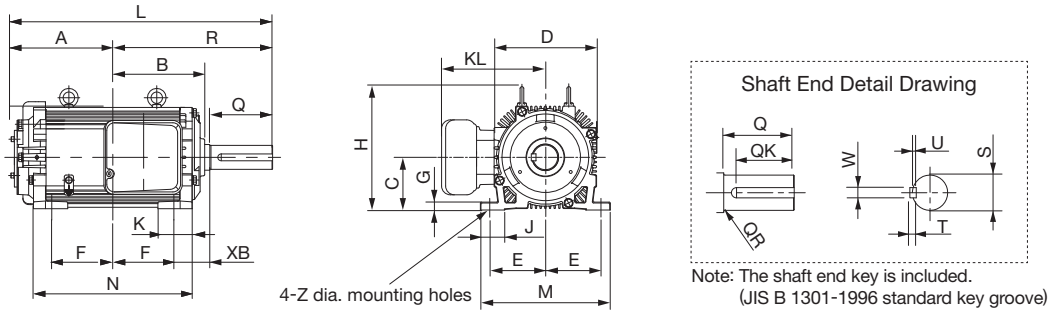


Figure 2

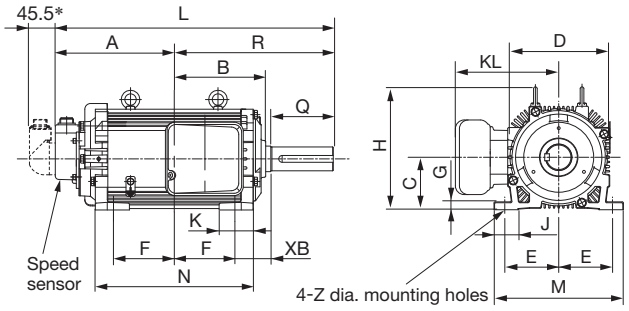
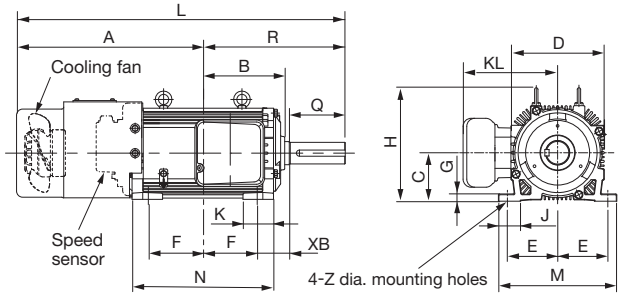


Figure 3



∗: For an optical encoder, the overall length increases by 45.5 mm.

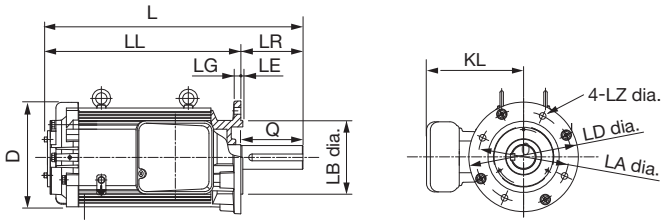
Drive Method	Sensor	Output kW 1750 min⁻¹	Output kW 1450 min⁻¹	Output kW 1150 min⁻¹	Figure	Frame No.	Dimensions mm A	B	C $^{0}_{-0.5}$	D	E	F	G	H	J	K	KL	L	M	N	R	XB	Z
Either Coupling or Belt Drive	Sensorless	2.2	1.5	0.75	1	90SA	153	136	90	175	95	82	12	211	40	60	178	359	220	228	206	63	12
		3.7	2.2	1.5		90SB	153	136	90	175	95	82	12	211	40	60	178	379	220	228	226	63	12
		5.5	3.7	2.2		90MA	178	161	90	175	95	107	12	211	40	60	178	429	220	278	251	63	12
		7.5	5.5	3.7		90MB	178	161	90	175	95	107	12	211	40	60	178	429	220	278	251	63	12
	Sensor-equipped	2.2	1.5	0.75	2	90SA	184.5	136	90	175	95	82	12	211	40	60	178	390.5	220	228	206	63	12
		3.7	2.2	1.5		90SB	184.5	136	90	175	95	82	12	211	40	60	178	410.5	220	228	226	63	12
		5.5	3.7	2.2		90MA	209.5	161	90	175	95	107	12	211	40	60	178	460.5	220	278	251	63	12
		7.5	5.5	3.7		90MB	209.5	161	90	175	95	107	12	211	40	60	178	460.5	220	278	251	63	12
	Sensorless/ Sensor-equipped	11	7.5	5.5	3	90MB	366	161	90	175	95	107	12	211	40	60	178	646	220	278	280	63	12
		15	11	7.5		132SA	405	190.5	132	250	127	115	18	299	45	80	290	719	300	313	314	89	14.5
		18.5	15	11		132SB	405	190.5	132	250	127	115	18	299	45	80	290	719	300	313	314	89	14.5
		22	18.5	15		132SC	405	190.5	132	250	127	115	18	299	45	80	290	719	300	313	314	89	14.5
		30	22	18.5		132MA	450	235.5	132	250	127	160	18	299	45	80	290	809	300	403	359	89	14.5
		37	30	22		132MB	450	235.5	132	250	127	160	18	299	45	80	290	839	300	403	389	89	14.5

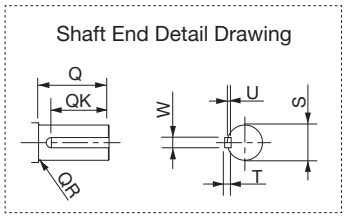
Drive Method	Sensor	Output kW 1750 min⁻¹	Output kW 1450 min⁻¹	Output kW 1150 min⁻¹	Figure	Frame No.	Shaft End Dimensions mm Q	QK	QR	S	T	U	W	Approx. Mass kg	Allowable Radial Shaft Load* N
Either Coupling or Belt Drive	Sensorless	2.2	1.5	0.75	1	90SA	60	45	0.5	28^{j6}	7	4	8	27	3,220
		3.7	2.2	1.5		90SB	80	60	0.5	38^{k6}	8	5	10	30	3,120
		5.5	3.7	2.2		90MA	80	60	0.5	38^{k6}	8	5	10	33	3,190
		7.5	5.5	3.7		90MB	80	60	0.5	38^{k6}	8	5	10	36	3,180
	Sensor-equipped	2.2	1.5	0.75	2	90SA	60	45	0.5	28^{j6}	7	4	8	27	3,220
		3.7	2.2	1.5		90SB	80	60	0.5	38^{k6}	8	5	10	30	3,120
		5.5	3.7	2.2		90MA	80	60	0.5	38^{k6}	8	5	10	33	3,190
		7.5	5.5	3.7		90MB	80	60	0.5	38^{k6}	8	5	10	36	3,180
	Sensorless/ Sensor-equipped	11	7.5	5.5	3	90MB	110	90	0.5	42^{k6}	8	5	12	38	3,090
		15	11	7.5		132SA	110	90	2	42^{k6}	8	5	12	68	5,460
		18.5	15	11		132SB	110	90	2	48^{k6}	9	5.5	14	77	5,900
		22	18.5	15		132SC	110	90	2	48^{k6}	9	5.5	14	86	5,950
		30	22	18.5		132MA	110	90	2	55^{m6}	10	6	16	106	6,070
		37	30	22		132MB	140	120	3	60^{m6}	11	7	18	115	5,900

∗ : The allowable value is given when only a radial load is applied. Inquire if a thrust load will be applied at the same time.
It is assumed that the load point is in the middle of shaft dimension Q.

Frame Number: 90SA to 132MB Flange-mounted

Figure 4





Note: The shaft end key is included.
(JIS B 1301-1996 standard key groove)

Figure 5

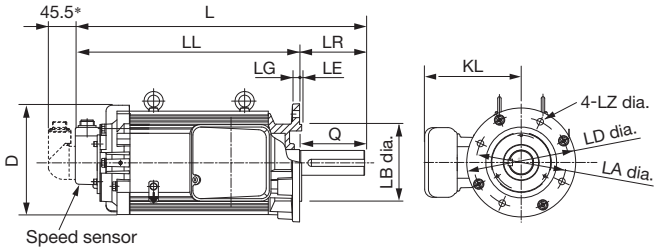
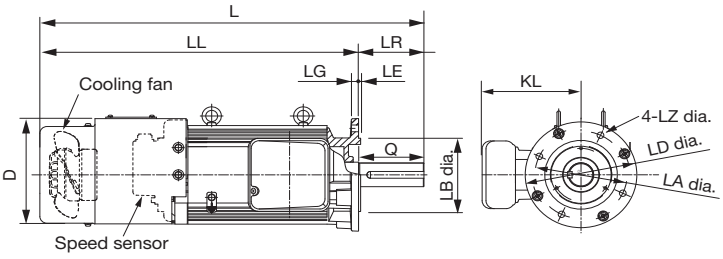


Figure 6



*: For an optical encoder, the overall length increases by 45.5 mm.

