TOSHIBA
Leading Innovation

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.
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.

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*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.

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

<table>
<thead>
<tr>
<th>Electric energy (MWh/year)</th>
<th>Power rates (US$/year)*</th>
<th>CO₂ Decrease (ton/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.5kw</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47 MWh (14 MWh Reduction!)</td>
<td>US$ 7,500-</td>
<td>US$ 2,200- 7.1 ton</td>
</tr>
<tr>
<td><strong>15kw</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>127 MWh (36 MWh Reduction!)</td>
<td>US$ 20,400-</td>
<td>US$ 5,900- 18 ton</td>
</tr>
<tr>
<td><strong>90kw</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>721 MWh (201 MWh Reduction!)</td>
<td>US$ 115,400-</td>
<td>US$ 32,200- 103 ton</td>
</tr>
</tbody>
</table>

* 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) CO₂ emission coefficient:0.51 kgCO₂/kWh

* (kgCO₂/kWh) Use edge of CO₂ 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.

Examples of loss comparison between IPM motor and Standard induction 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)

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

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 ①attracts 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.
### IPM MOTOR TYPE FORM DESCRIPTION

<table>
<thead>
<tr>
<th><strong>TYPE</strong></th>
<th><strong>None</strong></th>
<th><strong>Indoors</strong></th>
<th><strong>Outdoors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>W</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>C</strong></td>
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</tr>
<tr>
<td><strong>B</strong></td>
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<td></td>
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</tr>
<tr>
<td><strong>F</strong></td>
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<td></td>
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<tr>
<td><strong>T</strong></td>
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<td></td>
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</tr>
<tr>
<td><strong>A</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Y</strong></td>
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<td></td>
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<tr>
<td><strong>L</strong></td>
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<td></td>
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</tr>
</tbody>
</table>

### IPM Motor Standard Specification

**Capacity (kW)**

<table>
<thead>
<tr>
<th>Frame No.</th>
<th>0.4</th>
<th>0.75</th>
<th>1.5</th>
<th>2.2</th>
<th>3.7</th>
<th>5.5</th>
<th>7.5</th>
<th>11</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>71M</td>
<td>11M</td>
<td>80M</td>
<td>90L</td>
<td>100L</td>
<td>112M</td>
<td>132S</td>
<td>132M</td>
<td>160M</td>
<td>160L</td>
</tr>
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</table>

**Type**

<table>
<thead>
<tr>
<th>FORM</th>
<th>FBKAW / FCKAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLES</td>
<td>4P / 6P</td>
</tr>
</tbody>
</table>

**Rated Voltage (V)**

| 400 |

**Rated Current (A)**

| 0.75 | 1.3 | 2.55 | 3.65 | 6.1 | 10.3 | 13.9 | 20.8 | 28.25 |

**Rotating Speed (min⁻¹)**

| 1800 (min⁻¹) |

**Maximum Speed (min⁻¹)**

| 2160 (min⁻¹) |

**Degree of Protection**

| FPP |

**Cooling Method**

IC411 (Totally Enclosed Fan-Cooled)

**Installation Method**

IMB3

**Thermal Class**

Class B

**Temperature-rise**

| 85K [B] |

**Ambient Conditions**

- **Ambient Temperature**
  - -10°C~40°C (Operating temperature range)
- **Ambient 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
- **Coating Color**
  - Equals to Munsell N1.5
- **Applied Standard**
  - JE / JEC / JEM (JEC-2100-2008)
- **Applied Efficiency**
  - IE4 (IEC60034-30 Ed.2; under deliberation)
- **Efficiency (%)**
  - 88.3 92.3 90.4 92.5 94.1 94.2 93.7 94.3

