TOSHIBA
Leading Innovation >>>

eco スタイル

**PERMANENT MAGNETIC MOTOR·
DRIVE SYSTEM**

NEXT GENERATION
HIGH EFFICIENCY MOTOR DRIVE

Interior Permanent Magnet Synchronous Motor
TOSHIBA IPM MOTOR SERIES

**IE4 SUPER PREMIUM
EFFICIENCY**

0.4kW – 55kW

1,800min - 1 rated speed series

*Efficiency is approximately equal to IE4 level
'IEC60034-30-1' that is currently under
deliberation.

VF-AS1

VF-S15

TOSHIBA

In preservation for a better tomorrow to People and the Future, Toshiba IPM motor[*1] plays significant roles.

Nowadays, Energy conservation is a primary requirement in product and service development for various industries.
In order to meet various needs , Toshiba proposes the highest efficiency motor 'IPM motor'. This cutting edge motor product line is designed to meet the competitive demands of the global market as well as the requirements of IE4 efficiency level, while maintaining the same frame size as a standard motor which means it is easily replaceable. IPM motor is the new key component of competitive machine.

A new proposal on Energy Saving!

Toshiba proposes the highest efficiency motor drive 'IPM motor · Drive system'.

Energy saving with standard motor drive has been achieved by 'adopting a high efficiency motor and cut down loss on motor', 'decreasing unnecessary electricity with inverter speed control' so far. On the other hand, 'IPM motor · Drive system' provides the most advanced technology on energy efficiency.

●Features of IPM motor

The same frame size and total length as a standard induction motor
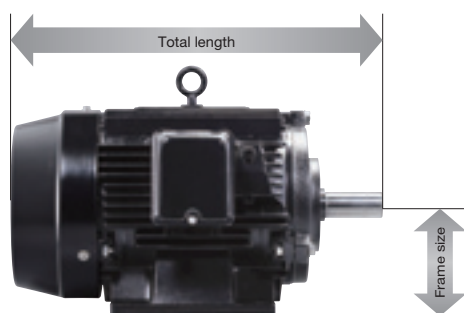
- IPM motor easily replaces the JIS standard motor with the same frame size and total length. (An inverter is necessary because IPM motor cannot be run with commercial power supply.)
- By placing a magnet with Toshiba's unique method and utilizing reluctance torque, the content of a permanent magnet on IPM motor is lesser.
- Replaceable with smaller frame sizes because of its greatly improved heating value. (Please contact us)

High efficiency design (Efficiency characteristic)
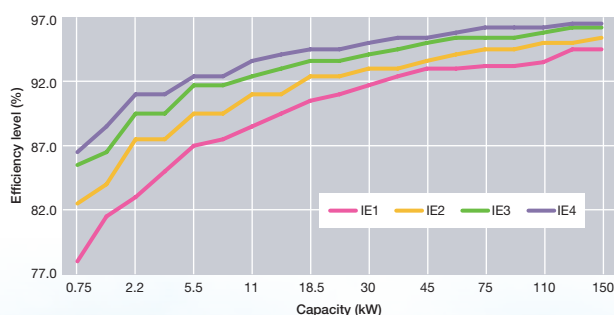
IPM motor is designed to meet the highest efficiency level that is approximately equal to IE4[*2] super premium efficiency 'IEC60034-30-1'.
Its 3 to 14% more efficient than IE1 efficient level.
IPM motor is exempt from new Japanese standard 'JIS C 4213'.

Product line (0.4-55kW)

Standard (Rotating speed 1800min^{-1}) series lines up from 0.4kW to 55kW.

For the use at rated speed

For the use at constant rated speed, IE3 efficient level 'Premium Gold Motor' has been prepared with higher efficient level than IE2 efficient level 'Gold Motor'. Please contact us for more details.

*1 IPM : Interior Permanent Magnet
*2 Relative to IE4 in IEc60034-30 Ed.2 (under deliberation)

- Toshiba's IPM motor is easy to replace with standard induction motor.
- Large energy saving can be obtained with High efficiency that is approximately equal to IE4 efficient level. Furthermore, larger energy saving is attainable with inverter speed control.
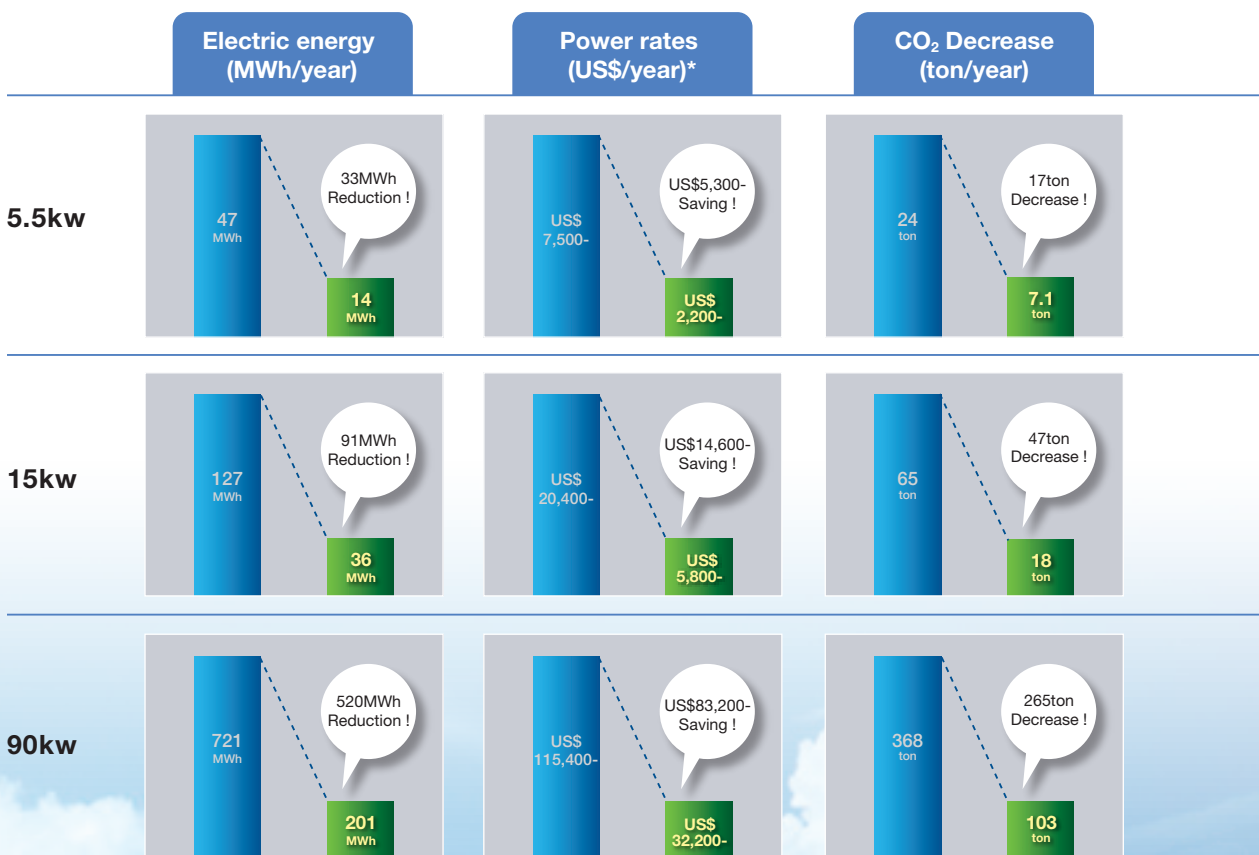
PUMP

