

Electric Energy Saving and Reliability Improvements using Inverters & new- generation IPM motor

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1. Electric Energy Saving

Textile factory use much electric energy not only at the processing machine like Dryer, Stenter but also facilities like HVAC .

Save electric energy leads

A: Save electric cost

B: Global warming prevention

1. Electric Energy Saving

Electric energy is used for lights, computers, motors and others.

Motor is most common equipment to change electric energy to Kinetic energy and equipment that use large amount of electric energy

Save the electric energy used at motor is one of the key factors of the electric energy saving.

1. Electric Energy Saving

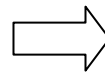
Using inverter is already popular way to save the electric energy used on motor especially for the variable torque applications like fans or pumps.

On the variable torque application, required energy is proportional to the cubic of the speed.

To control the motor speed directly by inverter leads much energy saving.

Example

Motor speed $\rightarrow 1/2$



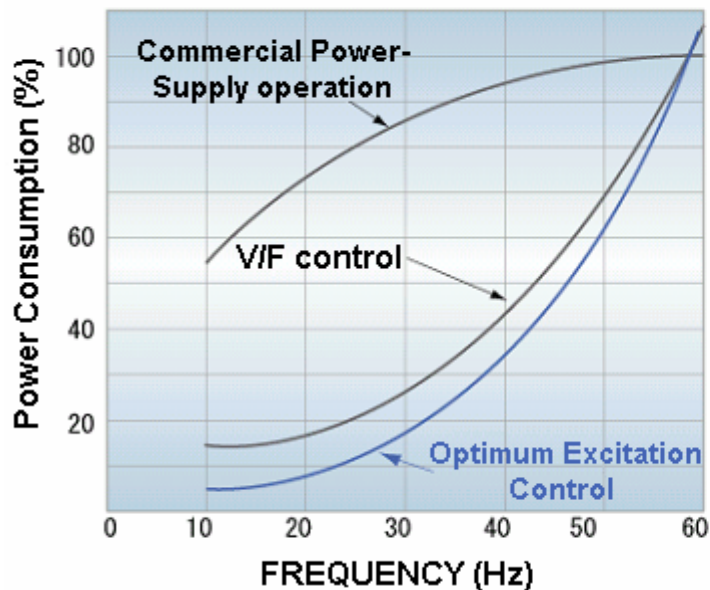
Motor output power $\rightarrow (1/2)^3 = 1/8$

2. More Energy Savings

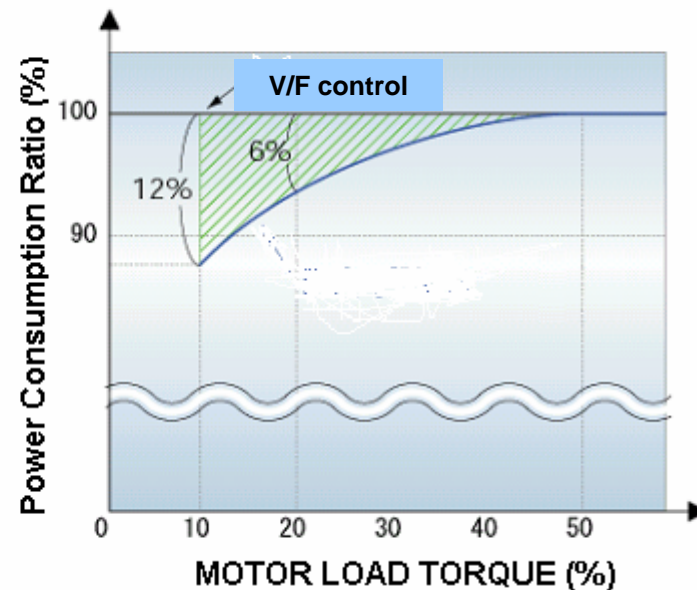
(1) Improve the motor control method

By controlling the excitation current to be at its optimum continuously, the motor runs at the highest efficiency thus enabling maximum energy savings. “Optimum excitation control” is used in new series.

Ex. of Blower Operation Characteristics



Ratio of Motor Power Consumption



2. More Energy Savings

The effect of energy savings can be confirmed using the operation panel, output signals and via networks with the newly developed energy saving monitoring functions.

Ex. of Power Savings Monitor Display



【 Energy Savings Monitor List 】

-
- Power savings monitor (kW)
 - Power savings rate (%)
 - Power savings amount (kWh)
 - Power savings amount (\$)
 - Power savings average value (kW)
 - Power savings rate average value (%)
 - Power savings amount average value (\$)
 - Annual power savings amount (kWh)
 - Annual power savings amount (\$)
-

2. More Energy Savings

(2) Use high efficiency motor

To save the electric energy used by motor, improve the motor efficiency is another method. Most of the motor manufacturer already develop high efficiency motor and the high efficiency motor is recommended to use in many place.

