Docket No.: P298048.US.03_506318-576

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	B. Scott Maxfield		
Appln. No.:	18/490,715	Confirmation No.:	5970
Filing Date:	19 October 2023	Examiner:	Shiref M Mekhaeil
Title:	MULTIFUNCTION BUTTON FOR LADDER ADJUSTMENT	Group Art Unit:	3634

DECLARATION UNDER 37 C.F.R. §1.132

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

I, David Smith, declare that:

1. I hold a Master's of Science in Mechanical Engineering from Brigham Young University, Provo, Utah an MBA with an emphasis in product development from the Marriott School of Management at BYU, Provo, and a Bachelor of Science Degree in Mechanical Engineering from Brigham Young University Idaho, Rexburg, Idaho.

2. I am a licensed professional engineer (P.E.) in the states of Utah and Idaho. I am a Certified Safety Professional (CSP) in comprehensive practice. I am listed as an inventor on seven US Patents, with other patents pending. I started working at Alpine Engineering & Design, Inc., a mechanical engineering consulting firm, as an intern in 2006 and have worked my way through positions of increasing responsibility to my current position of President.

3. Over the past 18 years as an engineer, I have consulted on the design of hundreds of products and equipment ranging from coffee makes and blenders to exercise equipment to garbage trucks. Many of the products I have consulted on incorporate hinges. In my work I have also been directly responsible for engineering decisions relating to work-at-height equipment including fixed ladders, portable ladders, mobile stair cases, scaffolding, fall protection equipment and man lifts.

4. I am familiar with the disclosure, subject matter, and currently pending claims of U.S. Patent Application 18/490,715 ("the '715 Application").

5. I have reviewed the examiner's rejection based on U.S. Patent Application Publication No. 2003/0037412 to Lee ("the Lee reference") and U.S. Patent No. 11,191,373 to Ng ("the Ng reference"), and disagree that the disclosures of these two references render the invention obvious for a number of reasons.

6. First, it is my opinion that the Ng reference is non-analogous art to the field of the claims of the '715 Application. The Ng reference relates to brackets for hanging pictures, while the present invention relates to ladders. It is my understanding that a reference can be shown to be analogous art based on two separate tests. The first test is whether the reference is from the same field of endeavor. Here, the primary focus is on what the references disclose. It is my opinion that the Lee reference is from the same field of endeavor as the claims, as it discloses a hinge for collapsible ladders. However, the Ng reference relates to a mounting device for hanging articles on a wall. The disclosure of Ng is not related to ladders and is in fact a completely separate field of endeavor. As an expert in the field, I would not consider picture hanging devices as being in the same field of endeavor as ladders because ladders are not conventionally used as

picture hanging devices, and picture hanging devices are not conventionally part of ladders.

7. The second test for non-analogous art is whether the reference is reasonably pertinent to the problem being solved. A mechanical engineer facing the problem of storing and supporting tools while on a ladder would have many known ways of hanging tools that would be pertinent to address the problem, such as ladder top caps, trays, tool belts, and similar devices common to ladders and tool users. However, the task of hanging pictures and any problems associated with hanging pictures are far removed from the problem of storing and supporting tools. Pictures are typically hung indoors in a controlled environment. Ladders are commonly used and stored outdoors and need to be designed with materials and components that are non-corrosive and capable of withstanding the elements. Further, pictures are hung against a wall. When a picture is hung from its top back side, a torque or moment is generated due to the force of gravity acting on the center of gravity of the picture. The picture therefore contacts the wall at the bottom to counteract the torque allowing the picture to hang flat against the wall. By comparison, ladders typically have an empty space under the hinge when set up and cannot support the bottom of whatever is being hung. Thus, to a skilled mechanical engineer, an object hanging from the ladder hinge will not hang appropriately if it hangs at all. Accordingly, a picture hanging bracket of Ng would not be pertinent to the problem of supporting objects while on a ladder or at a ladder hinge because there would be no lateral (*e.g.*, wall) support for a picture below the hinge. The expected result of adding an Ng bracket to the hinge would be an article that slips and rotates off of the bracket due to lacking lateral support below the bracket.

8. Further, the Ng disclosure, and the bracket in particular, are not pertinent to the problem that would be faced by a mechanical engineer tasked to support tools at the top of a ladder. Tools are repeatedly hung and removed from top caps, trays, and tool belts. Picture frames and articles that would be supported by the Ng bracket are hung and left in the hanging position rather than being hung and rehung multiple times a day. Because of this, ANSI-ASC A14.2, which is a safety standard for ladders that would be followed by a skilled mechanical engineer, requires testing a minimum of 6,000 cycles for components of a ladder. *See* Appendix A at §7.4.2. For all of these reasons, a person having ordinary skill in the art ("POSITA") would not turn to Ng (or any other picture hanger designs) to try and solve the problem of how to safely and securely hang tools on a ladder while the ladder is in use. For these reasons, based on my professional experience, the only way one would consider the teachings of the Ng reference as being obvious to use to obtain the pending claims would be by using hindsight rooted in already knowing the purpose and features of the claimed invention.

9. Additionally, even if the Ng reference was analogous art to the Lee reference, it is my opinion that it would not have been obvious to combine the Lee and Ng references to arrive at the invention claimed in the '715 application. In the Office Action, the Examiner contends that it would be obvious for a person having ordinary skill in the art to have a hanging bracket such as the one taught by Ng because it "would be useful to a worker on a ladder." Final Office Action dated 25 March 2024 at p. 12. Respectfully, the Examiner's opinion is not supported by the cited references and would not be obvious to a person having ordinary skill in the art lacking the Examiner's hindsight bias.

10. First, ladder hinges, including the hinges of Lee, are not intended to be weight bearing members, unlike other parts such as rails or rungs. Modifying a handle or button for a hinge requires a clear motivation to do so because it affects both the safety and functionality of the hinge and ladder overall. Persons having ordinary skill in the art of ladders would not generally design hinges to bear surplus or irregular loads, particularly those that would induce bending in the hinge components since doing so would affect safety and functionality of the hinge. Tools have various weights and sizes, so they would induce surplus or irregular loads to the hinge components and would need to be specifically designed around and tested for. Additionally, because hinge components such as the Lee handles are positioned far offset from the center of mass of the ladder, the weight of hanging tools would risk tilting or tipping the ladder. Thus, it would not be obvious to design hinge components to support potentially heavy hanging objects such as tools. For these reasons, in my opinion, there is no motivation or suggestion in Lee (or in the art in general at the time the '715 application was submitted) for the Lee handles to become weight bearing (*e.g.*, tool bearing) members. Without a reason to make them weight-bearing, there would be no reason to refer to the Ng bracket at all.