FAN·BLOWER
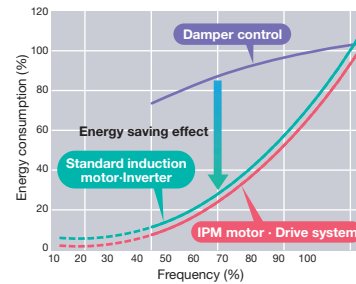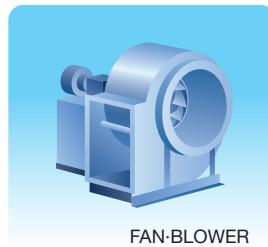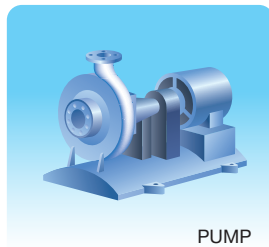
Examples of energy saving effect
(When a standard induction motor is replaced with IPM motor drive)

: Standard Induction Motor
: IPM Motor

	Electric energy (MWh/year)	Power rates (US$/year)*	CO$_2$ Decrease (ton/year)
5.5kw	47 MWh → 14 MWh (33MWh Reduction!)	US$ 7,500- → US$ 2,200- (US$5,300- Saving!)	24 ton → 7.1 ton (17ton Decrease!)
15kw	127 MWh → 36 MWh (91MWh Reduction!)	US$ 20,400- → US$ 5,800- (US$14,600- Saving!)	65 ton → 18 ton (47ton Decrease!)
90kw	721 MWh → 201 MWh (520MWh Reduction!)	US$ 115,400- → US$ 32,200- (US$83,200- Saving!)	368 ton → 103 ton (265ton Decrease!)

* Money exchange rate: US$1.00- = JPY100-

Calculation conditions
1) 24 hours per day, 365days per year and continuous operation.
2) Efficiency of inverter is considered along with IPM motor.
3) Commercial power drive is controlled by Pump valve/Damper at 60% of flow rate/air flow.
4) Power rate is 16cents/kWh.
5) CO$_2$ emission coefficient:0.51 kgCO$_2$/kWh
* (kgCO$_2$/kWh) Use edge of CO$_2$ emission unit without Kyoto mechanisms credit etc
   [Environmental action plan in electric industry, September, 2013 edition Japanese Federation of Electric Power Companies (FEPC)]

◉Features and Advantages for acquiring IPM motor
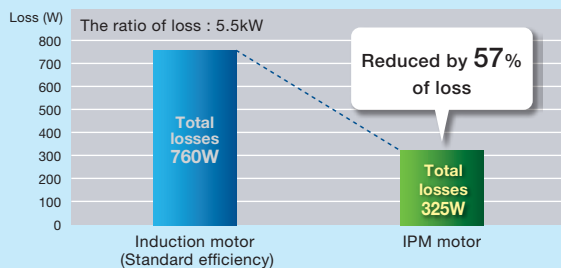
- Easy to replace a standard induction motor with compatibility of installation because of the same frame size.(Inverter is necessary to drive IPM motor)
- Highest efficiency level in all of motor line up and more advanced than IE3 level.
- By placing a magnet with Toshiba's unique method and utilizing reluctance torque, the content of a permanent magnet on IPM motor is lesser.
- IPM motor drives at a synchronous rotating speed, Therefore high precision speed control is available.
- Standard inverter can be used depending on inverter's software version. (Please confirm a specification list)
- Bearings are replaceable without pulling out a rotor.

Low noise level by adopting a small cooling fan
(In comparison to Standard induction motor + Inverter)

High efficiency · Energy conservation Sharp cut of loss (Approximately equal to IE4 efficiency level)

Reduction of motor temperature rise (B rise)

Less content of permanent magnet

Stator

Rotor

Permanent magnet

Frame No.

Suitable magnet position

Same mounting dimension as standard induction motor

Examples of loss comparison between IPM motor and Standard induction motor

Loss (W)

The ratio of loss : 5.5kW

Reduced by 57% of loss

Total losses 760W

Total losses 325W

Induction motor (Standard efficiency)

IPM motor

In comparison to standard induction motor, IPM motor minimizes the loss because it does not generate any loss on rotor part. Therefore, Bearing and other parts are expected to last for a long time as well as the excellent outcome of energy saving.