If a motor which efficiency is higher than the high efficiency motor and it can be controlled by inverter, isn't it suitable for the energy saving?

2. More Energy Savings

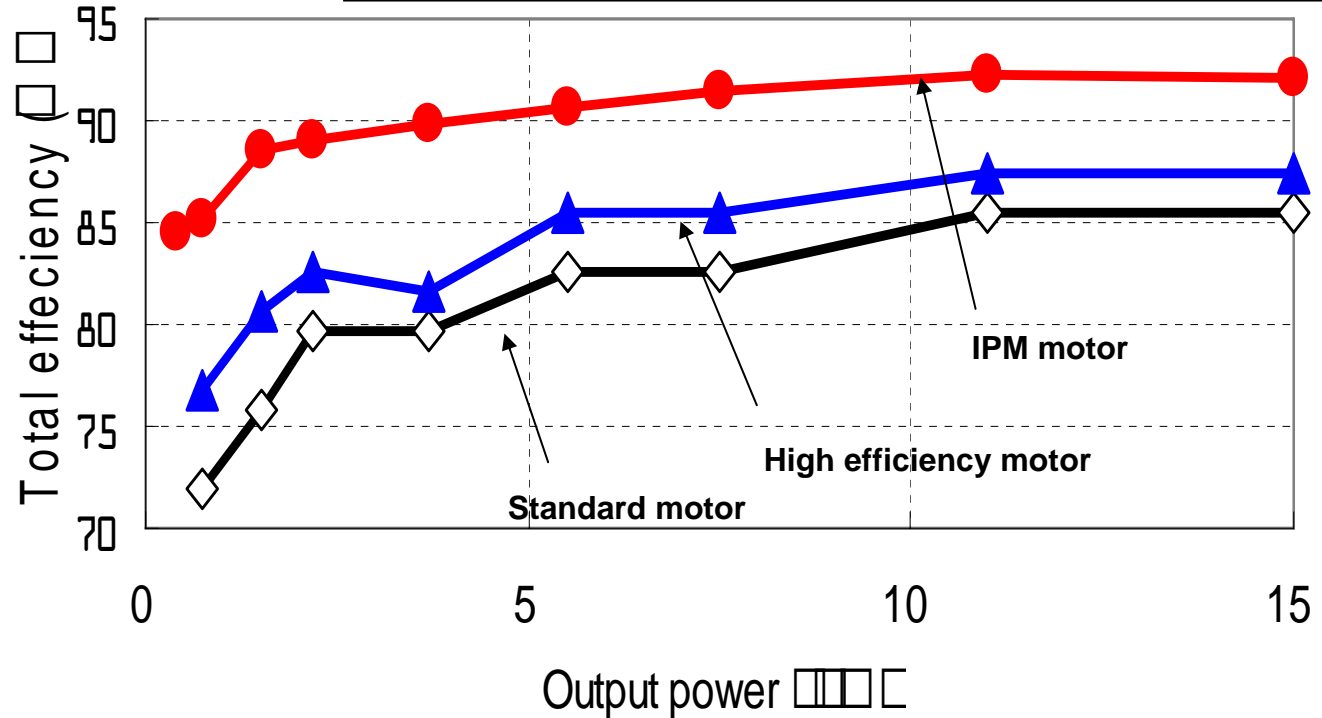
(2) Use high efficiency motor

The IPM motor that permanent magnet is buried in the rotor has higher efficiency than the high efficiency induction motor. To drive this IPM motor that does not have encoder with inverter achieves more effective energy saving than the inverter drive of the high efficiency motor.