11. Even if there were a motivation to combine Lee with the teachings of Ng, simply putting the bracket onto the hinge would violate basic engineering safety principles which a POSITA would understand. Design for safety is critical in the design and development of ladders. Ladders are consistently on OSHA's Top 10 Most Frequently Cited Standards, as shown, for example, in the appended top 10 lists for the periods of October 2021 to September 2022 and October 2022 to September 2023, which reflect the circumstances surrounding the filing of the current application. *See* Appendices B and C. Even the Lee disclosure is directed to improving the safety of the

ladder: "As described above, the hinge for the collapsible ladders having a safety structure according to the present invention... keep an operator safe during use of the ladder." Lee at para. [0024]. Thus, to add a bracket for hanging tools to the hinge would require significant structural design considerations and would need to be evaluated and tested. The standard in ANSI-ASC A14.2 covers articulating ladders and is particularly directed to "provide reasonable safety for life limb and property." Appendix A at §1.2. The standard further specifies that "design verification tests shall be conducted during the initial evaluation of a specific product design and thereafter whenever there is a change in the design, method of manufacture, or material." *Id.* at §7.1.5. It would be critical to provide a load rating for the new bracket. An overloaded bracket could fail, allowing tools to fall and impacting and injuring those below the ladder. An engineer having ordinary skill in the art would understand the importance of verification tests for design changes or modifications, and ensuring weight bearing members, particularly elevated weight bearing members are designed to hold a specified amount of weight. In contrast, a picture hanging bracket such as one from Ng would be under no such stringent requirements. A POSITA therefore would not have any motivation to turn to Ng to find load bearing brackets of the kind that could properly be used on an articulating ladder.

12. Further, an engineer would know that the added bracket would need to be sufficiently large to hold tools. A skilled person viewing the apparent width of the outer circular surface of the press part 508 of Lee would not find the press part 508 conductive to adding a bracket of sufficient size for holding tools. The hinge of Lee appears to be sized for a normal ladder, even if the patent drawings are not necessarily to scale. An engineer would not have found it obvious to add an Ng-style bracket to the outer surface

of the press part 508 as the outer surface is too small (probably about 1.5-2.0 inches across). A bracket attached to such a small surface would not be obvious to use for holding a variety of tools, particularly since Ng shows that about half of the width Ng bracket is taken up by the portions (30, 40) through which the fasteners attach the bracket to a picture frame, thereby making any hanging opening (beneath center portion 20) very small and not obviously suited for supporting normal tools. An engineer would first have to decide to change the Lee reference before deciding that the bracket of Ng could be added to it, and I do not see any reason an engineer would have done so.

13. Modifying the press part 508 of the hinge of Lee to be larger (*e.g.*, to accommodate a larger Ng bracket and therefore to support larger tools) would also not have been obvious. Doing so would introduce additional forces/moments on the press part 508 and the hinge itself, which would result in increased stress on the shaft of the handle (*i.e.*, a longer moment arm between the edge of the press part and the shaft) and would require significant effort to redesign and re-verify compliance with the ladder-related safety and manufacturing standards. As an example, ANSI-ASC A14.2 states "a spreader or locking device *of sufficient size and strength* to securely hold the front and back sections in the open position shall be a component part of each stepladder." Appendix A at §6.1.9 (emphasis added). Modifying the press part 508 by making it larger (*e.g.*, to accommodate a useful Ng bracket 50) would decrease the strength of the locking device (press axle 500 and locking device 580 to which it is attached) and would require significant analysis and testing for verification of compliance with the ANSI-ASC A14.2 standard.

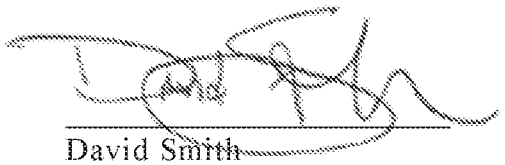
14. For at least the above reasons, an engineer or ladder designer would not

have been motivated to combine the Lee reference with the Ng reference.

15. Additionally, articulating ladders and picture frames with mounting brackets have both existed for many decades before the '715 application was filed. If the combination were indeed obvious, and there were teachings, suggestions, or motivations to combine the teachings of Lee and Ng, it stands to reason that the combination would have been made ages ago. As an expert in the field, I do not see anything in the cited references or in the knowledge of a POSITA at the relevant time that would have provided a design-based or market-based reason for a POSITA to modify Lee based on the teachings of Ng to obtain the ladder of the claims of the '715 application. Instead, I can only see the combination of these parts as a reconstruction of applied invention motivated by hindsight.

16. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced application or any patent issuing thereon.

Date: 6/17/2024



David Smith

4872-5806-2024\1

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- Appendix B: Copy of website entitled "Commonly Used Statistics," U.S. Department of Labor, Occupational Safety and Health Administration, accessed 17 June 2024, available at https://www.osha.gov/data/commonstats. (3 Pages)
- Appendix C: Copy of website entitled "OSHA's Top 10 Most Frequently Cited Standards," U.S. Department of Labor, Occupational Safety and Health Administration, accessed 17 June 2024, available at https://www.osha.gov/top10citedstandards. (3 Pages)

APPENDIX A

Copy of "American National Standard for Ladders – Portable Metal – Safety Requirements" - ANSI-ASC A14.2-2007, American Ladder Institute, American National Standards Institute, Inc., approved August 20, 2007. (78 Pages)

American National Standard for Ladders — Portable Metal — Safety Requirements

American National Standards

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American National Standard for Ladders — Portable Metal — Safety Requirements

Secretariat
American Ladder Institute

Approved August 20, 2007
American National Standards Institute, Inc.

For information on possible errata sheets and other ANSI-ASC A14 Standards please refer to the ALI website located at:
www.americanladderinstitute.org

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American National Standard

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Foreword

(This Foreword is not a part of American National Standard A14.2-2007.)

This standard on portable ladders is one of many American National Standards prepared under the supervision of the ANSI Accredited Standards Committee on Safety in the Construction, Care, and Use of Ladders, A14. Subcommittees that report to the American National Standards Committee A14 have developed all of the standards. The subcommittees are A14.1, Portable Wood Ladders; A14.2, Portable Metal Ladders; A14.3, Fixed Ladders, A14.4, Job-Made Ladders; and A14.5, Portable Reinforced Plastic Ladders, and 14.9, Ceiling Mounted Disappearing Climbing Systems.

