ICS 91.140.90
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China Elevator Association Standard

T/CEA 0051—2026

Counterweight Filler and Balancing Weight for Lifts

Released on 2026-02-10 Implemented on 2026-09-01

Issued by China Elevator Association

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Foreword

This document is drafted according to the rules specified in GB/T 1.1—2020.

Please note that some content may involve patents. The publisher of this document assumes no liability for identifying these patents.

The performance indicators required by this document shall be verified by manufacturers through design and manufacturing validation tests, and product compliance declarations shall be made for sold products.

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Introduction

With urban development and improved living standards, elevators have become essential vertical transportation tools. Counterweight filler and balancing weight (including car counterweight, governor tension wheel weight, and compensation device weight) are critical components affecting elevator safety.

The main fillers of Counterweight filler (Balancing weight) include steel plate, cast iron, Metal pressing, etc. At present, there are no targeted technical requirements for Counterweight filler (Balancing weight) in standards such as GB/T 7588.1-2020 "Safety Specifications for the Manufacture and Installation of Elevators - Part 1: Passenger Elevators and freight Elevators", but the importance of their reliability and safety for the safe operation of elevators is self-evident.

The quality of Counterweight filler (Balancing weight) products on the market varies greatly, and their on-site failure poses a huge risk to the safe use of elevators. How to reduce the safety risks brought about by the failure of Counterweight filler (Balancing weight), and how to ensure that elevators can use Counterweight filler (Balancing weight) products that conform to good engineering practices, the industry urgently needs standards for Counterweight filler (Balancing weight) component products to regulate the design, manufacture and inspection of Counterweight filler (Balancing weight).

This document establishes technical and management requirements for design, manufacturing, testing, marking, and packaging.

Counterweight Filler and Balancing Weight for Lifts

1 Scope

This document specifies the terminology, classification, technical requirements, testing methodologies, inspection rules, as well as requirements for marking, packaging, transportation, and storage of elevator counterweight filler and balancing weight..

This standard applies to counterweight filler and balancing weight used in elevators operating under the environmental conditions stipulated in GB/T 10058 and in coastal regions.

2 Normative References

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition (including all amendments) applies:

GB 175—2023 Common portland cement

GB/T 700 Carbon structural steels

GB/T 1031—2009 Geometrical Product Specifications (GPS)—Surface texture:Profile method—Surface roughness parameters and their values

GB/T 2423.22 Environmental Testing—Part 2:Test Methods—Test N:Change of Temperature

GB/T 4223 Iron and steel scraps

GB/T6060.1—2018 Surface Roughness comparison specimen—Part 1:Casting surface

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

GB/T 7314 Metallic materials—compression test method at room temperature

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

GB/T 9439 Gray iron castings

GB/T 10058 Specification for electric lifts

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

GB/T 20565—2022 Iron ores and direct reduced iron—Vocabulary

GB/T 25820—2025 Steel strapping for packaging

T/CEA 0010 Technical rules for lift counterweight requirements

3 Terms and Definitions

For the purposes of this document, the terms and definitions given in GB/T 7024, GB/T 7588.1, GB/T 10058, and T/CEA 0010 apply, along with the following.

3.1

Counterweight Filler
Component used in the counterweight system to increase mass, installed inside the counterweight frame and secured in a safe manner.

3.2

Balancing Weight
Component used to increase mass, balance the car, save energy, or tension governor ropes and compensation ropes.

4 Classification of Counterweight filler (Balancing Weight)

4.1 Steel plate filler(Balancing Weight):Manufactured by cutting steel plates into the required shapes.

4.2 Cast iron filler(Balancing Weight):Manufactured by melting coke, steel slag, and iron slag in specific proportions, pouring the molten mixture into molds, and allowing it to cool and solidify.

4.3 Metal pressing filler(Balancing Weight):Formed by compressing recycled scrap iron and steel under high temperature and high pressure.

(Note: Please refer to Appendix A for the preferred specifications of Counterweight filler.)

