

Operating and Maintenance Guide

Accompanying Document

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Operating and Maintenance Guide

Foreword

Passenger elevators, residential elevators, panoramic elevators, freight elevators, and elevators without machine rooms are now available at Suzhou Asia Fuji Elevator Co., Ltd, with carrying capacities ranging from 450kg to 5000kg and traveling speeds ranging from 0.5m/s to 1.75m/s.

Control modes of elevators include signal control and collective selective control, completely meeting the demands of all kinds of users. This Operating and Maintenance Guide applies to all elevators mentioned above.

The operating quality of elevators largely depends on the quality of installation. All the operating personnel are expected to strictly follow the requirements of this Operating and Maintenance Guide in the use and maintenance of elevators, in order to present our customers with high-quality, comfortable, and good-looking elevators.

Due to the continuous improvement on our products, some details in this manual may disagree with the actual product. Such discrepancies are not subject to further notice. In such a case please follow other relevant documents of the company.

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1 General

1.1 This Guide applies to the permanent-magnet synchronous gearless elevators and variable-frequency motor asynchronous elevators manufactured by our plant.

1.2 The normal operating conditions of the elevator control system shall meet relevant regulations on the elevator technology and requirements on service conditions of the frequency converter.

1.3 In order to ensure the safe operation of any elevator, appropriate maintenance and repair rules must be established with the following requirements:

- a) Check and maintain the safety circuits, electrical control components, and mechanical components once per week;
- b) Perform detailed inspections, adjustments, and repairs (e.g. inspection of the running condition and parameter settings of frequency converter) of important mechanical and electric equipment on a quarterly basis;
- c) Perform an inspection of the elevator control system every year. Check the running condition and insulating resistances of all mechanical and electrical safety circuits. Replace any component that has been seriously damaged;
- d) Determine the time limits for major overhauls of the elevator control system according to its service condition;
- e) If the elevator has been out of service for more than 7 days, it may not be put back to use unless after a thorough inspection;

1.4 Properly keep a record of the running condition of the elevator control system.

1.5 Only trained, qualified personnel of the user are allowed to handle the elevator control system. The keys to the home landing and the emergency unlocking keys of the elevator shall be kept by the same personnel.

1.6 The door to the machine room shall be kept locked.

1.7 The user shall take corresponding measures to prevent personnel from entering the incompletely closed hoistways, either intentionally or by accident.

2 Operating instructions

2.1 Preparing for startup

- a) Make sure that all operating switches are in the normal positions;
- b) Close the power switch of the power distribution box of the machine room;
- c) Put the power switch of the control cabinet to the ON position.

2.2 Manipulation and operation

a) Hall call

- 1) If the passenger presses the call button and the elevator is standing by on the same floor as the passenger is on, the indicator light of the call button will go on and the elevator door will automatically open in response to the passenger's call.
- 2) If the passenger presses the call button and the elevator is standing by on a different floor, the elevator will be immediately started in response to the passenger's call.
- 3) When the elevator is traveling upward, it will respond to the hall calls requesting upward travels in due order. Otherwise it will respond to hall calls requesting downward travels;
- 4) After the car reaches the last recorded calling landing in a certain direction, it will reverse in response to the calls in the opposite direction;
- 5) When several elevators are controlled as a group, the car call will be centrally controlled by the system, which will calculate the response time and response mode of each elevator in order to minimize the passengers' waiting time.

b) In-car commands

- 1) After entering the elevator, passengers may press the buttons that corresponds to the floors they want to ;
- 2) The elevator will respond to the car calls along the traveling direction in due order;
- 3) After responding to the last call signal, the elevator will stand by on the

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last floor with the door closed.