2. More Energy Savings

(2) Use high efficiency motor Efficiency comparison

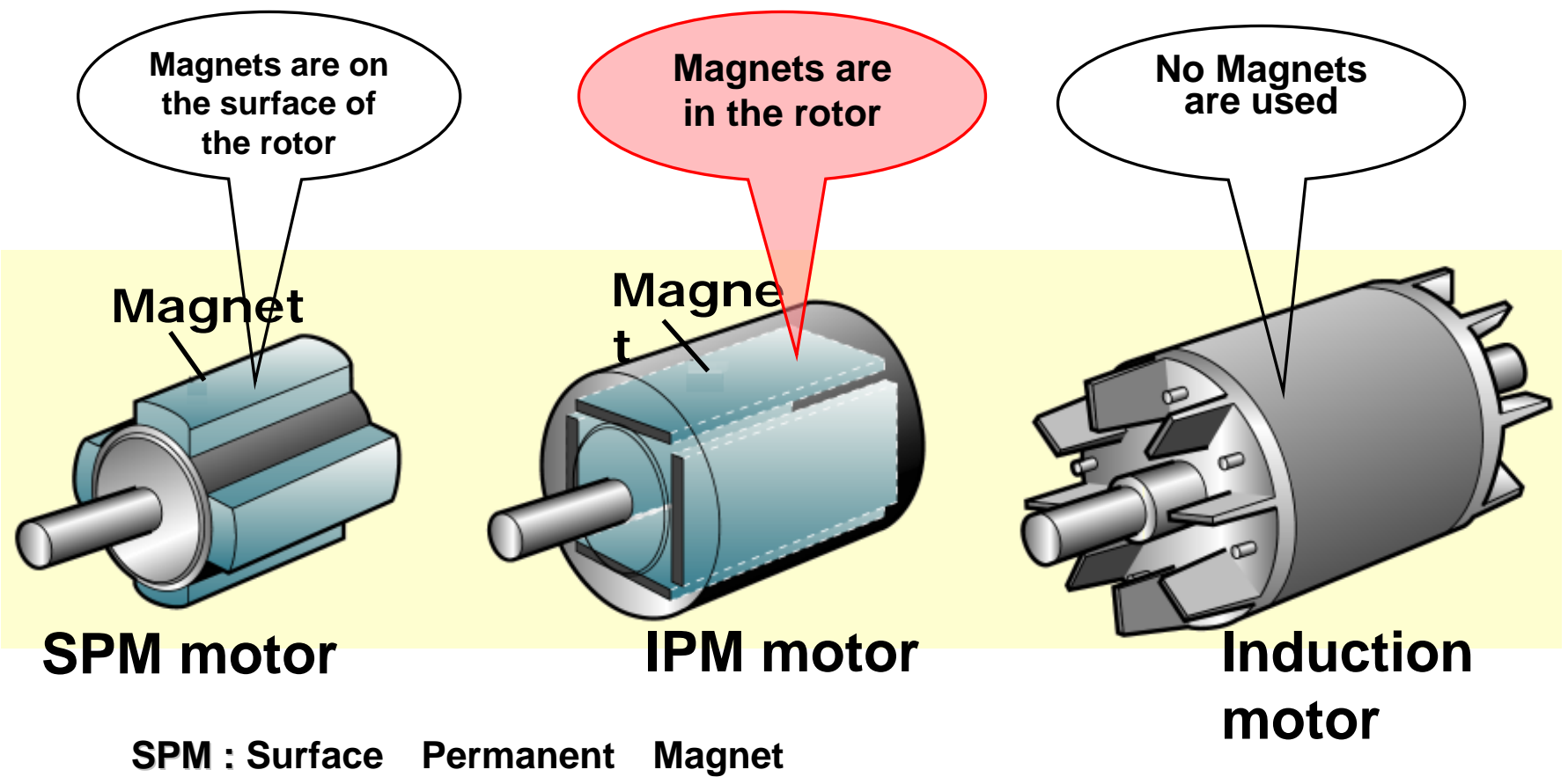
Around 7% higher than the high efficiency motor
Around 10% higher than the standard motor



