

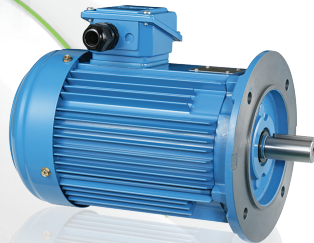
# FUKUTA®

FUKUTA ELEC. & MACH. CO., LTD.

## INDUCTION MOTOR INVERTER DUTY MOTOR

Operation Manual/Maintenance Manual

感應・變頻馬達系列使用手冊 / 保養手冊



## INDUCTION MOTOR INVERTER DUTY MOTOR



# Operation Manual

## 馬達使用手冊

### 一、外觀檢查

- 1.1 收到貨品時請先檢查是否有因運送過程而造成的損傷，若有運送造成的損傷，請馬上與客服聯繫。
- 1.2 開箱時，請確認馬達型號、馬達規格、額定電壓、頻率、型式與馬達上銘牌是否相符。
- 1.3 開箱過程請小心勿損傷馬達。
- 1.4 安裝前移除保護心軸的防鏽漆及絕緣膠帶。
- 1.5 檢查馬達外觀各部位是否有髒汙、油汙、損傷、鏽蝕...等。
- 1.6 以上檢查若有任何問題，請與客服聯繫。

### 二、安裝

- 2.1 一般標準馬達通用環境場所大致如下：

- (1) 環溫：-20~+40°C。
- (2) 濕度：相對溼度 95% 以下。
- (3) 海拔高度：1000 公尺以下。
- (4) 工業區、屋內用、無有害氣體、無液體汙染、灰塵異物少、無浸水之疑慮的環境。
- (5) 基礎足夠之剛性，無共振、衝擊之疑慮的環境。
- (6) 裝置於通風不良之屋內時，由於馬達或機械發生之熱量造成周圍溫度超過規定，須考慮良好之通風對策。
- (7) 若塵埃多時須考量以下問題之發生的可能：

**開放型馬達：**線圈及鐵心如大量附著塵埃時，將導致線圈過熱，同時由於塵埃之吸濕性，導致絕緣降低；若轉子之塵埃附著不均勻時，也可能導致動平衡失效，而加大振動。若侵入軸承內部，會導致軸承加速損壞。

**全密型馬達：**堆積於外框之散熱鰭片時，會導致散熱效果降低。

**如裝設於塵埃多之場所，務必顧慮以上情況而定期清潔。**

- 2.2 安裝馬達時，請確認各安裝孔均以鋼質螺栓、螺帽穩固地鎖定，易產生鏽蝕的場所，宜採不鏽鋼螺栓，高振動的場合宜加裝防震華司。
- 2.3 直接耦合設備時，確保馬達和負載軸準確地對心，及使用可撓性聯軸器；固定螺栓須正確的鎖緊，以防止運轉後鬆脫變動，全部鎖定後，需再確認對心正確無誤，方可運轉。
- 2.4 側向耦合負載（如皮帶輪或齒輪驅動）請確保軸端的側向拉力，不致使馬達受損，若有疑問請洽富田電機。
- 2.5 所有的安裝動作，勿使用鐵鎚重力敲打，以避免引起軸承或編碼器損壞。

### 三、連結方式

- 3.1 馬達底座或法蘭面須以適當螺栓確實固鎖緊密；使用聯軸器聯結出力軸時，須確實固定，並確認平行度、偏差在標準以內，其規範請參閱設計便覽。
- 3.2 滑輪、鏈輪或齒輪等在裝配時，應盡量靠近軸承以減少彎曲應力，與出力軸連接之鏈輪，皮帶輪等建議配合 H7 公差使用，可避免發出異聲與軸面受損。
- 3.3 聯軸器直結式傳動如兩軸同心度精度不良時，容易造成軸與軸承壞，發生嚴重不良後果，安裝時必須確實確認兩軸的同心度符合需求。
- 3.4 將聯軸器安裝到馬達之軸上，必須遵照聯軸器製造商規定之安裝程序作業，安裝時軸端不得施予過冷或過熱的溫度。

