Translated English of Chinese Standard: GB12142-2007
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ICS 13.100

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NATIONAL STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

GB 12142-2007

Replacing GB 12142-1989 and GB 7059.3-1986

Safety Requirements for Portable Metal Ladders

Issued on: June 26, 2007 **Implemented on: February 1, 2008**

Jointly issued by: **The General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and The Standardization Administration Committee (SAC) of the People's Republic of China**

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Foreword

The provisions of all chapters, except chapters 1, 2 and 3, shall be compulsory in this Standard.

This Standard is the combination of revision to GB 12142-1989 "Safety Standard for Light-metal Extension Ladders" and GB 7059.3-1986 "Safety Standard for Light Metals Portable Stepladder".

This Standard replaces GB 12142-1989 "Safety Standard for Light-metal Extension Ladders" and GB 7059.3-1986 "Safety Standard for Light Metals Portable Stepladder".

Compared with GB 12142-1989 "Safety Standard for Light-metal Extension Ladders" and GB 7059.3-1986 "Safety Standard for Light Metals Portable Stepladder", this Standard has the major technical differences as follows:

-Extend the application scope of the Standard, cover the safety requirements for two-section extension ladder, stepladder, as well as three-section extension ladder, single ladder and combination ladder;

-Add the normal load grading for ladders and the structure performance requirements corresponding to normal load;

-Add metal fitting load test requirements, rung torsion test requirements, stile cantilever bending test requirements and stile cantilever drop test requirements for extension ladder and single ladder;

-Add the following test requirements for stepladder: stile bending test requirement, step (or rung) and stile shear strength test requirements, torsional stability test requirements, transverse pull test requirements, front and back stile cantilever bending test requirements, front and back stile cantilever drop test requirements and stile torsion and spreader test requirements;

-Cancel the horizontal bending test requirement for stepladder;

-Make full revision to other contents on structural requirement, operating requirement and test requirement.

This Standard is proposed by the State Administration of Work Safety.

This Standard is under the jurisdiction of the National Technical Committee 288 on Safety Production of Standardization Administration of China (SAC/TC 288).

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All previously replaced editions hereof are as:

-GB 12142-1989;

-GB 7059.3-1986.

NATIONAL STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

GB 12142-2007

Safety Requirements for Portable Metal Ladders

1 Scope

This Standard specifies design/manufacturing safety requirements, test requirements, safe operation requirements and others for portable metal ladders.

This Standard is applicable to portable metal extension ladder (two-section or three-section extension ladders), portable metal single ladder, portable metal stepladder and portable metal combination ladder used on production activities.

2 Normative References

The provisions of following documents, through reference of this Standard, constitute provisions of this Standard. For those documents which are dated, neither their subsequent amendment (excluding correction) nor their revision applies to this Standard. However, the parties who enter into agreement according to these specifications are encouraged to research whether the latest edition of the document is applicable. For those documents which are undated, the latest edition of the normative document is applicable.

GB/T 17889.1 Ladder - Part 1: Terms, Types and Function Dimensions

3 Terms and Definitions

For the purposes of this Standard, the following terms and definitions and the ones given in GB/T 17889.1 apply.

3.1

Portable metal extension ladder

Portable leaning ladder formed by two or three sections, whose length is adjustable and primary components (stile and step/rung) are made by metallic material

3.2

Portable metal single ladder (straight ladder)

Portable leaning ladder formed by only a section, whose length is non-adjustable and primary components (stile and step/rung) are made by metallic material

3.3

Portable metal stepladder

Working length

The length measured (along the stile) from the ladder bottom supporting point to the top supporting point when the ladder is in the predetermined operation state

3.15

Maximum working length (maximum extension length)

The working length of an extension ladder when its extensible sections are extended to the maximum place (keeping the required minimal lap)

3.16

Highest standing level

The vertical distance from the supporting plane (ladder bottom) to the highest step (or rung) that the user is allowable to ascend to in the predetermined state