5 Technical Requirements

5.1 General Requirements

5.1.1 The materials of counterweight filler(Balancing weight)must be safe, non-toxic, harmless, and recyclable.

5.1.2 The surfaces of counterweight filler(Balancing weight)must be smooth and provided with corrosion protection.

5.1.3 The design service life shall not be less than 25 years.

5.1.4 Counterweight filler(balancing weight)appearance must be defect-free, with sharp edges chamfered to ensure safety.

5.1.5 The design of counterweight filler (balancing weight) shall facilitate handling and installation (refer to Figure 1)， Mass limitations are specified as follows:

a)Single operator:≤25 kg per piece;

b)Dual operators:≤50 kg per piece;

c)With lifting tools:>50 kg allowed.

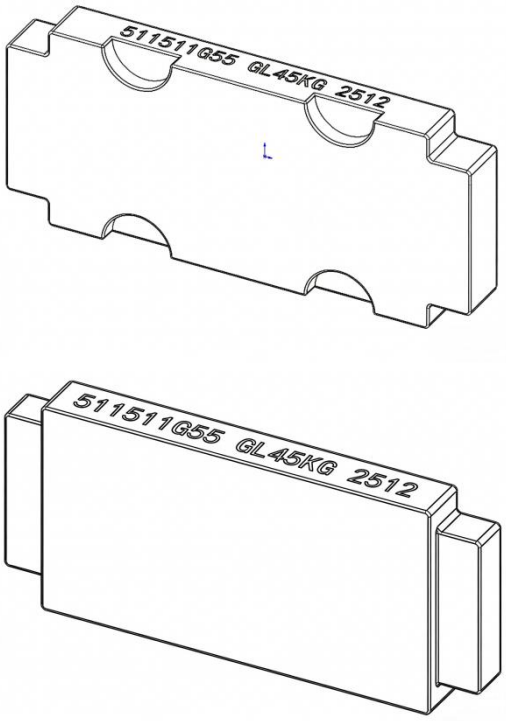


Figure 1 Counterweight filler with handling handle

5.1.6 Mass tolerance:±3% of the nominal mass.

5.1.7 Compressive strength:≥300 MPa without cracking.

5.1.8 Apparent density of Metal pressing filler(Balancing weight):≥6,800 kg/m³ .

Note: The apparent density refers to the definition in 7.1.2 of GB/T 20565-2022.

5.1.9 Surface Roughness

a)Steel plate filler(Balancing weight):Ra25 (in accordance with GB/T 1031—2009);

b)Cast iron filler(Balancing weight):Ra200 (in accordance with GB/T 6060.1—2018);

c)Metal pressing filler(Balancing weight):Ra200 (in accordance with GB/T 6060.1—2018).

5.2 Materials

5.2.1 Steel plate filler(balancing weight):Low-carbon steel conforming to GB/T 700.

5.2.2 Cast iron filler(balancing weight):Gray iron of grade ≥HT100 conforming to GB/T 9439,The sulfide content shall not exceed 1%.

5.2.3 Metal pressing filler(balancing weight):Scrap iron conforming to GB/T 4223,The sulfide content shall not exceed 1%.

Note: The iron content shall not be less than 92%.

5.3 Performance

5.3.1 Steel Plate filler(Balancing Weight)

The stack height shall meet the following requirements(refer to Figure 2):

a)Stack height tolerance (10 pieces): ≤10 mm relative to the nominal height;

b)Corner deviation (10 pieces): ≤10 mm .

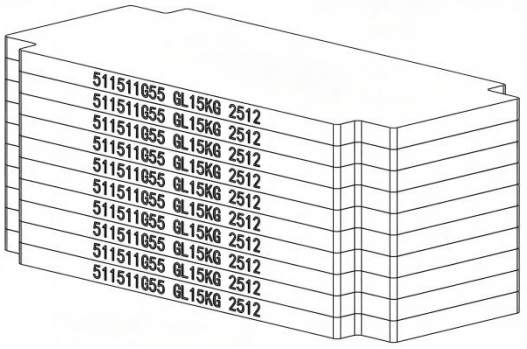


Figure 2 Schematic diagram of steel plate stacking

5.3.2 Cast Iron filler(Balancing Weight)

5.3.2.1 Stack height shall meet the following requirements(refer to Figure 3):

a)Stack height tolerance (10 pieces): ≤20 mm nominal height;

b)Corner deviation (10 pieces): ≤20 mm .