**Reduced Torque Mode Solutions**

- Set up inverter by following recommended parameters with motor
- Solutions

**Rated Torque**

| 180-1800min⁻¹ |

**Inverter**

<table>
<thead>
<tr>
<th>Form</th>
<th>VFS15</th>
</tr>
</thead>
</table>

**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 |

**Applied Motor (kW)**

| 1.1 | 1.8 | 3.1 | 4.2 | 7.2 | 10.9 | 13 | 21.1 | 25.1 |

**Output Capacity (kVA) [Nom]**

| 1.5 | 2.3 | 4.1 | 5.5 | 9.5 | 14.3 | 17 | 27.7 | 33 |

**Output Current (A) [Nom]**

| 1.5 | -1.5 | 2.1 | -3.7 | 5.5 | -8.6 | -13 | -17 | -25 | -30 |

**Rated output current (A) [Nom]**

| 3-phase 380V to 500V |

**Overload current rating**

| 150% - 60 seconds, 200% - 0.5 second |

**Voltage-Frequency**

| Voltage 380V to 500V - 50/60Hz |

**Allowable fluctuation**

| Voltage 380V to 500V [±0.5%], frequency ± / 5% |

**Protection degree (IEC60529)**

| IP20 |

**Cooling method**

| Forced air-cooled |

**Built-in filter**

| EMC filter |

**Detecting magnetic pole position**

| Yes |

**Controlling of maximum efficiency**

| Yes |

**Auto-restart operation**

| Possible |

*1: Inverter specifications are standard ones, setting up parameters and power conditions 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.

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 European EMC Directive IEC/EN61800-3, 1st environment, category C2 or IEC/EN61800-3, 2nd environment, category C3
### SPECIFICATIONS

#### IE4 SUPER PREMIUM EFFICIENCY COMPATIBLE PRODUCT

<table>
<thead>
<tr>
<th>Type</th>
<th>VFAS1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>4185PL</td>
</tr>
<tr>
<td></td>
<td>4220PL</td>
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<tr>
<td></td>
<td>4300PL</td>
</tr>
<tr>
<td></td>
<td>4370PL</td>
</tr>
<tr>
<td></td>
<td>4450PL</td>
</tr>
<tr>
<td></td>
<td>4550PL</td>
</tr>
<tr>
<td>Input Voltage Class</td>
<td>3-phase 400V</td>
</tr>
<tr>
<td>Applicable Motor (kW)</td>
<td>18.5 22 30 37 45 55</td>
</tr>
<tr>
<td>Output Capacity (kVA)</td>
<td>31 37 50 60 72 88</td>
</tr>
<tr>
<td>Output Current (A)</td>
<td>41 48 66 79 94 116</td>
</tr>
<tr>
<td>Rated output current (A)</td>
<td>41 48 66 79 94 116</td>
</tr>
<tr>
<td>Overload current rating</td>
<td>150% - 1 minute</td>
</tr>
<tr>
<td>Voltage-frequency</td>
<td>3-phase, 380 to 480 V, 50/60 Hz</td>
</tr>
<tr>
<td>Allowable fluctuation</td>
<td>Voltage +10% - 10% / -5%</td>
</tr>
<tr>
<td>Dynamic Braking Circuit</td>
<td>Built-in</td>
</tr>
<tr>
<td>Dynamic Breaking Resistor</td>
<td>Compatible with external options</td>
</tr>
<tr>
<td>Protective method</td>
<td>IPO encased type (IE4130)</td>
</tr>
<tr>
<td>Cooling method</td>
<td>Forced air-cooled</td>
</tr>
<tr>
<td>Cooling fan noise (dBA)</td>
<td>60 60 64 64 64 64</td>
</tr>
<tr>
<td>Color</td>
<td>RAL7016</td>
</tr>
<tr>
<td>Built-in filter</td>
<td>EMI noise filter</td>
</tr>
<tr>
<td>DC Reactor</td>
<td>Built-in</td>
</tr>
<tr>
<td>Detecting magnetic pole position</td>
<td>Yes</td>
</tr>
<tr>
<td>Controlling of maximum efficiency</td>
<td>Yes</td>
</tr>
<tr>
<td>Auto-restart operation</td>
<td>Not available currently.</td>
</tr>
</tbody>
</table>

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

**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.

**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% - 15% overload allowable (IEC60721-3-1, 2005).

**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 European EMC Directive IEC/EN61800-3, 1st environment, category C2 or IEC/EN61800-3, 2nd environment, category C3.