3.17

Inside clear width

The distance measured (parallel to the step / rung) between flanges on two stile of a ladder

3.18

Normal load

The maximum load (including weights of ascender, and carried materials and tools) that a ladder can bear in the predetermined operation condition

3.19

Test failure

Visible failure to ladder structure or component(s) due to test(s), including corrugation, distortion, shearing, tearing or breakdown

3.20

Ultimate failure

Severe failure to ladder structure or component(s) due to test, which causes that the ladder structure or component(s) due cannot work properly

3.21

Visible damage

Failure that can be distinguished and identified clearly by visual check

4 General

4.1 Normal Load

Portable metal ladders shall be able to bear a normal load not less than 90kg and identified by the normal load. By load bearing capacity, normal loads of ladders may be classified as four classes: 90kg, 100kg, 110kg and 135kg.

4.2 Corrosion Resistance

Ladders shall be made of corrosion-resistant material as much as possible; otherwise, they shall be applied with anti-corrosion treatment.

4.3 Exposed Metal Surface

Exposed metal surface of a ladder shall be free of sharp edge, burr and other structural defect.

rung shall be larger than 20mm.

6.4 Stepladder Inclination Angle

6.4.1 When a stepladder (front ladder section) separates to the working position, the inclination angle of the font section shall not be larger than 73° and the one of the back section shall not be larger than 80°.

6.4.2 When trestle ladder or accommodation ladder separates to the working position, the inclination angle of the stile shall not be larger than 77°.

6.5 Step (or Rung) Connection

When the stepladder is in working position, the steps (or rung) shall be kept horizontal and parallel with each other (allowable tolerance <= 3mm). When step (or rung) and stile are connected by fasteners, at least one fastener shall penetrate out of the front of each side stile, and at least one fastener shall penetrate out of the back of each side stile. Step (or rung) on bottom side shall be used with bracing reinforcer or equivalent reinforcing piece.

6.6 Ladder Tip

At least fasteners penetrate through each side of front stile so that the ladder tip is fixed up. The mode of fastening the back ladder foot to the tip shall enable the hinge rotate flexibly.

6.7 Gantry

The fixing of a gantry as a part of stepladder shall enable gantry to fold upward when the stepladder is folded up. When the ladder is 2.4m or shorter, the gantry structure shall enable it to be folded up before the ladder is folded, or to be folded with the ladder simultaneously; the gantry shall extend to the stile facing towards the user when ladder folding.

6.8 Stepladder Back

The back transverse bracing of a stepladder may be rung or rundle.

6.9 Ladder Foot

Ladder foot shall be made of anti-skid material. The upright projection area of anti-skid surface shall not be less than the projection area of the lower end cross section of the stile. At least two fasteners shall be used to fix the front ladder foot, and at least one fastener is used to fix back ladder foot.

6.10 Spreader (or Locking Piece)

A stepladder shall have a metal spreader (or locking piece) as one part with the ladder, to make front and back parts keep an open state. The height from the spreader to the bottom bearing surface shall not be larger than 2m. When adopting two sets of spreaders, the height limitation is only applicable to the lower set.

7 Structural Requirements for Combination Ladder

7.1 Combination Ladder Length

Length of combination ladder shall meet the requirements of Table 5. Where the ladder is used as stepladder, the ladder length is measured (along the front rim of the front stile) from the ladder foot bottom to the cap top (or to the top step/rung, if without top cap), and the allowable tolerance of the length shall be ±13m. Where the ladder is used as extension ladder, the maximum extension length shall be 900mm less than the sum of the lengths of the two

sections of the ladder, and the allowable tolerance hereof shall be ±13mm.

Table 5 Combination Ladder Length

Normal load /kg	Section length /m
90	1.2~2
100	1.2~3
110	1.2~3
135	1.2~3

7.2 Inclination angle of combination ladder

The structure of a combination ladder shall achieve that: when it is used as single-side stepladder and on the open position, the inclination angle of the front section shall not be larger than 73° and the back inclination angle shall not be larger than 80°.

