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T/CEA 0010—2026

Technical Requirements For Lift Counterweight

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Foreword

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Note that certain contents of this document may involve patents; the issuing body of this document shall not be liable for identifying such patents.

The performance indicators required by this document shall be verified and tested by the manufacturing enterprises adopting this document during the design and manufacturing process, and a product conformity declaration shall be made for the products sold.

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Main drafting units: Xuancheng Hualing Seiko Technology Co., Ltd.

Participating drafting team:Xuancheng Valin Precision Technology Co.,Ltd.、TK Elevator (Shanghai) Co., Ltd.、KONE Elevator Co., Ltd.、Otis Technology Development (Shanghai) Co., Ltd.、Shanghai Mitsubishi Elevator Co., Ltd.、Julong Elevator Co., Ltd.、Ningbo Special Equipment Inspection and Research Institute、Hitachi Elevator (China) Co., Ltd.、CABR Machinery Inspection & Testing (Beijing) Co., Ltd.、Xuancheng Hualing Precision Technology Co., Ltd.、Julong Elevator Co., Ltd.、Tianjin Shengchi Precision Industry Co., Ltd.、Tianjin Lifute Elevator Components Co., Ltd.、Shandong Bolt Elevator Co., Ltd.、Nantong Jiangzhong Optoelectronics Co., Ltd.、Schindler (China) Elevator Co., Ltd.、Xiji Schindler Elevator Co., Ltd.、Direct Branch of Jiangsu Special Equipment Safety Supervision Inspection Institute、Zhejiang Umay Heavy Industry Machinery Co., Ltd.、Shandong Rhine Aijia Elevator Co., Ltd.、Ningbo Special Equipment Inspection and Research Institute、Shandong Bolt Elevator Co., Ltd.

Main drafters:Yehuang Hua, Xinhong Wang, Xiaojian Wang, Yuancheng You, Xiangling Hao, Xiang Gao, Qi Cen, Wei Chen, Minghao Dong, Zhichao Ge, Jiaoke Liu, Rui Wang, Jinkuan Liu, Shengchao Fu, Minxiang Ji, Xiangyi Fan, Minpeng He, Chengming Xu, Hang Zhang, Shengxiao Lin, Xingxing Feng, Sihong Yu, Haitao Li

Introduction

With the development of urban construction and the improvement of people's quality of life, elevators have gradually become an important vertical transportation tool in people's daily production and life, exerting a profound impact on people's daily production and life. The domestic elevator market has broad prospects. As a key component of traction-driven elevators, the design and manufacturing quality of the counterweight system directly affects the safety performance of elevators.

The counterweight system functions to balance the mass of the car, thereby achieving the energy-saving effect of the elevator. The counterweight system is mainly composed of a counterweight frame, counterweight filler, and other components. The counterweight frame can be made of steel plates, section steels, or bent steel plate components. Counterweight fillers mainly come in various forms such as cast iron, steel plates, and press-formed types.

At present, standards such as GB/T 7588.1—2020 Safety Code for the Construction and Installation of Elevators - Part 1: Passenger and Goods Passenger Elevators do not specify detailed requirements for the counterweight system. The quality of products on the market varies. Problems such as unreasonable structural design of the counterweight frame, substandard mechanical properties (e.g., strength, stiffness) of the selected steel, and internal defects not only lead to high-frequency elevator failures and outages, affecting vertical transportation efficiency but also directly threaten the lives of elevator passengers and maintenance personnel. There are many potential safety hazards in actual applications. Therefore, it is necessary to strengthen the standardization of design, manufacturing, and inspection specifications for the counterweight system.

Technical requirements for lift counterweight

1 Scope

This document specifies the terms and definitions, design and technical requirements, test methods, inspection rules, packaging, marking, transportation, and storage of each component of the elevator counterweight system.

This document applies to the counterweight system of traction-driven elevators.

2 Normative References

The following documents are indispensable for the application of this document. For dated referenced documents, only the version with the indicated date applies to this document. For undated referenced documents, the latest version (including all amendments) applies to this document.

GB/T 700 Carbon structural steels

GB/T 7024-2025 Terminology of lifts,escalators and moving walks

GB/T 7588.1-2020 Safety rules for the construction and installation of lifts—Part 1:Passenger and goods passenger lifts

GB/T 10058-2023 Specification for electric lifts

GB/T 19418-2003 Arc-welded joints in steel--Guidance on quality levels for imperfections

GB 50017-2017 Code for Design of Steel Structures

T/CEA 0051 Counterweight filler and balancing weight for lifts

3 Terms and Definitions

The terms and definitions defined in GB/T 7024, GB/T 7588.1, GB/T 10058, and the following apply to this document.

3.1

counterweight

A component with a certain mass, used to ensure the traction capacity.

[Source: GB/T 7588.1-2020，3.8]

3.2

counterweight frame

A component formed by connecting profiles or steel plates processed into shape.

3.3

counterweight filler

A component in the counterweight system used to increase mass, which shall be installed in the counterweight frame and fixed in an appropriate and safe manner.