Drive Method	Sensor	Output kW 1750 min⁻¹	1450 min⁻¹	1150 min⁻¹	Figure	Frame No.	Dimensions mm D	L	LL	LR	LG	LE	LB	LA	LD	LZ	KL
Either Coupling or Belt Drive	Sensorless	2.2	1.5	0.75	4	90SA	187.5	359.5	299.5	60	12	3.5	130^{j6}	165	200	12	178
		3.7	2.2	1.5		90SB	187.5	379.5	299.5	80	12	3.5	130^{j6}	165	200	12	178
		5.5	3.7	2.2		90MA	187.5	429.5	349.5	80	12	3.5	130^{j6}	165	200	12	178
		7.5	5.5	3.7		90MB	187.5	429.5	349.5	80	12	3.5	130^{j6}	165	200	12	178
	Sensor-equipped	2.2	1.5	0.75	5	90SA	187.5	389.5	329.5	60	12	3.5	130^{j6}	165	200	12	178
		3.7	2.2	1.5		90SB	187.5	409.5	329.5	80	12	3.5	130^{j6}	165	200	12	178
		5.5	3.7	2.2		90MA	187.5	459.5	379.5	80	12	3.5	130^{j6}	165	200	12	178
		7.5	5.5	3.7		90MB	187.5	459.5	379.5	80	12	3.5	130^{j6}	165	200	12	178
	Sensorless/ Sensor-equipped	11	7.5	5.5	6	90MB	200	646	536	110	12	3.5	130^{j6}	165	200	12	178
		15	11	7.5		132SA	272	719	609	110	20	4	230^{j6}	265	300	14.5	290
		18.5	15	11		132SB	272	719	609	110	20	4	230^{j6}	265	300	14.5	290
		22	18.5	15		132SC	272	719	609	110	20	4	230^{j6}	265	300	14.5	290
		30	22	18.5		132MA	272	809	699	110	20	4	230^{j6}	265	300	14.5	290
		37	30	22		132MB	272	839	699	140	20	4	230^{j6}	265	300	14.5	290

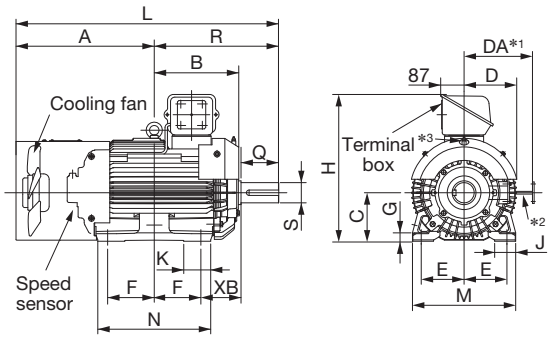
Drive Method	Sensor	Output kW 1750 min⁻¹	1450 min⁻¹	1150 min⁻¹	Figure	Frame No.	Shaft End Dimensions mm Q	QK	QR	S	T	U	W	Approx. Mass kg	Allowable Radial Shaft Load* N
Either Coupling or Belt Drive	Sensorless	2.2	1.5	0.75	4	90SA	60	45	0.5	28^{j6}	7	4	8	26	3,220
		3.7	2.2	1.5		90SB	80	60	0.5	38^{k6}	8	5	10	29	3,120
		5.5	3.7	2.2		90MA	80	60	0.5	38^{k6}	8	5	10	33	3,190
		7.5	5.5	3.7		90MB	80	60	0.5	38^{k6}	8	5	10	36	3,180
	Sensor-equipped	2.2	1.5	0.75	5	90SA	60	45	0.5	28^{j6}	7	4	8	26	3,220
		3.7	2.2	1.5		90SB	80	60	0.5	38^{k6}	8	5	10	29	3,120
		5.5	3.7	2.2		90MA	80	60	0.5	38^{k6}	8	5	10	33	3,190
		7.5	5.5	3.7		90MB	80	60	0.5	38^{k6}	8	5	10	36	3,180
	Sensorless/ Sensor-equipped	11	7.5	5.5	6	90MB	110	90	0.5	42^{k6}	8	5	12	38	3,090
		15	11	7.5		132SA	110	90	2	42^{k6}	8	5	12	68	5,460
		18.5	15	11		132SB	110	90	2	48^{k6}	9	5.5	14	77	5,900
		22	18.5	15		132SC	110	90	2	48^{k6}	9	5.5	14	86	5,950
		30	22	18.5		132MA	110	90	2	55^{m6}	10	6	16	104	6,070
		37	30	22		132MB	140	120	3	60^{m6}	11	7	18	113	5,900

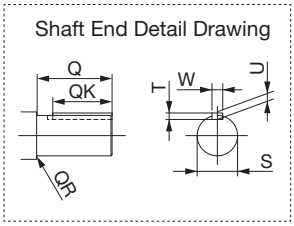
* : The allowable value is given when only a radial load is applied. Inquire if a thrust load will be applied at the same time.
It is assumed that the load point is in the middle of shaft dimension Q.

Dimensions (unit: mm)

Frame Number: 180SA to 250LA Foot-mounted

Figure 7





Note: The shaft end key is included.
(JIS B 1301-1996 standard key groove)

Figure 8

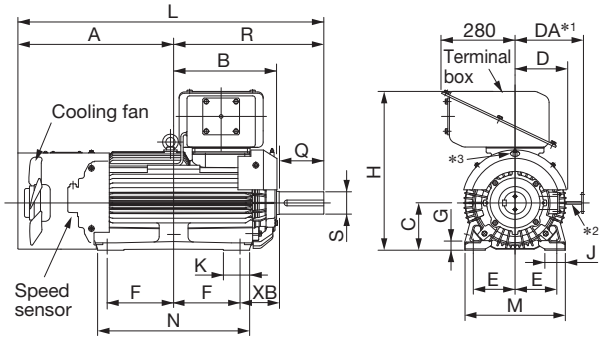
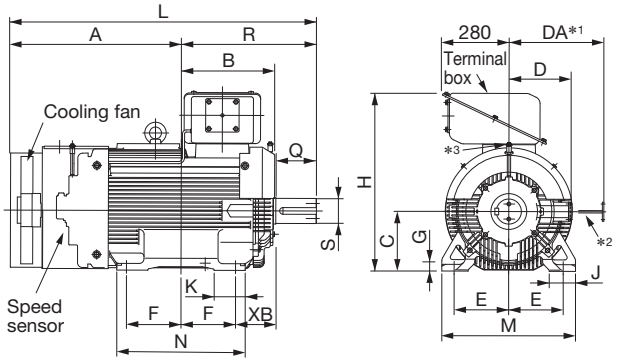


Figure 9



∗1: Dimension required to discharge grease. ∗2: Grease swab ∗3: Grease inlet

Drive Method	Output 1750 min⁻¹	Output 1450 min⁻¹	Output 1150 min⁻¹	Figure	Frame No.	Dimensions mm A	B	C $^{0}_{-0.5}$	D	DA	E	F	G	H	J	K	L	M	N	R	XB	Z
Either Coupling or Belt Drive	45	37	30	7	180SA	473.5	275	180	196	260	159	133.5	28	545	75	100	896	380	340	422.5	149	24
	55	45	37		180SB	473.5	275	180	196	260	159	133.5	28	545	75	100	896	380	340	422.5	149	24
	75	55	45		180MA	513	314	180	196	260	159	173	28	545	75	100	975	380	419	462	149	24
	90	75	55		180MB	513	314	180	196	260	159	173	28	545	75	100	975	380	419	462	149	24
	110	90	75	8	180LA	593	394	180	196	260	159	253	28	610	75	100	1165	380	579	572	149	24
	132	110	90		180LB	593	394	180	196	260	159	253	28	610	75	100	1165	380	579	572	149	24
	160	132	110	9	250SA	644	372	250	266	400	228.5	209.5	28	750	110	130	1192	560	500	547.5	168	28
	200	160	132		250SB	644	372	250	266	400	228.5	209.5	28	750	110	130	1192	560	500	547.5	168	28
	250	200	160		250MA	715	391	250	266	400	228.5	228.5	28	750	110	130	1282	560	538	566.5	168	28
	300	250	200		250LA	805	397	250	266	400	228.5	228.5	28	750	110	130	1372	560	538	566.5	168	28

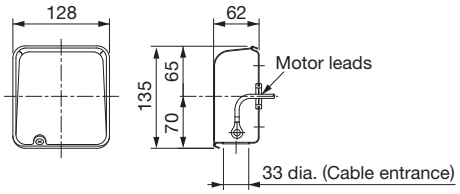
Drive Method	Output 1750 min⁻¹	Output 1450 min⁻¹	Output 1150 min⁻¹	Figure	Frame No.	Shaft End Dimensions mm Q	QK	QR	S	T	U	W	Approx. Mass kg	Allowable Radial Shaft Load* N
Either Coupling or Belt Drive	45	37	30	7	180SA	140	120	3	60^{m6}	11	7	18	230	9,220
	55	45	37		180SB	140	120	1.2	65^{m6}	11	7	18	250	
	75	55	45		180MA	140	110	1.2	75^{m6}	12	7.5	20	270	12,140
	90	75	55		180MB	140	110	1.2	75^{m6}	12	7.5	20	290	
	110	90	75	8	180LA	170	140	1.2	85^{m6}	14	9	22	370	14,390
	132	110	90		180LB	170	140	1.2	85^{m6}	14	9	22	410	
	160	132	110	9	250SA	170	140	1.2	95^{m6}	14	9	25	760	20,370
	200	160	132		250SB	170	140	1.2	95^{m6}	14	9	25	840	
	250	200	160		250MA	170	140	1.2	105^{m6}	16	10	28	930	23,540
	300	250	200		250LA	170	140	1.2	105^{m6}	16	10	28	1000	28,250

∗: The allowable value is given when only a radial load is applied.Inquire if a thrust load will be applied at the same time.
It is assumed that the load point is in the middle of shaft dimension Q.

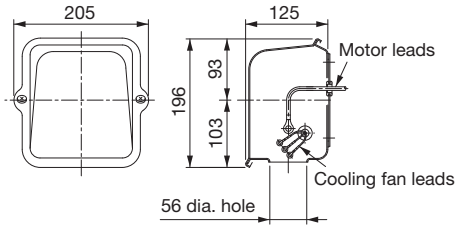
Note: For a motor with a sensor, the external motor dimensions are the same regardless of whether a resolver or optical encoder is selected.

Dimensions of Terminal Boxes

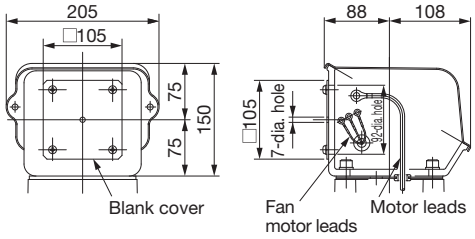
Terminal Box Dimensional Drawing 1 (Frame No. 90)



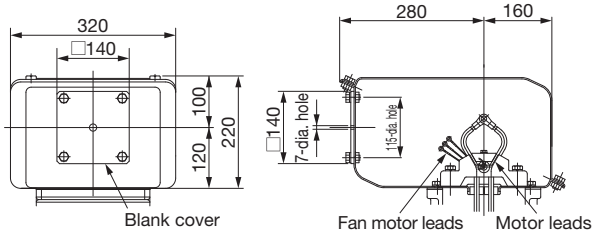
Terminal Box Dimensional Drawing 2 (Frame No. 132)



Terminal Box Dimensional Drawing 3 (Frame No. 180SA to 180MB)



Terminal Box Dimensional Drawing 4 (Frame No. 180LA to 250LA)



Note: The standard direction for the terminal cable entrance is to the left.
Prepare a hole in the middle of the cover (7 dia.) to match the connecting duct