- c) Automatically return to the home landing (optional)
 - 1) A certain floor (usually ground floor) may be set as the home landing as required by the user;
 - 2) If no call signal is received within the preset period of time after the elevator completes its response to the last call command, the elevator will automatically return to the home landing without opening the door;
 - 3) If anyone makes a call while the elevator is returning to the home landing and the call signal comes from the traveling direction, the elevator will go to the calling floor and open the door; if the call signal comes from the opposite direction, the elevator will stop at the nearest floor without opening the door and then switch to the direction of the calling floor.
- d) Door protection
 - 1) Safety edges or an infrared multi-beam screen protection system is used for the door protection system of the elevator. When the safety edges hit any obstacle or the infrared beams of the screen detect any obstacle, the door will be immediately opened;
 - 2) If the multi-beam screen keeps the elevator door open longer than the preset time, the buzzer of the control box of the multi-beam screen will buzz to indicate that the passenger should not prevent the elevator door from being closed;
- e) Full-car bypass
 - 1) In the stopped state, the elevator will enter the full-car mode once detecting an 80% load switch action. In this case the elevator door will be kept open. Once an in-car command is given, the door will be automatically closed and the elevator will be started;
 - 2) When the elevator is in the full-car bypass mode, it will only process internal calls and will not respond to hall calls.
- f) Overload protection

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- 1) If the elevator detects an overload when the elevator is not running and the car door is open, the buzzer in the car will buzz and the overload indicator on the operation panel will be lit. In the mean time the door will keep open and the elevator will not be able to start. If the car door has been completely closed, the elevator will not respond to the signals sent by the overload device.
- g) Automatic control of car lighting and fans
 - 1) The lighting and fans of cars that are not called within the preset time will be automatically switched off. Once there is a call signal, they will be automatically switched on. When the elevator is locked or in the fire emergency mode, the lighting and fans of the car will be automatically switched off.
- h) Arrival gong (optional)
 - 1) When the elevator car reaches the floor from which the passenger makes the hall call, the arrival gong on the top of the car will sound, reminding the passenger that the elevator has arrived.
- i) Voice stop announcement (optional)
 - 1) When the elevator car reaches the floor from which the passenger makes the call, the voice system will announce the floor information;
 - 2) If any other call signal is still outstanding when the elevator reaches a certain floor, the voice system will announce information about the direction where the elevator is going.
- j) Attendant operation (MANU or ATT)
 - 1) The attendant operation mode of the elevator must be activated by turning on the “ATT” switch in the operation panel. Whenever the attendant operation mode is active, the door-closing operation and response to hall calls will be handled by the attendant;
 - 2) If the elevator has any call signal active, the elevator will not start unless the attendant holds down the Close button until the door is completely

closed. Then the elevator will move to the calling floor and automatically open the door. If the Close button is released while the door is being closed, the door will open again;

- 3) In the attendant mode, the elevator will not respond to hall call signals but directly move to the floor designated by the in-car command;
 - 4) It is only when a call signal is present that the elevator door can be closed by using the Close button;
 - 5) When the elevator receives upward and downward call signals at the same time, the corresponding indicator lights in the operation panel will keep flashing. In this case the attendant may choose the traveling direction of the elevator by pressing a button that corresponds to either of the flashing indicators in the operation panel.
- k) Special service (optional)
- 1) In the special-service mode, the elevator will not respond to hall call signals but respond only to in-car command signals.
 - 2) Other settings of the special-service mode are identical to those of the attendant mode.
- l) Fire emergency operation (FIRE)
- 1) If the fire detector or fireman's switch is actuated, all call signal records will be cancelled and all calls will be invalidated;
 - 2) The fire light [FIRE] on the operation panel will be lit;
 - 3) If the elevator is not on the evacuation floor (usually the home landing):
 - a) If the elevator is traveling in the direction of the evacuation floor, it will keep moving towards the evacuation floor; otherwise it will stop at the nearest floor without opening the door and then change its direction and go straight to the evacuation floor;
 - b) If the elevator door is closed and the elevator is standing by, it will directly move to the evacuation floor;
 - c) If the door is being opened, the elevator will wait until it is fully

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open and then close the door and move to the evacuation floor. In this case the safety edges or multi-beam screen will be disabled during the door-closing process;

- d) Once the elevator reaches the evacuation floor, the door will be automatically opened;
 - 4) As long as the elevator is on the evacuation floor, even if the door has been closed and the elevator is not being used, the door will be opened again;
 - 5) After the door is opened, the lighting and fans will be automatically switched off and the elevator will be put out of service.
- m) Fireman service (optional)
- 1) The fireman service function is an extension of the fire emergency function;
 - 2) After the process of the fire emergency function is completed, it will be automatically switched to the fireman service.
 - 3) After entering the elevator, the fireman is supposed to first press the button of the floor to be reached and then press the Close button. Be sure to hold down the Close button until the door is fully closed and the elevator starts to move. The door will be opened again if the Close button is released during the closing process;
 - 4) If the fireman selects multiple commands on the operation panel, the elevator will move to the nearest calling floor and then cancel all in-car call signals;
 - 5) After the elevator reaches the floor of the fireman's call, the elevator door will not automatically open. The fireman has to hold down the Open button until the door is fully opened. The elevator door will remain open afterwards;
 - 6) After the fireman's switch is turned off, the fire emergency status will not be cancelled until the elevator returns to the evacuation floor, after which

the elevator will resume the normal status.