### 四、運轉

- 4.1 電線連結：所有控制及接地用之電源結線時須嚴格遵守國家電氣標準，及當地區域性規定，其結線請參照附於馬達上之結線銘牌。
- 4.2 請依照馬達銘牌電壓及頻率來確認供電電源之正確適用，除非有特定馬達可適用於馬達電壓  $\pm 10\%$ ，及頻率  $\pm 5\%$  之變動；綜合變動率：前述兩者絕對值之和在 10% 內。
- 4.3 當馬達安裝一切就緒後，需檢查線路。
  - a. 確認各線路接線正確無誤。
  - b. 使用電線之線徑是否正確，接頭有無鬆弛不良。
  - c. 除接線座外，其餘的接點應用絕緣膠帶加以包紮絕緣。
  - d. 開關器、保險絲或電磁接觸器容量是否正確，接觸器有無沾汙。
  - e. 接線箱及框架必須實施保護接地。
  - f. 啟動方式是否正確。
  - g. 開關器及啟動器是否設定於啟動位置。
  - h. 電熱器在開機運轉中請勿送電，待停機再使用。
- 4.4 運轉中不應有跳動、振動、摩擦、異音等異常現象。

## 五、注意事項


 警告，請遵守以下之安全預防措施：

如果馬達未正確的安裝、操作或保養會造成嚴重或致命的傷害；負責安裝、操作、保養及新進的人員須受完整的訓練，以了解其對於個人及其他人員之危險性。

歐盟可參考的安全資訊為：

EX60204 – 1、EN60034、EN292、EN294、IEE 配線法規。


特定的工業及國家有更進一步的安全要求，請諮詢他們的貿易及安規單位。


 馬達須接地，請參照相關的法規，諸如 EN60204 – 1、IEE 配線法規...等。


 應將馬達裝置於電源電壓變動或由於負載而使電壓下降較少之場所。


 維修時，所有連接到馬達及其附屬配件之電源須切離及拆線，轉動體部份須確認已停止。


 電容器如單相馬達裝置者，當與主電源切離後，仍可能殘留有電荷；請做任何接線前先將其放電及端子接地。

 馬達附有吊重裝置（如：吊環、吊耳）時，其僅供吊馬達本體使用；吊運馬達時，非馬達本身之組裝物件須拆除。當有一個以上之吊環（耳）則須一起使用分擔重量。

 馬達須有適當的外罩，以防止接近其旋轉體，自動起動或有自動復歸電驛或遙控啟動之場合，其啟動方式未切離時，須於四周設立標示，警告馬達可能之不預期啟動。

 安全防護及其他的保護裝置不可旁路或規避使用。


 防止馬達過載使用，最好裝設繞組溫度監測裝置；富田可於馬達繞組設溫度保護裝置，其引線可供接至控制器做自動跳脫保護。


 常閉型溫度開關的接線端子（P1、P2）須依接線圖指示接至馬達控制設備。


 馬達啟動前，須確認所有軸鍵已穩固裝妥。


 確認已有適當之安全防護，以避免剎車失效時所導致的不安全事件。

 馬達運轉之結果振動大時，將加入之電源切斷可初步判斷是屬電磁氣之振動或屬機械性之振動。

 回轉方向（由反負載端視之順時針之迴轉方向為標準迴轉方向）馬達之接線端子（U.V.W）或（1.2.3）與電源（RST）接線後，原則上由馬達之反負載端視之成順時針方向迴轉。若迴轉方向相反時，將 3 條出口線中之 2 條交換接線之。大多數馬達都可正反迴轉，但部份特殊機，如 2、4 極高速馬達或 6 極之大容量馬達，需要有一定之迴轉方向方可。

 馬達作用於可變之場合時，須確認未超過最大安全速度運轉，如有疑問請洽富田，同時請確認馬達未過載使用（低速時，採軸自帶外扇者，散熱能力降低，或須加裝輔助冷却扇）。

 如果須於馬達運轉中補給潤滑油脂時，請確認須由受過適當訓練之人員執行，且帶電體及運轉體部組已有完整的防護。

 為了確保軸承受到油層保護不致生鏽，軸必須每月一次旋轉數圈，旋轉時軸須分別施以不同方向之軸向力使其達到兩側最大的游隙端點。如果馬達停機時間超過三個月以上，軸必須每月一次旋轉數圈，以確保油脂能均勻的分佈在軸承內部。

