MF-J-084A

LIFE PARTS FOR FR-F700/F700P SERIES INVERTER

1. Outline of inverter design life

There are no legal specifications in respect to the inverter's life. Thus, the Mitsubishi inverter is designed with a life of 10 years or more with our in-house standards.
However, the following life parts are used. So, these parts must be replaced to fulfill a life of 10 years or more

1) Cooling fan
2) Power smoothing aluminum electrolytic capacitor
3) Inrush current suppression circuit contacts (thyristor, relay, contactor)
4) Aluminum electrolytic capacitor for control circuit

Preventive maintenance of the cooling fan is possible, so always service this part.

2. Necessity of preventive maintenance

The inverter consists of many parts. The functions of the inverter will not be achieved completely unless all parts, including those above, are operating correctly. Therefore, periodic inspection is necessary to find sings of part or device faults at an early stage and take proper corrective action.
The above parts have a life, and cannot be used infinitely. If the durable period of these parts, determined according to the type, has passed, faults will occur easily in the part characteristics and operations. Thus, these parts must be replaced every time the specified replacement years have passed.

The above matter is also recommended by the Japan Electric Manufacturing Association (JEMA). A "Guide to Periodic Inspections for Inverters (Only written in Japanese)" is available from this Association.

Table 1. Guide to Inverter's Periodic Inspection and Part Replacement
(excerpt from "Guide to Periodic Inspections for Inverters")

Part name	Inspection Item	Inspection Cycle	Standard replacement years	Replacement Method, etc.
Cooling fan	Abnormal vibration/ noise	Daily	Two-three years	Replace with new part
	Connection loose	One year		
	Cleaning of air filter	One year		
Smoothing capacitor	Fluid leaking	One year	Five years	Replace with new part
	Safety valve protruding/swelling	One year		
Magnetic relay	Chatter noise during operation	One year	-	Determine upon Investigations

3. Estimated life of life parts of the Mitsubishi inverter

There are no clear guaranteed values for the service life of the parts. However, the estimated life value for the FR-F700/F700P type inverter is given below.

Table 2. <FR-F700/F700P type inverter> estimated life value of parts

No.	Life part	Estimated life	Conditions
1	Cooling fan	87,600h	Approx. 10 years (24h/day, 365 days/year) Ambient temperature 40°C
2	Power smoothing aluminum electrolytic capacitor	87,600h	Approx. 10 years (24h/days, 365 days/year) Ambient temperature 40°C Output current: Mitsubishi standard motor(4 poles) 80% equivalent of rating current
3	Contacts (thyristor, relay, contactor)	Approx. 1,000,000 times (Approx. 500,000 times for The 200V class 37K to 55K)	Approx. 100,000 times/year (at a frequency of less then 10 times an hour) Approx. 50,000 times/year (5 times or less/hour) Power ON/OFF

The above estimated life values will differ according to the inverter's environmental conditions (ambient temperature, damage, etc.) and are not guaranteed values.

3-1. Cooling fan

The life of the cooling fan depends on the wear and deterioration of the bearings used in the fan. Thus, the fan's actual operation time will be the guide for the life of the fan. If the device is continuously operated, then normally, the cooling fan must be replaced once every two to three years. For the FR-F700/F700P type inverter, the replacement interval of the fan can be extended as the service life at an ambient temperature of 40°C is about ten years.

The FR-F700/F700P series inverter has the following functions. Thus, the replacement cycle for the fan's actual use can be extended, or the fan replacement work can be simplified.

1) Cooling fan ON/OFF control selection function
   With the conventional inverter, the fan starts operating when the power is ON. However, by using the ON/OFF control function, when the temperature is high, the inverter's cooling fin temperature is detected, and the fan is operated and when the temperature is not high because of while the operation is stopped, the fan is not operated. The control as the aforementioned can be selected.
2) Introduction of removable cooling fan cassette
   By adopting a cassette type as a structure for installing the inverter unit and fan, the fan can be removed/attached easily.

3-2. Aluminum electrolytic capacitor

The life of the aluminum electrolytic capacitor changes greatly according to the ambient temperature. This life generally follows " Arrehnius' Law", and the life drops to half when the ambient temperature increases by 10°C.

The estimated life allowing for the ambient temperature conditions can be calculated with the following expression.

{Arrehnius' Law}

$$\text{Estimated life at t°C environment} = \text{life value at 40°C (Table 2)} \times 2^{(40°C-t°C)/10}$$

For the FR-F700/F700P type inverter, the estimated life value at an ambient temperature of 40°C is ten years or more.

3-3. Contacts (thyristor, relay, contactor)

The Mitsubishi inverter used a contactor (large-capacity inverters) or a relay (medium capacity inverters) for the circuit for suppressing the inrush current when the power is turned ON. (Turns ON when the power is turned ON, and turns OFF when the power is turned OFF.)

These parts have contacts, and thus, the life will drop, according as switching the contacts.

For the FR-F700/F700P type inverter, the switching life is approx.1,000,000 times. The service life is ten years or more when the power is turned ON/OFF at a frequency of 10 times or less per an hour (The switching life is approx. 500,000 times for the 200V class 37K to 55K when the power is turned ON/OFF at a frequency of 5 times or less per an hour).

In addition, a thyristor is used for the following capacities of this series. Thus, the contacts don't have a switching life.

(Note) There is no switching life when the thyristor is used, but if the power is turned ON/OFF frequently, faults could occur due to overheating of the inrush suppression circuit.

Table3. The contact that is used in FR-F700/F700P inverter

FR-F720(P)-0.75K to 11K, 18.5K to 30K FR-F740(P)-0.75K to 11K, 22K to 110K	FR-F720(P)-15K FR-F740(P)-15K to 18.5K	FR-F720(P)-37K or more FR-F740(P)-132K or more
Thyristor is used	Relay is used	Contactor is used

4. Preventive maintenance

As explained above, life parts are used for the inverter. To prevent faults from occurring, the ambient temperature, operating time, etc. required for the inverter must be considered, and preventive maintenance must be taken.

The FR-F700/F700P type inverter has the life diagnosis function (Pr.255 to Pr.259), which can check the deterioration degree of life parts. This can be used as a guideline of parts replacement.

When replacing the aluminum electrolytic capacitor or magnetic contactor, etc., the PCB and internal wiring must be removed and assembled, requiring expertise work control. Thus, contact your nearest Mitsubishi representative for parts replacement of the inverter.