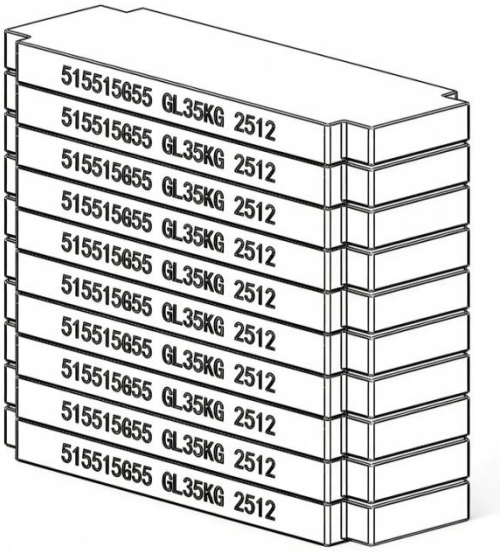


Figure 3 Schematic diagram of cast iron stacking

5.3.2.2 Drop Strength

Drop horizontally from a height of 1 m for 2 times, or tip the counterweight block 90° upright along its length direction and knock it over to the concrete ground for 3 times; no cracks are allowed.

5.3.2.3 Water Absorption

After immersion in water for 72 hours, the weight gain shall not exceed 0.3%; subsequent storage in air for 24 hours shall result in a weight gain reduction to not more than 0.1%.

5.3.3 Metal pressing filler(Balancing Weight)

5.3.3.1 Stack height shall meet the following requirements(refer to Figure 4):

a)Stack height tolerance (10 pieces): ≤20 mm nominal height;

b)Corner deviation (10 pieces): ≤20 mm .

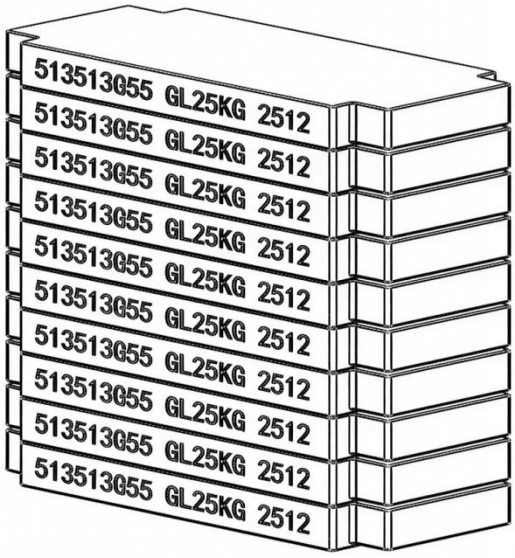


Figure 4 Schematic diagram of Metal pressing stacking

5.3.3.2 Stability

5.3.3.2.1 No cracks after high/low-temperature tests .

5.3.3.2.2 No cracks after salt spray tests.

5.3.3.3 Drop Strength

Drop horizontally from a height of 1 m for 2 times, or tip the counterweight block 90° upright along its length direction and knock it over to the concrete ground for 3 times; no cracks are allowed.

5.3.3.4 Impact Strength

No cracks after testing.

5.3.3.5 Water Absorption

After immersion in water for 72 hours, the weight gain shall not exceed 0.3%; subsequent storage in air for 24 hours shall result in a weight gain reduction to not more than 0.1%.

6 Measurement and Testing of Counterweight Filler (Balancing Weight)

6.1 Test specimens

Test specimens shall comply with the following provisions:

a)Specimens shall be finished counterweight filler (balancing weight) products that meet the requirements of Clauses 5.1 and 5.2, or samples of counterweight filler (balancing weight) with a compressive area of not less than 2500 mm². Samples shall be taken from the finished product itself;

b)Tests specified in Clauses 6.4, 6.5, 6.9, and 6.11 require finished products.

6.2 Mass Measurement

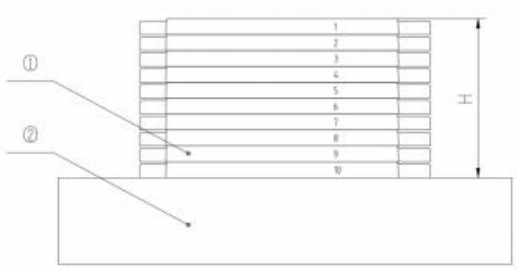
Measure the mass of the counterweight filler (balancing weight) using a platform scale with an accuracy of 0.01 kg. The result shall comply with the provisions of Clause 5.1.5.