## A. Appearance Inspection

- 1.1 Check for external damage upon receiving goods. Contact Fukuta if damage is found.
- 1.2 Check the information on the plate to see whether the motor model, specification, rated voltage, frequency, and type are correct.
- 1.3 Take out the motor from box with care to avoid damage.
- 1.4 Remove the protecting paint and tape on shaft before installation.
- 1.5 Check the motor surface for contamination of dirt, oil stain, damage or rust.
- 1.6 Contact Fukuta for any appearance inconformity.

## B. Installation

- 2.1 The general environment requirements for standard motors are as below:

1. Ambient temperature:  $-20 \sim +40^{\circ}\text{C}$
2. Relative humidity: less than 95%
3. Altitude: less than 1000m
4. Install the motor in a clean, dry, hazardous gas and substance free, and pollution free environment.
5. Install the motor on a firm ground, and in an environment free from resonance or other external impacts.
6. Ensure the motor is installed and operated in a well-ventilated area.
7. Beware of the following issues if the motor is installed and operated in dusty environment:

### **Weather Protected Motor:**

Accumulation of dust on stator and winding may cause overheating and decreasing of resistance. And accumulation of dust on rotor may cause unbalance rotation and increase vibration. The bearing may deteriorate rapidly if dust gets inside the bearing.

### **Totally Enclosed Fan Cooled Motor:**

The heat dissipation effectiveness may decrease if dust accumulate on the cooling fin.

### **\*Clean regularly to avoid the above-mentioned issues.**

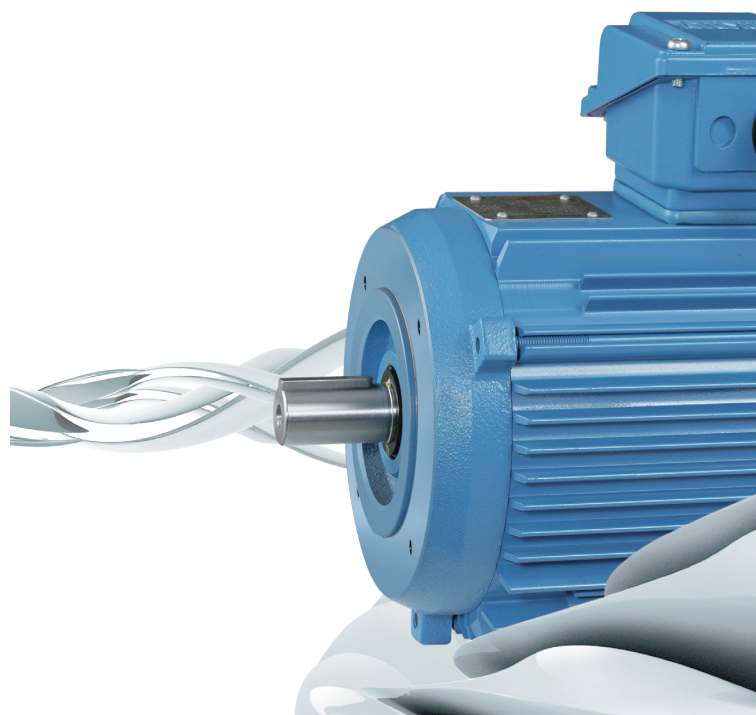
- 2.2 Ensure the motor is fastened properly when installing; use stainless steel bolts in environment that is subject to rust, and add a shake-proof washer in environment that is subject to obvious vibration.
- 2.3 Ensure the motor shaft and the load shaft of equipment are aligned properly and joined with flexible coupling when direct connection is required. Tighten the bolts properly to avoid loosening of join after starting operation. Check the alignment of shafts again after all bolts are tightened before starting.
- 2.4 Ensure the lateral force of shaft will not damage the motor when laterally coupling load is applied. Contact FUKUTA for any concern.
- 2.5 DO NOT hammer during installation to avoid damage to bearing or encoder.

