

Performance Evaluation Manual for Elevatory Equipment

Article 1: Scope of Application

This manual applies to the following types of performance evaluations:

- (1) Performance evaluations pertaining to approvals under Article 129-4 Paragraph 1 Item 3 of the Building Standard Law Enforcement Order
- (2) Performance evaluations pertaining to approvals under Article 129-8 Paragraph 2 of the Building Standard Law Enforcement Order
- (3) Performance evaluations pertaining to approvals under Article 129-10 Paragraph 2 of the Building Standard Law Enforcement Order
- (4) Performance evaluations pertaining to approvals under Article 129-12 Paragraph 2 of the Building Standard Law Enforcement Order
- (5) Performance evaluations pertaining to approvals under Article 129-12 Paragraph 5 of the Building Standard Law Enforcement Order

Article 2: Documents to be Submitted for Performance Evaluations

The documents to be submitted for performance evaluations are as below. Formats and other requirements are as stipulated in application procedures defined elsewhere.

- (1) Performance evaluation application
- (2) Summary of evaluation application
- (3) Structural and functional descriptions
- (4) Specifications
- (5) Drawings
- (6) Structural strength calculation report
- (7) Anti-seismic strength assessment

- (8) Reports on tests required for evaluations under Article 3(2) (Where test methods are stipulated in Article 3(2) 1) and 4), a report on tests conducted using that method is required.)

(Reports are required for each test needed for evaluations, other than those stipulated in Article 3(2) 1) and 4). However, if compliance is proven by existing data and calculations (simulations, etc.) without the use of tests, documents necessary to certify compliance must be submitted.)

- (9) Operational management system
- (10) Manufacturing, installation and maintenance management systems
- (11) Company outline
- (12) Other information

Article 3: Evaluation Method

(1) Implementation of evaluations

- 1) The evaluator must conduct evaluations using the documents stipulated in Article 2, on the basis of the evaluation criteria stipulated in Paragraph (2) 1) for performance evaluations under the provisions of Article 1 (1), on the basis of the evaluation criteria stipulated in Paragraph (2) 2) for performance evaluations under the provisions of Article 1 (2), on the basis of the evaluation criteria stipulated in Paragraph (2) 3) for performance evaluations under the provisions of Article 1 (3), on the basis of the evaluation criteria stipulated in Paragraph (2) 4) for performance evaluations under the provisions of Article 1 (4), and on the basis of the evaluation criteria stipulated in Paragraph (2) 5) for performance evaluations under the provisions of Article 1 (5).
- 2) If necessary for the purposes of the evaluation, the evaluator will ask the applicant to explain the content of the documentation submitted for the performance evaluation.
- 3) If necessary for the purposes of the evaluation, the evaluator may attend tests, etc.

(2) Evaluation criteria

- 1) Evaluation criteria for elevators and their principal support members under the provisions of Article 129-4 Paragraph 1 Item 3 of the Building Standard Law Enforcement Order

(Parameters for allowable unit stress)

- ① Where the strength of important support members, etc., may be reduced through wear or fatigue damage, the strength of those parts must be checked after 2×10^6 ascending and descending cycles using actual equipment. (In the case of elevators used only in private residence, the number of cycles may be adjusted to reflect the fact that the frequency of use will obviously be lower.) However, the following checking methods may be used under the circumstances described below.
 - A) If the state of wear or fatigue damage in a member can be reproduced by modeling, the residual strength of that member will be checked using that modeling method.
 - B) If strength can be determined by means of the tests stipulated in the Appendix, residual strength will be checked on the basis of a report showing the results of tests conducted by the applicant using that method.
- ② Based on the strength checked in ①, the stress level corresponding to a breaking load and the stress level at which stress remains within the elastic range will be determined. The allowable stress levels when the system is in use will be defined as the stress level at which stress remains within the elastic range, and allowable stress levels at the time of installation as the strength of the material concerned is before the start of testing. However, where materials for which safety ratios are stipulated in the notification adopted by the Ministry of Construction under the provisions of Article 129-4 Paragraph 1 Item 2 (Ministry of Construction Notification No. 1414 of May 31, 2000, “Standards for Elevators Covered by the Elevator Strength Verification Method, the Escalator Strength Verification Method and Structural Calculations for Elevators Installed Outside”) or similar materials are used, the force corresponding to breaking stress must be determined.