7.3 Width of Combination Ladder

The minimal inside clear width between front stiles, measured on top step (or rung), shall not be less than 280mm. The horizontal contained angle between front stile and step (or rung) shall not be larger than 80°. The inside clear width between two stiles of extended section or single section shall not be less than 280mm.

7.4 Step (or Rung)

When step (or rung) can be used as ladder front and back, the steps (or rung) shall be kept horizontal and parallel, and the allowable tolerance shall be within 3mm.

7.5 Step Depth

When used as stepladder, the step depth shall not be less than 80mm.

7.6 Gantry

When the gantry and the combination ladder are combined as one and the gantry structure shall be folded as a ladder, the gantry shall be folded up into the ladder.

7.7 Ladder Foot

Stile bottom shall be equipped with ladder foot and the anti-skid surface shall not be less than the projection area of the bottom cross section of the stile.

7.8 Spreader (or Locking Piece)

A combination ladder shall have a metal spreader (or locking piece) as one part with the ladder, to make front and back parts keep an open state. The height from the spreader to the bottom bearing surface shall not be larger than 2m.

7.9 Retainer

When a combination ladder is used as extension ladder, it shall be positioned and locked with reliable device, to make its length not less than the indicated maximum working length.

7.10 End Cap

When the stile surface is not coated with nonmetallic material, and end caps shall be used on stile top on both sides of a combination ladder.

8 Operating Requirements

8.1 Selection

8.1.1 Extension ladder, single ladder and stepladder shall be used on single side for only single person. Trestle ladder and accommodation ladder may be used on both sides (front and

8.2.7 Ladder ascending

8.2.7.1 When ascending a ladder upper and lower, the user shall face towards the ladder and keep touching the ladder on three points (any three points of both hands, and both feet). The user shall not ascend a ladder along a lateral face or from a ladder to another, nor ascend a ladder on a swinging plane.

8.2.7.2 In case the extension length is not enough, the user shall re-adjust the ladder after getting down to the ground. While the user is on a ladder, he/she shall not do actions like pushing or pulling the ladder.

8.2.8 Electrical hazards

8.2.8.1 The user shall take reliable safety measures when the ladder for working is close to electric circuit. These safety measures shall able to keep the user from touching any live un-insulated circuit or conductor (electric shock).

8.2.8.2 Except ladders specially designed for electric circuit working, metal ladders shall not be used in the circumstance with possible contact with live circuit. When the user uses a ladder under a live circuit, the operator (user) shall keep safe distance from the live circuit.

8.2.9 Non-normal use

Ladder shall not be used for the purposes below: supporter, skid-ways, lever, tension rod or central column, gang-board, platform, scaffold plate, materials hoisting device or any other non-predetermined use. Ladder shall not be placed on scaffold to acquire additional height.

8.2.10 Accessing or leaving ladder on upward plane

When a ladder is used to access to a high-level plane (roof or platform), the ladder shall extend over the plane by more than 1m. The ladder shall be fixed into the high-level plane reliably when accessing or leaving the ladder on the high-level plane. The user shall avoid making the ladder tip-over laterally or the ladder foot sliding due to fierce action when accessing or leaving the ladder on the high-level plane.

8.2.11 Ladder erection and adjustment

8.2.11.1 An extension ladder shall be erected to make its top section (extended section) above the bottom section and the rung lock joggled in place. The top section may be in front of at back of the bottom section, depending on the structure formation. If an extended section has been used as single ladder, the section shall be checked (whether it is assembled correctly, or the locking piece is joggled in place) in the erection.

8.2.11.2 The extension ladder shall be adjusted by the user only on the bearing surface (ladder bottom) for the purpose of observing whether the locking piece is joggled correctly. The user shall inspect whether the cable slides along the pulley wheel correctly. The user shall not adjust the ladder length on the ladder top (or locking piece).

8.2.11.3 In stepladder erection, it shall be ensured that the ladder is opened completely, the spreader is locked up and the feet contact with horizontal supporting surface firmly.

