

UL 184

ISBN 0-7629-0208-6

Portable Metal Ladders

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Portable Metal Ladders, UL 184

Sixth Edition, Dated October 20, 1997

Revisions: This Standard contains revisions through and including June 28, 2001.

Announcement Bulletin(s): This Standard contains the announcement bulletin(s) dated March 2, 2001. The announcement bulletin is located at the end of the Standard.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-3	June 28, 2001
4-61	October 20, 1997
62	June 28, 2001

No Text on This Page

May 28, 1998

1

UL 184

Standard for Portable Metal Ladders

First Edition – July, 1958
Second Edition – January, 1971
Third Edition – June, 1974
Fourth Edition – September, 1980
Fifth Edition – March, 1993

Sixth Edition

October 20, 1997

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

ISBN 0-7629-0208-6

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements apply to portable metal ladders of the following types: step, single, extension, platform, sectional, trestle, extension trestle, combination, and special-purpose ladders.

1.2 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.2 Units of measurement

2.2.1 When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 COMBINATION LADDER – A portable ladder capable of being used either as a stepladder or a single or extension ladder. It may also be capable of being used as a trestle ladder or a stairwell ladder. Its components may be used as single ladders. Its size is designated by the length of the ladder; when used as a self-supporting ladder, measured along the front edge of the front side rail from the bottom of the foot to the top of the top cap, or top step when a top cap is not provided.

3.2 EFFECTIVE SPAN – The distance between the supporting points on the ladder when under test.

3.3 EXTENSION LADDER – A nonself-supporting portable ladder, adjustable in length. It consists of two or more sections traveling in integral or separate guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the individual sections measured along the side rails, excluding any foot or end caps.

3.4 EXTENSION TRESTLE LADDER – A self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with means for locking the ladders together. The size is designated by the length of one of the side rails in the trestle ladder base, measured along the front edge, including the shoe, plus the allowable extended length of the extension section measured along one of the side rails.

3.5 INSIDE CLEAR WIDTH – The distance between the inside flanges of the side rails of a ladder, measured parallel to the rungs or steps.

3.6 LADDER – An appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step while ascending or descending.

3.7 PLATFORM LADDER – A self-supporting portable ladder of fixed size with a platform provided at the highest standing level. The size is determined by the distance along the front rail from the platform to the base of the ladder, including any foot or shoe.

3.8 SECTIONAL LADDER – A nonself-supporting portable ladder, nonadjustable in length, consisting of two or more sections so constructed that the sections may be combined to function as a single ladder. Its size is designated by the overall length of the assembled sections measured along the rails, plus any material necessary for attaching.

3.9 SINGLE LADDER – A nonself-supporting portable ladder, nonadjustable in length, consisting of only one section. Its size is designated by the overall length of the side rail, excluding any foot or end cap.

3.10 SPECIAL-PURPOSE LADDER – A portable ladder which represents either a modification or a combination of design or construction features in one of the general-purpose types of ladders defined in this section intended to adapt the ladder to special or specific uses.

3.11 STEPLADDER – A self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails, including any foot or top cap.

3.12 STEP STOOL (LADDER TYPE) – A self-supporting, foldable portable ladder, nonadjustable in length, 32 inches (813 mm) or less in overall size with flat steps, without a bucket shelf, designed to be climbed on the ladder top cap as well as on all steps. The side rails may continue above the top cap.

3.13 TEST FAILURE – Visible weakening of ladder structure or component or other damage in which the structure or component is buckled twisted, sheared, torn, or fractured as a result of the test.

3.14 TOP CAP – The uppermost horizontal member of a portable stepladder.

3.15 TOP STEP – The first step immediately below the top surface or top cap of a portable stepladder. When a ladder is constructed without a top cap, the top step is the first step below the top of the rails.

3.16 TRESTLE LADDER – A self supporting portable ladder, nonadjustable in length, consisting of two sections, hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge, including any foot or shoe.