Allowable stress levels can be defined as a value obtained by applying the safety ratio stipulated in the notification to this.

- ③ The evaluator will check the strength under the conditions identified by the applicant as conditions requiring replacement when members are maintained either under the conditions described in ① (strength reduced by wear or fatigue damage) or before that stage is reached.
- ④ Allowable stress levels for other members must, in principle, be defined according to the provisions of Chapter 3 Section 8 Clause 3 of the Building Standard Law Enforcement Order.
- ⑤ If there is a risk that the strength of members will deteriorate due to chemical changes or other factors, the extent of such deterioration must be ascertained, taking into account the frequency of use as stipulated in ①.

(Checking Stress)

- ① Stress levels at each cross-section of structurally important members must be determined for during normal ascending and descending operations and during the operation of safety devices.
 - ② Concerning the important support parts, etc., such as suspension ropes (or suspension chains) that will be affected by reduction in strength due to wear or fatigue damage (excluding parts that support the car using other parts that are not subject to wear or fatigue damage), the stress level affecting the remaining members must be determined in case that one of those parts is not present.
 - ③ It must be confirmed that the stress levels during normal ascending and descending operations and during the operation of safety devices are below allowable stress levels at the beginning of use and during use.
 - ④ In addition to the preceding estimations, any other verifications that are required concerning buckling or other factors will be carried out.
- 2) Evaluation criteria for elevator control device under the provisions of Article 129-8 Paragraph 2 of the Building Standard Enforcement Order

- ① It must be confirmed that the brakes (stop valves in the case of hydraulic elevators) or alternative mechanisms that hold the car in position when stopped at a floor are capable of keeping the car in position when it is setting overload level.
- ② Where there is a risk that the car will descend naturally when the elevator is not in use, such as with hydraulic elevators or other types of elevators, the data provided with the application must confirm that the elevator brake will automatically activate if the car descends more than 75mm.
- ③ In the case of elevators that carry out floor leveling or releveling with the doors open, the range of positions through which the car is allowed to move with the doors open must be confirmed.
- ④ The elevator maintenance and inspection method must be checked, and it must be confirmed that the elevator has been equipped to allow these operations to be carried out safely, such as through the mounting of low-speed operation controllers and stop switches, etc.

3) Evaluation criteria for elevator braking equipment under the provisions of Article 129-10 Paragraph 2 of the Building Standard Enforcement Order

The following items must be confirmed through testing with actual equipment. However, the use of simulations, etc., is permissible if the required conditions can clearly be confirmed in this way.

- ① In the following circumstances, the average vertical and horizontal acceleration experienced by persons inside the car must not exceed 9.8 m/s^2 and 4.9 m/s^2 respectively, and it must be possible for the person operating the elevator on the top of the cage to stop it in a way that is safe for persons on the top of the cage.
 - A. If the supply of power to the drive unit is interrupted while the car is in motion.
 - B. If there is a risk that the car will descend past the final floor and collide with the top or bottom of the hoistway.
 - C. If there is a risk that the car will accelerate and persons inside the car will experience average acceleration in excess of 1G due to the operation of

safety devices or buffers (If there is a risk that the following situation occurred either this speed has been directly detected, or the causes of such a situation can be identified)

- D. Other circumstances in which there is a risk of a shock that would cause persons inside the car to experience average vertical acceleration in excess of 1G, and average horizontal acceleration in excess of 0.5G.
- ② The elevator must be controlled in such a way that circumstances leading to the activation of the aforementioned systems will not occur during normal operation.
 - ③ In circumstances that could lead to the conditions described in ①A-D, the elevator must be stopped in the following cases:
 - A. If the person operating the controls ceases to operate the controls
 - B. If there is a power outage, etc.
- 4) Evaluation criteria for steps and main support members of escalators or moving walks under the provisions of Article 129-12 Paragraph 2 of the Building Standard Law Enforcement Order
- The evaluation criteria will be based on for elevator cars and main support members under Article 129-4 Paragraph 1 Item 3 of the Building Standard Law Enforcement Order of (1).
- 5) Evaluation criteria for braking systems of escalators or moving walks under the provisions of Article 129-12 Paragraph 5 of the Building Standard Law Enforcement Order
- The following items must be checked by means of tests using actual equipment. However, the use of simulations, etc., is permissible if the required conditions can clearly be confirmed in this way.
- ① It must be possible to stop the escalator under the following circumstances without causing the average forward acceleration on the steps to exceed 1.25 m/s².
 - A. If there is a power outage
 - B. If a fault occurs in the drive mechanism