Example of Allowable torque characteristic (37kW - Constant torque mode)

Torque (%)

Rotating speed (min-1)
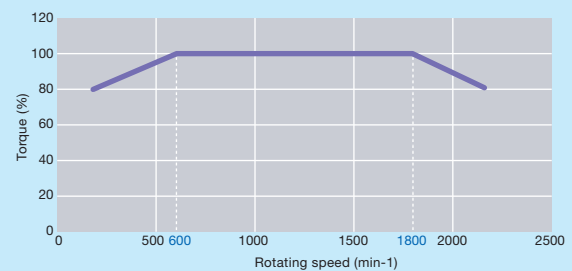
Standard recommended parameter setting is torque reduction mode but on constant torque mode, the characteristic above will be attainable. Please refer to a specification list for the details. For the capacity 75Kw and over, an electric cooling fan is necessary to be attached.

What is IPM motor?

Permanent magnet is built in the rotor.
Induction motor has an induced current (Secondary current) on a rotor conductor and generates losses (Heat). Alternatively, IPM motor has a permanent magnet in the rotor part and does not generate any loss from Secondary current with availability of higher efficient operation.

A particular controller such as inverter for each IPM motor is required because
the revolving magnetic field needs to be matched with a rotor position (Magnet).
One unit of inverter cannot operate multiple units of IPM motor.

Rotation principle comes with a magnet being pulled by revolving magnetic field of a stator. Therefore, Rotating speed is the same as revolving magnetic field without 'Slip'.
When replacing standard induction motor with IPM motor, Rotating speed will be slightly faster but it is adjustable with Inverter speed control.

*The difference between synchronous speed and actual speed is known as 'Slip'.

# Features Combined with Toshiba Inverter

- Easy installation without wiring a sensor as well as strong durability because of its 'Senseless pole sensing'.
- Higher efficiency can be obtained in accordance with characteristic of IPM motor through 'Current phase adjusting function'.
- Simple adjustment between IPM motor on this catalog and inverter with a parameter list attached.

Principle picture of IPM motor

Stator coil (Electromagnet)

Rotor(Bar magnet)

Load angle

Load torque
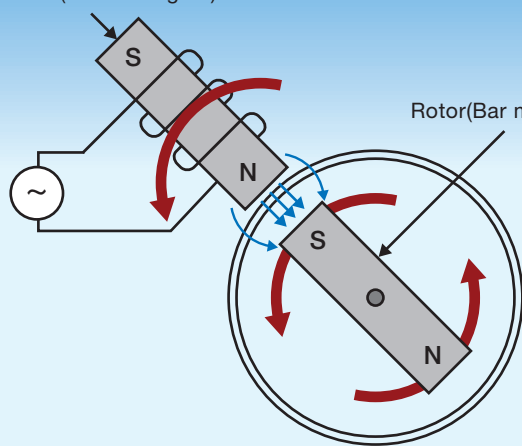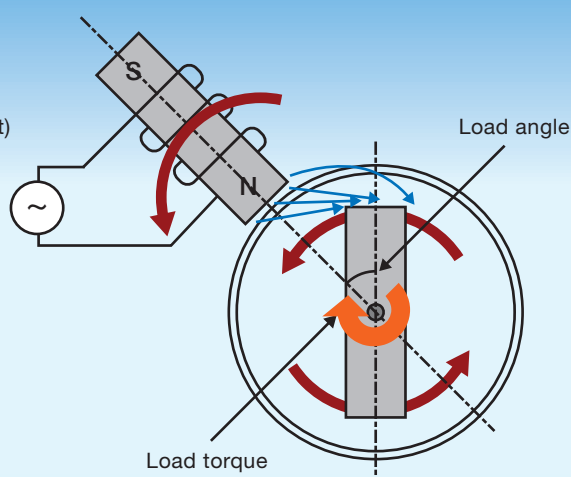
(a) IPM motor model　　　　　(b) IPM motor model on load

① Revolving magnetic field occurs on a stator part when AC voltage is added to stator coil, like a stator coil rotates around a rotor as the picture above shows.

② A rotor spins at a synchronous rotating speed as if the movement of magnetic field from ① attracts a bar magnet.

③ Operation continues with a certain load angle toward revolving magnetic field when load torque is added to a rotor. (Rotating speed does not change)

④ Rotating speed is controlled by frequency and capacity of AC voltage. The Strength of load torque is controlled by electric current from stator coil.

* For IPM motor drive, electric current, frequency and capacity of AC voltage need to be controlled with a particular control device such as inverter or driver.

* Commercial power supply (50/60Hz) such as Direct-on-line (DOL) or Star-Delta-starting cannot be used for IPM motor drive.

SPECIFICATIONS

■ IE4 SUPER PREMIUM EFFICIENCY COMPATIBLE PRODUCT

		Capacity (kW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
IPM Motor Standard Specification		Frame No.	71M	80M	90L	100L	112M	132S	132M	160M	160L
		TYPE	TAYL								
		FORM	FBKW / FCLW		FBKAW / FCKAW						
		POLES	4P		6P						
		Rated Voltage (V)	400								
		Rated Current (A)	0.75	1.3	2.55	3.65	6.1	10.3	13.9	20.8	29.25
		Rotating Speed (min^{-1})	1800 (min^{-1})								
		Maximum Speed	2160 (min^{-1})								
		Degree of Protection	IP55								
		Cooling Method	IC411 (Totally Enclosed Fan-Cooled)								
		Installation Method	IMB3								
		Thermal Class	Class B		Class F						
		Temparture-rise	85K (B)		80K (B)						
		Time Rating	Continuous								
	Ambient Conditions	Ambient Temperature	-10°C~40°C (Operating temperature range)								
		Ambinent Humidity	Up to 90% (relatively) (No condensation)								
		Above Sea Level	Up to 1000m								
		Gas, Steam	Indoors / Outdoors; Protects from Corrosive Gas / Explosive Gas / Steam								
		Lead Wire	3 lead wires								
		Lead Wire Connection	With screw-up type terminal block				With stud type terminal block				
		Coating Color	Equals to Munsell N1.5								
		Applied Standard	JIS / JEC / JEM (JEC-2100-2008)								
		Applied Efficiency	IE4 (IEC60034-30 Ed.2: under deliberation)								
		Efficiency (%)	88.3	92.3	90.4	92.5	92.8	94.1	94.2	93.7	94.3
Reduced Torque Mode		Solutions	Set up inverter by following recommanded parameters attached with motor.								
Rated Torque		Range of rated torque	180-1800min^{-1}						540-1800min^{-1}		
		Solutions	Please set up rated torque by following follow inverter parameters.								