All standards, except A14.7 Mobile Ladders Stands and Mobile Ladder Stand Platforms, derive from the original American National Standards Safety Code for Construction, Care, and Use of Ladders, which was first approved on July 25, 1923. Revisions were approved on April 11, 1935; April 2, 1948; and November 10, 1952.

The earlier editions contained some treatment of metal and fixed ladders. Requirements for these types were removed from the 1948 revision because rapid development in the metal ladder field warranted special consideration and treatment of metal ladders, and fixed ladders (usually metal) in separate standards.

The Metal Ladder Manufacturers Association is responsible for initiating the standard on portable metal ladders. This group prepared the original draft and submitted it to Standards Committee A14 for consideration in May 1951. Subcommittee A14.2 was then created to review the document and make any changes necessary to conform to the requirements of all the interested groups. After consideration and some revision by the subcommittee, nearly 200 copies of the draft were sent to various organizations and individuals for review and comment. The suggestions received were considered in the preparation of the final draft, which was submitted to the Standards Committee for letter ballot in December 1955, and approved in 1956. Subcommittee A14.2 also developed the 1972 edition.

Responding to a Consumer Product Safety Commission challenge in August 1975, the A14 Committee mounted a three-prong attack to upgrade the portable ladder standards within the consensus framework of developing standards. Three Task Forces — Anthropometric, Testing, and Labeling — were established in October 1975.

Without question the Testing Task Force carried out the most massive technically difficult task, which included a significant amount of human-factors work. Over 100 known ladder experts were solicited to join this task force and provide their technical expertise. The work involved 50 meetings, over 400 test documents and the use of numerous test ladders over a period of nearly two years. The cost of the project has been conservatively estimated at over $300,000.

At the August 11, 1977, joint meeting of the Testing Task Force and the A14 Advisory Committee, 23 procedures were presented. These procedures, with an accompanying rationale based upon statistical and human factors data, were distributed to the three portable-ladder subcommittees for review and incorporation into the standards. Recommendations for nomenclature, and for care and use of ladders had been previously balloted. In addition, the Ladder Use Survey Form and Bi-Level Fall Victim Report Form (that have been included in the Appendixes), had also been balloted so the more technical material from the Testing Task Force could receive full attention of the three subcommittees.

Test procedures were developed for three different applications, namely, design verification, quality control, and in-service testing. Design verification tests would generally be conducted on a one-time basis during the original design development of the product and would usually be destructive tests. The manufacturer on an on-going basis would conduct quality control tests; some of the tests would be destructive and some would be nondestructive. In-service tests would be conducted by the user on a periodic basis and would be nondestructive in nature.

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ANSI A14.2-1981 was approved March 4, 1980 with an effective date of March 4, 1982. This 2 year period was to allow the manufacturers the necessary lead time to evaluate their products for conformance to the 1981 edition of the three portable ladder standards, to redesign and test their products where applicable, to design and build the required manufacturing tooling and machinery, and to convert their manufacturing operations to produce the revised products.

During development of product for compliance with the 1981 revision, experience by some of the manufacturers indicated that the inclined load test was not practical when applied to all available length ladders. Also, recommendations were received for clarifications in test procedure descriptions. In the course of resolving these questions, evidence was produced to warrant modifications in the label test requirements and further investigations brought about changes in the label test specifications.

To allow time for investigating these issues, the effective date of the 1981 revision was postponed to June 4, 1982 and then to October 4, 1982. Once the issues were resolved, ANSI A14.2-1982 was approved with the needed changes incorporated and an effective date of October 4, 1982.

In the 1990 revision, several issues, which had arisen since the 1982 revision, were addressed. Most significantly, requirements were developed to cover the multipurpose articulated ladder. In addition the label/marking section improved the graphics as well as presented new labels.

Considerable effort went into preparing the 2000 revision to assure consistency between the A14.2 standard for portable metal ladders and the new revisions of A14.1 (portable wood ladders) and A14.5 (portable reinforced plastic ladders) standards.

In this current revision, several issues, which have arisen since the last revision, are addressed. As a result of efforts by an Articulated Ladder Task Force, additional dynamic testing has been added to the testing requirements for articulated ladders. Additionally, requirements for ladders with a 375 pound duty rating, designated as "Special Duty Type IAA" are now being incorporated within the ANSI A14.2 and A14.5 standards. Requirements for Special Duty Type IAA ladders were previously developed and issued in the ANSI A14.10-2000 standard. The A14.10 subcommittee was originally formed in order to *quickly* respond to a petition to ANSI by cable TV and electric companies for a higher duty rating ladder. After incorporation of the Special Duty Type IAA requirements into the A14.2 and A14.5 standards, the A14.10 standard will be withdrawn.

Each revision of the standard was processed and approved for submittal to ANSI by American National Standards Committee on Safety in the Construction, Care, and Use of Ladders, A14. Committee approval of the standard does not necessarily imply that all the committee members voted for its approval.

Suggestions for improvement of this standard are welcome. They should be sent to the American Ladder Institute, 401 N. Michigan Ave., Chicago, IL 60611.

At the time it approved this standard, the A14 Committee had the following members:

Erick Knox, Chairman
Don Gibson, Vice Chair
Ron Pietrzak, Administrative Secretariat

Organization Represented	**Name of Representative**
American Insurance Association	George Earhart
	Thomas Murray (Alt)
American Ladder Institute	Marc McConnell
American Society of Safety Engineers	Earnest Harper
	Michael Lorenzo (Alt)
Associated General Contractors of America	Charles Bird
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Canadian Standards Association	Walter Dick
Cosco Home and Office Products	Eric Kruse
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James Weil (Alt)
International Brotherhood of Electrical Workers . . . . . James Tomaseski
International Brotherhood of Painters and Allied Trades . . . . . Dan Penski
Mike Metz (Alt)
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Dale King (Alt)
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Scaffold Industry Association . . . . . Alan Kline (Alt)
Steel Plate Fabricators Association. . . . . Wallace Melvin
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Irving Ojalvo
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*non-voting advisory member

Subcommittee A14-2 on portable ladders, which revised this standard, consists of the following members:

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J. E. Johnson
J. Krafchick
I. Ojalvo
D. Plotner
T. Schmitt
M. Silverman
M. VanBree
K. Vidal
E. Wolff-Klammer

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American National Standard for Ladders — Portable Metal — Safety Requirements

1. Scope and Purpose

1.1 Scope

This standard prescribes rules governing the safe construction, design, testing, care and use of portable metal ladders of various types and styles. Ladder Types included are:

Duty Rating	Ladder Type	Working Load (pounds)
Special Duty	IAA	375
Extra Heavy-Duty	IA	300
Heavy-Duty	I	250
Medium-Duty	II	225
Light-Duty	III	200

Ladder styles include ladder type step stools, portable extension, step, trestle, sectional, combination, single, platform, and articulating ladders, but excluding ladders in and on mines, the fire services, mobile equipment, hoisting equipment, work platforms, antenna communications towers, transmission towers, utility poles, and chimneys. It does not cover special-purpose ladders that do not meet the general requirements of this standard, nor does it cover ladder accessories, including, but not limited to, ladder levelers, ladder stabilizers or stand-off devices, ladder jacks, or ladder straps or hooks, that may be installed on or used in conjunction with ladders.