3.17 ULTIMATE FAILURE – Collapse of the ladder, structure, or where applicable, a component thereof.

3.18 VISIBLE DAMAGE – Damage clearly evident to the eye without recourse to optical measuring devices.

4 Instructions

4.1 Instructions covering the intended use of the specific ladder shall be provided with each ladder and shall contain information which applies only to the specific type of ladder. These instructions shall comply with the requirements in 16.2.9.

CONSTRUCTION

5 General

5.1 General

5.1.1 Specific design and construction requirements are not a part of this standard because of the wide variety of metals and design possibilities. A ladder shall have sufficient strength and other characteristics to comply with the performance requirements specified in this standard.

5.1.2 Materials shall be protected against corrosion unless inherently corrosion-resistant.

5.2 Duty rating

5.2.1 A metal ladder shall be marked and identified by duty rating based on work load, in compliance with the requirements in 16.2.10.

5.3 Lengths

5.3.1 A step, platform, or trestle ladder, and an extension trestle section shall have lengths as specified in Table 5.1.

Table 5.1
Ladder lengths step, platform, trestle and extension trestle ladders

Duty rating,		Length					
		Stepladder,		Platform ladder,		Trestle and extension trestle,	
pounds	(kg)	feet	(m)	feet	(m)	feet	(m)
200	90.7	3 to 6	0.9 to 1.8 ^a	2 to 4	0.6 to 1.2	—	—
225	102.1	3 to 12	0.9 to 3.7	2 to 10	0.6 to 3.0	—	—
250	113.4	3 to 20	0.9 to 6.1	2 to 18	0.6 to 5.5	6 to 20	1.8 to 6.1
300	136.1	3 to 20	0.9 to 6.1	2 to 18	0.6 to 5.5	6 to 20	1.8 to 6.1

^aStep stool having rating of 200 pounds with length less than 32 inches (813 mm).

5.3.2 A single, sectional, and extension ladder shall have lengths as specified in Table 5.2.

Table 5.2
Ladder lengths single, sectional and extension ladders

Duty rating,		Length ^a ,	
pounds	(kg)	feet	(m)
200	90.7	7 to 16	2.1 to 4.9
225	102.1	7 to 24	2.1 to 7.3
250	113.4	7 to 30	2.1 to 9.1
300	136.1	7 to 30	2.1 to 9.1

^aLength specified applies to individual section of multiple-section ladders.

5.4 Exposed metal surfaces

5.4.1 An exposed metal surface shall be free from sharp edges, burrs, and structural defects.

5.5 Bolted connections

5.5.1 A bolt hole shall be accurately punched or drilled and there shall be no burrs in excess of 1/32 inch (0.8 mm) high. All bolts, nuts, and screws shall be tight or shall permit smooth functioning of component parts when used in pivotally connected joints. All nuts shall be locknuts, or be used with a lock washer, or what has been determined to be the equivalent. A minimum of 1-1/2 threads shall be exposed beyond the nut.

5.6 Riveted connections

5.6.1 A rivet hole shall be accurately punched or drilled and there shall be no burrs in excess of 1/32 inch (0.8 mm). Each rivet shall be full, neatly made, without major visible cracks or splits, concentric with the rivet hole, and in contact with the surface of the member, so that for non-pivotable connections, a 0.005 inch (0.127 mm) feeler gauge cannot be fully inserted between the rivet head and surface of the member or between two members attached together by the rivet.

5.7 Welds

5.7.1 All welds shall be free from undercuts, cracks, and closely spaced in-line surface porosity.

5.8 Rung or step spacings

5.8.1 The spacing of rungs or steps shall be on $12 \pm 1/8$ inch (305 ± 3 mm) centers, except for minimum 8 inch (203 mm) centers for step stools. On a stepladder, the top step may be located 18 inches (457 mm) below the top cap when means are provided to restrict inadvertent stepping into the opening, or when the tread of the top step is extended so that it will contact a vertical line from the lower front edge of the top cap. When the top step is located 18 inches (457 mm) below the top cap, the bottom step shall be located 6 inches (152 mm) above the base support.