2.3 Inspection travel

a) Emergency motor-operated running of machine room

- 1) Whether the elevator door is open or closed, both the car door and landing door of the elevator should be immediately closed after the emergency motor switch is closed. In this case the Open button is available only for checkpoint operation;
- 2) Whatever operating mode the elevator is in (normal operation, self-tuning operation, car top inspection operation), the elevator will immediately stop after the emergency motor switch is actuated;
- 3) The emergency motor-operated running speed is 0.2m/s (which can be adjusted by using the frequency converter). After the emergency motor switch is actuated, holding down the Up or Down button on the controller should enable the elevator to travel upward or downward;
- 4) The emergency motor-operated running will disable the governor switch, upper and lower limit switches, and electrical safety switch;
- 5) If the elevator is switched to the emergency motor-operated running mode during normal operation, the position indication of the elevator will be changed to “Maintenance”; if the elevator is switched to the emergency motor-operated running mode while standing by on a certain leveling position and then moved away from the door area by pressing the Up or Down button, the position indication of the elevator will also be lost;
- 6) When the elevator is switched from the emergency motor-operated running mode to the normal running mode, the elevator will search for the nearest leveling position if the position indication has been lost as mentioned above.

b) Car-top inspection travel

- 1) Whether the elevator door is open or closed, the car door of the elevator should be immediately closed after the car-top inspection travel switch is

closed. In this case the Open button is available only for checkpoint operation;

- 2) Whatever operating mode the elevator is in (normal operation, self-tuning operation, emergency motor-operated running of machine room), the elevator will immediately stop after the car-top inspection travel switch is actuated;
- 3) The emergency motor-operated running speed is 0.2m/s (which can be set by using the frequency converter). After the car-top inspection travel switch is actuated, holding down the Common switch and Up or Down button on the car-top inspection station should enable the elevator to travel upward or downward;
- 4) If the elevator is switched to the car-top inspection travel mode during normal operation, the position indication of the elevator will be changed to “Maintenance”; if the elevator is switched to the car-top inspection travel mode while standing by on a certain leveling position and then moved away from the door area by pressing the Up or Down button, the position indication of the elevator will also be lost;
- 5) When the elevator is switched from the car-top inspection travel mode to the normal running mode, the elevator will search for the nearest leveling position if the position indication has been lost as mentioned above.

2.4 Correction running (COR. RUN)

- a) If the elevator is not parking in the leveling position of the top floor or the ground floor and the elevator is in the normal running mode when it is electrified, the elevator will move downward or upward to the nearest leveling position for position correction;
- b) Once the elevator detects a floor position error signal in any position, it will be immediately stopped. In this case the Open button will be disabled, all call records will be cancelled, and no call signal will be registered;
- c) Within the duration of the floor position error, the elevator displayer will

display “F”. The elevator will not resume normal running until the error of the elevator is eliminated and the normal floor display is resumed;

- d) In the correction running mode, the elevator will search for the nearest leveling position under normal circumstances.

2.5 Elevator safety protection facilities

a) Safety circuit shutdown

- 1) If the safety circuit is broken, the elevator door is opened, or the safety switch is actuated during the operation of the elevator, an emergency shutdown will be triggered;
- 2) In the event of an emergency shutdown, the floor display will be “F”;
- 3) Once the normal status of the safety circuit is restored, the elevator will start correction running.

b) Terminal landing forced slowdown device (SSD/SXD)

- 1) For the 1m/s elevator, the terminal landing SSD/SXD is installed ahead of the normal deceleration point in case the elevator from hitting the top or the bottom of the hoistway; for the 1.75m/s elevator, the terminal landing SSD/SXD is installed behind the normal deceleration point and if the speed of the elevator fails to lower to the permissible range as the elevator travels to the terminal floor, the elevator will be forced to slow down and stop.