Note: Ladder type step stools are covered by A14.2. It is recognized that a step stool standard is under development. When the step stool standard is approved, A14.2 will no longer cover ladder type step stools.

These requirements are also intended to prescribe rules and criteria for labeling/marking of the kinds of portable ladders cited in this standard, but exclusive of furniture type step stools and special purpose ladders. These labeling/marking requirements do not apply to those situations where training, supervision, or documented safety procedures would be in conflict, or serve in lieu of, these labeling/marking requirements.

1.2 Purpose

The purpose of this standard is to provide reasonable safety for life, limb, and property. In order to develop an effective safety program, the standard may serve also as a basis for purchase requirements and for instructions in personnel training, and in the preparation of motivational/instructional material such as safety practices, manuals, posters, and the like.

This standard is also intended to provide the manufacturer, purchaser, and user of metal ladders with a set of performance and dimensional requirements against which this product may be compared. It is not the purpose of this standard to specify all the details of construction of portable metal ladders. The limitations imposed are for the purpose of providing adequate general requirements and testing methods needed for consistency.

2. General

2.1 Rationale

A rationale has been developed covering the specifications and performance requirements of this standard.[1]

2.2 Application

This standard is intended for voluntary use by establishments that use, manufacture or evaluate ladders. It is also designed to serve as a guide to federal and state authorities or other regulatory bodies in the formulation of laws or regulations.

The methods employed to ensure compliance with this standard shall be determined by the proper regulatory or administrative authority.

[1]The rationale is on file with the Secretariat. American Ladder Institute, 401 N. Michigan Avenue, Chicago, IL. 60611.

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2.3 Interpretation

To secure uniform application of this standard, it is recommended that suggestions involving changes in the requirements or disputes over its interpretation shall be referred to the following organization:

A14 Administrative Secretariat
American Ladder Institute
401 N. Michigan Ave.
Chicago, IL 60611
FAX: 312-673-6929
www.americanladderinstitute.org

If it is determined that your inquiry requires an interpretation of the standard, the inquiry must be submitted in writing and the Secretariat will forward the inquiry to the appropriate Subcommittee Chairman for committee response.

In view of the many different kinds of ladders and the many different conditions under which they are used, this standard should be liberally construed considering the rationale (see 2.1). In cases of practical difficulty or under special-service conditions, it is expected that the administrative authority will grant exceptions to the literal requirements of this standard or will permit the use of alternate designs or features, but only if equivalent safety is thereby secured.

2.4 Mandatory and Advisory Provisions

The word "shall" is to be understood as denoting a mandatory requirement. The word "should" is to be understood as denoting a recommendation.

2.5 Equivalent

The word "equivalent" in this standard means a construction, connection, or material providing equal performance.

2.6 Effective Date

The requirements of this standard shall become effective one year after the date the revised A14.2 standard is approved by ANSI.

3. Related Standards

This standard is intended for use in conjunction with the following American National Standards (see Section 10):

American National Standard Safety Requirements for Scaffolding, ANSI A10.8-2001

American National Standard for Ladders — Portable Wood — Safety Requirements, ANSI A14.1-2007

American National Standard for Ladders — Portable Reinforced Plastic — Safety Requirements, ANSI A14.5-2007

4. Definitions and Nomenclature

Angle of inclination. The preferred pitch for portable non-self-supporting ladders.

Articulated joint. A hinge which can be locked in one or more positions.

Articulated ladder. A portable ladder with one or more pairs of locking articulated joints which allow the ladder to be set up in several modes such as a straight or extension ladder, with or without a stand-off, as a regular or double front stepladder, scaffold or work table.

Back leg (rear rail). The support members of a self-supporting portable ladder back section. The back legs are joined by rungs, bars, rear braces or other bracing to form the back section.

Combination ladder. A portable ladder capable of being used either as a stepladder or as 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.

Duty rating. The combination of factors, including, but not limited to, ladder types and design features, which imply service capability.

Extension ladder. A non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets or the equivalent and so arranged as to permit length adjustment.

Extension trestle ladder. A self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable extension section, with a suitable means for locking the ladders together.

Highest Standing Level. The vertical distance, expressed in feet and inches, from the uppermost rung or step the climber is advised to use to the horizontal plane of the ladder base support, with the ladder in the preferred climbing position.

Inside clear width. The distance between the inside flanges of the side rails of a ladder.

Ladder. A device incorporating or employing steps, rungs, or cleats on which a person may step to ascend or descend.

Ladder foot, shoe, or slip-resistant bearing surface. That component of ladder support that is in contact with the lower supporting surface.

Ladder Type. The designation that identifies the working load.

Marking. Any sign, label, stencil, or plate of a primary hazard or informational character, or both, affixed, painted, burned, stamped or embossed on a ladder surface. (See Appendixes A and B.)

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Maximum extended length or maximum working length. The total length of the extension ladder when the middle or intermediate and top or fly sections are fully extended (maintaining the required overlap).

Permanent deformation (set). That deformation remaining in any part of a ladder after all external loads have been removed.

Pitch. The included (acute) angle between the horizontal and the ladder, which is measured on the side of the ladder opposite the climbing side. It is usually expressed as the ratio H/L, which is the horizontal distance H from the base of the ladder to the supporting surface divided by the working length L of the ladder.

Plastic top cap. Molded thermoset or thermoplastic uppermost horizontal member of a portable stepladder.

Platform. A landing surface that is used as a working or standing location.

Platform ladder. A self-supporting portable ladder of fixed size with a platform provided at the intended highest standing level.

Portable ladder. A ladder that can readily be moved or carried, usually consisting of side rails joined at intervals by steps, rungs, cleats, or rear braces.

Rail. The side members joined at intervals by rungs, steps, cleats, or rear braces.

Rear braces. Crosspieces or diagonals (in the back section of a self-supporting ladder) not intended for climbing, which may be spaced at any interval.