		Type	VFS15								
Inverter		Form	4004PL	4007PL	4015PL	4022PL	4037PL	4055PL	4075PL	4110PL	4150PL
		Input Voltage Class	3-Phase 440V								
		Applicable Motor (kW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
	Rating	Output Capacity (kVA) Note1)	1.1	1.8	3.1	4.2	7.2	10.9	13	21.1	25.1
		Output Current (A) Note 2)	1.5 -1.5	2.3 -2.1	4.1 -3.7	5.5 -5	9.5 -8.6	14.3 -13	17 -17	27.7 -25	33 -30
		Rated output current (A) Note3)	3-phase 380V to 500V								
		Overload current rating	150%-60 seconds, 200% -0.5 second								
	Power supply	Voltage-frequency	3-phase 380V to 500V - 50/60Hz								
		Allowable fluctuation	Voltage 323V to 550V Note 4), frequency + / -5%								
		Required Power supply capacity (kVA) Note 5)	1.6	2.7	4.7	6.4	10	15.2	19.5	26.9	34.9
		Protection degree (IEC60529)	IP20								
		Cooling method	Forced air-cooled								
		Color	RAL7016								
		Built-in filter	EMC filter								
		Detecting magnetic pole position	Yes								
		Controlling of maxium efficiency	Yes								
		Auto-restart operation	Possible								

*1: Inveter specifications are standard ones, setting up parameters and power condistions are required for using with IPM Motor. Please refer to instructions manual for more details.

Note 1) Capacity is calculated at 440V for the VFS15 500V models, 440V for the AS1 400V models.
Note 2) Indicates rated output current setting when the PWM carrier frequency (parameter f300) is 4kHz or less. When exceeding 4kHz, the rated output current setting is indicated in the parentheses. It needs to be further reduced for PWM carrier frequencies above 12 kHz.
The rated output current is reduced even further for 500V models with a supply voltage of 480V or more. The default setting of the PWM carrier frequency is 12kHz.
Note 3) Maximum output voltage is the same as the input voltage.
Note 4) At 342V-550V for the 500V models when the inverter is used continuously (load of 100%).
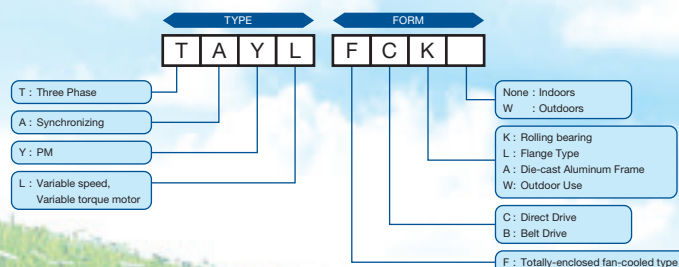Note 5) Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
Note 6) +/-10% when the inverter is used continuously (load of 100%)
Note 7) Inverters, 18.5kW or greater, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit. If they are fitted external to the cabinet, please use an optional wiring port cover.
Note 8) Complies with the Europian EMC Directive IEC/EN61800-3, 1st environment, category C2 or IEC/EN61800-3, 2nd environment, category C3

■ IPM MOTOR TYPE FORM DESCRIPTION

TYPE | T A Y L

T : Three Phase
A : Synchronizing
Y : PM
L : Variable speed, Variable torque motor

FORM | F C K

None : Indoors
W : Outdoors

K : Rolling bearing
L : Flange Type
A : Die-cast Aluminum Frame
W : Outdoor Use

C : Direct Drive
B : Belt Drive

F : Totally-enclosed fan-cooled type

SPECIFICATIONS

IE4 SUPER PREMIUM EFFICIENCY COMPATIBLE PRODUCT

		Capacity (kW)	18.5	22	30	37	45	55
IPM Motor Standard Specification		Frame No.	180M	180M	180L	200L	200L	225S
		TYPE	TAYL					
		FORM	FBKW / FCKW					
		POLES	6P					
		Rated Voltage (V)	400					
		Rated Current (A)	33.5	39.5	54.5	63	78	96.5
		Rotating Speed (min⁻¹)	1800 (min⁻¹)					
		Maximum Speed	2160 (min⁻¹)					
		Degree of Protection	IP55					
		Cooling Method	IC411 (Totally Enclosed Fan-Cooled)					
		Installation Method	IMB3					
		Thermal Class	Class F					
		Temparture-rise	80K (B)					
		Time Rating	Continuous					
	Ambient Conditions	Ambient Temperature	-10°C~40°C (Operating temperature range)					
		Ambinent Humidity	Up to 90% (relatively) (No condensation)					
		Above Sea Level	Up to 1000m					
		Gas, Steam	Indoors / Outdoors; Protects from Corrosive Gas / Explosive Gas / Steam					
		Lead Wire	3 lead wires					
		Lead Wire Connection	With stud type terminal block					
		Coating Color	Equals to Munsell N1.5					
		Applied Standard	JIS / JEC / JEM (JEC-2100-2008)					
		Applied Efficiency	IE4 (IEC60034-30 Ed.2: under deliberation)					
		Efficiency (%)	94.6	94.7	95.4	95.4	95.8	95.9
Reduced Torque Mode		Solutions	Set up inverter by following recommanded parameters attached with motor.					
Rated Torque		Range of rated torque	540-1800min⁻¹					
		Solutions	Please set up rated torque by following follow inverter parameters.					