5.9 Rung or step connections

5.9.1 Rung or step to side-rail connections shall be constructed so as to provide the rigidity as well as the strength to comply with the performance requirements in this standard.

5.10 Rungs, steps, and platforms

5.10.1 Rungs, steps, and platforms shall be corrugated, serrated, knurled, dimpled, or coated with slip-resistant material.

5.11 Hardware and fasteners

5.11.1 Hardware shall be of a material that is protected against corrosion or is inherently corrosion-resistant. Metals shall be closely spaced in the galvanic or electromotive series.

6 Single and Extension Ladders

6.1 Ladder width

6.1.1 The minimum clear width between side rails of the bottom section of an extension ladder shall be as specified in Table 6.1. The minimum clear width between side rails of a single ladder or any section of an extension ladder shall not be less than 12 inches (305 mm). The minimum clear width between side rails on a single ladder over 10 feet (3.0 m) in length shall increase 1/4 inch (6.4 mm) for each additional 2 feet (0.61 m) of length.

Table 6.1
Minimum clear width

Nominal length, feet (m)	Width,	
	inches	(mm)
Up to and including 28 (8.5)	14	356
Over 28 (8.5), up to and including 40 (12.2)	15	381
Over 40 (12.2)	18	457

6.2 Ladder length

6.2.1 The length of a single ladder shall not exceed 30 feet (9.1 m). A ladder having two or more sections shall not exceed 60 feet (18.3 m) in length. The measured length of each section shall be within ± 3 inches (76.2 mm) of the marked length, excluding any foot or end cap.

6.3 Overlap

6.3.1 Each section of a multisection ladder, when fully extended shall overlap the adjacent section by not less than the number of inches specified in Table 6.2. The nominal length is the total length of the individual sections.

Table 6.2
Minimum overlap for multisection ladders

Nominal length, feet (m)	Overlap			
	Two sections,		More than two sections,	
	inches	(m)	inches	(m)
Up to and including 32 (9.6)	34	0.86	33	0.84
Over 32 (9.6), up to and including 36 (11.0)	46	1.17	45	1.14
Over 36 (11.0), up to and including 48 (14.6)	58	1.47	57	1.45
Over 48 (14.6), up to 60 (18.3)	70	1.78	69	1.75

6.4 Stops

6.4.1 An extension ladder shall be equipped with positive stops or other means which will provide the overlap specified in Table 6.2. Use of the pulley location to limit the overlap is not considered to comply with this requirement.

6.5 Guide fittings

6.5.1 When guide fittings are used to interlock ladder sections, they shall provide a 1-1/4 inch (38 mm) minimum length along the rails.

6.6 Locks

6.6.1 Locks may be of any design, such as gravity-, spring-action, rope operated, or stationary types. A section incorporating locks, which result in the elimination of a rung in the section, shall either be marked as specified in 16.2.4 or shall be provided with permanently attached locks to prevent removal of the section. Permanently attached locks are considered as those that would require cutting, drilling, or similar forcible means for removal.

6.7 Feet

6.7.1 Each rail of a single ladder and each rail of an extension ladder base section shall be provided with slip-resistant tread secured to the foot, or equivalent means of slip resistance. The foot bracket shall pivot freely to allow the tread to reset squarely when the ladder is inclined for intended use.