### C. Connection Method


- 3.1 Tighten retaining bracket or flange properly with correct bolts. Ensure proper fixing, and parallelism and deviation are within standard when the output shaft is connected with coupling (please refer to the design specifications).
- 3.2 Install the pulley, sprocket, and gear as close to the bearing as possible to reduce bending stress. Use H7 tolerance for sprocket and pulley that connect to the output shaft, to avoid noise and damage to the shaft surface.
- 3.3 Ensure the concentricity of the shafts when using coupling for direct connection, to avoid the damage of shaft and bearing.
- 3.4 Install the coupling on motor shaft in accordance with the coupling's instruction of installation. DO NOT apply any temperature at the shaft end while installing.

### D. Operation

- 4.1 Wiring: Ensure all wire and cable connection used for control and grounding follow the NEC standard and local regulation. Please refer to the nameplate attached on the motor for connection.
- 4.2 Ensure the voltage and frequency of power supply are appropriate for intended application by checking the specification on the motor's nameplate. Unless the specific motor is suitable for voltage variation of  $\pm 10\%$  and frequency variation of  $\pm 5\%$ ; the overall rate of variation: the sum of the absolute values is 10%.
- 4.3 Check the wiring connection after installation of the motor.
  - a. Ensure each of the wiring connection is correct.
  - b. Ensure the diameter of the wire used is correct, and whether the connector is loose.
  - c. Ensure all contacts, except the terminal block, are protected and insulated with insulating tape.
  - d. Ensure the contact capacity of switch, fuse, and magnetic contactor are appropriate; check whether the contactor is clean.
  - e. Ensure the junction box and frame are grounded.
  - f. Ensure the initiating method is correct.
  - g. Ensure the switch and the starter are set in correct position.
  - h. DO NOT supply power to the space heater (if the motor has) during operation.
- 4.4 Ensure no abnormal phenomenon such as jumping, vibrating, rubbing, or noise making is occurred during operation.



















## Precautions

 **WARNING!** Please follow the safety precautions below:

Ensure the person(s) appointed for installation, operation, or maintenance is trained properly, and understand the risk and dangerousness of assigned task to the person and the surrounding; improper installation, operation, or maintenance may cause serious or fatal injury.

Please consult local authority and regulations for the appropriate safety requirement and guideline for that country. For European countries, please refer to EN60204-1, EN60034, EN292 and EN294 of European Standard, and IEE wiring regulation.

-  Ground the motor properly in accordance with relative regulations such as EN60204-1 and IEE wiring regulations.
-  Install the motor in a place where voltage variation is low or voltage drop due to load is less.
-  Disconnect all power supply wirings to the motor and its attachment before maintenance work. Make sure all rotating or moving body is not in motion.
-  Discharge the capacitor of single-phase motor and ground the terminal after disconnecting the main power before any wiring work, for there may be residual charge.
-  Use the eye bolt(s) for lifting and moving the motor only. Disassemble parts that are not belong to the motor before lifting. Make sure all eye bolts on the motor are used for better distribution of load.
-  Cover the motor properly to prevent from getting close to the rotating part. Place warning sign and notice around if the motor is automatic controlled or remote controlled that may start unexpectedly.
-  DO NOT remove or bypass any safety protection and measure.
-  Install the winding temperature detector to prevent overloading. Connect the trip wire of the winding temperature detector to the controller for automatic protection in case of overheating.
-  Connect the terminals (P1, P2) of temperature switch to the control system in accordance with the wiring diagram.
-  Ensure the shaft key is fixed tight in position before starting.
-  Ensure there is appropriate protection to prevent accident caused by brake failure.
-  Cut off the power supply to determine electromagnetic noise or mechanical resonance if obvious vibration occurs during operation.
-  Check the rotation direction after connecting motor terminal (U.V.W. or 1.2.3.) with the power supply (R.S.T.); the rotation should be clockwise when looking from the back side of the motor to the shaft direction). Reverse the connection if rotation is counterclockwise.
-  Ensure the motor is operating under the maximum speed limit when the intended operation requires variable speed. Contact FUKUTA for any question and ensure the motor is not overloaded. (Install auxiliary cooling fan for the motor whose cooling fan is driven by rotor, for its cooling effect will be reduced at low-speed operation.)
-  Use only trained personnel to lubricate the motor when lubrication during operation is unavoidable. Ensure all electrified parts and rotating parts are fully covered before lubricating.
-  Rotate the shaft thoroughly in clockwise and counterclockwise direction monthly, to ensure the clearance in the bearing is fully lubricated.