$Rotating Speed: 1800\,(\text{min}^{-1})$, $Maximum Speed: 2160\,(\text{min}^{-1})$, $Range of rated torque: 540\text{-}1800\,\text{min}^{-1}$

		Type	VFAS1					
Inverter		Form	4185PL	4220PL	4300PL	4370PL	4450PL	4550PL
		Input Voltage Class	3-phase 400V					
		Applicable Motor (kW)	18.5	22	30	37	45	55
	Rating	Output Capacity (kVA) Note1)	31	37	50	60	72	88
		Output Current (A) Note 2)	41 -37	48 -38	66 -53	79 -60	94 -75	116 -93
		Rated output current (A) Note3)	3-phase, 380 to 480 V (The maximum output voltage is the same as the input voltage.)					
		Overload current rating	150% - 1 minute					
	Power supply	Voltage-frequency	3-phase, 380 to 480 V . 50/60 Hz					
		Allowable fluctuation	Voltage +10% - 15% Note 6) Frequency + / -5%					
	Electric braking	Dynamic Braking Circuit	Built-in					
		Dynamic Breaking Resistor	Compatible with external options					
		Protective method	IP00 enclosed type (JEM1030) Note 7)					
		Cooling method	Forced air-cooled					
		Cooling fan noise (dBA)	60	60	64	64	64	64
		Color	RAL7016					
		Built-in filter	EMI noise filter Note 8)					
		DC Reactor	Built-in					
		Detecting magnetic pole position	Yes					
		Controlling of maxium efficiency	Yes					
		Auto-restart operation	Not available currently.					

*1: Inveter specifications are standard ones, setting up parameters and power condistions are required for using with IPM Motor. Please refer to instructions manual for more details.

Note 1) Capacity is calculated at 440V for the VFS15 500V models, 440V for the AS1 400V models.
Note 2) Indicates rated output current setting when the PWM carrier frequency (parameter f300) is 4kHz or less. When exceeding 4kHz, the rated output current setting is indicated in the parentheses. It needs to be further reduced for PWM carrier frequencies above 12 kHz.
The rated output current is reduced even further for 500V models with a supply voltage of 480V or more. The default setting of the PWM carrier frequency is 12kHz.
Note 3) Maximum output voltage is the same as the input voltage.
Note 4) At 342V-550V for the 500V models when the inverter is used continuously (load of 100%).
Note 5) Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
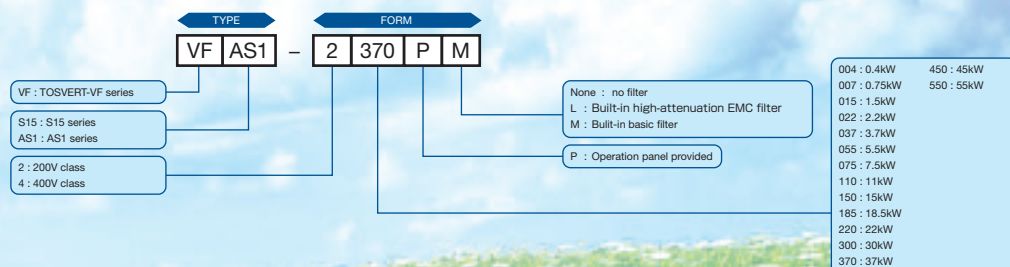Note 6) +/-10% when the inverter is used continuously (load of 100%)
Note 7) Inverters, 18.5kW or greater, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit. If they are fitted external to the cabinet, please use an optional wiring port cover.
Note 8) Complies with the Europian EMC Directive IEC/EN61800-3, 1st environment, category C2 or IEC/EN61800-3, 2nd environment, category C3

INVERTER TYPE FORM DESCRIPTION

VF AS1 – 2 370 P M
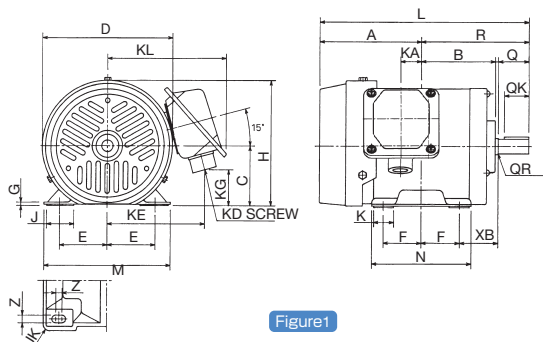
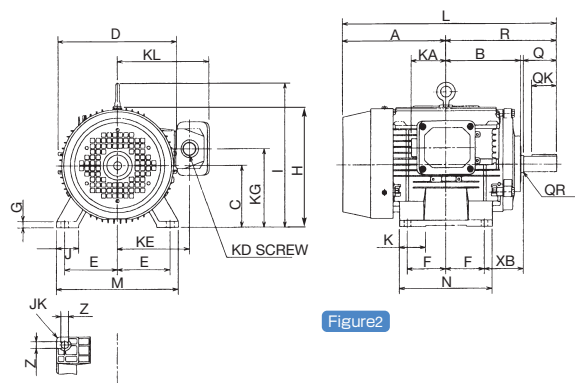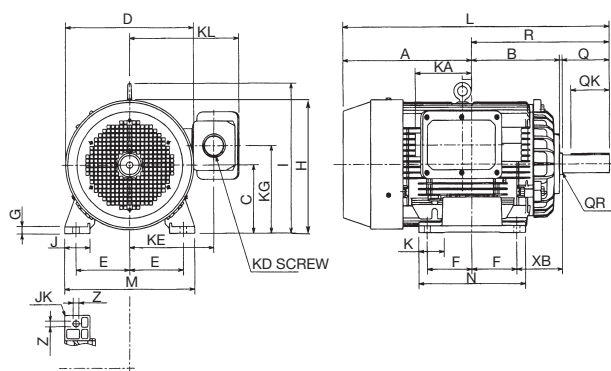TYPE:
VF : TOSVERT-VF series
S15 : S15 series
AS1 : AS1 series