Rungs, steps, or cleats. Ladder crosspieces that are intended for use by a person in ascending or descending.

Scaffold. A temporary elevated platform and its supporting structure used for supporting worker(s) or materials or both.

Section

(1) **Bottom or base section**. The lowest section of a non-self-supporting portable ladder.

(2) **Top or fly section**. The uppermost section of a non-self-supporting portable ladder.

(3) **Middle or intermediate section**. The section between the top (fly) and bottom (base) sections of a non-self-supporting portable ladder.

Sectional ladder. A non-self-supporting portable ladder, nonadjustable in length, consisting of two or more sections, and so constructed that the sections may be combined to function as a single ladder.

Single ladder. A non-self-supporting portable ladder, nonadjustable in length, consisting of one section.

Size. The quantitative description of the length of the ladder. Methods of defining size are presented in the individual standards.

Special-purpose ladder. A portable ladder that is either an experimentally designed ladder or a modification or assemblage of A14 approved requirements for design, testing or construction features of one of the general-purpose ladders defined elsewhere in this section, in order to adapt the ladder for special or specific climbing uses.

Stand-off. A means by which a ladder may be erected at some horizontal distance away from its upper support point.

Stepladder. A self-supporting portable ladder, nonadjustable in length, with flat steps and hinged base.

Step stool (ladder type). A self-supporting, foldable, portable ladder, nonadjustable in length, 32 inches or less in size, with flat steps and without a pail shelf, designed so that the ladder top cap as well as all steps can be climbed on. The side rails may continue above the top cap.

Step surfaces. The clear portion of steps, rungs, or cleats on which a person may step while ascending or descending ladder.

Straight ladder. An articulated ladder where all of the sections are in-line.

Test failure. Damage or visible weakening of the ladder structure or a component, except where otherwise defined by the test protocol.

Test load. The applied load used to demonstrate compliance with performance test requirements.

Top cap. The uppermost horizontal member of a portable stepladder or step stool.

Top step. The first step below the top cap of a portable stepladder or step stool. Where a ladder is constructed without a top cap, the top step is the first step below the top of the rails.

Trestle (double front) ladder. A self-supporting portable ladder, non-adjustable in length, consisting of two sections, designed to be able to be climbed on by two (2) individuals simultaneously, one (1) per side and hinged at the top to form angles with the base.

Ultimate failure. The collapse of the ladder structure or, where applicable, a component thereof.

Uncoated vinyl flooring. In this standard, it shall be the Classic Corlon vinyl flooring from Armstrong.

Visual damage. Damage evident by visual inspection.

Visual inspection. Inspection by the eye without recourse to any optical device except prescription eyeglasses.

Working length. The length of a non-self-supporting portable ladder measured along the rails from the base support point of the ladder to the point of bearing at the top.

Working load. The maximum applied load, including the weight of the user, materials, and tools which the ladder is to support for the intended use.

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5. General Requirements

Specific design and construction requirements are minimized in this standard because of the wide variety of metals and design possibilities. However, the design shall have such characteristics as to produce a ladder of sufficient strength and stiffness to meet the performance requirements of this standard and shall produce a ladder without structural defects or accident hazards such as sharp edges, burrs, and the like.

While this standard addresses known performances issues, it is based on current designs and materials of construction. Alternative designs and materials may bring new issues that are not presently addressed. Therefore, in addition to the requirements of this standard, each design/material configuration must be carefully evaluated according to sound engineering practice to assure a ladder that meets its intended use.

5.1 Flare

Because of the varied conditions and the wide variety of ladder uses, ladders may be designed with parallel side rails, with side rails varying uniformly in separation along the length (tapered), or with side rails flaring at the base.

5.2 Side Rails

The design of the side rails shall be such as to ensure a product that will conform to the requirements of this standard.

5.3 Rung and Step Spacing

The spacing between ladder rungs or steps shall be on 12-inch centers ±1/8 inch, except for step stools where the spacing shall be uniform but not less than 8 inches ±1/8 inch nor more than 12 inches ±1/8 inch measured along the side rail. On articulated and combination ladders, the 12-inch spacing shall be maintained across hinged sections.

Note: Stepladders with the top step 18 inches below the top cap and the bottom step 6 inches above the base support are permitted as an alternate means of construction. In this case the top step may be used for stepping purposes. When the top step is 18 inches below the top cap, provision should be made to restrict inadvertent stepping into the opening.

5.4 Rung Connections

Rung-to-side-rail or step-to-side-rail connections shall be so constructed as to ensure sufficient rigidity and strength to conform to the requirements of this standard. All connections shall be riveted, welded, swaged, fastened with a locking type bolt or other permanent means.

5.5 Rungs, Steps, and Platform

Those surfaces of rungs, steps, and platforms designed for use in ascending, descending, working, or standing, shall be corrugated, serrated, knurled, dimpled, or coated with a slip-resistant material, across their entire width. Provided the overall slip-resistant characteristics are not compromised, interruption in the slip-resistant surfaces is permissible if necessitated by operational and/or structural requirements or other considerations that could affect safety or function.

5.6 Hardware

Hardware shall meet the requirements for the ladder's component parts and shall be of a material that is protected against corrosion unless it is inherently corrosion-resistant. Metals shall be so selected as to avoid excessive galvanic action.

5.7 Burrs, Bolts, Rivets, and Welds

All workmanship shall be free from burrs in excess of 1/64 inch.

5.8 Angle of Inclination

The angle of inclination for single and extension ladders, and articulated ladders, and combination ladders when used as a single ladder, shall be 75-1/2°. The angle of inclination for articulated ladders using rungs, when used as a single or extension ladder shall be 75-1/2°, but the tread portion is not required to be horizontal. For articulated or combination ladders using steps, this angle may range from 70° to 75-1/2°, to the extent necessary to permit the tread portion of the steps to be horizontal (level).

5.9 Plastic Top Caps

Top cap shall be manufactured in a controlled process yielding good commercial workmanship of the part. Finished component shall meet specified dimensions, possess a minimum of shorts or voids, be reasonably free from distortion or warping, discoloration and excessive sink marks or parting line flash.

6. Specifications

6.1 Stepladders

6.1.1 Stepladder Size. The size shall be measured along the front edge of the front side rail, including top cap and foot, with a tolerance of ±1/2 inch, and shall be within the limits as follows:

Duty Rating	Ladder Type	Size (feet)
Special Duty	IAA	3-12
Extra Heavy-Duty	IA	3-20
Heavy-Duty	I	3-20
Medium-Duty	II	3-12
Light-Duty	III	3-6

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6.1.2 Slope. Slope is the angle of the side rails or back legs with respect to the vertical and is expressed as the horizontal deviation from the vertical per unit length of the member. Stepladders shall be constructed so that when they are in the open position, the slope of the front section is not less than 3-1/2 inches, and the slope of the back section is not less than 2 inches, for each 12-inch length of side rail.