c) Motor overheat (synchronous motor)

- 1) The overheat protection of the system will be triggered whenever the elevator detects an over-temperature of the motor coils;
- 2) If the system detects an overheat signal of the motor during normal running, the elevator will stop to wait for the motor coil temperature to fall below the preset detection temperature of the frequency converter. After the frequency converter resumes the normal state, the elevator will move to the nearest floor at a low speed and then stop and open the door. After the door is opened, all call records will be cancelled and no any call

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signal will be registered. Then the elevator will be out of service and wait for resumption;

3) The elevator will resume the normal state after the motor temperature is reduced;

4) If any motor overheat signal is given while the elevator is standing by, the elevator will be put out of service;

d) Frequency converter failure

1) If the frequency converter has any failure during the operation of the elevator, the elevator will immediately stop running;

2) In this case all internal and external call signals will be cancelled and the elevator will be inactive;

3) If the elevator is not in a leveling position after the failure is eliminated, it will move to the nearest leveling.

2.6 Handling serious situations

a) Under any of the following three serious situations, the elevator shall not be used until it is strictly inspected, repaired, and tested by relevant authorities.

1) The elevator seriously hits the top or bottom of the hoistway or gets stuck;

2) A fire breaks out;

3) There is an earthquake.

b) Rules and procedure for releasing passengers trapped in the elevator:

In the event of an elevator failure, the elevator maintenance department shall be promptly informed. If a sudden power failure occurs before the professional repairmen arrive, trained rescuers shall follow the steps below to release the trapped passengers according to the specific situation.

1) Switch off the general power of the elevator machine room and hang an "Under Maintenance" sign;

2) Check if everything is OK in the elevator machine room;

3) Check if the machine room is provided with sufficient lighting; check the floor marks on steel wire ropes or steel bands to determine the parking

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position.

- 4) If the car is parked close to the hall door and its distance from the floor is not greater than 0.5m:
 - a) Use a special hall door key to open the hall door;
 - b) Manually open the car door on the car top;
 - c) Help passengers get out of the car;
 - d) Close the door.
- 5) If the car is far away from the landing door, first move the car close to the landing door and then follow the abovementioned steps to rescue the passengers. To move the car:
 - a) Use the intercom to ask passengers to keep quiet and warn them that the car may move at any time. Tell them not to put any part of their body out of the car in case of danger. If the car door is half closed, close it completely.
 - b) Before using the band-type brake spanner:
 - i. Make sure the main switch of the elevator has been turned off;
 - ii. Make sure all hall doors and car door have been properly closed.
 - iii. If the elevator has no machine room, light the jacklight beside the hoisting machine and observe the steel wire ropes near the hoisting machine.
 - c) If the elevator has a machine room, use a band-type brake spanner. Make sure that one operator controls the release of the brake and the other turns the hand wheel.
 - d) Use a remote brake release spanner if the elevator has no machine room. Release the brake while monitoring the running speed and position of the steel wire rope so that the brake can be released at any time.
 - e) Pull down the band-type brake spanner on the brake to slowly

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release the brake. The other operator shall turn the hand wheel leftward or rightward. Choose the direction which is easier to turn.

- f) Warn the passengers again that the rescue is in progress. Then slowly winch the car. The car may move due to gravity. To prevent the car from ascending or descending too fast and causing danger, use intermittent actions during operation to gradually move the car in case of accident.
 - g) Slowly lift or lower the car until it approaches the hall door where the emergency key hole is located.
- 6) Before using the emergency key to open the door, make sure that the passengers do not leave the car until the distance between the car sill and the hoistway sill is less than 100mm.
- 7) After all passengers leave the elevator, be sure to properly close and lock the hall door.
- 8) During operation, be informed that:

If the car is parked above the topmost hall door or below the bottommost hall door, do not allow the car to move freely by opening the brake. In stead, hold tight to the hand wheel whiling opening the brake and manually winch the car towards the forward direction.

Under other complicated circumstances, please wait for elevator professionals!