2 : 200V class
4 : 400V class

FORM:
None : no filter
L : Built-in high-attenuation EMC filter
M : Built-in basic filter

P : Operation panel provided

004 : 0.4kW
007 : 0.75kW
015 : 1.5kW
022 : 2.2kW
037 : 3.7kW
055 : 5.5kW
075 : 7.5kW
110 : 11kW
150 : 15kW
185 : 18.5kW
220 : 22kW
300 : 30kW
370 : 37kW
450 : 45kW
550 : 55kW

Figure1 Figure2 Figure3 Figure4
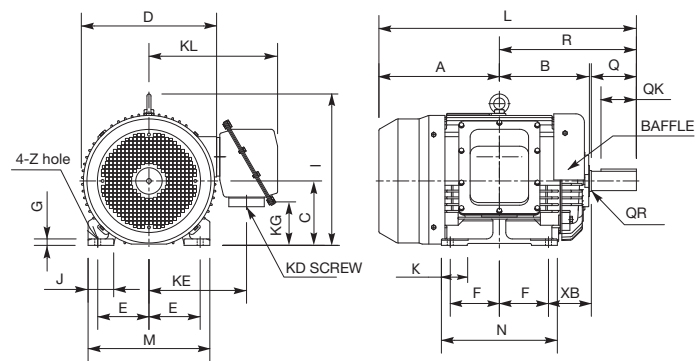
| Frame No. | Output (kW) | | | | Thermal class | Fig No. | Dimension (mm) | | | | | | | | | | | | | | | | | |
	2P	4P	6P	8P			A	B	C	D	E	F	G	H	I	J	K	L	M	N	R	Z	XB	JK
71M	0.4	0.4	0.2	0.1	E	1	121	86	71	150	56	45	2.3	146	—	30	25	241	140	110	120	7×8	45	8
80M	0.75	0.75	0.4	0.2	E	1	133	96	80	170	62.5	50	4.5	165	—	35	30	273	165	130	140	10×8	50	8
90L	1.5 / 2.2	1.5	0.75	0.4	E	2	143	114.5	90	198	70	62.5	10	190	—	40	40	311.5	176	150	168.5	10×12	56	5
100L	—	2.2	1.5	0.75	E	2	157.5	129	100	198	80	70	12	200	—	40	46	350.5	200	168	193	12×14	63	5
112M	3.7	3.7	2.2	1.5	E	2	186	135	112	214	95	70	12	219	261	40	46	386	220	168	200	12×14	70	5
132S	5.5 / 7.5	5.5	3.7	2.2	B	2	210.5	153	132	252	108	70	15	257	303	50	50	449.5	260	175	239	12×14	89	5
132M	—	7.5	5.5	3.7	B	2	229.5	172	132	252	108	89	15	257	303	50	50	487.5	260	213	258	12×14	89	5
160M	11 / 15	11	7.5	5.5	B	3	302	206	160	304	127	105	18	305	351	60	60	625	308	250	323	14.5×18.5	108	5
160L	18.5	15	11	7.5	B	3	280	228	160	304	127	127	18	305	351	60	60	625	308	294	345	14.5×18.5	108	5
180M	22	18.5 / 22	15	11	B	4	320	237.5	180	382	139.5	120.5	20	—	431	60	82.5	671.5	324	286	351.5	14.5	121	—
180L	30	30	18.5 / 22	15	F	4	339	256.5	180	382	139.5	139.5	20	—	431	60	82.5	709.5	324	324	370.5	14.5	121	—
200L	37 / 45	—	—	—	F	4	374	281.5	200	420	159	152.5	20	—	470	80	80	769.5	378	360	395.5	18.5	133	—
200L	—	37 / 45	30 / 37	18.5 / 22	F	4	374	281.5	200	420	159	152.5	20	—	470	80	80	799.5	378	360	425.5	18.5	133	—
225S	55	—	—	—	F	4	380.5	288	225	464	178	143	22	—	517	80	120	782.5	416	366	402	18.5	149	—
225S	—	55	45	30	F	4	380.5	288	225	464	178	143	22	—	517	80	120	812.5	416	366	432	18.5	149	—