6.1.3 Width and Spread. The minimum inside clear width at the top step shall be 12 inches. From top to bottom the spread between the side rails shall increase a minimum of 1-1/4 inches per foot of side rail length.

6.1.4 Steps. Steps shall be parallel and level within 1/8 inch (see 5.3).

6.1.5 Step Width. The minimum width of the step or tread shall be 3 inches.

6.1.6. Bucket (Pail) Shelves. Where bucket shelves are an integral part of the stepladder, they shall be so fastened that they can be folded up within the ladder when the ladder is closed. On ladders eight feet or less in length, the shelf shall be designed 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.

6.1.7 Back Section. The back section may be designed with any type of rear braces as long as it meets the general and testing requirements (see Section 7).

6.1.8 Feet. The bottoms of the four rails shall be made of or covered with slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail.

6.1.9 Spreaders. A spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component part of each stepladder. The spreader shall not be more than 6-1/2 feet above the lower support surface and shall have all sharp points or edges covered or removed to protect the user. For ladders using double sets of spreaders, the foregoing height limitation applies only to the lower set.

6.1.10 Plastic Top Caps. Specification of the particular resin, filler and additives are the responsibility of the manufacturer, who shall give consideration that certain requirements are achieved. All filled thermoplastics shall have the appropriate coupling agent and adequate ultraviolet inhibitors should be incorporated.[1]

The assembled part shall be designed to exhibit satisfactory corrosion resistance, outdoor weathering, thermal stability, and structural integrity under the stipulated thermal conditions outlined in the standard.

6.2 Single and Extension Ladders

6.2.1 Single Ladder Width. The minimum inside clear width shall be not be less than 12 inches for ladders 10 feet and under and shall increase 1/8 inch for each additional foot of length.

6.2.2 Extension Ladder Width. The minimum inside clear width between side rails of the fly or intermediate section shall not be less than 12 inches. The minimum inside clear width between side rails at the bottom of the base section shall not be less than the following dimensions:

Ladder Size (feet)	Minimum Inside Clear Width (inches)
Up to and including 28	14
Over 28, up to and including 40	15
Over 40, up to and including 72	18

6.2.3 Single Ladder Size. The size of a single ladder is designated by the overall length at the side rail, excluding any foot or end cap, with a tolerance of ±1/2 inch. Single ladders shall not exceed the sizes specified in Table 1.

6.2.4 Extension Ladder Size. The size of an extension ladder is designated by the sum of the lengths of one side rail of each section measured along the side rails, excluding any foot or end cap. A tolerance of ±3 inches per section shall be allowed. Extension ladders shall not exceed the sizes specified in Table 1.

Extension ladders shall be marked to indicate both the total length of sections and the maximum extended length or maximum working length.

6.2.5 Overlap and Bearing Length. Each section of a multi-section ladder, when fully extended in the locked in-use position shall overlap the adjacent section as indicated in Table 2. Bearing length is determined by performance tests.

6.2.6 Overlap Control. Extension ladders shall be equipped in such a manner that the ladder cannot be used with an overlap less than the minimum specified in Table 2. Designs employing ladder lock location, mechanical stops, or the equivalent are acceptable, but not those depending upon pulley location.

6.2.7 Extension Locking Device. The extension locking device shall be designed to withstand all performance tests. Locks may be any design, such as gravity, spring-action, rope-operated, or stationary types.

A section incorporating locks that result in the elimination of a rung in the section or one not intended

[1] One preferred system is a minimum of 0.25% by weight of HALS (Hindered Amino Light Stabilizer) and 0.12% antioxidant.

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Table 1
Single and Extension-Ladder Size

Duty Rating and Type	Single Ladder	Two-Section (feet)	Three-Section (feet)
Special duty - Type IAA	Up to and including 16	Up to and including 32	Up to and including 36
Extra heavy-duty - Type IA	Up to and including 30	Up to and including 60	Up to and including 72
Heavy-duty - Type I	Up to and including 30	Up to and including 60	Up to and including 72
Medium-duty - Type II	Up to and including 24	Up to and including 48	Up to and including 60
Light-duty - Type III	Up to and including 16	Up to and including 32	–

for separate use because of non-compliance with single ladder requirements shall include a permanent marking*, in letters not less than 1/8 inch high, such as:

Caution — This Ladder Section Is Not Designed for Separate Use

*labels qualify as permanent markings provided they comply with Section 7.6.

In lieu of the above marking, permanently attached stops shall be provided to prevent removal of the section. Permanently attached stops are considered to be those that would require cutting or drilling, or similar forcible means, for removal.

6.2.8 Rope and Pulley.

6.2.8.1 Extension ladders 20 feet and longer shall be equipped with a rope and pulley. The pulley shall be attached to the ladder in such a manner as not to weaken either the rungs or the side rails. Fastening means to secure the pulley shall not be construed as weakening the rungs, provided the rungs meet the applicable rung bending strength test. The pulley shall be not less than one inch in diameter, measured at the base of the sheive.

6.2.8.2 The rope used with the pulley shall be not less than a nominal 5/16 inch in diameter, shall have a minimum breaking strength of 560 pounds, and shall be of sufficient length for the purpose intended. On three-section ladders, on the fly section only, wire cable may be used in the rope and pulley hook-up. The cable shall be not less than 1/8 inch in diameter.

Table 2
Minimum Required Overlap for Extension Ladders (inches)

Ladder Size (feet)	Two Section	Three Section
Up to and including 32	34	33
Over 32, up to and including 36	46	45
Over 36, up to and including 48	58	57
Over 48, up to and including 72	70	69

6.2.9. Shoes, Spurs, and Other Slip-Resistant Devices. Each rail of a single ladder and each rail of an extension ladder base section shall be provided with a means of slip resistance secured to the lower end of the ladder rail and designed to function at the specified angle of inclination. Such devices include, but are not limited to, safety shoes, spurs, spikes, conformable shoes, and flat or radiused tread feet.

6.2.10 End Caps and End Closures. End caps shall be provided on the upper end of each side rail of the fly or intermediate section of an extension ladder and on a single ladder. End closures or equivalent protection against sharp edges and snagging shall be provided on the bottom of each side rail of the fly or intermediate section when it operates on the front of the base section, or on the top of the base section when the fly or intermediate section operates in the rear of the base section. End closures on the bottom of the fly or intermediate sections, when suitably designed in accordance with 6.2.9, may serve as ladder shoes where the unit permits the sections to be taken apart.