Inverter control, at rated speed and at rated load

2. More Energy Savings

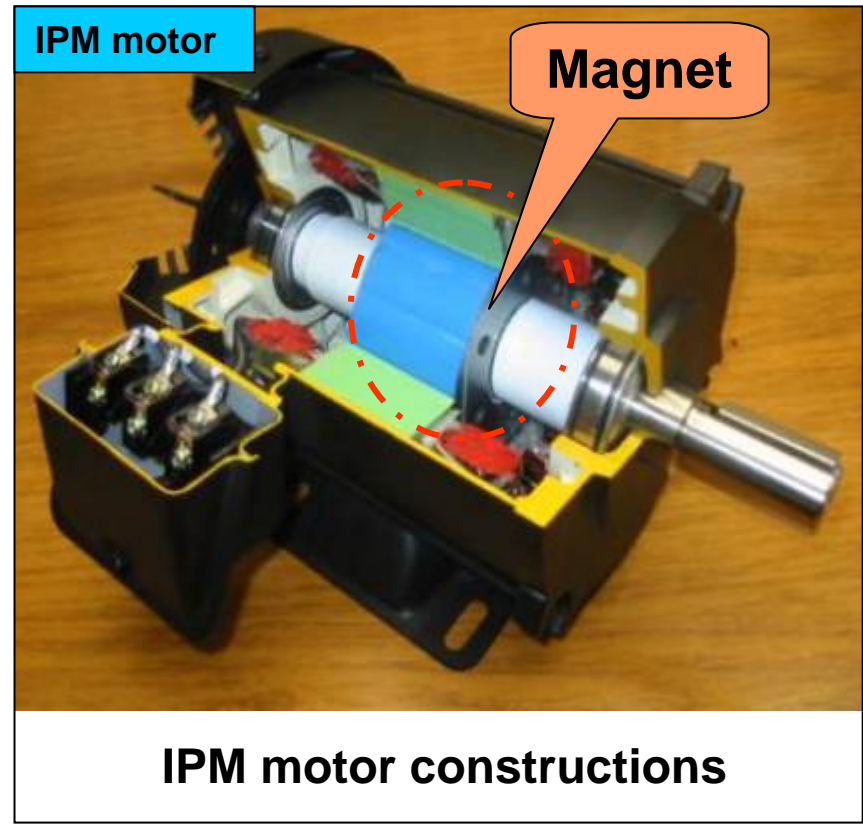
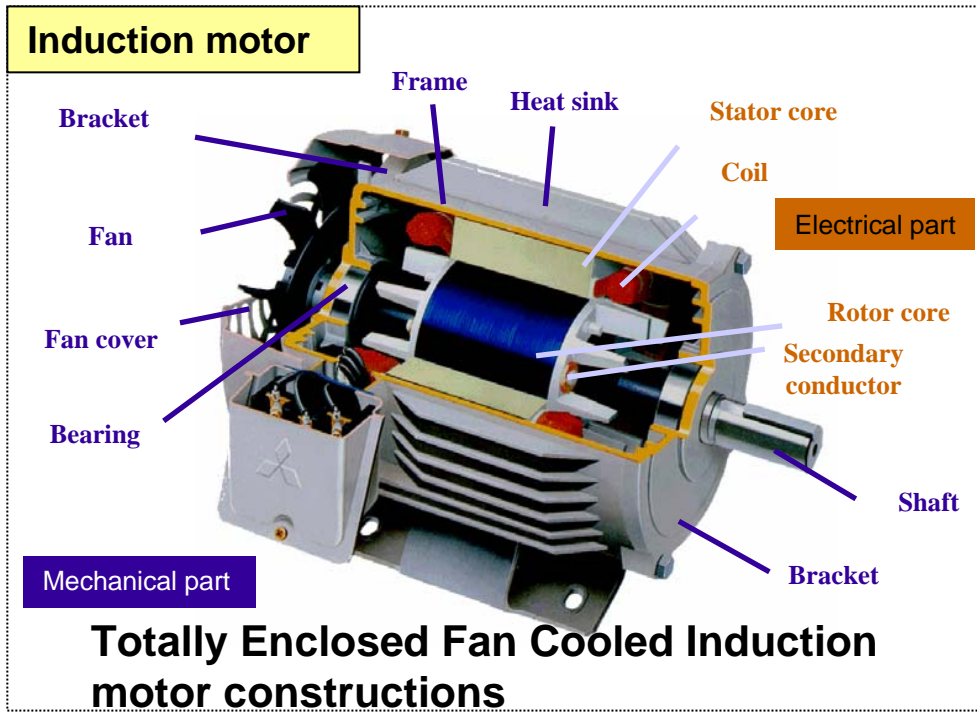
(3) What is the IPM motor?



2. More Energy Savings

(3) What is the IPM motor?

IPM motor constructions



- High efficiency and small dimensions
As the current does not run in rotor, high efficiency is obtained.
- Synchronous speed operation
As the slip does not exist, the motor speed is synchronized to the input frequency