Bearing Types

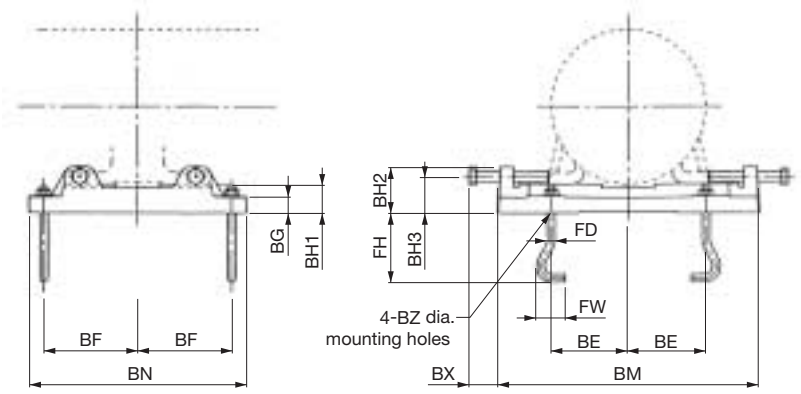
Drive Method	Dimensional Drawing	Coupling-Side Bearing	Bearing Opposite from the Coupling Side
Either Coupling or Belt Drive	90 to 132	Ball bearing (sealed)	Ball bearing (sealed)
	180	Cylindrical roller bearing (regreasable)	Ball bearing (sealed)
	250	Cylindrical roller bearing (regreasable)	Ball bearing (regreasable)

Specifications of Cooling Fan Motors

Output kW			Frame No.	Cooling Fan Motor		Cooling Fan Motor Current A
1750 min^{-1}	1450 min^{-1}	1150 min^{-1}		Model	Specification	
11	7.5	5.5	90MB	【200 V Class】 TR155P5H-3-E22 【400 V Class】 TR155P9H-340-E22	【200 V Class】 Three-phase, 2-pole, 16/17/23/24 W 200/220/200/220 V 50/50/60/60 Hz 【400 V Class】 Three-phase, 2-pole, 18/19/20/23/25/27 W 380/400/440/380/400/440 V 50/50/50/60/60/60 Hz	【200 V Class】 200 V | 220 V | 200 V | 220 V 50 Hz | 60 Hz 0.11 | 0.12 | 0.11 | 0.12 【400 V Class】 380 V | 400 V | 440 V | 380 V | 400 V | 440 V 50 Hz | 60 Hz 0.06 | 0.06 | 0.07 | 0.06 | 0.06 | 0.07
15	11	7.5	132SA	【200 V Class】 T200P59H-3-A18 【400 V Class】 T200P99H-340-A18	【200 V Class】 Three-phase, 2-pole, 44/46/60/65 W 200/220/200/220 V 50/50/60/60 Hz 【400 V Class】 Three-phase, 2-pole, 43/44/46/55/60/65 W 380/400/440/380/400/440 V 50/50/50/60/60/60 Hz	【200 V Class】 200 V | 220 V | 200 V | 220 V 50 Hz | 60 Hz 0.21 | 0.23 | 0.24 | 0.25 【400 V Class】 380 V | 400 V | 440 V | 380 V | 400 V | 440 V 50 Hz | 60 Hz 0.10 | 0.11 | 0.12 | 0.11 | 0.12 | 0.13
18.5	15	11	132SB			
22	18.5	15	132SC			
30	22	18.5	132MA			
37	30	22	132MB			
45	37	30	180SA	【200 V Class】 T350P549H-3-A20 【400 V Class】 T350P949H-340-A20	【200 V Class】 Three-phase, 4-pole, 80/110/115 W, 200/220/200/220 V, 50/50/60/60 Hz 【400 V Class】 Three-phase, 4-pole 75/80/100/110/115 W, 380/400/440/380/400/440 V, 50/50/50/60/60/60 Hz	【200 V Class】 200 V | 220 V | 200 V | 220 V 50 Hz | 60 Hz 0.46 | 0.50 | 0.45 | 0.50 【400 V Class】 380 V | 400 V | 440 V | 380 V | 400 V | 440 V 50 Hz | 60 Hz 0.20 | 0.23 | 0.25 | 0.21 | 0.23 | 0.25
55	45	37	180SB			
75	55	45	180MA			
90	75	55	180MB			
110	90	75	180LA			
132	110	90	180LB			
160	132	110	250SA	【200 V Class】 T450P549H-3-A73 【400 V Class】 T450P949H-340-A73	【200 V Class】 Three-phase, 4-pole, 170/185/230/245 W, 200/220/200/220 V, 50/50/60/60 Hz 【400 V Class】 Three-phase, 4-pole 160/175/185/215/232/245 W, 380/400/440/380/400/440 V, 50/50/50/60/60/60 Hz	【200 V Class】 200 V | 220 V | 200 V | 220 V 50 Hz | 60 Hz 0.83 | 0.91 | 0.87 | 0.88 【400 V Class】 380 V | 400 V | 440 V | 380 V | 400 V | 440 V 50 Hz | 60 Hz 0.41 | 0.43 | 0.45 | 0.43 | 0.45 | 0.46
200	160	132	250SB			
250	200	160	250MA			
300	250	200	250LA			

Motor Option

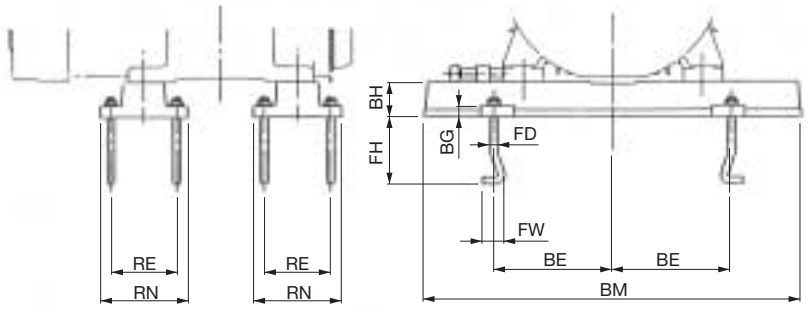
Dimentions of Slide Bases



Slide Base No.	Applicable Motor Frame No.	Dimensions mm													Motor Movement Distance	Approx. Slide Base Mass
		BE	BF	BG	BH1	BH2	BH3	BM	BN	BX	BZ	FD	FH	FW	mm	kg
SB-90SES	90SA to 90SB	110	122.5	20	40	58	48	342	285	5 to 65	13	10	90	40	60	15
SB-90MES	90MA to 90MB	110	147.5	20	40	58	48	342	335	5 to 65	13	10	90	40	60	16
SB-132SES	132SA to 132SC	140	173.5	35	55	85	68	480	402	18 to 103	15	12	110	50	85	33
SB-132MES	132MA to 132MB	140	217.5	35	55	85	68	480	490	18 to 103	15	12	110	50	85	36

Note: Coating Color: Munsell 6.0 PB 3.9/11.0

Slide Rails



Slide Rail No.	Applicable Motor Frame No.	Dimensions mm									Motor Movement Distance	Approx. Slide Rail Mass
		BE	BH	BM	BG	FD	FH	FW	RE	RN	mm	kg
R-65SS	180	180	70	650	25	16	150	50	120	170	560-M	56
R-86AB	250	270	80	860	25	16	155	50	150	200	755-M	70

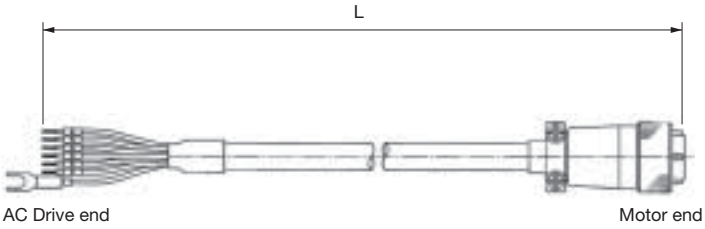
Note: Coating Color: R-65SS : Munsell 6.0 PB 3.9/11.0
R-86AB : Munsell 7.5 BG 4/1.5

Electrolytic Corrosion Countermeasures

Contact your Yaskawa representative for an estimate on insulating bearings and grounding brushes.

Sensor Cables and Other Parts

Resolver Cables

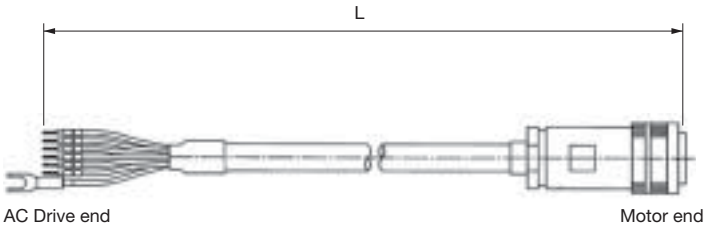


Recommended AC Drive
A1000*

*: You can also connect to the U1000.

Motor Models	Name	Code Number	Length L (m)
EST4-□□□□□□R (Motor with an encoder code of R)	Resolver Cable	SS7RSC-010-E	10
		SS7RSC-030-E	30
		SS7RSC-050-E	50
		SS7RSC-100-E	100

Encoder Cables



Recommended AC Drive
A1000*

*: You can also connect to the U1000.

Motor Models	Name	Code Number	Length L (m)
EST4-□□□□□□A (Motor with an encoder code of A)	Encoder Cables	72616-W5501	10
		72616-W5502	30
		72616-W5503	50
		72616-W5504	100

AC Drive Option: PG Card

An AC Drive option must be prepared to operate with a sensor.

Motor Models	Encoder Type	AC Drive Option: PG Card		
		Name	Code Number	Remarks
EST4-□□□□□□R (Motor with an encoder code of R)	Resolver: TS2640N321E64 manufactured by Tamagawa Seiki Co. Ltd. (or product with equivalent electrical characteristics)	Resolver Interface	PG-RT3	・Excitation voltage: 7 Vrms AC, 10 kHz ・Transformer ratio [K]: 0.5 ±5% ・Input current: 100 mArms Note: This Card cannot be used for the CIMR-A□4A0930 or CIMR-A□4A1200.
EST4-□□□□□□A (Motor with an encoder code of A)	Optical encoder: LMA-102.4BM-S324C manufactured by HEIDENHAIN	Line-driver PG Interface	PG-X3	・Phase A, B, and Z pulse (differential pulse) inputs ・Maximum input frequency: 300 kHz ・Power supply output for PG: 12 VDC, Maximum current: 200 mA

(1) Applying a V-Belt and V-Pulley

If the motor is coupled to the machine with a V-belt, the V-belt tension and usage of V-pulleys greatly affects the motor shaft strength and bearing service life.