| Frame No. | Output (kW) | | | | Thermal class | Fig No. | Dimension (mm) | | | | | | | | | | | | Bearing No. | | | |
| | | | | | | | Terminal Box | | | | | Shaft end | | | | | | | 2 Pole | | ≥4 Pole | |
	2P	4P	6P	8P			KA	KD	KE	KG	KL	Q	QK	QR	S	W	T	U	L.S	O.S	L.S	O.S
71M	0.4	0.4	0.2	0.1	E	1	35	(22)	122	38	151	30	22	1.3	14	5	5	3	6203	6203	6203	6203
80M	0.75	0.75	0.4	0.2	E	1	27.5		129	49	157	40	32	0.5	19	6	6	3.5	6204	6204	6204	6204
90L	1.5 / 2.2	1.5	0.75	0.4	E	2	63	(22)	123.5	120	159	50	40	0.5	24	8	7	4	6205	6304	6205	6304
100L	—	2.2	1.5	0.75	E	2	63		123.5	120	159	60	45	0.5	28	8	7	4	—	—	6206	6304
112M	3.7	3.7	2.2	1.5	E	2	63		130.5	142	166	60	45	1.5	28	8	7	4	6207	6305	6207	6305
132S	5.5 / 7.5	5.5	3.7	2.2	B	2	111	(42)	178.5	167	240	80	63	0.5	38	10	8	5	6308	6306	6308	6306
132M	—	7.5	5.5	3.7	B	2	111		178.5	167	240	80	63	0.5	38	10	8	5	—	—	6308	6306
160M	11 / 15	11	7.5	5.5	B	3	133	(42)	199.5	205	259	110	90	2	42	12	8	5	6310C3	6208	6310	6208
160L	18.5	15	11	7.5	B	3	111		199.5	205	259	110	90	2	42	12	8	5	6310C3	6208	6310	6208
180M	22	18.5 / 22	15	11	B	4	—	(54)	283	75	380	110	90	0.5	48	14	9	5.5	6312C3	6210C3	6310C3	6210C3
180L	30	30	18.5 / 22	15	F	4	—		283	75	380	110	90	1.5	55	16	10	6	6212C3	6210C3	6312C3	6210C3
200L	37 / 45	—	—	—	F	4	—	(82)	303	120	400	110	90	1.5	55	16	10	6	6212C3	6312C3	—	—
200L	—	37 / 45	30 / 37	18.5 / 22	F	4	—		303	120	400	140	110	1.5	60	18	11	7	—	—	6313C3	6312C3
225S	55	—	—	—	F	4	—		328	150	425	110	90	1.5	55	16	10	6	6312C3	6312C3	—	—
225S	—	55	45	30	F	4	—		328	150	425	140	110	1.5	65	18	11	7	—	—	6315C3	6312C3
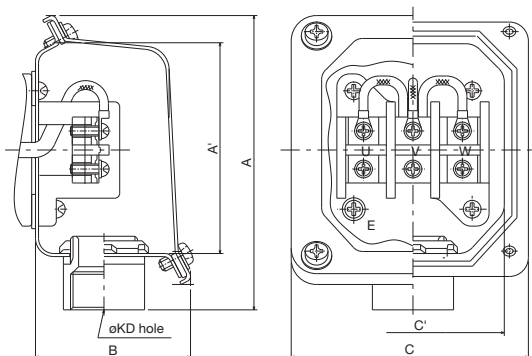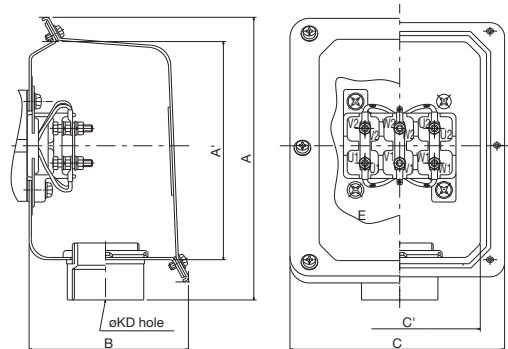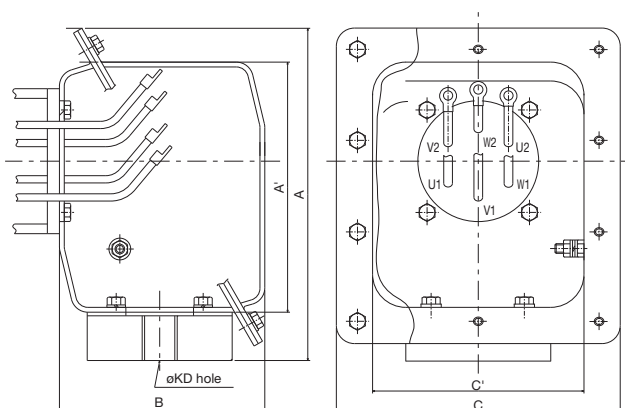
Figure5

Figure6

Figure7

Frame No	Fig No.	Dimension（mm）						
		A	A'	B	C	C'	φ KD	Size of Terminal Screw
71M～112M	5	116	83	62	96	72	PF3/4	M5
132S～160M	6	203	155	116	158	116	PF1 1/2	M6
180M	7	263	201	190	235	175	PF2	M8
180L～225S	7	263	201	190	235	175	PF3	M8

Multifunction · Compact Inverter VF-S15

Features

- **Easy setting** • **Energy saving design**
- **Long lasting design**
- **High torque performance**
- **Safety function**
- **Various communication network**
- **Noise reduction**
- **Easy sequence function**

Capacity Range

Input Voltage Class	Applicable motor Output (kW)																									
	0.1	0.2	0.4	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	200	220	280	315
Three Phase 200V		0.2 ～ 15																								
Single Phase 200V		0.2 ～ 3.7																								
Three Phase 400V				0.75 ～ 15																						

High-performance Inverter VF-AS1

Features

- **Standardized Built-in DC reactor** (200V-11Kw ～ 45kW, 400V-18.5kW ～ 75kW)
- **Standardized Built-in Noise filter** (200V-0.4Kw ～ 45kW, 400V-0.75kW ～ 500kW)
- **Easy setting, Simple choice of parameter with 'Easy key' function**
- **Space-saving using Side-by-side installation**

Capacity Range

Input Voltage Class	Applicable motor Output (kW)																											
	0.1	0.2	0.4	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	200	220	280	355	400	500
Three Phase 200V			0.4 ～ 45																									
Three Phase 400V				0.75 ～ 500																								

■ : Induction motor control range

Reduction of noise influence on an external equipment. [VF-S15] [VF-AS1]

Standardized built-in noise filter in each models.

Unnecessary noise will be cut down without an external noise filter installed.

* EMC Directive compliant noise reduction filter is built-in upon on voltage and capacity.

■ Example of built-in EMC filter (VF-AS1)

■ Effect of built-in filter

Example of noise occurrence data

EN61800-3 1st Environment Category C2
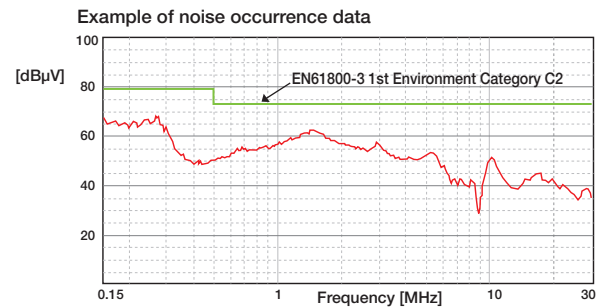
Contribution to Miniaturize control panel and Optimize necessary power capacity [VF-AS1]

(200V-11kW ～ 45kW, 400V-18.5kW ～ 75kW)

The new built-in DC reactor makes it possible to save wider space in comparison to install an external option.