Other features of IPM

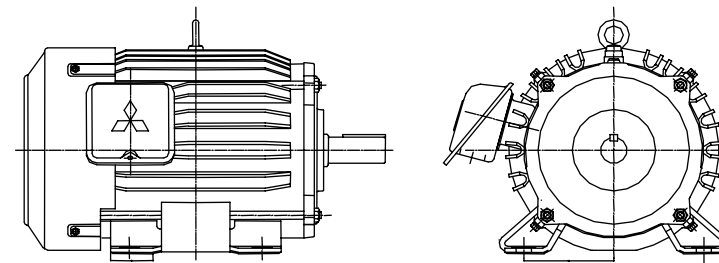
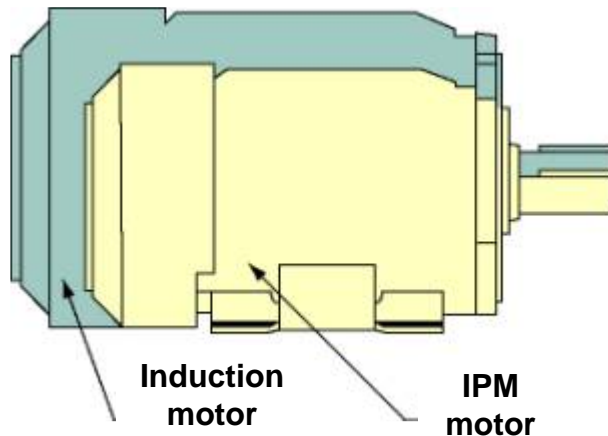
A: Small and lightweight

As the IPM motor is high efficiency, the motor loss is small and possible to make motor small and lightweight.
Compare with our standard motor (7.5kW)

Length:79%

Volume:58

Weight:63

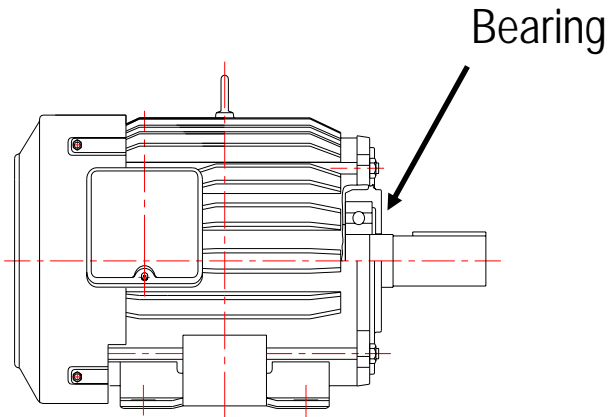


Outline

Other features of IPM

B: Motor grease life is extended

As the rotor loss is small, bearing temperature is reduced and grease life is extended.



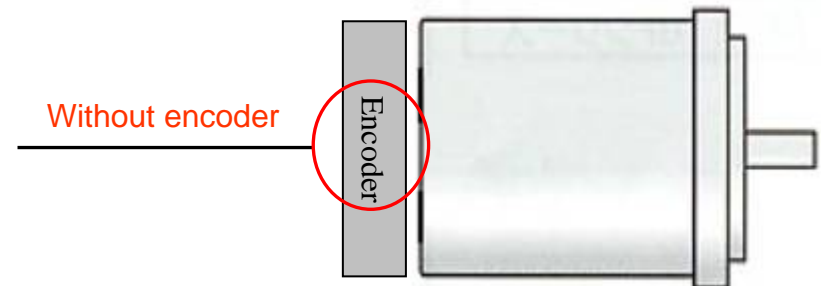
	Grease life
Induction motor 3.7□W	50 thousand hours
IPM motor 3.7□W	60 thousand hours

1.2 times

Rated load, 1800r/min, ambient temperature 40 degree C

C: High reliability “sensorless control”

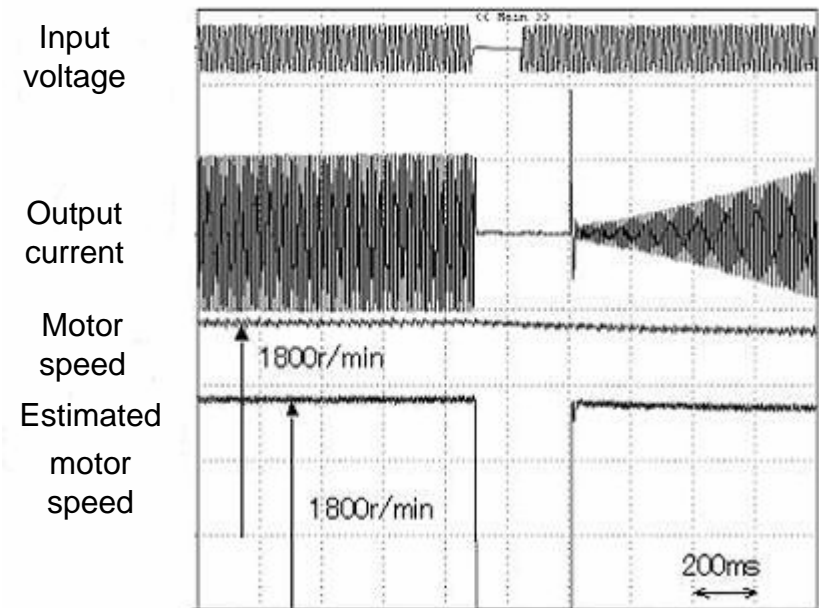
Magnet position can be detected by the drives.
Possible to run the motor without encoder.