2.7 Notes

- a) Keep the machine room door locked

Only authorized personnel are allowed to access the machinery and control cabinet in the machine room. And proper means (e.g. locks) shall be used to prevent misuse. The keys must be readily accessible to the authorized personnel so that emergencies, rescues, and repairing operations can be timely handled. Be sure to keep unblocked the safety accesses to the machine room or the machinery area and controller. Be sure to immediately report any changes or dangers to the repairs

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company.

b) Loading and unloading safety

According to the types of the load and drive control, the car may be parked slightly lower or higher than the landing ground. Be sure to prevent passengers or goods from being tripped, especially when goods are moving on wheels. Wheels shall not be too small; otherwise they may be trapped in the clearance between the car sill and the landing sill or in the sill tracks or damage the sills.

Special attention must be drawn to the clearance between the car sill and the landing sill to make sure that nothing (sticks, heels, etc.) is stuck and nothing is dropped in the hoistway.

If goods are carried, the goods must be evenly distributed and fixed on the floor of the elevator car lest they move inside the car while the elevator is traveling. Check the maximum lifting capacity of your elevator with the weight of goods and persons to be carried. Overloading may endanger the load (goods and passengers) and the elevator. If this function is not listed in the intended purposes of the elevator, it is forbidden to use a forklift to load or unload in the car.

c) Precautionary measures for partly closed hoistway of the elevator

If the hoistway is partly closed, dampers or barriers must be used to prevent elevator users from being injured by the equipment during operation. These barriers or dampers must be always kept in good condition under all circumstances and meet national regulations. If these barriers are made of glass, special attention shall be paid. If such glass needs to be clean, advice of the repairs company shall be asked for safety reasons.

d) Matters that require supervisor's involvement

The owner of the elevator has a major legal responsibility for guaranteeing the full maintenance of the elevator devices. Therefore it is important that the repairs company make a maintenance plan before the elevator is put into normal operation. The elevator devices must be used only for their intended purposes. Ventilating devices shall be installed so that the environment for the elevator car

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hoistway, machine room, or machinery area and control cabinet does not exceed the operating conditions/temperature of the equipment (usually between +5°C and 40°C, unless otherwise specified in the manual). Be sure to keep the elevator documents in such an appropriate place that authorized personnel can access them freely whenever necessary. Be sure to guarantee the safety accesses to the building and its facilities under emergency and during maintenance. Measures (e.g. locks) shall be taken to ensure that only authorized personnel have access to the machinery.

Make sure that the machine room or machinery area, the hoistway, and the accesses are always provided with sufficient lighting. All rooms, hoistways, and compartments related to the elevator shall not be used for other purposes (e.g. as warehouse or for wiring). Maintenance must be commissioned to a qualified repairs company in order to ensure complete safety of the devices. General maintenance instructions can be found in the corresponding elevator documents of this manual. Make sure that the elevator provides the user with emergency service on a permanent basis. While using the elevator, be sure to keep the communication lines of the cabin smooth.

It is necessary to perform an inspection in accordance with local regulations. In the absence of regulations on this device, the inspection shall be undertaken by a qualified repairs company.

If the elevator has been put away for a period of time, it shall not be put into normal operation until a qualified repairs company cleans and lubricate the elevator, replaces the damaged parts, and checks the safety components.

Any abnormality or emergency situation found in the operation of the elevator must be immediately reported to the repairs company. In addition, any changes in the building and facilities that may affect the elevator shall also be reported.

e) Documents to be retained

All “Elevator Operating and Maintenance Guides” shall be properly kept by specially-assigned persons.

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f) Use of emergency unlocking keys

Each landing door may be unlocked from the outside by using a triangular key.

This type of keys shall be managed by only one person in charge. To prevent accidents caused by failure to effectively relock the door after it is unlocked; these keys shall be provided with detailed instructions on important measures to be taken.

After the landing door is unlocked in an emergency and then closed, the locking device should not remain in the unlocked position.

3 Maintenance instructions

3.1 Notes

- a) The maintenance personnel are required to
 - 1) Be familiar with the working mechanism, structure, and operating methods of the purchased elevator system;
 - 2) Be familiar with the structures and action processes of major components, especially the use of the frequency converter;
 - 3) Be familiar with the workflow of the control program;
 - 4) Be dexterous with the judgment, analysis, and elimination of failures;
 - 5) Have the knowledge of work safety.
- b) An elevator under maintenance is not allowed to carry any passenger or goods. A sign reading “Under Maintenance; Do NOT Switch on (Use)” shall be hung at the main power switch and at the hall door of each floor.
- c) During maintenance, a director (usually one having a high level of skill) shall be assigned to take command. All other members of the maintenance crew must be absolutely subject to his command.
- d) During maintenance, the elevator can only be placed in the “Maintenance” mode. If the car does not have to run, corresponding switches shall be turned off.
 - 1) If maintenance is carried out in the machine room, the main power switch shall be turned off;