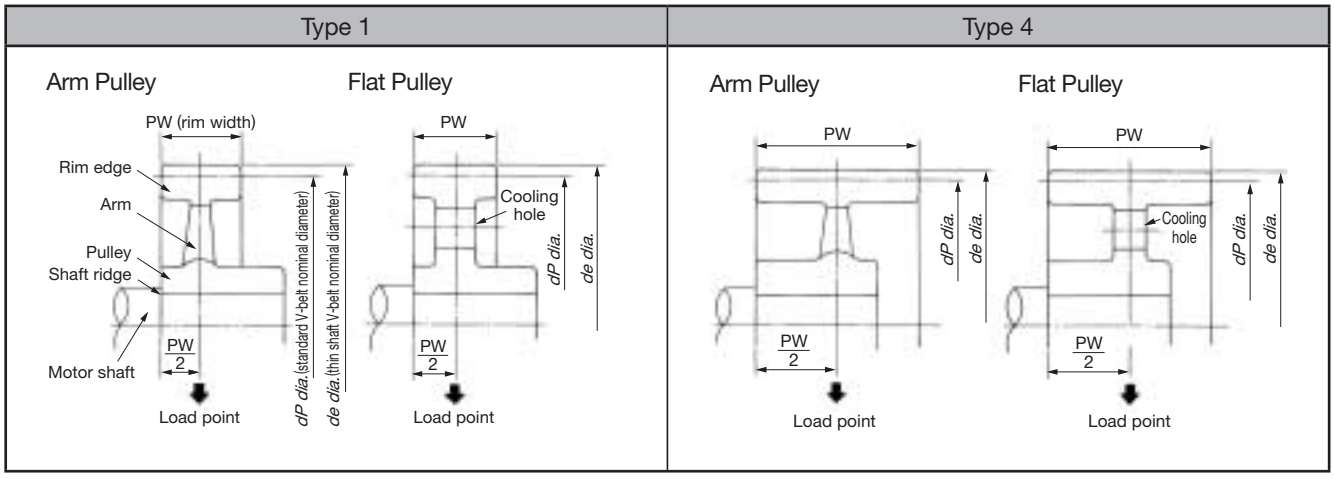
- If the V-belt is loose, increased V-belt slipping will reduce the mechanical efficiency of power transmission and belt vibration will lead to bearing damage.
- If the V-belt is too tight, an excessive load will be placed on the shaft, leading to shaft damage, bearing burning, reduced V-belt service life, etc.

If you plan to use a V-belt and V-pulleys, refer to table labeled V-Belt and V-Pulley Application and Tension Loads on the next page and set up the system within the specified ranges. A special design may be required for applications outside of the specified ranges. Inquire if you need to exceed these ranges.

Installing V-Pulleys

1 Normally arm pulleys are used as the V-pulleys for motors so as not to interfere with air cooling of the motors. If you use a flat pulley, create as large of an air hole as possible as shown in the following diagrams.

2 When you attach the V-pulley to the motor, the shaft load point resulting from V-pulley tension must be placed as close to the motor as possible to minimize the load on the motor shaft ridge and bearings. Therefore, attach the V-pulley so that the edge of the V-pulley rim is at the ridge on the shaft as shown in the following diagrams.



Tightening the V-Belt

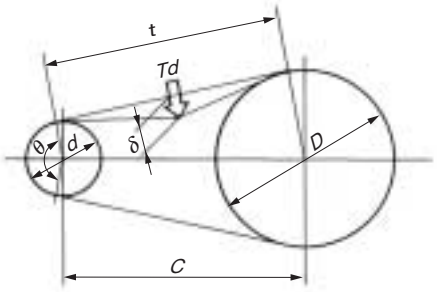
V-belt tension loading is used to achieve a suitable V-belt tension. Suitable tension must be applied to the V-belt as described below.

Use the following formula to calculate the distance between contact points for the belt and V-belt pulley: $t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2}$

Find the center of t and apply a vertical load on the V-belt at that center point. Find the tension load Td (N/belt) that will produce a slack δ with the following value.

$\delta = 0.016 \times t$ (mm) (See diagram at right.)

[For example, if the belt contact distance is 1 m, the slack would be 0.016 × 1,000 = 16 mm.]



δ : Slack (mm)
θ : Contact angle (degrees)
D : Large V-pulley diameter (mm)
d : Small V-pulley diameter (mm)
C : Distance between shafts (mm)
Td : Tension load (N/belt)

Adjust the belt tension so that the average vertical load for all of the belts is within the tension load Td range given in the table below.

If more than one V-belt is used, used a matched set with the same belt circumferences.
Use a V-belt-V-pulley contact angle of 140˚ or greater.
The tension loads (Td) given in the following table are for a V-belt-V-pulley contact angle of 140˚ or greater.
If a different contact angle is used, reduce the tension load with the following correction factor.

$Td\,\theta = K\theta \times Td$

Contact angle θ	140˚	150˚	190˚	170˚	180˚
Correction factor K θ	1.0	0.98	0.94	0.91	0.90

Where, Td θ : V-belt tension load after contact angle correction

Td : V-belt tension load at contact angle of 140˚ (from following table)

$K\theta$: Contact angle correction factor for tension load

V-Belt and V-Pulley Application and Tension Loads

(Contact angle: 140°, Speed ratio: 2.04)

Output	Motor Speed	Standard V-Belts							Narrow V-Belts						
		Pulley Dimensions mm		Belts		Belt Load	Belt Tension Load *Td* (N/belt)		Pulley Dimensions mm		Belts		Belt Load	Belt Tension Load *Td* (N/belt)	
		Min.	Max.	Type	Qty	Point	When	When	Min.	Max.	Type	Qty	Point	When	When
kW	min^{-1}	pitch dia.	width			mm	replacing	readjusting	pitch dia.	width			mm	replacing	readjusting
2.2	1150	100	50	A	3	25	11.8 to 12.7	8.8 to 11.8	90	27.7	3V	2	13.9	18.6 to 20.6	14.7 to 18.6
	1450	100	35	A	2	17.5	13.7 to 15.7	10.8 to 13.7	75	27.7	3V	2	13.9	17.6 to 20.6	13.7 to 17.6
	1750	90	35	A	2	17.5	11.8 to 13.7	8.8 to 11.8	75	27.7	3V	2	13.9	14.7 to 17.6	11.8 to 14.7
3.7	1150	125	63	B	3	31.5	15.7 to 17.6	12.7 to 15.7	100	38	3V	3	19	18.6 to 21.6	14.7 to 18.6
	1450	112	50	A	3	25	13.7 to 15.7	10.8 to 13.7	100	27.7	3V	2	13.9	22.5 to 25.5	17.6 to 22.5
	1750	112	50	A	3	25	11.8 to 13.7	9.8 to 11.8	100	27.7	3V	2	13.9	18.6 to 21.6	14.7 to 18.6
5.5	1150	150	63	B	3	31.5	19.6 to 21.6	14.7 to 19.6	140	38	3V	3	19	19.6 to 22.5	15.7 to 19.6
	1450	125	63	B	3	31.5	18.6 to 21.6	14.7 to 18.6	100	38	3V	3	19	21.6 to 25.5	16.7 to 21.6
	1750	125	63	B	3	31.5	16.7 to 18.6	12.7 to 16.7	100	38	3V	3	19	18.6 to 21.6	14.7 to 18.6
7.5	1150	150	82	B	4	41	19.6 to 22.5	15.7 to 19.6	140	48.3	3V	4	24.1	20.6 to 23.5	15.7 to 20.6
	1450	150	63	B	3	31.5	21.6 to 24.5	16.7 to 21.6	125	38	3V	3	19	23.5 to 27.4	18.6 to 23.5
	1750	150	63	B	3	31.5	19.6 to 22.5	14.7 to 19.6	125	38	3V	3	19	20.6 to 23.5	15.7 to 20.6
11	1150	170	101	B	5	50.5	20.2 to 23.5	15.7 to 20.2	140	58.6	3V	5	29.3	23.5 to 26.5	18.6 to 23.5
	1450	160	82	B	4	41	22.5 to 25.5	17.6 to 22.5	125	48.3	3V	4	24.1	26.5 to 30.4	20.6 to 26.5
	1750	160	82	B	4	41	20.6 to 23.5	15.7 to 20.6	125	48.3	3V	4	24.1	22.5 to 25.5	17.6 to 22.5
15	1150	224	101	B	5	50.5	22.5 to 25.5	17.6 to 22.5	160	68.9	3V	6	34.4	23.5 to 26.5	18.6 to 23.5
	1450	170	101	B	5	50.5	23.5 to 6.5	17.6 to 23.5	125	68.9	3V	6	34.4	23.5 to 27.4	18.6 to 23.5
	1750	170	101	B	5	50.5	21.6 to 24.5	16.7 to 21.6	125	68.9	3V	6	34.4	20.6 to 23.5	15.7 to 20.6
18.5	1150	224	110.5	C	4	55.2	35.3 to 40.2	27.4 to 35.3	180	60.4	5V	3	30.2	52.9 to 59.8	41.2 to 52.9
	1450	200	101	B	5	50.5	25.5 to 28.4	19.6 to 25.5	140	68.9	3V	6	34.4	26.5 to 30.4	20.6 to 26.5
	1750	200	101	B	5	50.5	23.5 to 26.5	18.6 to 23.5	140	68.5	3V	6	34.2	22.5 to 25.5	17.6 to 22.5
22	1150	224	136	C	5	68	34.3 to 39.2	26.5 to 34.3	180	77.9	5V	4	38.9	47.0 to 53.9	37.2 to 47.0
	1450	224	101	B	5	50.5	27.4 to 31.4	21.6 to 27.4	160	68.9	3V	6	34.4	27.4 to 31.4	21.6 to 27.4
	1750	224	101	B	5	50.5	25.5 to 29.4	19.6 to 25.5	160	68.9	3V	6	34.4	23.5 to 27.4	18.6 to 23.5
30	1150	265	136	C	5	68	40.2 to 46.1	31.4 to 40.2	224	77.9	5V	4	38.9	51.9 to 59.8	41.2 to 51.9
	1450	224	136	C	5	68	39.2 to 45.1	30.4 to 39.2	180	77.9	5V	4	38.9	51.9 to 59.8	41.2 to 51.9
	1750	224	136	C	5	68	38.2 to 44.1	30.4 to 38.2	180	77.9	5V	4	38.9	46.1 to 51.9	36.3 to 46.1
37	1150	265	161.5	C	6	80.7	41.2 to 47.0	32.3 to 41.2	224	77.9	5V	4	38.9	62.7 to 72.5	49.0 to 62.7
	1450	224	161.5	C	6	80.7	40.2 to 46.1	31.4 to 40.2	200	77.9	5V	4	38.9	57.8 to 66.6	45.1 to 57.8
	1750	224	161.5	C	6	80.7	39.2 to 45.1	30.4 to 39.2	200	77.9	5V	4	38.9	51.0 to 57.8	40.2 to 51.0
45	1150	280	187	C	7	93.5	41.2 to 48.0	32.3 to 41.2	224	95.4	5V	5	47.7	61.7 to 70.6	48.0 to 61.7
	1450	265	161.5	C	6	80.7	44.1 to 51.0	34.3 to 44.1	224	77.9	5V	4	38.9	62.7 to 72.5	49.0 to 62.7
	1750	265	161.5	C	6	80.7	44.1 to 51.0	34.3 to 44.1	224	77.9	5V	4	38.9	55.9 to 63.7	43.1 to 55.9
55	1150	300	212.5	C	8	106.2	43.1 to 49.0	33.3 to 43.1	250	112.9	5V	6	56.4	56.8 to 65.7	45.1 to 56.8
	1450	265	187	C	7	93.5	46.1 to 52.9	46.1 to 52.9	224	95.4	5V	5	47.7	61.7 to 70.6	48.0 to 61.7
	1750	265	187	C	7	93.5	46.1 to 52.9	46.1 to 52.9	224	95.4	5V	5	47.7	54.9 to 62.7	43.1 to 54.9
75	1150	355	233	D	6	116.5	76.4 to 87.2	59.8 to 76.4	315	112.9	5V	6	56.4	63.7 to 72.5	50.0 to 63.7
	1450	315	212.5	C	8	106.2	51.0 to 58.8	39.2 to 51.0	250	112.9	5V	6	56.4	63.7 to 73.5	50.0 to 63.7
	1750	315	212.5	C	8	106.2	52.9 to 60.8	41.2 to 52.9	250	112.9	5V	6	56.4	56.8 to 65.7	45.1 to 56.8
90	1150	-	-	-	-	-	-	-	355	95.4	5V	5	47.7	82.2 to 94.3	63.9 to 82.2
	1450	-	-	-	-	-	-	-	280	112.9	5V	6	56.4	70.4 to 80.7	54.8 to 70.4
	1750	-	-	-	-	-	-	-	280	95.4	5V	5	47.7	73 to 83.8	56.9 to 73
110	1150	400	270	D	7	135	88.2 to 101.2	68.7 to 88.2	355	130.4	5V	7	65.2	73 to 83.7	56.9 to 73
	1450	-							315	112.9	5V	6	56.4	77.4 to 88.8	60.2 to 77.4
	1750	-							315	112.9	5V	6	56.4	69.9 to 80.2	54.5 to 69.9
132	1150	475	270	D	7	135	100.5 to 115.4	78.1 to 100.5	400	123.8	8V	4	61.9	145.1 to 166.5	113.1 to 145.1
	1450	-							355	130.4	5V	7	65.2	73.9 to 84.8	57.5 to 73.9
	1750	-							315	130.4	5V	7	65.2	71.4 to 82	55.7 to 71.4
160	1150	-							450	123.8	8V	4	61.9	159.9 to 183.5	124.4 to 159.9
	1450	-							355	147.9	5V	8	73.9	77.5 to 89	60.3 to 77.5
	1750	-							315	147.9	5V	8	73.9	74.9 to 85.9	58.3 to 74.9
200	1150	-							450	152.4	8V	5	76.2	159.9 to 183.5	124.4 to 159.9
	1450	-							450	147.9	5V	8	73.9	83.1 to 95.4	64.6 to 83.1
	1750	-							355	165.4	5V	9	82.7	77.3 to 88.7	60.2 to 77.3
250	1150	-							-						
	1450	-							450	182.9	5V	10	91.4	83.1 to 95.4	81.4 to 93.4
	1750	-							400	182.9	5V	10	91.4	64.6 to 83.1	63.3 to 81.4