6.8 End caps and closures

6.8.1 An end cap, when provided, shall not extend the rail length in excess of the depth of the side rail. An end cap shall comply with the strength requirements of the ladder and shall be protected against corrosion unless inherently corrosion resistant. An end cap or protection determined to be the equivalent against sharp edges and snagging shall be provided:

- a) On the bottom of each side rail of the fly or intermediate section when the fly or intermediate section operates on the front of the base section, and
- b) On the top of the base section when the fly or intermediate section operates in the rear of the base section. An end closure on the bottom of the fly or intermediate section may serve as feet if:
 - 1) The unit permits the section to be taken apart and
 - 2) The end closure is provided with slip resistance in compliance with the requirements of 6.7.1

6.9 Rope and pulley

6.9.1 An extension ladder may be equipped with a rope and pulley securely attached to the ladder so as not to weaken either the rungs or the side rails. The fastening means to secure the pulley shall not be considered as weakening the rungs, when the rungs comply with the rung strength test specified in 13.6.1 – 13.6.3.

6.9.2 The rope used with the pulley shall:

- a) Be not less than a nominal 5/16 inch in diameter,
- b) Have a minimum breaking strength of 560 pounds (2491 N), and
- c) Be of sufficient length to fully extend the ladder.

On a three-section ladder, on the fly section only, where wire cable is used in rope-and-pulley hookup, the cable may be 1/8 inch (3.2 mm) in diameter.

6.10 Rungs

6.10.1 A rung that is round or has a flat surface shall be attached to the side rail so that the flat portion is horizontal when the ladder is placed at an angle of 75-1/2 degrees from the horizontal.

7 Stepladders

7.1 Slope

7.1.1 A stepladder shall have a minimum slope of 3-1/2 inches per foot (292 mm/m) of length of the front section, and a minimum slope of 2 inches per foot (167 mm/m) of length of the back section.

7.2 Width and spread

7.2.1 The minimum clear width between the side rails at the top step shall be 12 inches (305 mm). The spread of the side rails shall increase at a rate of at least 1-1/4 inches per foot (104 mm/m) of length.

7.3 Length

7.3.1 The length of a stepladder measured along the front rail, including the top and foot tread, shall be within $\pm 1/2$ inch (12.7 mm) of the marked length. Maximum lengths shall be as specified in 5.2.1. A stepladder shall not exceed 20 feet (6.1 m) in length.

7.4 Top

7.4.1 The top shall be secured with at least two fasteners through each front rail. The rear legs shall be fastened to the top in a manner to allow hinge action.

7.5 Bucket shelf

7.5.1 A bucket shelf that is an integral part of a stepladder shall be fastened so that it can be folded up when the ladder is closed. On a ladder 8 feet (2.44 m) or less in length, the shelf shall be constructed so that it must be folded before the ladder can be closed, or during the closing of the ladder the shelf shall fold and the bucket shelf arms shall not project beyond the front rail frame surfaces facing the user.

7.6 Back section

7.6.1 The back section may be provided with either rungs or cross-bracing.

7.7 Steps

7.7.1 The depth of the step or tread shall be not less than 3 inches (76.2 mm). Steps shall be spaced on $12 \pm 1/8$ inch (305 ± 3.2 mm) centers and shall be parallel and level [within $1/8$ inch (3.2 mm)] when the ladder is in position for use. Steps shall be connected to each side rail with a minimum of one fastener through the front portion and one fastener through the rear portion of each step. The bottom step shall be provided with diagonal braces or what is determined to be the equivalent. In addition, each ladder shall be provided with either of the following:

- a) A second fastener through the front portion of each step and side rail or
- b) Diagonal braces or what is determined to be the equivalent at the top step. On a ladder over 8 feet (2.4 m) the diagonal braces may be located on the second step from the top. On a ladder with the first step 18 inches from the top cap, the diagonal braces may be attached to the top cap.

7.8 Feet

7.8.1 The bottoms of the rails and legs shall be provided with slip-resistant material. The projected rectangular area of the slip-resistant surface shall not be less than the projected area outlined by the cross-section of the end of the rail. A minimum of two fasteners shall be used to secure the front rail feet. A minimum of one fastener shall be used to secure the back rail feet.

7.9 Spreader

7.9.1 A ladder shall include an integral metal spreader or locking device to hold the front and back sections securely in the open position. The spreader or locking device shall be located at a height not exceeding 6-1/2 feet (2.0 m). When double sets of spreaders are used, the height limitation applies only to the lower set.