8.2.12 Ladder repositioning

The ladder shall not be shifted for repositioning when there is person on the ladder.

8.2.13 Use in strong static electricity area

Specially-designed electrostatic-grounding (anti-electrostatic) metal ladder shall be used in strong static electricity area to protect the user from electric shock.

8.3 Maintenance

8.3.1 Inspection

Ladder shall subject to total inspections whey they are purchased and bought into operation; and they shall subject to total inspection regularly and before use each time after bought into operation. In case of structural failure or other defect(s) causing possible hazards, the ladder shall be discarded as useless or repaired by the qualified technician.

8.3.1.1 Turnover and other impact failure

After the ladder suffers from turnover or other impact, it shall be inspected whether there is stile jog or bending, or over-bending of step (or rung). Total inspection shall be carried out for all metal fittings, step (or rung), stile connecting piece and component.

8.3.1.2 High temperature exposure

After exposed to hot temperature (like close to fire), the ladder strength may decrease, so it shall be inspected damage or not, and deflection test, stile lateral bend test and rung torsion test may be carried out for extension ladder and single ladder, so as to ensure they meet the safety requirement before used.

8.3.1.3 Corrosive substance

If a ladder is exposed to some acid or alkali material, such material may reduce the strength of the ladder due to the chemical corrosion. Please consult the manufacturer or the qualified technician before use.

8.3.1.4 Oil and wax

The ascending and grabbing surfaces of a ladder shall be kept from easy-skid materials like oil and wax.

8.3.1.5 Cable and Pulley Wheel

Cable and pulley wheel shall be inspected and tested periodically, to ensure normal operation of them; in case of any wearing or defect, the ladder shall be replaced in time.

8.3.2 Damaged ladder

Damaged or bent ladder shall be marked clearly and disused, and then repaired by the qualified technician or discarded as useless.

8.3.3 Transportation

The ladders, when transported by motor vehicles, shall be supported properly. The supporter should be steel tubes covered with wood or rubber to re reduce wearing and road surface impact; and the ladders shall be kept well contacting all supporters to reduce damage due to road surface impact.

8.3.4 Storage

The ladder out-of-service shall be stored on dedicated placement bracket. The bracket shall provide adequate supporting points to prevent ladder from bending or sagging due to gravity. During the storage, other materials shall not place on the ladder.

8.3.5 Daily maintenance

Metal fittings, wearing parts and other accessories shall be inspected periodically to keep their normal working state. All rotation connections and rung lock gliding surfaces shall be lubricated frequently. If connection bolt or rivet is lost or connection between step (or rung) and stile is loosening, the ladder shall be used after repaired to normal state. Stile bottom anti-skid pieces, in case if excessive wearing, damage or loss, shall be replaced in time.

Figure 3 Diagrams for Inclination Load Test

9.4 Metal fitting load test

9.4.1 The ladder subjecting to the test specified in 9.4.2~ 9.4.3 shall not have permanent deformation or test failure.

9.4.2 The tested ladder shall be a whole ladder or a shorter specimen satisfying the testing conditions. When testing a whole ladder, the extended section shall be extended to the minimal extension that the ladder extends out of the first-level rung when the ladder is in the minimal working length. The shorter specimen (length) shall include the extension ladder bottom section and a part of the extended section with all metal fittings.

9.4.3 The ladder is placed to form an inclination angle of 75° to the horizontal plane and to make the two lock joggled. The loading method shall be to make the test load uniformly distributed on the lowest rung in the extended section above the ladder lapping part, and both ends of the loading position shall keep 3mm~6mm to each inside of the two stiles. The test load specified as Table 4 is applied vertically downwards on the ladder continuously (as shown in Figure 4) for at least 1min before releasing the load. And the ladder is checked against if there is permanent deformation or test failure.