Note: Inquire about the blank table cells.

(2) Calculating the Motor Rated Output

The following formulas illustrate how to find the required power for different applications.

General Formula

$$P = \frac{T \cdot N}{974} \text{ (kW)}$$

P : Required power (kW)
T : Required torque [kg·m (N·m/9.8)]
N : Motor speed (min^{-1})

Pump

$$P = \frac{\gamma \cdot Q \cdot H}{6.12\eta} \text{ (kW)}$$

γ : Liquid specific gravity (kg/ℓ)
Q : Pump discharge volume (m^3/min)
H : Lifting height (m)
η : Pump efficiency*

* : Although it depends on the model, the value is approximately 0.6.

You can use Figure 1 to find the approximate required output if the liquid is water.

Example: If the liquid is water, the discharge volume is 3 m^3/min, and the total lifting height is 10 m, a 7.5-kW motor would be required for the pump.

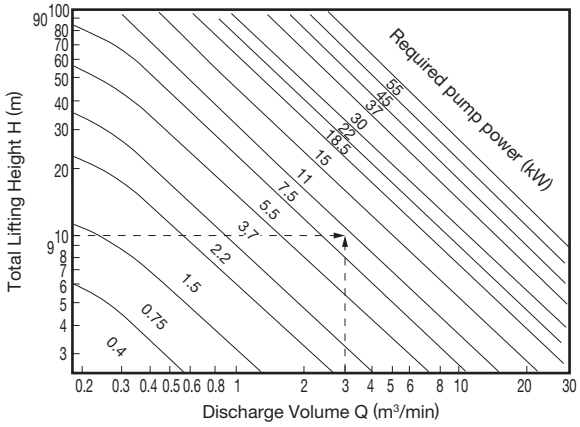


Fig.1 Diagram to Find Approximate Required Output from Lifting Height and Discharge Volume (Liquid: Water)

Note: The pump discharge volume Q is proportional to the motor speed and the total lifting height H is proportional to the square of the motor speed. Therefore, the pump output P is proportional to the cube of the motor speed.

Fans and Blowers

$$P = \frac{Q \cdot H}{6120\eta} \cdot k \text{ (kW)}$$

Q : Air flow (m^3/min)
H : Air pressure (mm of water)
η : Fan/blower efficiency
k : Slack factor

Efficiency η and Leeway Coefficient k

Fan Type	Efficiency η	Leeway Coefficient k
Propeller Fan	0.5 to 0.75	1.3
Desktop Fan	0.3 to 0.5	1.5
Scirocco Fan	0.45 to 0.55	1.2 to 1.3
Turbo Fan	0.6 to 0.7	1.2 to 1.3

Compressors

You can calculate the theoretical output P for an air compressor with the following formula.

$$P = 343P_1 \cdot Q \left(\left(\frac{P_2}{P_1} \right)^{0.286} - 1 \right) \text{ (kW)}$$

Q : Gas volume before compression (m^3/s)
P_1 : Pressure before compression (N/m^2)
P_2 : Pressure after compression (N/m^2)

A diagram for the above formula is provided in Figure 2.

Example: If the discharge pressure is 7 kg/cm^2 and the discharge volume is 0.3m^3/min, a 1.5-kW motor would be required for the air compressor.

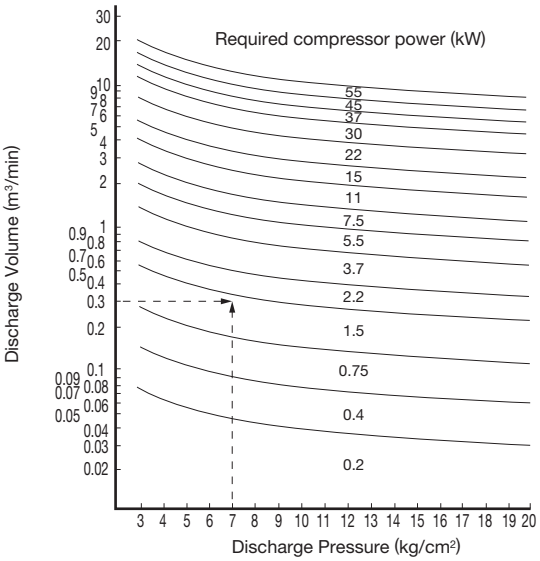


Fig.2 Theoretical Output from Air Compressor

Materials Handling Equipment

You can use the following formulas to calculate the required power for cranes, hoists, chain blocks, and other materials handling equipment.

Hoisting

$$P = \frac{(W+h_0)\cdot V}{6.12\eta}\ (kW)$$

W : Load (t)
h_0 : Hanging tool mass (t)
V : Hoisting speed (m/min)
η : Mechanical efficiency Estimated as 0.75.

Traversing

$$P = \frac{(W+h_0+C_0)\cdot \mu_1 \cdot V_1}{6.12\eta}\ (kW)$$

W : Load (t)
h_0 : Hanging tool mass (t)
C_0 : Mass of crab (t)
μ_1 : Resistance to travel Estimated as approximately 10/1,000.
V_1 : Traverse speed (m/min)
η : Mechanical efficiency Estimated as 0.75.

Traveling

$$P = \frac{(W+R)\cdot \mu_2 \cdot V_2}{6.12\eta}\ (kW)$$

W : Load (t)
R : Total mass of crane (t)
μ_2 : Resistance to travel Estimated as approximately 10/1,000.
V_2 : Travel speed (m/min)
η : Mechanical efficiency Estimated as 0.75.

Turning

$$P = \frac{(W+R_1)\cdot \mu_3 \cdot V_3}{6.12\eta}\ (kW)$$

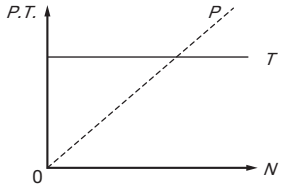
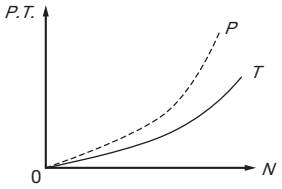
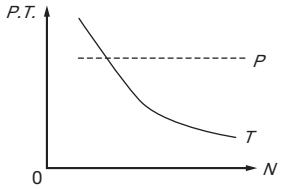
W : Load (t)
R_1 : Mass of turning structure (t)
μ_3 : Resistance to travel Estimated as approximately 10/1,000.
V_3 : Turning speed (m/min)
η : Mechanical efficiency Estimated as 0.75.

(3) General Explanation of Motors

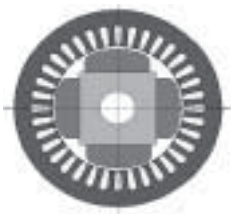
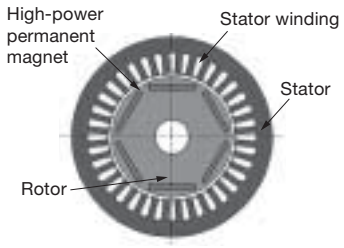
Load Torque Characteristic

Classifications based on torque characteristics are given in the following table as one more type of applicable mechanical load classification.