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- 2) If maintenance is carried out on the car top, the emergency shutdown switch of the car-top inspection cabinet shall be turned off;
 - 3) If maintenance is carried out in the pit, the emergency shutdown switch of the pit cabinet shall be turned off.
- e) It is strictly forbidden to short-circuit the safety circuit and door lock circuit for operation.
 - f) Be sure to turn off the main power switch before using a hand plate wheel to lift or lower the car.
 - g) The portable lamp shall be a 36V safety lamp with a shield.
 - h) It is strictly forbidden to lean from outside the hall door into the car or onto the car top for an operation. It is strictly forbidden to put one foot on the edge of the hoistway or the car sill and the other on any supporting point inside the hoistway for an operation. It is strictly forbidden to work inside the traveling area of the counterweight. Even if it is absolutely necessary to work in such an area, the operation can be carried out only when the car stop switch is watched by specially-assigned persons.
 - i) If the connecting wires of the drive circuit have been removed during maintenance, make sure that exactly the same phase sequence is applied during their recovery and test-run the hoisting machine to check if it rotates in the right direction.
 - j) After maintenance is completed, restore all switches to their original positions, keep the maintenance records, and deliver the elevator over to acceptance and service.

3.2 Safety rules

- a) Before driving the elevator for a normal travel, the attendant is supposed to:
 - 1) Check if the car is parked at the current floor before opening the hall door and enter the car;
 - 2) Open the in-car lighting;
 - 3) At the beginning of each day, make several upward and downward travels

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of the elevator to check if there is any abnormality;

- 4) Do not use hands to open the hall door from the outside. The elevator will not be able to start if the hall door and car door are not fully closed;
 - 5) Check if there is any significant change in the leveling accuracy;
 - 6) Clean the hall door in the car and parts visible to passengers but not with water.
- b) During normal travel, the attendant needs to pay attention to the following matters:
- 1) If the attendant has to leave the car, the car shall be parked at the home landing, the power switch in the car shall be turned off, and the hall door shall be closed;
 - 2) The carrying capacity of the car shall not exceed the rated loading capacity of the elevator;
 - 3) A passenger elevator shall not be frequently used as a freight elevator;
 - 4) Flammables and explosives shall not be carried. If they have to be carried by the elevator under special circumstances, prior permission of competent authorities shall be obtained and safety precautions shall be taken;
 - 5) It is strictly forbidden to perform a normal travel with the maintenance speed when the hall door or the car door is open.
 - 6) It is not allowed to open the car-top safety window or the car emergency exit in order to carry long objects;
 - 7) Advise the passengers not to lean on the car door in case of danger;
 - 8) Do not put objects on the top of the car;
 - 9) Whenever possible, the load shall be properly placed in the middle of the car lest it falls during the travel;
- c) In the event of any of the following failures of the elevator, press the alarm button to give an alarm and promptly notify the maintenance personnel;
- 1) The elevator fails to start traveling as usual after the hall door and car

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door are closed;

- 2) An elevator which is supposed to start after its Start button is pressed starts to travel when the Start button is not pressed after the hall door and car door are closed;
 - 3) There is a significant change in the traveling speed;
 - 4) The traveling direction is opposite to the requested direction;
 - 5) Internal selection, leveling, speed change, call, and internal floor selection signals are ineffective and out of control;
 - 6) There is abnormal noise, great vibration, or shock;
 - 7) The elevator continues to travel after passing the terminal landing;
 - 8) The safety gear is malfunctioning;
 - 9) Any metal part contacted feels tingling;
 - 10) Any electrical component gives off a burning smell due to overheat.
- d) After using the elevator, the attendant shall part the car at the home landing, turn off all switches on the operation panel, and close the hall door.
- e) If the elevator suddenly stops or goes out of control during a travel, the attendant shall stay composed, immediately press the Emergency Stop button, seriously advise passengers against trying to jump out of the car, and promptly notify the maintenance personnel. After the car is moved into the door opening area by manually winching a hoisting machine, the attendant may pull the door open so that the passengers can safely escape the car.