Table 10 Metal Fitting Test and Single Lock Test Loads

Normal load /kg	Metal fitting test load /N	Single lock test load /N
135	5 296	4 315
110	4 315	4 315
100	3 923	3 923
90	3 530	3 530

9.5 Single-lock load test

9.5.1 The lock on each side shall be able to withstand the test specified in 9.5.2~ 9.5.3 and have no permanent deformation or test failure; after the test, the other components of the ladder may have permanent deformation and the loaded rung shall be able to continue support the test load after loading although the rung has permanent deformation.

9.5.2 The tested ladder shall be a whole ladder or a shorter specimen satisfying the testing conditions. When testing a whole ladder, the extended section shall be extended to the minimal extension that the ladder extends out of the first-level rung when the ladder is in the minimal working length. The shorter specimen (length) shall include the extension ladder bottom section and a part of the extended section with all metal fittings.

9.5.3 The test ladder is placed to form an inclination angle of 75° to the horizontal plane and the lock on a side is demounted off. The loading method shall be to make the test load uniformly distributed on the lowest rung in the extended section above the ladder lapping part, and both ends of the loading position shall keep 3mm~6mm to each inside of the two stiles. The test load specified as Table 9 is applied vertically downwards on the rung in the extended section above the ladder lapping part (Figure 4) continuously for at least 1min before releasing the load, and the ladder is checked whether there is test failure or not. Repeat the test specified as 9.5.2~9.5.3 on the lock of the other side.

4.5	32.3	-
5.0	34.0	-
5.5	35.6	-
6.0	37.3	-
6.5	38.9	-
7.0	40.6	-
7.5	42.3	-
8.0	43.9	-
8.5	45.6	-
9.0	47.3	-
Note: Y3=3.33L+17.3 (rounded off with a decimal digit).		

9.10 Stile cantilever bending test

9.10.1 After the test specified in 9.10.2~ 9.10.4, the permanent deformation (the difference of the widths of the two stile bottom ends before and after the test) of any stile bottom end shall not be higher than 6mm. When the stile can continue to support the test load, other component may have permanent deformation or ultimate failure.

9.10.2 The tested ladder shall be a whole single ladder or the bottom section from an extension ladder. Ladder foot or other anti-skid pieces shall be demounted off prior to the test. The tested ladder shall be placed sideways to make the rung in the vertical plane (Figure 8). The lower stile is clamped close to the supporter and the stile part from the ladder bottom end to the lowest rung center does not touch the supporter. When the rung face is a plane, this plan shall be parallel to the rim of the supporter.

test failure.

10.1.2 The tested ladder shall be a whole ladder, placed on a horizontal floor, and opened to the normal working state; the spreader is on the predetermined position (Figure 12).

10.1.3 The uniformly distributed load equal to 4 times of the normal load is applied on the top cap or the highest step (or rung) of the single side stepladder by means of wooden loading block 40mm in thickness. The top caps of both side sections of a double-side ladder shall be applied with the uniformly-distributed test load equal to 2 times of the normal load simultaneously; without top cap, the load is applied on the highest steps (or rung) on both sides. The load is applied continuously for at least 1min, and the ladder is checked whether there is test failure.

10.2 Stile Bending Test

10.2.1 After tested as required by 10.2.2~10.2.3, the stile and its component shall not have test failure.

10.2.2 The tested ladder shall be a whole ladder, placed on a horizontal floor, and opened to the normal working state; the spreader is on the predetermined position (Figure 12).

Stepladder length (L) /m	Maximum allowable transverse pull displacement (Y4) /mm		
	Normal load 90kg	Normal load 100kg	Normal loads 110kg and 135kg
0.9~2	Y_4=112.5L+201		
0.9~4		Y_4=112.5L+201	
0.9~6			Y_4=112.5L+99

10.7.2 The ladder shall be placed on a horizontal floor, and opened fully; the spreader is on the predetermined position. The two feet shall be positioned respectively with mold clamps, prevent the move relative to the ground. As for ladder with gantry, the gantry shall be on the working position.