P : Output, *T* : Torque, *N* : Motor speed

Constant Torque Load	Variable Torque Load	Constant Output Load
 The load torque is constant regardless of the motor speed. The required power is proportional to the motor speed.	 The load diminishes in proportion to the square of the motor speed. Fluid-type application is a typical example.The required power is proportional to the cube of the motor speed.	 The load is inversely proportional to the motor speed. The required power is constant and not related to the motor speed. A high load torque is required in the low-speed area, which requires special motor selection.
Application Examples ・Machine tools feed ・Traverse operation of conveyors and cranes ・Printing machines	**Application Examples** ・Fans ・Pumps	**Application Examples** ・Machine tool spindles ・Woodworking machines and mixers ・Gate operation

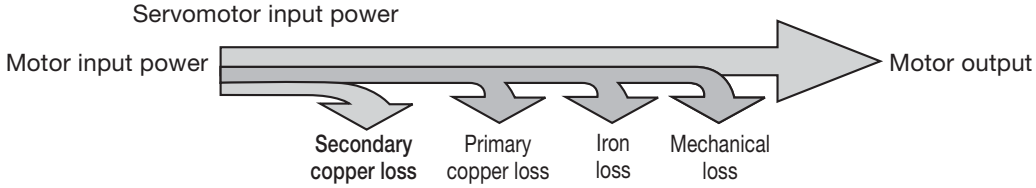
Motor Structures and Features

Type		Induction Motor	SPM Motor	IPM Motor
Structure				
Features	Efficiency	Poor	Good	Good
	Compact	Poor	Good	Good
	High Speed	Good	Medium	Good
	Maximum Torque	Good	Good	Medium
	Torque Component	Induction	Magnetism	Magnetism + Reluctance

Motor Loss Mechanisms

The motor loss is the difference between the motor input power and motor output. The lower the loss is, the higher the motor efficiency is. PM motors have high efficiency because they have no secondary copper loss.

Motor input power = Motor output + Primary copper loss + Iron loss + Mechanical loss + Secondary copper loss



(4) Application Notes

Variable-speed drives for PM motors are synchronous motors that use a permanent magnet for the rotor.
Observe the following precautions when using this type of motor.

1 Synchronous motors cannot be started directly from line power. Applications requiring line power to start should use an induction motor with the drive.

2 A single drive is not capable of running multiple synchronous motors at the same time. Use a standard induction motors for such setups.

3 When the power to a drive running a PM motor is shut off, voltage continues to be generated at the motor terminals while the motor coasts to stop. Take the precautions described below when handling charged sections.
- Make sure that the motor is stopped before performing maintenance, inspections, or wiring.
- Applications where the load can rotate the motor even when the power to the drive is shut off (e.g., fans or blowers) should have a load switch installed to the output side of the drive. Yaskawa recommends manual load switches from the AICUT LB Series by Aichi Electric Works Co., Ltd. When you inspect the drive, electrically isolate the motor.
- Do not connect to a load that could potentially rotate the motor faster than the maximum allowable speed even when the drive has been shut off.

4 Do not use a sensorless drive in applications that require restarting a coasting motor at 50% or greater of the rated speed. Restarting a coasting motor at 50% to 100% of the rated speed will activate overcurrent or overvoltage protection, and operation cannot be continued.
If restarting a coasting motor at a speed that exceeds the rating of the sensorless drive, the drive may be damaged.

5 When you use a sensorless drive, confirm the motor starting torque, allowable load characteristics, impact load tolerance, and speed control range in advance and use the drive within the specified ranges.
If useing a sensorless drive for general machines other than machines for fluid-type application, you must check the load moment of inertia and other machine specifications.
For example, for loads with high inertia and high starting torque, such as centrifuges, startup failure may occur even for applications within the motor's allowable load characteristics. In such cases, you must use a drive with a PG.
If these machine specifications are not known, use a drive with a PG, or combine an induction motor with a general-purpose drive. Inquire for details.

6 If the drive input voltage is high (i.e., over 440 V) or the wiring distance is long, you must consider the motor's insulation voltage. For details, contact your Yaskawa representative.

7 For a drive with a sensor, use an optical encoder in applications that require high-precision speed/torque control, such as testing machines and printing machines.

A1000 High-Performance Vector Control Drive

c UL us LISTED CE RoHS compliant

* CE and UL approval still pending for some models

Features

The Most Advanced Drive Technology

- Capable of driving any kind of motors (IM and PM)
- Switch easily between motor types with a single parameter setting.

Sensorless Position Control

- Use an IPM motor to perform position control without motor feedback.

Cutting-Edge Torque Characteristics

- Powerful torque at 0 Hz, without a motor sensor.

Loaded with Auto-Tuning Features

- Auto-Tuning features optimize drive parameters for operation with induction motors as well as synchronous motors to achieve the highest performance levels possible.

Tackling Power Loss and Recovery

- Momentary power loss can be handled by selecting either speed searching or KEB (kinetic energy backup).

Next-Generation Energy Saving

- Loaded with the most advanced energy-saving control technology for either IM or PM motors.

Safety Regulations

- The products comply with ISO/EN13849-1 Cat.3 PLd and IEC/EN61508 SIL2 (two safety inputs and one EDM output).

Even More and More Compact

- Yaskawa continues to make applications even smaller by combining the world's smallest drive in its class with the light, efficient design of a synchronous motor.
- Dual Rating (Normal Duty or Heavy Duty operation) allows for an even more compact setup.

Easy Maintenance

- The first terminal board with a parameter backup function enables rapid recovery of system operations should the drive fails.
- You can manage the parameter settings for all drives right on your PC to simplify drive adjustment and maintenance.

Standard Specifications

200 V Class

Model CIMR-A 2A			0006	0010	0012	0021	0030	0040	0056	0069	0081	0110	0138	0169	0211	0250	0312	0360	0415
Max. Applicable Motor Capacity*1 kW		ND	1.1	2.2	3	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	110
		HD	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Input	Rated Input Current*2 A	ND	7.3	10.8	13.9	24	37	52	68	80	92	111	136	164	200	271	324	394	394
		HD	5.8	7.5	11	18.9	28	37	52	68	80	82	111	136	164	200	271	324	394
Output	Rated Output Capacity*3 kVA	ND*4	2.3	3.7	4.6	8	11.4	15.2	21	26	31	42	53	64	80	95	119	137	158
		HD	1.9*5	3*5	4.2*5	6.7*5	9.5*5	12.6*5	17.9*5	23*5	29*5	32*5	44*5	55*6	69*6	82*6	108*6	132*6	158*6
	Rated Output Current A	ND*4	6	9.6	12	21	30	40	56	69	81	110	138	169	211	250	312	360	415
		HD	5*5	8*5	11*5	17.5*5	25*5	33*5	47*5	60*5	75*5	85*5	115*5	145*6	180*6	215*6	283*6	346*6	415*6
	Overload Tolerance		ND Rating*7: 120% of rated output current for 60 s, HD Rating*7: 150% of rated output current for 60 s (Derating may be required for repetitive loads)																
	Carrier Frequency		1 to 15 kHz*7											1 to 10 kHz*7					
	Max. Output Voltage		Three-phase 200 to 240 V (relative to input voltage)																
	Max. Output Frequency		400 Hz*7																
Power	Rated Voltage/ Rated Frequency		Three-phase AC power supply: 200 to 240 Vac 50/60 Hz, DC power supply: 270 to 340 Vdc*8																
	Allowable Voltage Fluctuation		−15% to +10%																
	Allowable Frequency Fluctuation		±5%																
	Power Supply*9 kVA	ND	3.3	4.9	6.4	11	17	24	31	37	42	51	62	75	91	124	148	180	215
		HD	2.7	3.4	5.0	8.6	13	17	24	31	37	37	51	62	75	91	124	148	180
Harmonic Suppression	DC Reactor		Option									Built-in							
Braking Function	Braking Resistor		Built-in											Option					

400 V Class

Model CIMR-A 4A			0004	0005	0007	0011	0018	0023	0031	0038	0044	0058	0072	0088	0103	0139	0165	0208	0250	0296	0362	0414	0515	0675
Max. Applicable Motor Capacity*10 kW		ND	1.5	2.2	3	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	250	355
		HD	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	315
Input	Rated Input Current*2 A	ND	4.3	5.9	8.1	14	20	24	38	44	52	58	71	86	105	142	170	207	248	300	346	410	465	657
		HD	3.2	4.4	6	10.4	15	20	29	39	44	43	58	71	86	105	142	170	207	248	300	346	410	584
Output	Rated Output Capacity*11 kVA	ND*4	3.1	4.1	5.3	8.5	13.3	17.5	24	29	34	44	55	67	78	106	126	159	191	226	276	316	392	514
		HD	2.6*5	3.7*5	4.2*5	7*5	11.3*5	13.7*5	18.3*5	24*5	30*5	34*5	46*5	57*5	69*5	85*6	114*6	137*6	165*6	198*6	232*6	282*6	343*4	461*4
	Rated Output Current A	ND*4	4.1	5.4	6.9	11.1	17.5	23	31	38	44	58	72	88	103	139	165	208	250	296	362	414	515	675
		HD	3.4*5	4.8*5	5.5*5	9.2*5	14.8*5	18*5	24*5	31*5	39*5	45*5	60*5	75*5	91*5	112*6	150*6	180*6	216*6	260*6	304*6	370*6	450*4	605*4
	Overload Tolerance		ND Rating*7: 120% of rated output current for 60 s, HD Rating*7: 150% of rated output current for 60 s (Derating may be required for repetitive loads)																					
	Carrier Frequency		1 to 15 kHz*7													1 to 10 kHz*7							1 to 5 kHz*7	
	Max. Output Voltage		Three-phase 380 to 480 V (relative to input voltage)																					
	Max. Output Frequency		400 Hz*7																					
Power	Rated Voltage/ Rated Frequency		Three-phase AC power supply: 380 to 480 Vac 50/60 Hz, DC power supply: 510 to 680 Vdc*8																					
	Allowable Voltage Fluctuation		−15% to +10%																					
	Allowable Frequency Fluctuation		±5%																					
	Power Supply*12 kVA	ND	3.9	5.4	7.4	12.8	18.3	22	35	40	48	53	65	79	96	130	155	189	227	274	316	375	425	601
		HD	2.9	4.0	5.5	10	13.7	18.3	27	36	40	39	53	65	79	96	130	155	189	227	274	316	375	534
Harmonic Suppression	DC Reactor		Option									Built-in												
Braking Function	Braking Resistor		Built-in											Option										