# Maintenance Manual

## 馬達保養手冊

日常檢查和保養主要是操作人員透過視覺、聽覺、嗅覺，再加上電錶、溫度計等簡易儀器對馬達做檢查，從啟動與運轉的過程中可以判斷出馬達的運轉狀況是否正常以及其他消耗性零件的磨耗程度，才可以確保馬達的壽命，避免故障的發生。

※ 注意：保養前須確保斷電，並且接地線接續妥當，方可開始作業。

### 一、外部保養

1. 馬達入風口處不得聚集灰塵，線頭等雜物，以免阻礙通路，使得空氣無法自由流通。
2. 避免灰塵堆積在扇葉，造成不平衡及振動。扇葉必須定期清除灰塵。
3. 馬達殼外觀不應有鏽蝕、髒污或脫漆，若發現以上問題，必須檢查造成原因，並且立即處理；若鏽蝕或脫漆，需除鏽後重新噴塗防鏽漆；如髒汙附著，應盡快清潔乾淨，避免時間久了，髒汙腐蝕面漆。
4. 需定期檢查螺絲是否鎖固於裝設面，並確認鎖固螺絲是否變形或生鏽，若有以上情況需進行更換，更換或鎖固螺絲需依照螺絲尺寸的建議鎖至固定扭力值。
5. 確認聯軸器是否接合正確，沒有脫離的疑慮。

#### 潤滑油脂補給說明

油品：PETAMO GHY 133 N 或同級品  
 期間：每運轉 2000 小時  
 補充方式：注油重量約 30~40g。  
第一次注油及不易控制重量時，以舊油被擠出，新油出現為止。

### 二、軸承保養

1. 目前馬達大多採用雙遮蓋型軸承，為預注油式無須再注油保養。除框架大於 280mm( 包含 280mm) 之鑄鐵框馬達需定期注油保養。須注油保養之馬達，其馬達出廠會於注油孔貼上保養貼紙，貼紙格式如右圖所示：
2. 軸承的清潔度對軸承的壽命影響相當大，軸承的清潔度越高壽命越長，因此，軸承周圍因盡量保持清潔。
3. 超過三個月不運轉之設備，容易造成軸承生鏽，因此若長期不運轉，或停車周期過長之馬達，應定期旋轉馬達軸，讓潤滑脂充分潤滑，避免生鏽。
4. 軸承清潔時，應避免使用酸性或鹼性溶劑清潔，而導致軸承腐蝕。
5. 若發現軸承出現振動或異音，建議更換軸承，更換的軸承需相同型號。

### 三、長期存放或長停機再運轉

1. 馬達安裝後或使用一段時間後（視環境差異做周期調整），擬長期停車（超過一周），建議每三個月須運轉一次，避免軸承失油生鏽。
2. 長期存放之位置建議馬達若長時間儲存，或存於潮濕環境中，送電前須確認絕緣阻值大於 100MΩ。若低於 100MΩ 則需烘烤除濕到阻值大於 100MΩ 後再使用。

### 四、受潮與烘烤

若馬達已受潮需進行除濕的動作，可參考以下兩種方式除濕：

1. 置於溫度不超過 90°C 的烘乾爐中，並確保爐內、外通風良好。
2. 堵住轉子不動，低壓電接至馬達繞組，逐漸提高電壓致電流約 1/3 銘牌額定，必要時，請調整電壓確保繞組溫度不超過 90°C，當絕緣阻抗阻值停止不動並大於 100MΩ，即烘乾完成。