6.3 Material Test

For Metal pressing filler (Balancing weight), harmful element analysis and radioactivity analysis shall be conducted on the materials， The results shall comply with the provisions of Clause 5.2.3.

6.4 Stack Height Measurement (10 Pieces)

Clean the surfaces of 10 counterweight filler (balancing weight), stack them in an orderly manner on an inspection platform, and measure the total height H using a steel tape measure (see Figure 5). The result shall comply with the provisions of Clause 5.3.

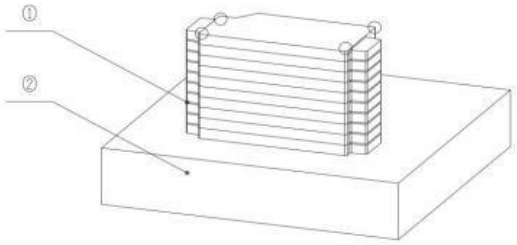


Legend:
①——Finished counterweight filler (balancing weight)
②——Inspection platform

Figure 5 Schematic Diagram of 10-Piece Stacking Test

6.5 Corner Deviation Measurement

After stacking 10 pieces on the inspection platform, use a steel tape measure to measure the height values corresponding to the four corners of the upper surface of the top piece. The difference between the maximum and minimum values shall comply with the provisions of Clause 5.3(refer to Figure 6).



Legend:
①——Finished counterweight filler (balancing weight)
②——Inspection platform

Figure 6 Schematic Diagram of Four-Corner Deviation Test

6.6 High/Low-Temperature Test

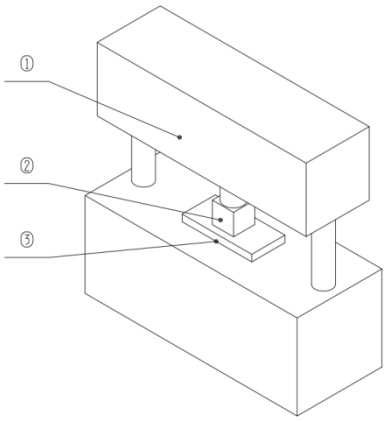
Refer to GB/T 2423.22. Conduct tests at a high temperature of 70 ℃ and a low temperature of -40 ℃, with a holding time of 30 minutes per cycle, for a total of 250 cycles. The result after the test shall comply with the provisions of Clause 5.3.3.2.1.

6.7 Salt Spray Test

Conduct the corrosion resistance—salt spray performance test in accordance with the provisions of GB/T 10125. The test chamber temperature shall be 35 ℃, the sodium chloride concentration 5%, the spray pressure 0.07-0.17 MPa, the pH value 6.5~7.2, and the average sedimentation rate on a horizontal area of 80 cm^2 shall be 1.5 ml/h ± 0.5 ml/h. The test duration shall be not less than 360 h. The result shall comply with the provisions of Clause 5.3.3.2.2.

6.8 Compressive Strength Test

Use a press and refer to the test method for compressive strength in GB/T 7314 for testing (refer to Figure 7). Apply a uniformly distributed pressure vertically on a circular (or square) area of 2500 mm^2. The result shall comply with the provisions of Clause 5.1.7.



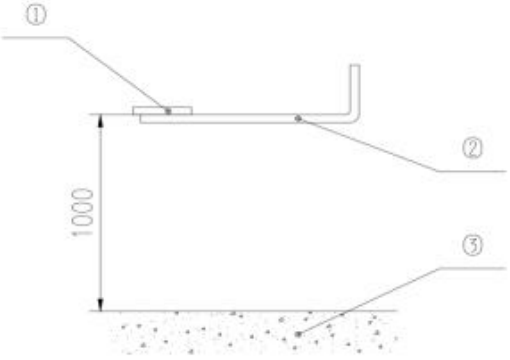
Legend:
①——Press
②——Counterweight filler (balancing weight) specimen
③——Test platform

Figure 7 Schematic Diagram of Compressive Strength Test

6.9 Drop Test

The drop strength test shall comply with the following provisions:

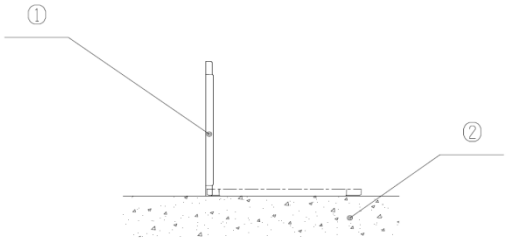
1)Lift the counterweight filler (balancing weight) specimen to a height of 1 m, and allow it to drop freely horizontally onto a ground surface that meets the requirements of Grade P·O42.5 strength specified in GB 175—2023 Common Portland Cement (Clause 7.4.3) (refer to Figure 8). The result shall comply with the provisions of Clause 5.3.



Legend:
①——Finished counterweight filler (balancing weight)
②——Drop device
③——Ground surface of Grade P·O42.5 strength

Figure 8 Schematic Diagram of 1 m Drop Test

2)Stand the counterweight filler (balancing weight) test piece upright at 90° along its lengthwise direction and knock over to drop freely onto a ground surface that meets the requirements of Grade P·O42.5 strength specified in GB 175—2023 Common Portland Cement (Clause 7.4.3) (see Figure 9). The result shall comply with the provisions of Clause 5.3.



Legend:
①——Finished counterweight filler (balancing weight)
②——Ground surface of Grade P·O42.5 strength

Figure 9 Schematic Diagram of 90° Drop Test

6.10 Impact Test

Use a press and refer to the compressive test method in GB/T 7314 for testing (see Figure 7). Apply a force equal to the maximum design theoretical pressure × impact coefficient (the impact coefficient is determined according to the working condition of "safety gear operation" in Table 14 of GB/T 7588.1—2020) on the tested counterweight filler (balancing weight) specimen. The result shall comply with the provisions of Clause 5.3.3.4.

6.11 Water Absorption Test

1)Weigh the surface-dry mass of the specimen. Immerse the specimen in water at (20±2)℃, with the bottom of the specimen supported by steel bars with a diameter of 10 mm. The water level shall be at least 25 mm above the top of the specimen. After soaking for 72 h, take out the specimen, air-dry it naturally for 24 h, then weigh and record the mass of the specimen. The weighing accuracy shall be 0.01 kg.

2)Calculate the test result using the following formula:

$$Wa = \frac{ms-md}{md} \times 100\%$$

Wa——Water absorption rate(%)，with the calculation result accurate to 0.1%;

ms——Surface-dry mass of the specimen before water absorption, in kilograms(kg);

md——Mass of the specimen after water absorption and air drying, in kilograms(kg).

3)The specimen shall comply with the provisions of Clause 6.1. The test result shall comply with the provisions of Clause 5.3.3.5.

6.12 Tests for counterweight filler (balancing weight) shall be conducted in accordance with the following table (Table 1)

Table 1 Test List for Counterweight Filler (Balancing Weight)

Test Item \ filler	Steel Plate filler(Balancing weight)	Cast Iron filler(Balancing weight)	Metal pressing filler(Balancing weight)
Dimension	6.4	6.4	6.4
	6.5	6.5	6.5
Material	/	/	6.3
Stability	/	/	6.6
	/	/	6.7
Strength	/	6.8	6.8
	/	6.9	6.9
	/	/	6.10
Water Absorption	/	/	6.11

Mass	6.2	6.2	6.2

7 Inspection Rules

7.1 Factory inspection:100% inspection shall be conducted before delivery.

7.2 Annual inspection:Sampling inspection shall be conducted on products that have passed previous inspections.

7.3 If there is any change in the formula or process of the Counterweight filler(Balancing weight), it should be re-inspected according to the items of the first inspection.

7.4 Inspection Implementation

Initial inspection, factory inspection, and annual sampling inspection shall be carried out in accordance with Table 2.

The dimension inspection of individual counterweight filler (balancing weight) shall be conducted in accordance with the requirements agreed upon by the supplier and the buyer.