3.4

pulley cover

A protective cover that prevents foreign objects from entering the rope and rope groove and shall not hinder the inspection and maintenance of the diversion pulley.

3.5

retaining device

A device provided on the counterweight frame to keep the counterweight frame on the guide rails when the guiding device (e.g., guide shoe) fails.

3.6

rope retainer

A protective component that prevents the suspension means, compensation rope, or governor rope from detaching from the rope groove.

[Source: GB/T 7024-2025，5.4.8]

3.7

diversion pulley

A movable pulley provided on the car (or load-carrying device) frame and the counterweight frame.

Note: The suspension means can bypass the movable pulley to form different suspension ratios as required.

[Source: GB/T 7024-2025，5.2.9]

4 General Principles

To enable the counterweight system to achieve the optimal balancing effect on the car and ensure the traction capacity of the elevator system, the total mass of the counterweight system shall be calculated according to the following formula:

$$W = P + q \times Q$$

W——Total mass of the counterweight system, in kilograms (kg);

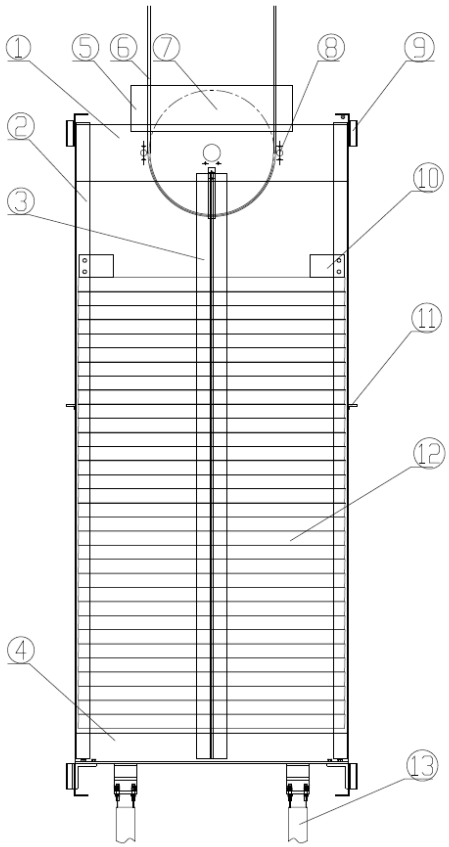
P——Sum of the masses of the empty car and the components supported by the car (e.g., part of the traveling cable, compensation rope or chain (if any)), in kilograms (kg);

q——Counterweight overbalance (ranging from 0.4 to 0.5);

Q——Rated load capacity, in kilograms (kg).

5 Technical Requirements

5.1 Counterweight (refer to Figure 1).



Legend:

①——Upper beam

②——Column

③——Intermediate column

④——Lower beam

⑤——Pulley cover

⑥——suspension means

⑦——Diversion pulley

⑧——Rope retainer

⑨——Guiding device

⑩——Counterweight filler fixing device

⑪——Retaining device

⑫——Counterweight filler

⑬——Compensation device

Figure 1 lift Counterweight

5.2 Counterweight Frame

5.2.1 The counterweight frame shall consist of an upper beam, a lower beam, columns, and other components.

5.2.2 The upper beam, lower beam and columns of the counterweight frame can be composed of steel plates, section steels or steel plate bending components. The mechanical properties of the material shall not be lower

than that of Q235 specified in GB/T 700.

When complying with the provisions of 5.2.5, the following conditions shall also be met:

1) For elevators with a rated load capacity of 630 kg to 1150 kg，
   a) If the load-bearing components of the upper beam and lower beam are steel plate bending components, the nominal thickness of the material shall not be less than 6 mm;
   b) If the load-bearing components of the upper beam and lower beam are directly made of steel plates, the nominal thickness of the material shall not be less than 10 mm;
   c) If the columns are steel plate bending components, the nominal thickness of the material shall not be less than 4.5 mm.
2) For elevators with a rated load capacity greater than 1150 kg,

a) If the load-bearing components of the upper beam and lower beam are steel plate bending components, the nominal thickness of the material shall not be less than 8 mm;

b) If the load-bearing components of the upper beam and lower beam are directly made of steel plates, the nominal thickness of the material shall not be less than 12 mm;

c) If the columns are steel plate bending components, the nominal thickness of the material shall not be less than 6 mm.

5.2.3 The surfaces of counterweight frame shall be provided with anti-corrosion measures,The design service life shall not be less than 25 years.

5.2.4 The connection of the counterweight frame shall be safe and reliable:

5.2.4.1 For bolted connections, the requirements specified in Chapter 11 of GB 50017-2017 Code for Design of Steel Structures shall be complied with.

5.2.4.2 The quality of all load-bearing welds shall meet the requirements of Grade C specified in Table 1 of GB/T 19418-2003.