This built-in DC reactor reduces Harmonics and Input electric current so that Transformer, Circuit breaker and electric wire size can be smaller. These advantages let your control panel become smaller and optimize necessary power capacity.

■ Effect of built-in DC reactor

Input current

Input current · Voltage waveform

Conventional model (400V-30kW)	VF-AS1 (400V-30kW)
Input current value 87.6A	Input current value 58.8A
Total input power factor 59%	Total input power factor 88%
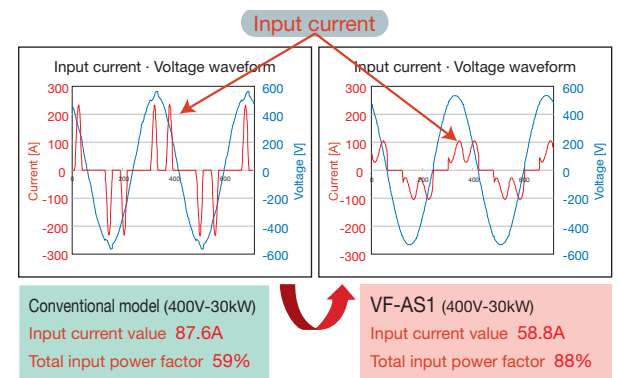
Simple sequence control function [VF-S15] [VF-AS1]

Programming up to 28 steps is possible with parameter on the inverter VF-AS1 series.

'My function' enables logical operation, internal data operation and complex terminal input.

Sample 1: One terminal can take three signals at the same time such as 'Forward run', 'Preset speed operation' and 'Acceleration/Deceleration pattern selection' etc. Without 'My function, only 1 terminal is necessary though 3 terminals are normally necessary.

Sample 2: Acceleration/Deceleration time can be changed by hand based on load with an external 0 ～ 10V signal (Volume etc.).

* VF-S15 has an easy programming function 'My function-S'

My function

Programming	: 28 steps
Internal relay	: 8 points
Internal counter	: 2 points
Logic order	: ST, STN, AND, ANDN, OR, ORN, SET, RSET, HOLD
Data order	: EQ, NE, GT, GE, LT, LE, ASUB

Precautions

To users of IPM motor · Drive system

In comparison to standard induction motor, IPM motor has outstanding performance such as highly efficiency, compact and lighter weight. On the other hand, there are some differences from the standard induction motor; therefore the following attentions are necessary in case of model selection and operation.

* Technical consideration about IPM motor and Inverter combination is necessary in advance. (Evaluation test for all of combinations on this catalog has been complete)
* When you consider using IPM motor or drive system, please contact us.

1   IPM motor cannot be operated with commercial power supply.

Generally, revolving magnetic field occur within a certain load angle towards the rotor part. Therefore, Inverter (Driver) is required to drive the IPM motor. When the IPM motor is driven with commercial power supply, the rotor on the IPM motor will fail to step-out which means it will damage the IPM motor or trip a contact breaker on the primary side because of excessive electric current.

2   IPM motor has a generation action

When a shaft part of IPM motor is rotated by external power, voltage tends to cause the terminals on IPM motor (Generation action), IPM motor becomes a 'so-called Generator' and will generate Voltage Frequency according to the rotating speed. For example, a 4P-1.5kW-200V of IPM motor is rotated by external power at 1,800min-1,it will generate 200V-60Hz; at 900min-1, it will generate 100V-30Hz. The rated speed will exceed, for example, 2,700min-1 will cause 300V-90Hz.
When IPM motor receives exceeded power than the rated value from an equipment or a machine connected to the IPM motor, an inverter (same voltage 200V class as IPM motor) connected to the IPM motor for control can be damaged because of overcurrent. In order to prevent those accidents, it is necessary to be careful with generated voltage on motor and inverter terminal when IPM motor is connected to an equipment or a machine (E.g.: fan etc.) that is able to give external power to the IPM motor. Furthermore, counter measure for overcurrent such as installation of a circuit breaker between an IPM motor and an inverter, installation of a mechanism to restrain the rotation by external power or sending an operation signal only when the inverter drives is necessary.

3   Maintenance of IPM motor

IPM motor has permanent magnet, therefore different attentions from standard induction motor are required when taking an IPM motor apart for maintenance.
When a rotor of IPM motor is pulled out, foreign substances such as metal powders and metal piece can be attached on the rotor. Please do not pull out the rotor when disassembling the IPM motor (up to bearing replacement) for maintenance. If a rotor is pulled out, magnetic flux from the magnet on the rotor can cause an influence around or the rotor can fly out of its IPM motor and lead to a man-made accident.
Please contact us to request maintenance for IPM Motor.

4   Precautions for inverter

- One unit of inverter cannot operate multiple units of IPM motor.
- In IPM motor control mode, a rotor on IPM motor can fail to step-out when load torque exceeds allowable output torque of IPM motor. In this case, protection function on inverter often does not work properly depending on the condition of load torque on IPM motor.
- Please install a circuit breaker on the input side of the inverter.
  Please use a circuit breaker based on protection coordination and power supply.
- Before touching terminals, please perform the following steps.
  (1) Shut down all input power to the inverter and confirm a IPM motor is not running
  (2) Wait at least 15 minutes and confirm that the charge lamp of inverter is no longer lit
  (3) Use a tester that can measure DC voltages and check that the voltage to the DC main circuits
- Please stop a running IPM motor before setting the parameter.
  Do not touch or be close to a moving part of an IPM motor and a machine/equipment while setting the parameter.
- Please follow an inverter instruction manual for other instructions.

To users of our product

TOSHIBA