Other features of IPM

D: Catch up the motor speed after instantaneous power failure

Even the encoder is not used, it is possible to sense the motor speed and magnet position of the rotating motor. No need to worry about the instantaneous power failure.



Other features of IPM

A: Synchronous speed operation

As the slip does not exist, the motor speed is synchronized to the input frequency.

B: 150% start torque is available (Standard type)

150% start torque is available for standard type.

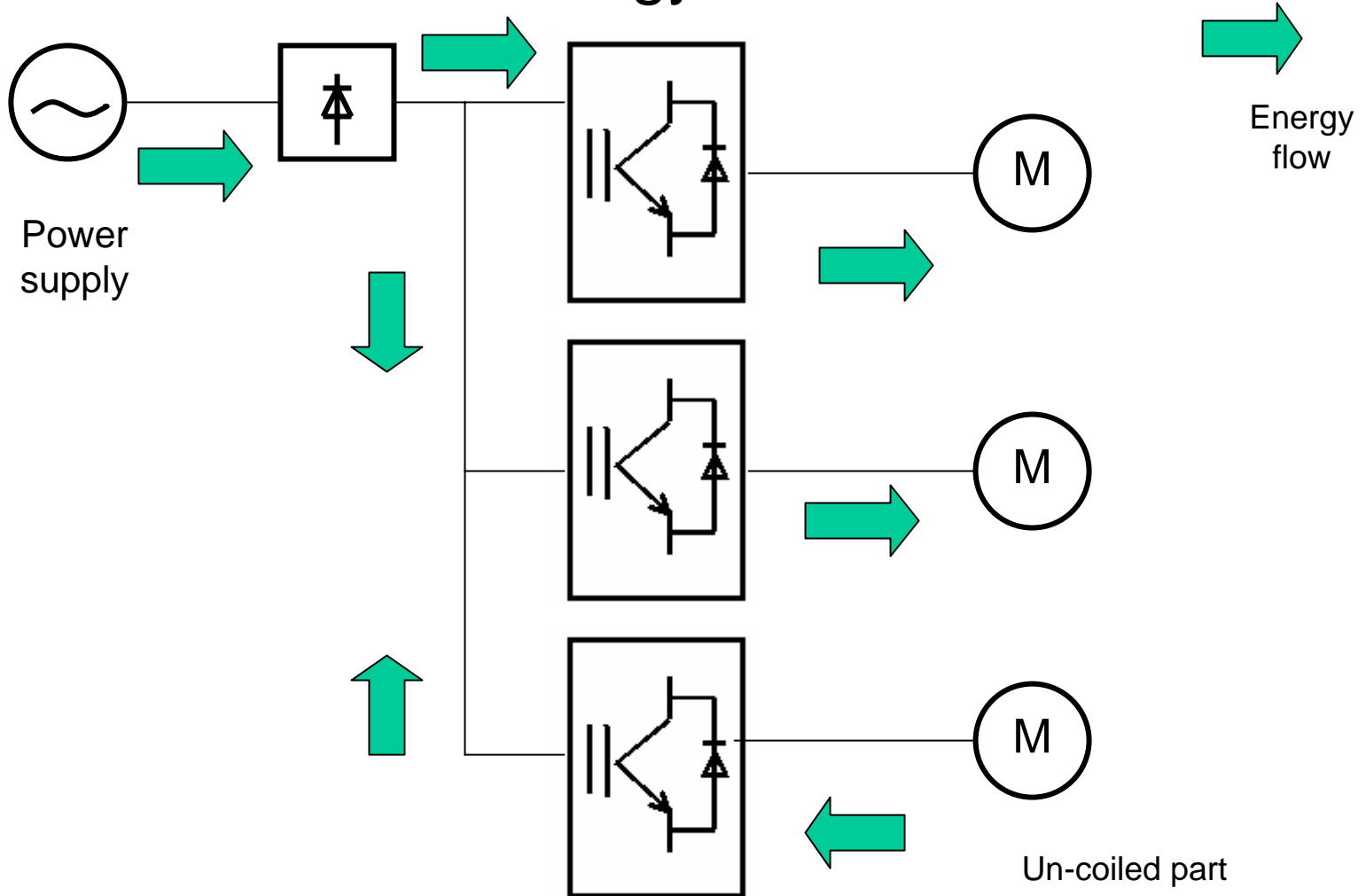
(120% for high-speed type)