5.2.5 Safety Factor and Deflection:

5.2.5.1 The safety factor of the counterweight frame and its connecting parts shall not be less than 6.

Note: The safety factor in this document refers to the requirement based on tensile strength under static force conditions.

5.2.5.2 The deflection requirement for the upper beam and lower beam of the counterweight frame shall not be less than 1/1000 of the span.

5.2.6 A counterweight filler fixing device shall be provided to prevent the counterweight filler from jumping and relative sliding during the operation of the elevator; even in the case of the safety gear action or collision with the buffer, the counterweight filler can be kept in the counterweight frame.

5.2.7 When the width of the counterweight frame is greater than 1100 mm, an intermediate column shall be added.

5.3 Counterweight Filler

5.3.1 Counterweight filler shall comply with T/CEA 0051—2026 Counterweight Filler and Balancing Weight for Lifts.

5.3.2 The center of gravity formed by the counterweight filler and the counterweight frame shall be preferably designed at the suspension center point. For the design deviating from the suspension center, the guide shoe and guide rail shall be fully verified.

5.3.3 After the counterweight filler and the counterweight frame are installed, a mark for quickly identifying the number of counterweight filler shall be provided.

5.3.4 Welding the counterweight frame and the counterweight filler together in any way is not allowed.

5.4 Guiding Device

5.4.1 The counterweight frame is guided by guide rails on both sides, and guiding devices shall be provided at the upper and lower parts of both sides of the counterweight frame;
5.4.2 The counterweight frame shall be provided with a retaining device to keep the counterweight frame on the guide rail when the guiding device fails.

5.5 Protection of Diversion Pulley

5.5.1 If a diversion pulley is configured, a pulley cover shall be provided to prevent foreign objects from entering or being involved between the suspension means and the diversion pulley.
5.5.2 For elevators where the suspension means is connected to the counterweight through the diversion pulley, a corresponding risk assessment shall be conducted. For hazards that may be caused by situations such as bearing jamming and breakage, such as the inclination of the diversion pulley, the detachment of the suspension means or the separation of the diversion pulley from the fixed structure, effective protective devices shall be provided. A clear indication mark shall be set at the corresponding position of the protective device.
5.5.3 A rope retainer or related device shall be provided to prevent the suspension means from coming out of the pulley groove, and the rope retainer shall have sufficient strength and reliability.

5.6 Connection of suspension means

The fixed structure or supporting structure on the counterweight frame connected to the termination device of the suspension means shall be able to bear the gravity of the counterweight system and other components connected to the counterweight system, and its safety factor shall be at least 5.

5.7 Connection of Compensation Device

If a compensation device is configured, the fixed structure or supporting structure on the counterweight frame connected to the compensation device shall be able to bear the maximum suspended mass of the compensation device when the counterweight frame is at the highest position, as well as half of the total mass of the tensioning device (if any), and its safety factor shall be at least 5.

6 Packaging, Marking, Transportation and Handling, Storage

6.1 Packaging

The products shall be preferably packed in packing cases; if shipped without packing (nude packing), necessary protection shall be provided.

6.2 Marking

Relevant labels and quality certification documents shall be attached, and the contents shall preferably include:

a）Manufacturer's name and production date;
b）Batch number;
c）Specifications;
d）Appearance quality and dimension inspection results;
e）Material qualification certificate;
f）Seal of the quality inspection department.

6.3 Transportation and Handling

During transportation and handling, collision and dropping are strictly prohibited. Appropriate tools shall be used for handling to ensure the safety of operators.

6.4 Storage

The storage site shall be solid and flat. Products of different specifications and batches shall be stored separately.

References

[1] GB/T 116 Specifications for rivet

[2] GB/T 228.1 Metallic materials—Tensile testing—Part 1: Method of test at room temperature

[3] GB/T 2423.22 Environmental testing - Part 2: Tests methods - Test N: Change of temperature

[4] GB/T 5782 Fasteners—Hexagon head bolts

[5] GB/T 5783 Fasteners—Hexagon head bolts—Full thread

[6] GB/T 7314 Metallic materials—Compression test method at room temperature

[7] GB/T 7588.2-2020 Safety rules for the construction and installation of lifts—Part 2: Design rules, calculations, examinations and tests of lift components

[8] GB/T 8903 Steel wire ropes for lifts

[9] GB/T 9286 Paints and varnishes—Cross-cut test

[10] GB/T 10125 Corrosion tests in artificial atmospheres—Salt spray tests

[11] GB/T 11352 Carbon steel castings for general engineering purpose

[12] GB/T 19418 Arc-welded joints in steel--Guidance on quality levels for imperfections

[13] GB 50661 Code for welding of steel structures

[14] ISO 12944-1 Paints and Varnishes - Corrosion Protection of Steel Structures by Protective Paint Systems Part 1:General introduction

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China Elevator Association

Add: 61 Jin-Guang Ave., Langfang, Hebei 065000, P.R. China

Tel: (0316) 2311426, 2012957

Fax: (0316) 2311427

Email: info@cea-net.org

URL: http://www.elevator.org.cn