∗1: The motor capacity (kW) refers to a Yaskawa 4-pole, 60 Hz, 200 V motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
∗2: Value displayed is for the input current when operating Yaskawa standard motors of max. applicable capacity with the rated load at the rated motor speed. This value may fluctuate based on the power supply side impedance, as well as the input current, power supply transformer, input side reactor, and wiring conditions.
∗3: Rated output capacity is calculated with a rated output voltage of 220 V.
∗4: This value assumes a carrier frequency of 2 kHz. Increasing the carrier frequency requires a reduction in current.
∗5: This value assumes a carrier frequency of 8 kHz. Increasing the carrier frequency requires a reduction in current.
∗6: This value assumes a carrier frequency of 5 kHz. Increasing the carrier frequency requires a reduction in current.
∗7: Carrier frequency can be set by the user.
∗8: Not compliant with the UL standards when using a DC power supply.
∗9: Rated input capacity is calculated with a power line voltage of 240 V × 1.1.
∗10: The motor capacity (kW) refers to a Yaskawa 4-pole, 60 Hz, 400 V motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
∗11: Rated output capacity is calculated with a rated output voltage of 440 V.
∗12: Rated input capacity is calculated with a power line voltage of 480 V × 1.1.
Note: Parameter C6-01 sets the drive for Normal Duty or Heavy Duty performance (default).

Common Specifications

Item		Specifications
Control Characteristics	Control Method	V/f Control, V/f Control with PG, Open Loop Vector Control, Closed Loop Vector Control, Open Loop Vector Control for PM, Advanced Open Loop Vector Control for PM, Closed Loop Vector Control for PM
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital reference: within ±0.01% of the max. output frequency (−10 to +40°C) Analog reference: within ±0.1% of the max. output frequency (25 ±10°C)
	Frequency Setting Resolution	Digital reference: 0.01 Hz, Analog reference: 0.03 Hz / 60 Hz (11 bit)
	Output Frequency Resolution	0.001 Hz
	Frequency Setting Resolution	Main frequency reference: −10 to +10 Vdc, 0 to 10 Vdc (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference: Pulse train input (max. 32 kHz)
	Starting Torque	150%/3 Hz (V/f Control and V/f Control with PG), 200%/0.3 Hz*1 (Open Loop Vector Control), 200%/0 r/min*1 (Closed Loop Vector Control, Closed Loop Vector Control for PM, and Advanced Open Loop Vector Control for PM*2*3), 100%/5% speed (Open Loop Vector Control for PM)
	Speed Control Range	1 : 1500 (Closed Loop Vector Control and Closed Loop Vector Control for PM) 1 : 200 (Open Loop Vector Control) 1 : 40 (V/f Control and V/f Control with PG) 1 : 20 (Open Loop Vector Control for PM) 1 : 100*2 *3 *4 (Advanced Open Loop Vector Control for PM)
	Speed Control Accuracy*5	±0.2% in Open Loop Vector Control (25 ±10°C), ±0.02% in Closed Loop Vector Control (25 ±10°C)
	Speed Response	10 Hz in Open Loop Vector Control (25 ±10°C), 50 Hz in Closed Loop Vector Control (25 ±10°C) (excludes temperature fluctuation when performing Rotational Auto-Tuning)
	Torque Limit	All vector control modes allow separate settings in four quadrants
	Accel/Decel Time	0.00 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)
	Braking Torque*6	①Short-time decel torque*7 : over 100% for 0.4/ 0.75 kW motors, over 50% for 1.5 kW motors, and over 20% for 2.2 kW and above motors (Overexcitation Deceleration, High Slip Braking: approx. 40%) ②Continuous regen. torque: approx. 20% (approx. 125% with dynamic braking resistor option*8: 10% ED,10 s)
	V/f Characteristics	User-selected programs and V/f preset patterns possible
	Main Control Functions	Torque Control, Droop Control, Speed/Torque Control switch, Feed Forward Control, Zero Servo Control, Momentary Power Loss Ride-Thru, Speed Search, Overtorque detection, torque limit, 17 Step Speed (max.), accel/decel time switch, S-curve accel/decel, 3-wire sequence, Auto-Tuning (rotational, stationary), Online Tuning, Dwell, cooling fan on/off switch, slip compensation, torque compensation, Frequency Jump, Upper/lower limits for frequency reference, DC Injection Braking at start and stop, Overexcitation Deceleration, High Slip Braking, PID control (with Sleep function), Energy Saving Control, MEMOBUS comm. (RS-485/422, max. 115.2 kbps), Fault Restart, Application Presets, DriveWorksEZ (customized functions), Removable Terminal Block with Parameter Backup...
Protection Function	Motor Protection	Motor overheat protection based on output current
	Momentary Overcurrent Protection	Stops over 200% rated output current (Heavy Duty)
	Overload Protection	Drive stops after 60 s at 150% of rated output current (when set for Heavy Duty performance)*9
	Overvoltage Protection	200 V class: Stops when DC bus exceeds approx. 410 V, 400 V class: Stops when DC bus exceeds approx. 820 V
	Undervoltage Protection	200 V class: Stops when DC bus exceeds approx. 190 V, 400 V class: Stops when DC bus exceeds approx. 380 V (approx. 350 V when the power supply voltage is less than 400 V)
	Momentary Power Loss Ride-Thru	Stops immediately after 15 ms or longer power loss (default). Continuous operation during power up to 2 s (standard).*10
	Heatsink Overheat Protection	Thermistor
	Braking Resistance Overheat Protection	Overheat sensor for braking resistor (optional ERF-type, 3% ED)
	Stall Prevention	Stall prevention during acceleration/deceleration and constant speed operation
	Ground Fault Protection	Protection by electronic circuit *11
	Charge LED	Charge LED remains lit until DC bus has fallen below approx. 50 V
Environment	Area of Use	Indoors
	Ambient Temperature	−10 to +50°C (open-chassis), −10 to +40°C (NEMA Type 1)
	Humidity	95% RH or less (no condensation)
	Storage Temperature	−20 to +60°C (short-term temperature during transportation)
	Altitude	Up to 1000 meters (derating required at altitudes from 1000 m to 3000 m)
	Shock	10 Hz to 20 Hz, 9.8 m/s² max. (5.9 m/s² for models larger than 400 V 450 kW (when set for Heavy Duty performance)) 20 Hz to 55 Hz, 5.9 m/s² (200 V: 45 kW or more, 400 V: 75 kW or more (when set for Heavy Duty performance)) or 2.0 m/s² max. (200 V: 55 kW or less, 400 V: 90 kW or less (when set for Heavy Duty performance))
Standards Compliance		· UL508C · IEC/EN61800-3, IEC/EN61800-5-1 · Two Safe Disable inputs and 1EDM output according to ISO/EN13849-1 Cat.3 PLd, IEC/EN61508 SIL2
Protection Design		IP00 open-chassis, IP20 NEMA Type 1 enclosure *12

∗1: Requires a drive with recommended capacity.
∗2: Valid when high frequency injection is enabled (n8-57=1).
∗3: Rotational Auto-Tuning must be performed to achieve the performance described with Advanced Open Loop Vector Control for PM.
∗4: Contact your Yaskawa or nearest agent when not using SSR1 series or SST4 series motors manufactured by Yaskawa Motor Co., Ltd.
∗5: Speed control accuracy may vary slightly depending on installation conditions or motor used.
∗6: Varies by motor characteristics.
∗7: Momentary average deceleration torque refers to the deceleration torque from 60 Hz down to 0 Hz. This may vary depending on the motor.
∗8: Set L3-04 to 0 or 3 to disable stall prevention when using a braking unit, a braking resistor, or a braking resistor unit. If the function is enabled under these conditions, the drive may not stop within the specified deceleration time. Drives of 200/400 V 30 kW (CIMR-A□2A0138/A□4A0072) or less have a built-in braking transistor.
∗9: Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.
∗10: Varies in accordance with drive capacity and load. Drives with a capacity of smaller than 11 kW in the 200 V (model: CIMR- A□2A0056) or 400 V (model: CIMR- A□4A0031) require a separate Momentary Power Loss Recovery Unit to continue operating during a momentary power loss of 2 s or longer.
∗11: Protection may not be provided under the following conditions as the motor windings are grounded internally during run:
· Low resistance to ground from the motor cable or terminal block.
· Drive already has a short-circuit when the power is turned on.
∗12: Removing the cover of changes the drive's NEMA Type 1 rating to IP20 (models 2A0004 to 2A0081 and 4A0002 to 4A0044).

Dimensions mm

Parameter C6-01 sets the drive for Normal Duty or Heavy Duty performance (default).

200 V Class

ND : Normal Duty, HD : Heavy Duty

Model CIMR-A□2A□□□□		0006	0010	0012	0021	0030	0040	0056	0069	0081	0110	0138	0169	0211	0250	0312	0360	0415
Max. Applicable Motor Capacity (kW)	ND	1.1	2.2	3	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	110
	HD	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Enclosure Panel【NEMA Type 1】		Standard									Made to order∗1							∗2
Open-Chassis		Remove top cover of wall-mount enclosure for IP20 rating									IP00 standard						Made to order	

400 V Class

ND : Normal Duty, HD : Heavy Duty

Model CIMR-A□4A□□□□		0004	0005	0007	0009	0011	0018	0023	0031	0038	0044	0058	0072	0088	0103	0139	0165	0208	0250	0296	0362	0414	0515	0675
Max. Applicable Motor Capacity (kW)	ND	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	250	355
	HD	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	315
Enclosure Panel【NEMA Type 1】		Standard										Made to order∗1										∗2		
Open-Chassis		Remove top cover of wall-mount enclosure for IP20 rating										IP00 standard										Made to order		

∗1 : Contact a Yaskawa for IP20/NEMA Type 1 Kit availability.
∗2 : NEMA 1 Type 1 is not available for this capacity.