C: High speed-type is also line up

Line up constant torque 7,200rpm type and 10,000rpm type

2. More Energy Savings

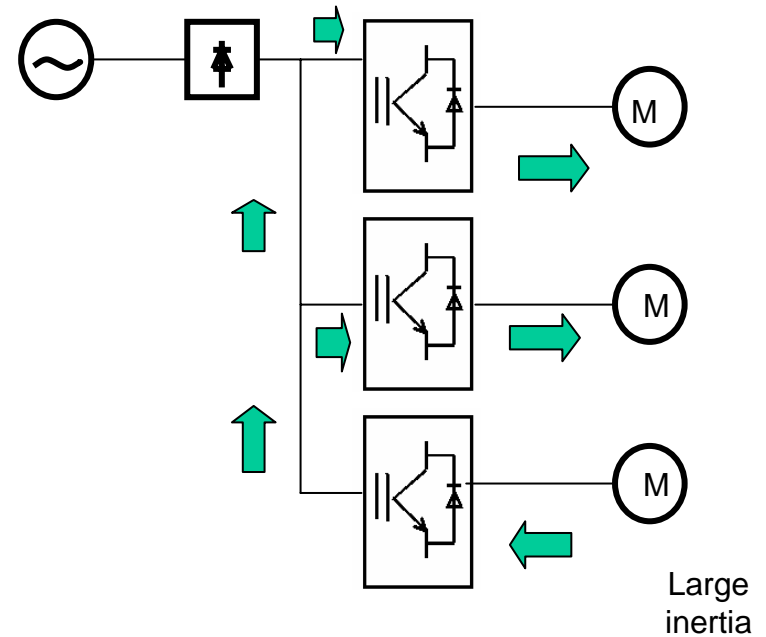
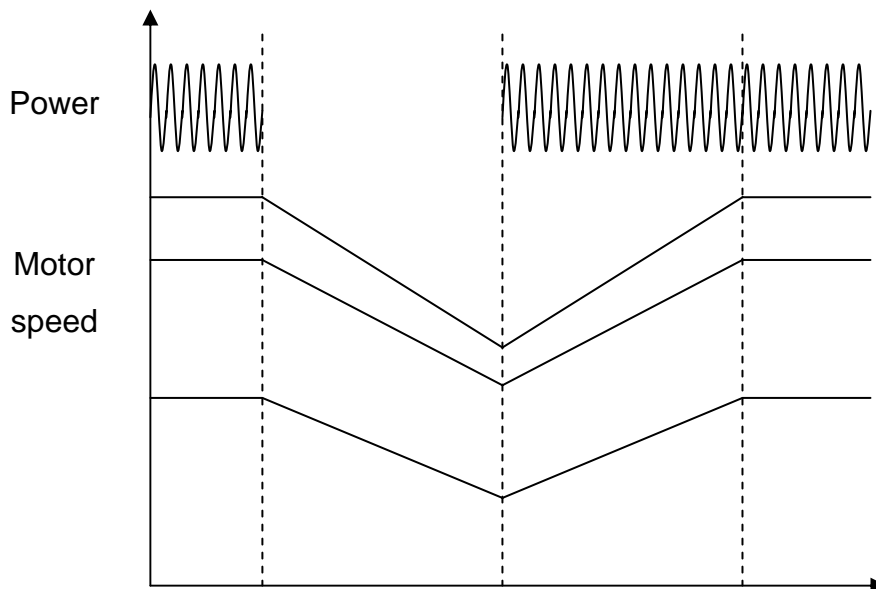
(4) Return the kinetic energy to other motors



2. More Energy Savings

Use the kinetic energy to operate motor while power failure

Common DC bus is also suitable for continues operation while power failure. To decelerate all motors to keep the speed ratio constant, the kinetic energy of large inertia load can be used for all motor.



3. Improve Reliability and Maintainability:

To improve reliability and maintainability of the inverter system, following points are key points.

- (1) Extend the components life.
- (2) Pre-alarm the component life before it comes.
- (3) Easy replacement of parts or inverters to minimize the replacement period.
- (4) Notice inverter condition to factory management system.

3. Improve Reliability and Maintainability:

(1) Further extended components life

Inverter use components that have life. Targeted 10 years life in new series inverters at rated loads.

- The design life of a newly developed cooling fan has been extended to 10 years.
- The life of the cooling fan is further extended with ON/OFF control of the cooling fan.
- The design life of capacitors are also 10 years.
- Life indication of the components.