8 Trestle and Extension Trestle Ladders

8.1 Size

8.1.1 A trestle ladder and extension sections and base sections of an extension trestle ladder shall be not more than 20 feet (6.1 m) in length. A tolerance of plus 2 inches (50.8 mm), minus 1/2 inch (12.7 mm) shall apply to all sections. In no case shall the extension section size exceed the base section size. The length shall be measured as follows:

- a) Trestle Ladder – The size is determined by the length of the side rails measured along the front edge including the foot or shoe.
- b) Extension Trestle Ladder – The size is determined by the length of the trestle ladder base along the front edge of the side rail including the shoe plus the allowable extended length of the extension section measured along its side rail.

8.2 Width

8.2.1 The clear width between side rails of the trestle or extension section at the narrowest point shall be not less than 12-1/2 inches (318 mm). The spread of side rails shall increase at a rate of at least 1-1/4 inches per foot (104 mm/m) of length of side rail.

8.3 Spread

8.3.1 When the section is open the spread of the base shall be not less than 5-1/2 inches per foot (458 mm/m) of base section side rail.

8.4 Spreaders

8.4.1 Each trestle ladder shall include an integral metal spreader or locking device to securely hold the front and back sections in the open position. All sharp points or edges of the spreader shall be covered or removed. When double sets of spreaders are used, the lower set shall be not more than 6-1/2 feet (1.98 m) above the lower support surface. On an extension trestle ladder where the extension guidance system serves as the spreaders, its location may be more than 6-1/2 feet (1.98 m) above the base.

8.5 Overlap

8.5.1 Based on the size of the ladder, the extension section of the extension trestle ladder, when fully extended, shall overlap the base section by the number of feet, ± 2 inches (50.8 mm) as indicated in Table 8.1.

Table 8.1
Required extension trestle overlaps

Base section size, feet (m)	Minimum required overlap,	
	feet	(m)
6 (1.33), up to and including 8 (2.44)	3	0.91
Over 8 (2.44), up to and including 12 (3.66)	4	1.22
Over 12 (3.66), up to and including 16 (4.88)	5	1.52
Over 16 (4.88), up to and including 20 (6.10)	6	1.83

8.6 Overlap control

8.6.1 An extension trestle ladder shall be equipped so that the ladder cannot be used with an overlap of less than the minimum specified in Table 8.1, with a tolerance of ± 2 inches (50.8 mm). Constructions using ladder lock locations, mechanical stops, or what is determined to be the equivalent, are capable of being used.

8.7 Feet

8.7.1 The bottoms of the four rails of the trestle ladder and the base section of an extension trestle ladder shall be provided with slip-resistant material. The dimensions of the slip-resistant surfaces shall be not less than the dimensions of the projected area outlined by the cross-section of the end of the rails.

8.8 End caps and end closures

8.8.1 An end cap shall be provided on the upper end of each side rail of the extension section of an extension trestle ladder. An end closure, or protection determined to be the equivalent against sharp edges and snagging, shall be provided on the bottom of each side rail of the extension section. End closures on the bottom of the extension section may serve as ladder shoes where the unit permits the sections to be taken apart.

9 Platform Ladders

9.1 Size

9.1.1 The size of a platform ladder is to be determined by the length of the front edge of the front side rail from the top of the platform to the base of the ladder, including any foot or shoe, with a tolerance of $\pm 1/2$ inch (12.7 mm).

9.2 Width and spread

9.2.1 The clear width between side rails at platform level shall be at least 14 inches (356 mm) for a 225, 250, and 300 pound (102.1, 113.4, and 136.1 kg) duty rated ladder and 13 inches (330 mm) for a 200 pound (90.7 kg) duty rated ladder. The width spread shall be not less than 1-1/4 inches per foot (104 mm/m) of length.