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#### INVERTER TYPE FORM DESCRIPTION

**VF AS1**

- **VF:** INVERTER/VF series
- **AS1:** 515 series
- **S15:** 515 series
- **AS1:** AS1 series
- **P:** 200V class
- **M:** 400V class
- **2:** No filter
- **370:** 370 series
- **P:** Built-in high-termination EMI filter
- **M:** Built-in low-pass filter

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**SMC**

- **G01:** 0.4kW
- **G02:** 0.75kW
- **G03:** 1.5kW
- **G04:** 2.2kW
- **G05:** 3.7kW
- **G06:** 5.5kW
- **G07:** 5.6kW
- **G08:** 7.5kW
- **G09:** 11kW
- **G10:** 18.5kW
- **G11:** 22kW
- **G12:** 30kW
- **G13:** 37kW
- **G14:** 45kW
- **G15:** 55kW

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**F01**

- **G01:** 0.4kW
- **G02:** 0.75kW
- **G03:** 1.5kW
- **G04:** 2.2kW
- **G05:** 3.7kW
- **G06:** 5.5kW
- **G07:** 7.5kW
- **G08:** 11kW
- **G09:** 18.5kW
- **G10:** 22kW
- **G11:** 30kW
- **G12:** 37kW
- **G13:** 45kW
- **G14:** 55kW
Outline & Dimension

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

<table>
<thead>
<tr>
<th>Capacity Range</th>
<th>Input Voltage</th>
<th>Class</th>
<th>Applicable motor Output (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Pass. 900</td>
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</tr>
<tr>
<td>Low Pass. 500</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>High Pass. 5</td>
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</tbody>
</table>

High-performance Inverter **VF-AS1**

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

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

Standardized built-in noise filter in each models.

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

Example of noise occurrence data

Effect of built-in filter

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.

Example of built-in DC reactor

Effect of built-in DC reactor

Simple sequence control function  **VF-S15**  **VF-AS1**

Programming up to 28 steps is possible with parameter on the inverter VF-S15 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’
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.

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

Please read the instruction manual before installing or operating motor and inverter.

This product is intended for general purpose uses in industrial application. It cannot be used applications where may cause big impact on public uses, such as power plant and railway, and equipment which endanger human life or injury, such as nuclear power control, aviation, space flight control, traffic, safety device, amusement, or medical.

It may be considerable whether to apply, under the special condition or an application where strict quality control may not be required. Please contact our headquarters, branch, or local offices printed on the front and back covers of this catalogue.

When exporting Toshiba motor and inverter separately or combined with your equipment, please be sure to satisfy the objective conditions and inform conditions listed in the export control policies, so called Catch All restrictions, which are set by the Ministry of Economy, Trade and Industry of Japan, and the appropriate export procedures must also be taken.

Please use our product in applications where do not cause serious accidents or damages even if product is failure, or please use in environment where safety equipment is applicable or a backup circuit device is provided outside the system.

None of Toshiba, its subsidiaries, affiliates or agents, shall be liable for any physical damages, including, without limitation, malfunction, anomaly, breakdown or any other problem that may occur to any apparatus in which Toshiba motor is incorporated or to any equipment that is used in combination with Toshiba Motor. Nor shall Toshiba, its subsidiaries, affiliates or agents be liable for any compensatory damages resulting from such utilization, including compensation for special, indirect, incidental, consequential, punitive or exemplary damages, or for loss of profit, income or data, even if the user has been advised or apprised of the likelihood of the occurrence of such loss or damages.

For further information, please contact your nearest Toshiba Representative or International Operations-Producer Goods.

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