- C. If a person or object is trapped
- D. If there is any other risk of harm to persons or objects
- ② If the width of the steps of moving walks exceeds the width stipulated in Article 129-12 Paragraph 1 Item 4 of the Enforcement Order, persons riding the moving walks must normally be able to ride without falling even if they are not holding onto the handrails.

Article 4: Performance Evaluation Report

The evaluation report will include the following items.

- (1) Evaluation number and evaluation completion date
- (2) Name of applicant (company, representative, address)
- (3) Name of elevator, escalator or moving walk.
- (4) Scope of application
- (5) Summary of evaluation content
- (6) Evaluation results
- (7) Other items identified during the evaluation process as necessary for inclusion in the report.

Appendix

Testing Methods and Evaluation Criteria for Wire Ropes

1. Test items

- Rope breaking test
- Rope diameter measurement
- Rope fatigue test
- Rope wear test

2. Testing methods and evaluation criteria

(1) Rope breaking test

1) Test method: Based on JIS G 3525

A suitable length is cut from the tail of the rope and formed into a conical shape using white metal or zinc, etc., or another appropriate method. The rope is then attached to a tensile testing machine and gradually tensed to breaking point. The maximum load at that point is the breaking load.

2) Evaluation criteria

The breaking strength must be at least the rated value or the value stated in the application.

(2) Rope diameter measurement

1) Test method: Based on JIS G 3525

Calipers are used to measure the diameter at two or more points at least 1.5 meters from the end of the rope or in two or more directions in the same cross-section. The average of these measurements is the diameter of the rope.

2) Evaluation criteria

- Less than 10mm: 0 to +10% of nominal diameter
- 10mm or greater: 0 to 7% of nominal diameter

(3) Rope fatigue test

1) Test conditions

- Test equipment: Planet type U-bending tester
- Sheave: $D/d = 40$, or any value, U-groove or 35° V-groove

- Tension load: 1/10 of breaking load of rope (rated value or value stated in application)
- Test speed: Maximum of 200 bends per minute
- Number of tests: 2×10^6 (25×10^4 for 35° v-groove)

2) Evaluation criteria

The following items must be checked under the conditions defined above.

- Breakage of wires must not exceed 10%.
- The residual strength of the rope must be at least 80% of the rated value or the value stated in the application.

(4) Rope wear test

1) Test conditions

- Test equipment: Rotational wear tester
- Sheave: $D/d = 40$, or any value, U-groove or 35° V-groove
- Tension load: 1/10 of breaking load of rope (rated value or value stated in application)
- Test speed: 6 cycles per hour (relative speed: 2mm/sec., maximum bends per minute: 200)
- Total slide distance: 3,000m

2) Evaluation criteria

It must be confirmed by the wear length that the cross-sectional area of wire wear does not exceed 30%.

Rope End Testing Methods and Evaluation Criteria

1. Test items

- Rope end efficiency test
- Rope end fatigue test

2. Testing methods and evaluation criteria

(1) Rope end efficiency test

1) Test conditions

A suitable length is cut from the end of the rope and both ends are fixed using the end fixing method by which the evaluation will be conducted. The rope is then mounted on a tensile testing machine and gradually tensed until the rope breaks or an end slips out. The end efficiency ratio is calculated by dividing the load at this time by the breaking load of the rope (rated value or value stated in application).

2) Evaluation method

The end efficiency must be at least 80% of the breaking load (rated value or value stated in application) of the rope to which the test is applied.

(2) Rope end fatigue test rope

1) Test conditions

- Test equipment: Cyclic tensile tester
- Tension load: 20% (maximum) or 10% (minimum) of breaking load of rope (rated value or value stated in application)
- Number of tests: 1×10^7 times

2) Evaluation method

The rope must not pull out or fail under the above conditions, and damage must not exceed the usage standard for the rope.