6.3 Trestle (Double Front) and Extension Trestle Ladders

6.3.1 Size. Trestle ladders, or extension sections, or base sections of extension trestle ladders, shall be sized as follows:

Duty Rating and Type	Trestle	Extension Trestle
Special Duty - Type IAA	3-12	–
Extra Heavy-Duty - Type IA	3-20	6-20
Heavy-Duty - Type I	3-20	6-20
Medium-Duty - Type II	3-12	6-12
Light-Duty - Type III	3-6	–

A tolerance of +2 inches, -1/2 inch, shall apply to all sections. In no case shall the extension section size exceed the base-section size.

6.3.1.1 Trestle (Double Front) Ladder. The length of the side rails measured along the front edge, including the foot or shoe designates the size of a trestle ladder.

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6.3.1.2 Extension Trestle Ladder. The size of an extension trestle ladder is designated by the length of the trestle ladder base along the front edge of the side rail, including the shoe.

6.3.2 Width. The minimum inside clear width of the trestle or extension section at any point shall not be less than 12-1/2 inches. The width spread shall not be less than 1-1/4 inches per foot of side rail length.

6.3.3 Base Spread. The spread when the base section is open shall not be less than 5-1/2 inches per foot of base section side rail.

6.3.4 Extension Trestle Overlap. The extension section of the extension trestle ladder, when fully extended, shall overlap the base section as indicated in Table 3.

Table 3
Minimum Required Extension Trestle Ladder Overlap

Base Section Size (feet)	Overlap (inches)
6 up to and including 8	34
Over 8, up to and including 12	46
Over 12, up to and including 16	58
Over 16, up to and including 20	70

6.3.5 Overlap Control. Extension trestle ladders shall be equipped in such a manner that the ladder cannot be used with an overlap less than the minimum specified in Table 3. Designs employing ladder lock locations, mechanical stops, or the equivalent are acceptable.

6.3.6 Extension Locking Device. The extension locking device shall be designed to withstand all load tests.

6.3.7 Spreaders. A spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each trestle ladder. The spreader shall have all sharp points or edges covered or removed to protect the user. When double sets of spreaders are used, the lower set shall not be more than 6-1/2 feet above the lower support surface. On extension trestles where the extension guidance system serves as the spreaders, its location may be more than 6-1/2 feet above the base.

6.3.8 Feet. The bottoms of the four rails of the trestle ladder and the base section of an extension trestle ladder shall be made of or covered with slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail.

6.3.9 End Caps and End Closures. End caps shall be provided on the upper end of each side rail of the extension section of an extension trestle ladder. End closures or equivalent protection 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, when suitably designed, may serve as ladder shoes where the unit permits the sections to be taken apart.

6.4 Platform Ladders

6.4.1 Size. The size of a platform ladder is designated by the overall length as 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 ±1/2 inch and shall be within the limits as follows:

Duty Rating	Ladder Type	Size (feet)
Special Duty	IAA	2-8
Extra Heavy-Duty	IA	2-18
Heavy-Duty	I	2-18
Medium-Duty	II	2-10
Light-Duty	III	2-4

6.4.2 Slope. Slope is the angle of the side rails or back legs with respect to the vertical and is expressed as the horizontal deviation from the vertical per unit length of the member. Platform ladders shall be so constructed that when in the open position, the slope of the front section is not less than 3-1/2 inches, and the slope of the back section is not less than one inch, for each 12-inch length of side rail.

6.4.3 Width and Spread. The minimum inside clear width at the platform shall be 14 inches for Type IAA, Type IA, Type I and Type II ladders and 13 inches for Type III ladders. The width spread shall not be less than 1-1/4 inch per foot of side rail length.

6.4.4 Platform. The platform area shall be at least 20 inches below the top of the ladder. The platform area shall not be less than 200 square inches for Type IAA, Type IA, Type I and Type II ladders, and not less than 130 square inches for Type III ladders. The platform shall not extend more than 1-1/2 inches beyond the back rail.

6.4.5 Top Rail. The back legs and side rails of a platform-type ladder shall extend at least 20 inches of vertical height above the top of the platform and shall be connected with a top member to form a three-sided rail. Equivalent construction may be provided.

6.4.6 Spreaders. Extra spreaders shall be provided on all ladders greater than six feet in size. Only ladders six feet or under may use the platform hinging device as the spreader if the device locks the ladder open. The spreaders shall have all sharp points or edges covered or removed to protect the user. The spreader shall not be more than 6-1/2 feet above the lower support surface. For ladders where double sets of spreaders are used, the foregoing height limitation applies only to the lower set.

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6.4.7 Feet. The bottoms of the four rails shall be made of or covered with slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail.

6.4.8 Other Requirements. The requirements of 6.1.1 through 6.1.9 that are not in conflict with 6.4.1 through 6.4.7 shall also apply to platform ladders.

6.5 Combination Ladder

6.5.1 Size. When the combination ladder is used as a self-supporting ladder, the size is designated by the length of the 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 to the top step when no top cap is used, with a tolerance of ±1/2 inch, and shall be within the limits shown in Table 4.

When the combination ladder is used as an extension ladder, the maximum extended length shall be at least twice the stepladder length less 3 feet. The stepladder length and the maximum extension ladder length shall be within ±1/2 inch of the size indicated on the label.

Table 4
Combination Ladder Size

	Length in Feet	
Duty Rating and Type	Minimum	Maximum
Special duty - Type IAA	4	10
Extra heavy duty - Type IA	4	10
Heavy duty - Type I	4	10
Medium duty - Type II	4	10
Light duty - Type III	4	6

6.5.2 Slope. Slope is the angle of the front side rails (stepladder section) or the rear side rails (single or extension-ladder section) with respect to the vertical and is expressed as the horizontal deviation from the vertical per unit length of the member. Combination ladders shall be so constructed that when in the open position for use as a stepladder, the slope of the front section is not less than 3-1/2 inches, and the slope of the back section is not less than 2 inches for each 12-inch length of side rail.

6.5.3 Width and Spread. The minimum inside clear width between front side rails at the top step shall be 12 inches. From top to bottom the spread shall increase a minimum of 1-1/2 inches per foot of side rail length. The inside clear width of the rear section (extension or single ladder section) shall be 12 inches.