Table 2 Inspection and Test Table for Counterweight Filler (Balancing Weight)

Serial No.	Inspection Item	Clause	Initial Inspection	Factory Inspection	Annual Sampling Inspection
1	Mass Measurement	6.2	√	√	√
2	Material Test [a]	6.3	√		
3	10-Piece Stack Height Measurement	6.4	√		√
4	Four-Corner Deviation Measurement	6.5	√		√
5	High/Low-Temperature Test[a]	6.6	√		
6	Salt Spray Test[a]	6.7	√		
7	Compression Strength Test[a/b]	6.8	√		√
8	Drop Strength Test[a/b]	6.9	√		√

Table 2(Continued) Inspection and Test Table for Counterweight Filler (Balancing Weight)

Serial No.	Inspection Item	Clause	Initial Inspection	Factory Inspection	Annual Sampling Inspection
9	Impact Strength Test[a]	6.10	√		
10	Water Absorption Test [a]	6.11	√		

Note: a) Applicable only to Metal pressing filler balancing weight; b) Applicable only to cast iron filler balancing weight

8 Packaging, Transportation, Handling, and Storage

8.1 Packaging

a)Products shall be packed in cartons; if shipped unpackaged, protective measures shall be taken (see Figures 10~12);

b)The nominal size of the steel strapping shall not be lower than the requirement of 0.9×25.4 mm specified in Table 4 of GB/T 25820-2025;

c)The total mass of a whole package of counterweight filler (balancing weight) shall be ≤1700 kg;

d) Shipping mark information shall include at least the outer dimensions and total mass of the whole package, and shall be fixed in a prominent position on the package for easy identification.

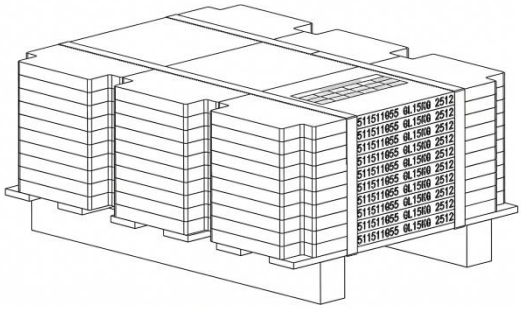


Figure 10 Packing Status of Steel Plate filler Balancing weight

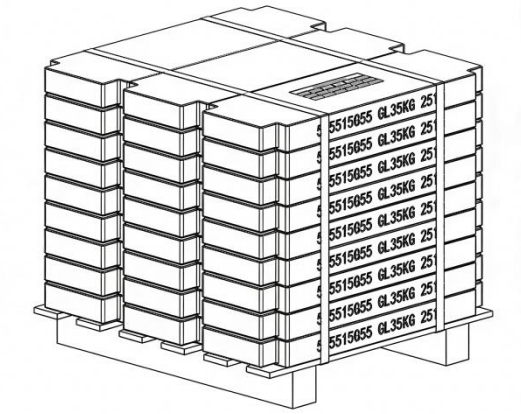


Figure 11 Packing Status of Cast Iron filler Balancing weight

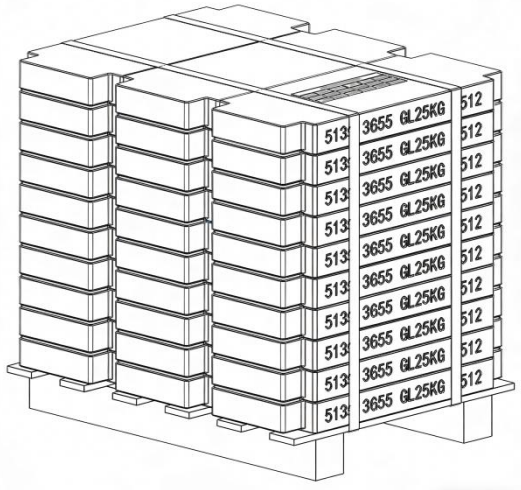


Figure 12 Packing Status of Metal pressing filler Balancing weight

8.2 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.

8.3 Storage

The storage site shall be solid and level. Products of different specifications and batches shall be stored separately. The stacking height of counterweight filler (balancing weight) shall not exceed 2 m, and measures shall be taken to prevent moisture and erosion by corrosive substances.