## 五、故障原因與排除

故障狀態	原因	對策
不能起動	電流過大繼電器跳開	馬達超載待冷卻後之後再起動，如果再試亦不能起動時，請檢查下述各點檢查：
	電源沒有接上	檢查電源通過控制器而接於電動機之迴路與接點。
	保險絲燒斷	檢查控制器及操作盤之保險絲。
	控制器之配線錯誤	查看並比較接線圖與實際之配線。
	結線端子鬆脫	將結線端子鎖緊。
	出力軸卡住	鬆開馬達之負載，如馬達能起動時則檢查負載端是否卡住。
	定子或轉子線圈斷路	檢查線圈是否斷線。
	定子線圈短路	檢查線圈是否短路。
	線圈接地	檢查線圈是否接地。
	軸承故障	分解檢查之。
	控制器故障	檢查控制器。
	電壓降低	檢查電壓。
有異音或振動	單相運轉	停止後再起動，如不能順利起動，則判定單相運轉。此時檢查電源或馬達是否一相斷路。
	電氣上負荷不平衡	檢查是否電壓不平衡或單相運轉。
	主軸之軸端游隙不良而振動	檢查中心對正及皮帶狀況，如使用軸承台，檢查轉子軸中心及游隙。
	有振動時	可能負載端不平衡，拆開馬達負載，如還有振動，則須對轉子做平衡校正。
	氣隙不均時	調整轉子與定子的同心度，如有必要時須更換軸承，將螺絲全部鎖緊。
	矽鋼片疊片鬆動或轉子矽鋼片與心軸發生鬆動	聯繫富田客服人員。
	轉子與定子摩擦	調整轉子與定子的同心度，如有必要時須更換軸承。
	風扇與扇蓋間有異物	拆開異物取出，並清理周邊。
	馬達鎖固之鬆動	重新鎖固馬達，並確定聯結之同心度無偏差。
	聯軸器鬆動	將聯軸器螺絲鎖緊。
溫度上升及冒煙	超載	檢查負載，過高時需降載。
	電氣負載不平衡	檢查是否電壓不平衡或單相運轉。
	保險絲燒斷，控制器故障等	檢查電源與控制器。
	風路堵塞	清潔風路與線圈。
	電壓或頻率錯誤	檢查馬達銘牌數值是否與輸入相同。
	負載設備或軸承過緊而停止時	向原廠家聯絡，尋求解決方案。
	定子線圈短路	聯繫富田客服人員。
	定子線圈接地	
	轉子導體接續鬆弛	
	皮帶過緊時	確認皮帶需求之張力，重新調整。
	馬達急速逆轉時	配合負載更換適合此用途之馬達。
軸承之溫度上升	軸承壓板鬆脫或位置不正確	確認軸承位置與狀況後重新鎖固壓板。
	皮帶張力或齒輪推力過大	調整皮帶至符合的張力或對軸進行調心。
	軸彎曲	重新校直心軸，若無法校直請聯絡富田。
	冷卻不足	檢查冷卻液水量與流量。

# Maintenance Manual

Daily check and maintenance shall be done by operator through sight, hearing, smell, and simple instruments like multimeter, thermometer and etc. By observing and checking the process of starting and operation of the motor, it is easy to determine whether the motor is operating normally, and whether the consumable parts should be replaced. These actions can prevent the occurrence of malfunction and prolong the service life of motor.

\*Notice : Make sure the grounding wire is connected properly. Cut off the power supply before performing maintenance work.

## A. Appearance Maintenance

1. Keep the air intake clean at all time. Make sure no accumulation of dust, wire lead and/or other debris obstruct the air intake.
2. Clean the fan blade regularly to prevent abnormal vibration that caused by accumulation of dust.
3. Clean and paint the motor housing when corrosion, stain or peeling paint are found. Find out the cause of these phenomena and deal with them immediately, to prevent recurrence.
4. Check the tightness of screws on surface regularly. Replace deformed or corroded screw when found.
5. Make sure the coupling and/or the motor shaft are properly connected.

## B. Bearing Maintenance

1. Most motors are using double shielded bearing, which are pre-lubricated and no refilling work is required. However, regular lubrication is required for cast iron frame size over 280mm (including 280 mm). Lubrication instruction (as shown on the right) can be found nearby the oil hole of the motors that require regular lubrication.
2. Keep the bearing and its surrounding clean at all time.
3. Lubricate the motor shaft and run the motor regularly, at least once in 3 months, to prevent corrosion.
4. Use neutral solvent cleaner to clean the bearing only. Do not use acid or alkaline solvent cleaner.
5. Replace the bearing with the same model if vibration or noise is found.