Enclosure Panel (NEMA Type 1)

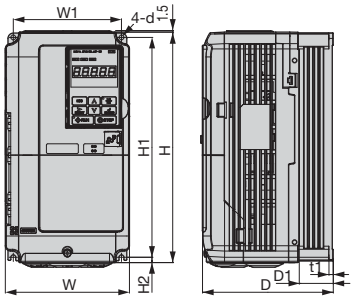


Figure 1

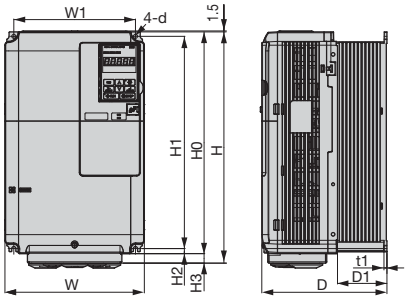


Figure 2

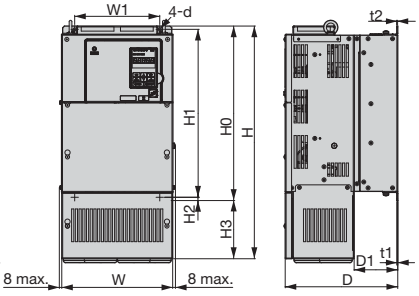


Figure 3

200 V Class

Model CIMR-A□2A□□□□	Max. Applicable Motor Capacity (kW) Normal Duty	Max. Applicable Motor Capacity (kW) Heavy Duty	Figure	Dimensions mm W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	Weight kg	Cooling
0006	1.1	0.75	1	140	260	147	122	–	248	6	–	38	5	–	M5	3.1	Self cooling
0010	2.2	1.5														3.2	
0012	3.0	2.2															
0021	5.5	3.7		140	260	164	122	–	248		–	55	5	–		3.5	Fan cooled
0030	7.5	5.5				167										4	
0040	11	7.5															
0056	15	11		180	300	187	160	–	284	8	–	75	5	–		5.6	
0069	18.5	15		220	350	197	192	–	335	8	–	78	5	–	M6	8.7	
0081	22	18.5	2	220	365	197	192	350	335	8	15	78	5	–		9.7	
0110	30	22	3	254	534	258	195	400	385	7.5	134	100	2.3	2.3		23	
0138	37	30		279	614		220	450	435		164					28	
0169	45	37		329	730	283	260	550	535		180	110				41	
0211	55	45														42	
0250	75	55		456	960	330	325	705	680	12.5	255	130	3.2	3.2	M10	83	
0312	90	75														88	
0360	110	90		504	1168	350	370	800	773	13	368	130	4.5	4.5	M12	108	

400 V Class

Model CIMR-A□4A□□□□	Max. Applicable Motor Capacity (kW) Normal Duty	Max. Applicable Motor Capacity (kW) Heavy Duty	Figure	Dimensions mm W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	Weight kg	Cooling
0004	1.5	0.75	1	140	260	147	122	–	248	6	–	38	5	–	M5	3.2	Self cooling
0005	2.2	1.5															
0007	3.0	2.2		140	260	164	122	–	248	6	–	55	5	–		3.4	Fan cooled
0011	5.5	3.7														3.5	
0018	7.5	5.5				167										3.9	
0023	11	7.5															
0031	15	11		180	300	167	160	–	284	8	–	55	5	–		5.4	
0038	18.5	15				187						75				5.7	
0044	22	18.5		220	350	197	192	–	335	8	–	78	5	–		8.3	
0058	30	22	3	254	465	258	195	400	385	7.5	65	100	2.3	2.3	M6	23	
0072	37	30		279	515	258	220	450	435							27	
0088	45	37		329	630	258	260	510	495		120	105				39	
0103	55	45															
0139	75	55			730	283		550	535		180	110				45	
0165	90	75														46	
0208	110	90		456	960	330	325	705	680	12.5	255	130	3.2	3.2	M10	87	
0250	132	110		504	1168	350	370	800	773	13	368	130	4.5	4.5	M12	106	
0296	160	132														112	
0362	185	160														117	

● Open-Chassis (IP00)

Note: The enclosure type of figure 1 and figure 2 is IP20.

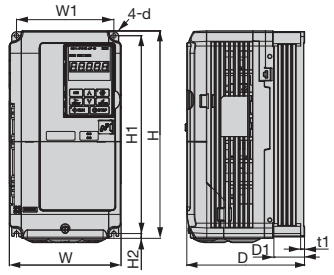


Figure 1

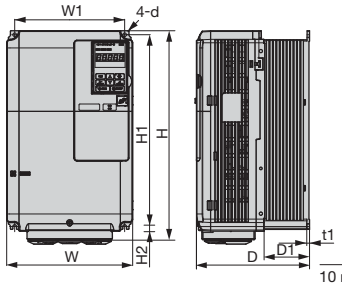


Figure 2

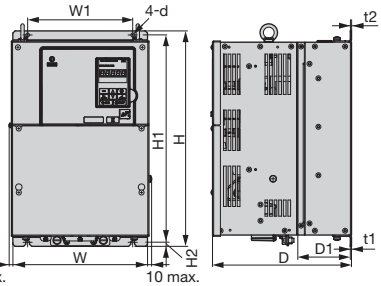


Figure 3

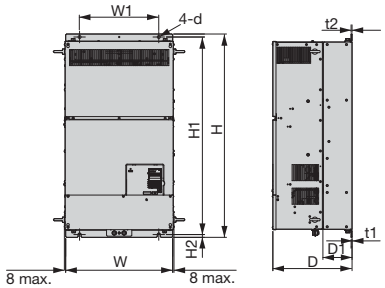


Figure 4

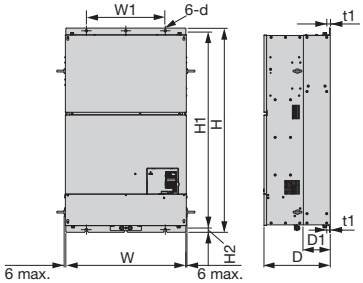


Figure 5

200 V Class

Model CIMR-A 2A	Max. Applicable Motor Capacity (kW) Normal Duty	Heavy Duty	Figure	Dimensions mm W	H	D	W1	H1	H2	D1	t1	t2	d	Weight kg	Cooling
0006	1.1	0.75	1	140	260	147	122	248	6	38	5	–	M5	3.1	Self cooling
0010	2.2	1.5												3.2	
0012	3	2.2													
0021	5.5	3.7		140	260	164	122	248	6	55	5	–		3.5	Fan cooled
0030	7.5	5.5				167								4	
0040	11	7.5													
0056	15	11		180	300	187	160	284	8	75	5	–		5.6	
0069	18.5	15		220	350	197	192	335	8	78	5	–	M6	8.7	
0081	22	18.5	2	220	365	197	192	335	8	78	5	–		9.7	
0110	30	22	3	250	400	258	195	385	7.5	100	2.3	2.3		21	
0138	37	30		275	450		220	435						25	
0169	45	37	4	325	550	283	260	535	7.5	110	2.3	2.3		37	
0211	55	45												38	
0250	75	55		450	705	330	325	680	12.5	130	3.2	3.2	M10	76	
0312	90	75												80	
0360	110	90		500	800	350	370	773	13	130	4.5	4.5	M12	98	
0415	110	110												99	

400 V Class

Model CIMR-A 4A	Max. Applicable Motor Capacity (kW) Normal Duty	Heavy Duty	Figure	Dimensions mm W	H	D	W1	H1	H2	D1	t1	t2	d	Weight kg	Cooling
0004	1.5	0.75	1	140	260	147	122	248	6	38	5	–	M5	3.2	Self cooling
0005	2.2	1.5													
0007	3	2.2		140	260	164	122	248	6	55	5	–		3.4	Fan cooled
0011	5.5	3.7												3.5	
0018	7.5	5.5		140	260	167	122	248	6	55	5	–		3.9	
0023	11	7.5													
0031	15	11		180	300	167	160	284	8	55	5	–		5.4	
0038	18.5	15				187				75				5.7	
0044	22	18.5		220	350	197	192	335	8	78	5	–	M6	8.3	
0058	30	22	3	250	400	258	195	385	7.5	100	2.3	2.3		21	
0072	37	30		275	450		220	435						25	
0088	45	37		325	510	258	260	495	7.5	105	2.3	3.2		36	
0103	55	45													
0139	75	55	4	325	550	283	260	535		110		2.3		41	
0165	90	75												42	
0208	110	90		450	705	330	325	680	12.5	130	3.2	3.2	M10	79	
0250	132	110		500	800	350	370	773	13	130	4.5	4.5	M12	96	
0296	160	132												102	
0362	185	160												107	
0414	220	185		500	950	370	370	923	13	135	4.5	4.5	M12	125	
0515	250	220	5	670	1140		440	1110	15	150				221	
0675	355	315													

Checklist for PM Motor (Three-Phase Permanent-Magnet Synchronous Motor) Drive Specifications

Customer : _____ Application : _____

Location of application : _____ Load characteristics : ■ Constant torque

Item	Qty	Specifications
1		**PM Motor (Three-Phase Permanent-Magnet Synchronous Motor)**

Model _____ – _____

Rated output _____kW

Motor speed _____min^{-1}

Rated voltage
☐ 200 V class (power supply voltage: 200 to 230 V)
☐ 400 V class (power supply voltage: 400 to 460 V)
☐ Other ( )

Time rating
■ Continuous
☐ Other ( )

Speed control range
☐ 1 : 20
☐ 1 : 1500
☐ Other ( )

Installation location ■ Indoors

Mounting method
☐ Foot mounted
☐ Flange mounted Note. Selectable motor frame number: 90SA to 132MB

Load coupling
☐ Coupling
☐ V belt : Belt type : _____
No. of belts : _____
Pulley PCD (mm) _____
(Pulley diameters (mm) : At motor : _____, At machine : _____)

Rotation direction ■ Counterclockwise when viewed from the coupling side. (Rotation in both directions is also possible.)

Terminal box position and Cable entrance direction

Frame No.	Terminal box position (viewed from coupling side)	Cable Entrance Direction (viewed from coupling side)
90 to 132	☐Top	☐Left ☐Right
	■Left ☐Right	☐Bottom (Flange mounted) ■Opposite from coupling side
180	■Top	■Left ☐Right
	☐Left (180SA to 180MB)	☐Bottom ☐Opposite from coupling side
250	■Top	■Left ☐Right

Coating Color
■ Standard Munsell 6.0 PB 3.9/11.0
☐ Specified color Munsell _____

Options ☐ Thermostat (1)

2		**Options** ☐ Slide base (Frame No.: 90 to 132) ☐ Slide rail (Frame No.: 180 or larger) Other specifications [ ]
3		**Recommended Drive** ☐ A1000 ☐ Other ( )

Note: ■: Indicates standard specifications. If no specification is made, the standard specification will be used.

MEMO

SS7-Series Eco PM Motor

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