9 Marking

Counterweight filler (balancing weight) shall be clearly marked with the following content:

a)Manufacturer’s name and production batch (for Metal pressing filler only);

b)Product code and mass;

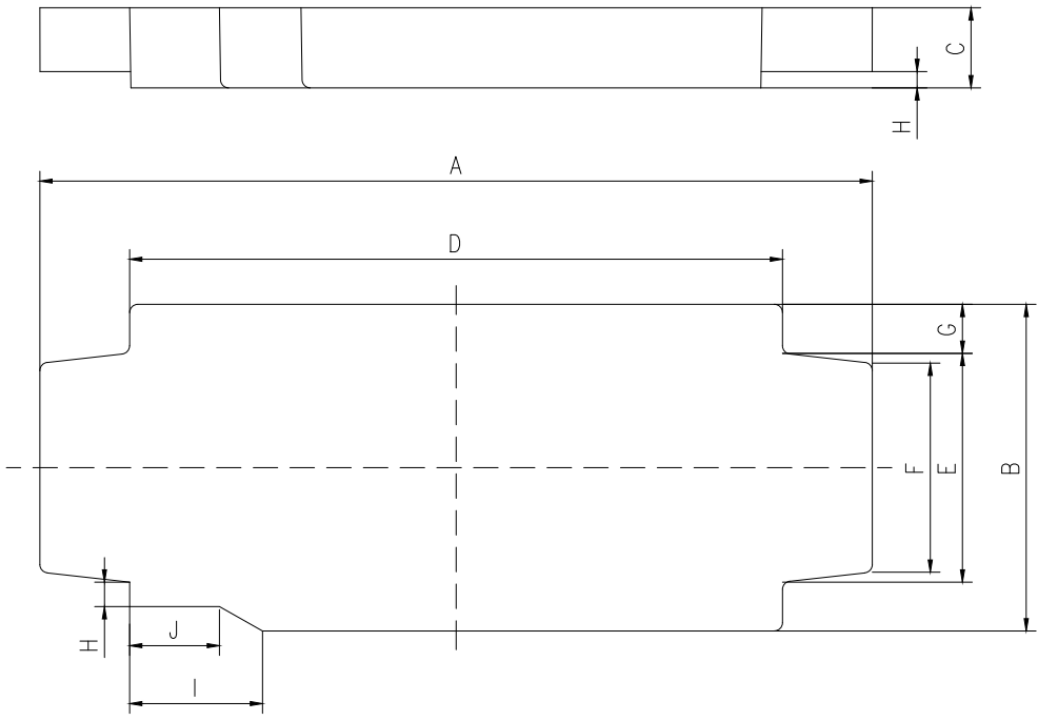
c)The wording "Two-Person Handling" (if applicable);

d)The marking color shall be safety warning yellow;

e)Marking position: If the thickness of the counterweight filler (balancing weight) is ≥30 mm, the marking shall be on the thickness side; if the thickness is <30 mm, the marking shall be on the upper surface.

Appendix A
(Informative)
Preferred Specifications for Counterweight Filler (Balancing Weight)

Figure 13 Schematic Diagram of Counterweight Filler (Balancing Weight) Dimensions



A.1 Preferred Specifications for Steel Plate filler Balancing weight

Table A.1 Preferred Specifications for Steel Plate filler Balancing weight (Density:7850 kg/m^3)

Serial No.	Dim A/mm	Dim B/mm	Dim C/mm	Dim D/mm	Dim E/mm	Dim F/mm	Dim G/mm	Dim H/mm	Dim I/mm	Dim J/mm	Dim H/mm	Single Mass /kg	Figure
1	500	210	30	358	120	/	/	/	/	/	/	21	13
2	680	150	30	540	106	95	/	/	/	/	/	22	13
3	1025	100	30	915	70	/	/	/	/	/	/	23	13
4	825	125	30	715	95	/	/	/	/	/	/	23	13
5	510	260	30	400	140	128	30	295	105	55	/	25	13

A.2 Preferred Specifications for Cast Iron filler Balancing weight

Table A.2 Preferred Specifications for Cast Iron filler Balancing weight (Density: 6800 kg/m³)