3.3 Maintenance of important components and parts

- a) Hoisting machine
 - 1) Hoisting wheel
 - a) Keep the hoisting rope races clean. Do not inject lubricating oil into the rope races;
 - b) Rope races shall be reconditioned or replaced if they are not evenly

worn and the maximum difference reaches 1/10 of the diameter of the hoisting steel wire rope or if they are seriously rugged to the extent that normal service of the elevator is affected;

- c) When the clearance between the hoisting rope and the bottom of the rope race is $\leq 1\text{mm}$ or when the notched semi-circular race has been to the extent that the notch depth is less than 2mm, the race shall be reconditioned or replaced. After reconditioning, the thickness of the wheel edge of the rope wheel shall be not less than the diameter of the hoisting rope.

2) Motor

- a) Always keep the motor clean and the cooling fan normal;
- b) Insulation of the motor shall meet relevant requirements;
- c) The noise made by the motor shall be normal.

b) Brake

- 1) The action shall be easy and reliable. The pin rolls shall be lubricated from time to time. The working surfaces of the brake shoes and the brake wheel shall be kept clean and protected from oil contamination;
- 2) During the braking process, both brake shoes should closely fit the surfaces of the brake wheel. During the releasing process, both brake shoes should depart from the working surfaces of the brake wheel simultaneously and the clearances shall be not greater than 0.7mm. If the clearances are too large, a proper adjustment is necessary.
- 3) The brake band shall be free of oil contamination. The fastening rivets shall be buried in the brake band and prevented from contacting the brake wheel. If the wear on the brake band causes abnormality and noise in the braking process, proper adjustments may be made. If the wear is so great that the rivets protrudes out of the surface of the brake band or if the wear is greater than 1/4 of the brake band, the brake band shall be replaced;
- 4) Connecting wires of the electromagnetic coil shall not be loose. The

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insulation shall be OK. And the temperature rise shall be not greater than 80°C.

c) Speed governor

- 1) The action shall be easy and reliable. The rotational part shall be oil-injected once per month and cleaned and refilled with oil once per year (the speed governor has been adjusted and sealed before shipment. The user is not advised to disassemble it for adjustment);
- 2) Tension shall be evenly distributed on the tensioning device. Rotation shall be easy. The rope wheel and guiding device shall be oil-injected once per month and cleaned and refilled with oil once per year;
- 3) Frequently check the rope jaws and clear extraneous matter in order to ensure reliable actions. If the rope of the speed governor stretches beyond the specified range and cuts the control circuit, it shall be truncated.

d) Safety gear

- 1) The action shall be sensitive and reliable. The drive link shall be checked on a weekly basis to see if it is flexible and free of jams and the lifting force and lifting height meet corresponding requirements;
- 2) The rotational part shall be oil-injected once per month. The clearances between the wedges and the working faces of the guide rails shall be 2~3mm and equal to each other. The action shall be easy and reliable. The rotational part shall be coated with Vaseline for lubrication and rust prevention.

e) Car door, hall door, car, and automatic door mechanism

- 1) If the hanger rollers of the car door and the hall door are worn to the extent that the door leaves are lowered and the lower ends are less than 3mm away from the sill, the rollers need to be replaced or the clearance shall be adjusted to 4~5mm. When the wear hampers normal operation, the rollers must be replaced;
- 2) Guide rails of the door shall be frequently wiped and coated with some oil

so that it moves easily and steadily. If the slide blocks of the door are so worn that normal operation is hampered, they shall be replaced promptly;

3) Weekly inspection

- a) Check all magnetic switches of the gate operator to make sure the actions are accurate;
- b) The actions of the safety edges are easily and reliable. The colliding force shall be less than 5N;
- c) Actions of the locking hook, locking arm, and movable contact of the hall door lock shall be easy. The stationary and movable contacts of the hall door lock shall be properly aligned with at least 7mm engagement. Incomplete connection and adhesion shall be prevented;
- d) The interlock traction device of the hall door shall promptly tensioned if it is loose;
- e) Check if any extraneous matter is stuck in the clearance between the movable car bottom and the car walls. Make sure that the car bottom can move without being impeded.