3. Improve Reliability and Maintainability:

(2) Pre-alarm the components life before it comes

Even extend the life of components, the life is not eternal. Hence provide pre-alarm function to new series inverters.

- Life of main circuit capacitor, control circuit capacitor or inrush current limit circuit can be monitored.
- Since a parts life alarm can be output by self-check function, troubles can be avoided. Especially, flupp exists in many of textile application; Pre-alarm of cooling fan helps.

3. Improve reliability and Maintainability:

(3) Easy replacement to shorten the replacement period.

When inverter output the pre-alarm of the fans, it is the time of replacement. In new designs, the fans are provided on top of the inverter and can be replaced without opening the inverter cover and also without using screwdrivers.

As the fans are located on the top of the inverter, it is not necessary to disconnect main circuit wires.

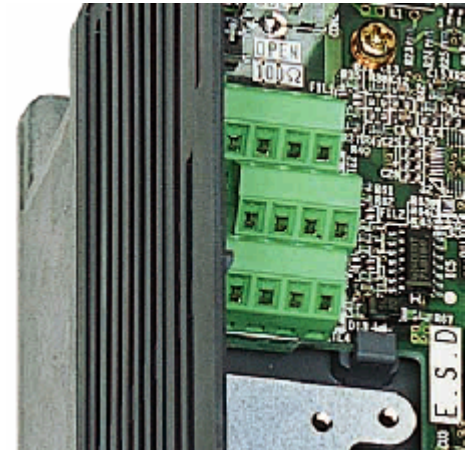


3. Improve reliability and Maintainability: (4) Notice inverter condition to factory management system through ERP Systems.

To notice the inverter condition to factory management system, using network become popular.

A: RS-485 communication

- The RS-485 terminals are equipped as standard.
- Since the inverter can be connected to the network with terminals, multi-drop connection is also easily done .



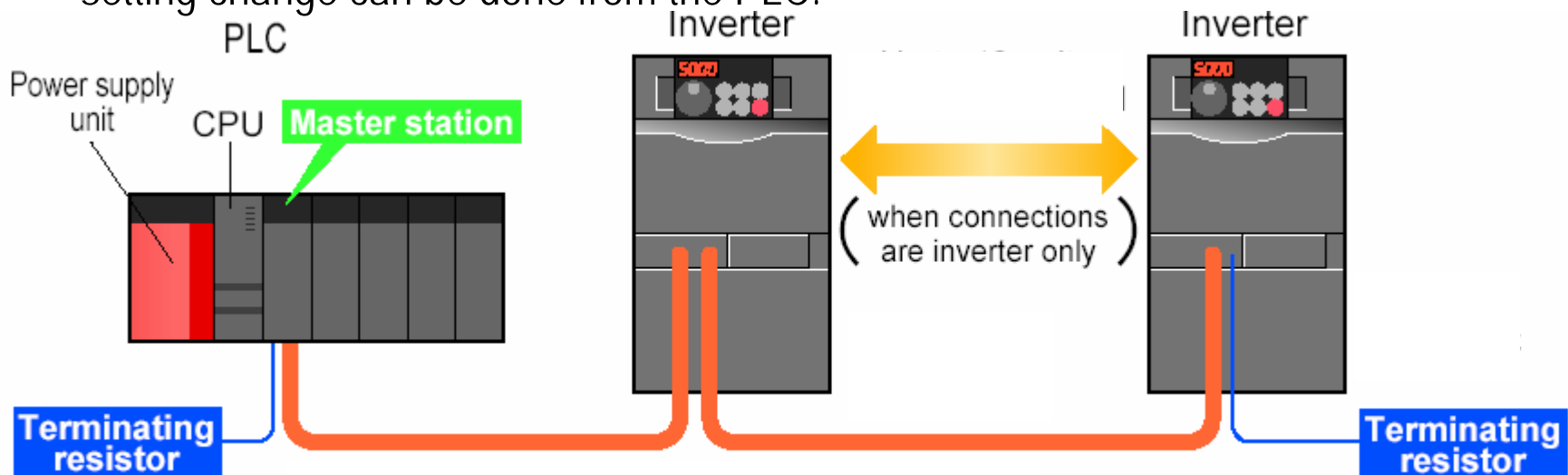
3. Improve reliability and Maintainability:

(4) Notice inverter condition to factory management system.

B: Corresponds to major networks

(High speed connectivity)

- The new series inverter can be connected to PLC with popular networks such as CC-Link, Device-NET™, PROFIBUS-DP, LONWORKS and CANOpen when communication options are used. The inverter operation, monitoring and parameter setting change can be done from the PLC.



*Thank you very much
for your attention*