### Lubrication Instruction

Lubricant: PETAMO GHY 133N or similar level  
 Cycle Time: Every 2000 hours of operation  
 Quantity: 30 to 40 grams of lubricant  
 Note: Make sure the used lubricant is totally replaced.

## C. Operation after long storage/downtime

1. Run the motor once in 3 months during long storage or downtime to prevent the bearing from rusting.
2. Make sure the insulation resistance value is over 100MΩ before supplying power to it. Bake or dehumidify the motor if the insulation resistance value is less than 100MΩ.

## D. Dehumidification

The insulation resistance value should be over 100MΩ before connecting to power. In case the motor is damp, here are two methods for dehumidification:

1. Heat the motor in drying oven with temperature below 90°C . Make sure the oven has proper ventilation.
2. Block the rotor from rotating and connect low voltage power to the winding. Increase the voltage gradually to 1/3 of the rated voltage shown on nameplate. Adjust the voltage whenever necessary to ensure the winding temperature does not exceed 90°C .

## E. Failure and Troubleshooting

Failure state	Possible Causes	What to Check
Start failure	Relay tripped by overcurrent	Restart after the motor cooled down. Check the following if restart fails:
	Power is not connected	Check the circuit and contact of motor that are connected to power supply through controller.
	Fuse blowout	Check the fuse of controller and panel.
	Controller wiring error	Check and compare the diagram with the actual wiring.
	Loose connection terminal	Tighten the connection terminal.
	Output shaft stock	Check whether the motor can start without load. If the motor can start, then check whether the load end is stuck.
	Stator or rotor coil open circuit	Check whether the coil is broken.
	Stator coil short circuit	Check whether the coil is short circuit.
	Grounded coil	Check whether the coil is grounded.
	Bearing malfunction	Disassemble the bearing and check.
	Controller malfunction	Check the controller.
	Voltage drop	Check the voltage.
Noise & Vibration	Single- phase operation	Stop and restart the motor. If the motor can not start, then it is single-phase operation. Check whether there is open circuit in one of the phases.
	Imbalance electrical load	Check whether the voltage is imbalance or it is operated by single-phase.
	Bad shaft clearance	Check the alignment and condition of belt. If bearing holder is used, then check the rotor shaft center and clearance.
	Imbalance load	Loosen the load and check vibration again. Perform dynamic balance correction if vibration still occurs.
	Air gap eccentricity	Align the concentricity of rotor and stator. Replace bearing if necessary. Make sure all screws are tightened.
	Loosened lamination or loosened rotor shaft.	Please contact with FUKUTA.
	Rotor and stator friction	Align the concentricity of rotor and stator. Replace the bearing if necessary.
	Debris found between fan and cover	Clean out the debris and the surrounding area.
	Loosened motor lock	Re-lock the motor and ensure the concentricity.
	Loosened coupling	Tighten the coupling screws.
Temperature rise and smoke	Overload	Check the load, and reduce the load if it is too high.
	Imbalance electrical load	Check whether the voltage is imbalance or it is operated by single-phase.
	Blown fuse, controller malfunction etc.	Check the power and the controller.
	Air path blocked	Clean the air path and the coil.
	Voltage or frequency error	Check whether the input value is matching with the values shown on plate.
	Loading equipment or bearings too tight and cause shutdown.	Please contact with the equipment manufacturer for solution.
	The stator coil short circuit.	Please contact with FUKUTA.
	The stator coil grounded.	
	The rotor conductor is loose.	
	The belt is too tight.	Adjust the tightness of the belt to the required tension.
Bearing temperature rise	The motor reverses rapidly.	Replace with a proper motor to fit the load.
	Loose or incorrect position of bearing plate.	Check the bearing position and tighten the plate.
	Excess belt tension or gear thrust.	Adjust the tightness of belt or align the shaft and the bearing.
	Bearing deformation.	Adjust the bearing or contact with FUKUTA.
	Insufficient cooling.	Check the cooling liquid and flow volume.



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