4) Monthly inspection

- a) Check the door closing safety switch of the car door and make sure that the elevator does not get started when the car door is not fully closed;
- b) Check if the connecting wires of the wiring terminals, motors, and magnetic switches of the door operator are free of looseness, scratches, and bruises;
- c) Hall doors: Do not manually pull the door open from outside (except with a triangular key);
- d) Check if the nudging device can automatically close the hall door tightly and lock it when the hall door is opened to any extent in the absence of the car door;

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- e) Check the car-bottom overload and full-load switches to ensure accurate actions.
- 5) Quarterly inspection
 - a) Check if the actions of the motors of the automatic door mechanism are easy and reliable;
 - b) Check if the car walls are loose.
- f) Hoisting steel wire ropes
 - 1) Check the nuts of the rope end combination on a weekly basis to make sure that tension is evenly distributed among all hoisting ropes.
 - 2) If the wear on any hoisting steel wire rope reaches the limits given in Table 1, the rope shall be immediately replaced with a new one;

Table 1. Criteria for replacing hoisting steel wire ropes of the elevator

Number of broken threads within a pitch		Percent ratio of wear or corrosion on steel wire surface to diameter (%)					
		0	10	15	20	25	<30
Diameter of steel wire rope (mm)	6~10	16	13	12	11	9	8
	>10~12	18	15	13	12	10	9
	>12~14	20	17	15	14	12	10
	>14~16	22	18	16	15	13	11

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Note 1. If the percent ratio of wear or corrosion on steel wire surface to the diameter of the wire is zero but the number of broken threads reaches the corresponding number in the table, the steel wire rope has to be replaced;

Note 2. If the percent ratio of wear or corrosion on steel wire surface to the diameter of the wire is 30%, the steel wire rope has to be replaced even if none of the threads is broken;

Note 3. If the percent ratio of wear or corrosion on steel wire surface to the diameter of the wire has already reached the limit but the number of broken threads has not reached the corresponding limit, the steel wire rope does not have to be replaced;

Note 4. The steal wire rope shall be replaced if any strand is broken.

3) Excessively long hoisting steel wire ropes shall be truncated. If extraneous matter such as dirt or sand on the surfaces of the hoisting steel wire rope shall be timely wiped clean with kerosene.

g) Guide rails and guide shoes

1) The car guide rails and counterweight rails shall always be well lubricated. Check the oil level in the oil box of the automatic lubricating device on a monthly basis and timely refill the oil box;

2) If the working surfaces of the guide rail are damaged due to the operation of the safety gear or have dents, burrs, or scratches, they shall be promptly polished and leveled;

3) If the service wear of the lining of the guide shoes is greater than 1mm, the lining shall be replaced. If the lining is seriously worn within the first month, shut down the system and take an inspection to remedy any defects before putting the system back to operation.

4) Perform a careful inspection of the connecting bolts of the guide rail linking plates and the guide rail frame on an annual basis. Re-tighten all fastening bolts and re-calibrate the dimensions and verticality of the end faces of the guide rails.

h) Compensation chain

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- 1) If the compensation chain gives out a great noise during operation, perform an inspection or coat it with noise reduction oil.
- i) Electrical equipment
 - 1) All contact switches of the electrical safety device of the elevator shall be nimble and reliable. Perform an inspection every month to wipe off the dust and dirt on the surface and verify the contacting reliability of the contacts. The ablated parts shall be smoothed or replaced if ablation is too severe;
 - 2) The limit switches shall be sensitive and reliable. Perform an over-travel test every quarter to check they can be reliably tripped off;
 - 3) Control cabinet;
 - 4) Frequency converter
 - a) Power must be switched off (OFF);
 - i. Key points of maintenance and inspection
 - ii. Since the capacitor will continue to discharge after the power is switched off, start the operation after the corresponding indicator light of the frequency converter on the operation panel goes off;
 - b) Routine inspection
 - i. Check if the frequency converter has any abnormal noise, abnormal smell, or damage. If there is abnormality, determine the location and the degree of the abnormality. Frequently clear the dust, dirty, and extraneous matter on the control panel and vents to keep the frequency converter in normal service condition.
 - c) Regular maintenance
 - i. The service life of the frequency converter varies with service environment and service time. When used on a continuous basis within the permitted scope, normal electrolytic capacitors have

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a life span of about 5 years and cooling fans need to be replaced in about 3 years.