Serial No.	Dim A/mm	Dim B/mm	Dim C/mm	Dim D/mm	Dim E/mm	Dim F/mm	Dim G/mm	Dim H/mm	Dim I/mm	Dim J/mm	Dim H/mm	Single Mass /kg	Figure
1	650	240	26	576	74	/	93	28	45	/	/	25	13
2	983	90	42	/	/	/	/	/	/	/	/	25	13
3	1025	100	53	915	70	/	/	/	/	/	10	35	13
4	825	125	53	715	95	/	/	/	/	/	10	35	13
5	680	150	55	540	106	95	/	/	/	/	10	35	13
6	650	240	37	576	74	/	93	28	45	/	10	35	13
7	634	240	37	512	158	146	/	/	/	/	10	35	13
8	610	300	35	500	140	128	10	/	138	55	10	35	13
9	610	260	38	500	140	128	30	/	105	55	10	35	13
10	610	240	41	500	140	128	10	/	105	55	10	35	13
11	510	260	47	400	140	128	30	/	105	55	10	35	13
12	500	260	47	358	120	/	95	/	/	/	10	35	13
13	500	210	57	358	120	/	/	/	/	/	10	35	13
14	1025	125	50	915	95	/	/	/	/	/	10	42	13
15	823	253	34	730	109	/	60	15	160	160	10	42	13
16	825	240	34	751	74	/	93	28	45	/	10	42	13
17	723	253	39	630	109	/	60	15	160	160	10	42	13
18	710	260	38	600	140	128	30	/	105	55	10	42	13
19	610	360	35	500	140	128	70	/	138	55	10	42	13
20	610	300	40	500	140	128	10	/	138	55	10	42	13
21	610	210	54	500	140	128	30	/	105	55	10	42	13
22	1025	160	42	915	125	/	/	/	/	/	10	45	13
23	710	300	36	600	140	128	70	/	105	55	10	45	13
24	695	200	50	555	170	/	/	/	/	/	10	45	13

A.3 Preferred Specifications for Metal pressing filler Balancing weight

Table A.3 Preferred Specifications for Metal pressing filler Balancing weight (Density: 6800 kg/m³)

Serial No.	Dim A/mm	Dim B/mm	Dim C/mm	Dim D/mm	Dim E/mm	Dim F/mm	Dim G/mm	Dim H/mm	Dim I/mm	Dim J/mm	Dim H/mm	Single Mass /kg	Figure
1	650	240	26	576	74	/	93	28	45	/	/	25	13
2	983	90	42	/	/	/	/	/	/	/	/	25	13
3	1025	100	53	915	70	/	/	/	/	/	10	35	13
4	825	125	53	715	95	/	/	/	/	/	10	35	13
5	680	150	55	540	106	95	/	/	/	/	10	35	13
6	650	240	37	576	74	/	93	28	45	/	10	35	13
7	634	240	37	512	158	146	/	/	/	/	10	35	13
8	610	300	35	500	140	128	10	/	138	55	10	35	13
9	610	260	38	500	140	128	30	/	105	55	10	35	13
10	610	240	41	500	140	128	10	/	105	55	10	35	13
11	510	260	47	400	140	128	30	/	105	55	10	35	13
12	500	260	47	358	120	/	95	/	/	/	10	35	13
13	500	210	57	358	120	/	/	/	/	/	10	35	13
14	1025	125	50	915	95	/	/	/	/	/	10	42	13
15	823	253	34	730	109	/	60	15	160	160	10	42	13
16	825	240	34	751	74	/	93	28	45	/	10	42	13
17	723	253	39	630	109	/	60	15	160	160	10	42	13
18	710	260	38	600	140	128	30	/	105	55	10	42	13
19	610	360	35	500	140	128	70	/	138	55	10	42	13
20	610	300	40	500	140	128	10	/	138	55	10	42	13
21	610	210	54	500	140	128	30	/	105	55	10	42	13
22	1025	160	42	915	125	/	/	/	/	/	10	45	13
23	710	300	36	600	140	128	70	/	105	55	10	45	13
24	695	200	50	555	170	/	/	/	/	/	10	45	13

References

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

[2] GB/T 2828.1 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

[3] GB/T 6461 Methodsfor corrosion testing of metallic and other inorganic coatings on metallic substrates--Rating of test specimens and manufactured articles subjected to corrosion tests

[4] GB 6566 Limits of radionuclides in building materials

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

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

[7] GB/T 10561 Determination of content of nonmetallic inclusions in steel—Micrographic method using standard diagrams

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

[9] GB 13367 Principles for the exemption of radiation sources and practices from regulatory control

[10] GB/T 31002.1 Ergonomics—Manual handling—Part 1：Lifting and carrying

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