10.7.3 The uniformly-distributed static load of 441N is applied on the lowest step (or rung), and a pull force perpendicular upwards is applied on the back center of the ladder top cap; if without top cap, on the back center of the top step (or rung); this pull force pulls the two back foot 75mm away from the ground (Figure 15). The perpendicular pull force is applied by means of a cable at least 8mm in diameter and at least 0.9m in length and it shall be ensured that no move of the cable at any direction occurs on the ladder top cap within at least 0.9m range. A transverse pull force of 27N is applied on the bottom side of a back stile.

10.7.4 The transverse pull force is kept constant, and the transverse displacement of the back stile bottom end relative to the unloaded state shall be measured along the direction along the transverse pull force direction. After unloading the force, the ladder is checked whether there is ultimate failure or not.

12 Marking

12.1 General

12.1.1 Each ladder shall be affixed with the markings indicating basic hazardous cautions "Dangerous" and "Take Care" and product data.

12.1.2 The marking shall be clear, apparent, and easy to see. This marking shall be affixed on the outer side of the right stile, 1.4m~1.8m (in height) to the ladder bottom end.

12.1.3 It shall be ensured that the location of the marking cannot be damaged or affected by other component in the procedure of extension or constriction (extension ladder), opening or folding (stepladder).

12.1.4 Where the marking cannot be affixed as required by 12.1.2 due to the limitation in ladder dimension or structure, it shall be located on a position easy to see.

12.2 Product Data Marking

12.2.1 All ladders shall be affixed with the product data marking as specified by 12.2.2.

12.2.2 The marking shall provide the following data:

a) The model or name, and the normal load;
b) The total length of the ladder;
c) The maximum working length (for extension ladder);
d) The lengths of the sections (for extension ladder);
e) The elevation of the highest standing level;
f) The name (identification) of the manufacturer or the distributor;
g) The manufacturing data (year and month);
h) The standard applied.

12.3 Accident Prevention Marking

12.3.1 Permanent dangerous caution marking or equivalent graphical marking shall be affixed on the highest standing level of extension ladder and single ladder, for example, "Danger: Don't Step On Or Above This Rung"; the marking is located on the inside of the right stile; when the second high rung is 600mm or more away from the top, the marking shall be close to and pointed with an arrowhead to the second high rung; when the second high rung is less 600mm to the top, the marking shall be close to and pointed with an arrowhead to the third high rung.

Note: the highest standing level is the vertical distance from the ladder bottom supporting plane to the topmost rung that the user is allowable to ascend when the extension ladder or the single ladder is placed at a 75°inclination angle.

12.3.2 The extended section not equipped with permanent section locking piece to prevent section shifting shall be affixed with permanent caution marking, like "Note: This Section Is Forbidden to Split for Use".

12.3.3 The top cap of a stepladder shall have permanent dangerous caution marking like "Danger: Don't Stand or Sit on This Position"; plastic top cap marking for stepladder shall be pressed on the top cap. The arrangement of such marking shall ensure it is located on the position easy to sea and consistent with form, structure and material surface layer.

12.3.4 The position of the highest standing level of a stepladder shall be affixed with dangerous caution marking, like "Danger: Don't Step On Or Above This Rung"; when the first

step (or rung) below the top cap is 450mm or less away from the top cap, the marking is located on the inside of the right stile near this step (or rung); otherwise, this marking may not be affixed.

12.3.5 Each ladder shall have electric shock danger caution marking or equivalent graphical marking, like "Note: To Prevent Electric Shock - Metal Ladder Shall Not Be Used in the Circumstance with Possible Exposure to Electric Circuit". This marking shall be located on the outer side of the right stile, 1.4m~1.8m (in height) to the ladder bottom end.

References and Original Chinese Documents

[1] GB 12142-2007 Safety requirements for portable metal ladders.
http://www.chinesestandard.net/Default.aspx?PDF-English-ID=GB%2012142-2007
[2] GB/T 17889.1 Ladder - Part 1: Terms, Types and Function Dimensions.
http://www.chinesestandard.net/Default.aspx?StdID=GB/T%2017889
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