6.5.4 Steps and Rungs. Either steps or rungs may be used on the front and rear sections. Step surfaces shall be parallel and level within ±1/8 inch. When steps are used in the rear section, the step surfaces shall be parallel within ±1/8 inch with the step surfaces in the front section when the ladder is used as a single or extension ladder.

6.5.5 Step Width. Where used, the minimum width of the step in the front section only (stepladder section) shall be 3 inches.

6.5.6 Bucket (Pail) Shelves. Where bucket shelves are provided they shall be in compliance with Section 6.1.6 and 7.5.5 test requirements.

6.5.7 Feet. The bottoms of the four rails shall be made of or covered with slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail.

6.5.8 Spreaders. A spreader or locking device of sufficient size and strength to securely hold the front and rear sections in the open position shall be a component part of each combination ladder. The spreader shall have all sharp points or edges covered or removed to protect the user. The spreaders shall not be more than 6-1/2 feet above the base supporting surface.

6.5.9 Extension locking device. The extension locking device shall be designed to withstand all load tests without test failure (see also Section 7.3.4.5).

6.5.10 Stops. Combination ladders shall be equipped in such a manner that the ladders, when used as extension ladders, shall not exceed the maximum working lengths specified by the manufacturer. Designs employing ladder lock location, mechanical stops, or the equivalent are acceptable.

6.5.11 End Caps. End caps shall be provided on the upper ends of each side rail of a combination section when the rail is not otherwise capped.

6.6 Step Stools (Ladder Type)

6.6.1 Size. Step stool size shall be 32 inches or less measured along the front edge of the front side rail, including the top cap and feet, with a tolerance of ±1/2 inch. The front side rails may continue around and over the top cap, but such side rail extension is not considered part of the ladder size. This standard does not cover Type IAA ladder type step stools (see 8.2.1.1).

6.6.2 Slope. Slope is the angle of the side rails or back legs with respect to the vertical and is expressed as the horizontal deviation from the vertical per unit length of the member. Step stools shall be constructed so that when in the open position, the slope of the front section is not less than four inches, and the slope of the back section is not less than 2-1/2 inches, for each 12-inch length of side rail.

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6.6.3 Width and Spread. The minimum inside clear width at the top step shall be 10-1/2 inches. The minimum outside width at the top cap shall be 12 inches. From top to bottom the spread between the side rails shall increase a minimum of 1-1/4 inches per foot of side rail length.

6.6.4 Steps. Steps shall be parallel and level within the tolerance specified (see 5.3). Excluding the interval between the bottom step and the support surface, the steps and top cap shall be uniformly spaced at intervals of 8 to 12 inches.

6.6.5 Step Width. The minimum width of the step or tread shall be 3 inches.

6.6.6 Back Section. The back section may be designed with any type of rear braces as long as it meets the General and Test requirements (See Section 7).

6.6.7 Feet. The bottoms of the 4 rails shall be made of or covered with slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail.

6.6.8 Spreaders. A spreader or locking device of sufficient size and strength to securely lock the front and back sections in the open position shall be a component part of each step stool. All sharp points or edges shall be covered or removed to protect the user.

6.6.9 Top Cap. The top cap shall be of sufficient strength and slip resistance to permit its use as a climbing surface. Its size shall be not less than 12 inches wide and 4-3/4 inches deep. The top cap shall not overhang the ladder in any direction in excess of the dimensions of the attaching hardware or the equivalent. The top cap shall not be split for folding the ladder.

6.7 Articulated Ladders

6.7.1 Articulated Ladder Size. When the articulated ladder is used in a stepladder mode, the size is designated by the length of the ladder measured along the front edge of the front side rail from the bottom of the foot to the center of the pivot pin of the hinge, with a tolerance of ±1/2 inch, and shall be within the limits as follows:

Duty Rating	Ladder Type	Size (feet)
Special Duty	IAA	Not Provided
Extra Heavy-Duty	IA	3-15
Heavy-Duty	I	3-15
Medium-Duty	II	3-12
Light-Duty	III	3-6

This standard does not cover Type IAA articulated ladders (See 8.2.1.1).

When the articulated ladder is used in a straight or extension ladder mode, the size is designated by the overall length at the side rail, including any feet and hinges, with a tolerance of ±1/2 inch, and shall be within the limits as follows:

Duty Rating	Ladder Type	Size (feet)
Special Duty	IAA	Not Provided
Extra Heavy-Duty	IA	Not to Exceed 30
Heavy-Duty	I	Not to Exceed 30
Medium-Duty	II	Not to Exceed 24
Light-Duty	III	Not to Exceed 12

6.7.2 Slope. Slope is the angle of the front side rails or the rear side rails with respect to the vertical and is expressed as the horizontal deviation from the vertical per unit length of the member. Articulated ladders shall be constructed so that when the ladder is in the open position for use in the stepladder mode, the slope of the front section is not less than 3-1/2 inches, and the slope of the back section is not less than 2 inches, for each 12-inch length of side rail.

If the ladder permits use in the double front stepladder mode, the spread when the ladder is open shall not be less than 5-1/2 inches for each 12-inch length of side rail.

6.7.3 Width and Spread. The minimum inside clear width at the top step when set up in a stepladder mode shall be 12 inches. If the ladder is provided with a straight back section, then the front section's minimum outside width at the bottom support shall exceed the width at the top of the rails by 1-1/2 inches per foot of ladder length when measured to the outside of the top side rails. If the ladder is provided with both a front and back section which spread, then both sections' minimum outside width at the bottom support shall exceed the width at the top of the rails by 1-1/4 inches per foot of ladder length when measured to the outside of the top side rails. The minimum inside clear width at the base when set up in a single or extension ladder mode shall be 12 inches for ladders 10 feet and under and the minimum inside width shall increase 1/8 inch for each additional foot of length.

6.7.4 Steps and Rungs. Either steps or rungs may be used on the front and rear sections. Step surfaces shall be parallel and level within ±1/8 inch. When steps are used in the rear section, the step surfaces shall be parallel within ±1/8 inch with the step surfaces in the front section when the ladder is used in a single or extension ladder mode.

6.7.5 Step Width and Rung Diameter. If steps are used, the minimum width of a step shall be three inches. If rungs are used, they may be round, D-shaped or equivalent, trapezoidal, square, or rectangular.

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Round rungs shall have a minimum diameter of 1-1/8 inches. Trapezoidal, D-shaped or equivalent, square or rectangular rungs shall have a step surface of not less than 1 inch, either flat or along a segment of arc of 3 inches or greater radius. Right-angle or near-right angle corners shall have their edges rounded to a radius of not less than 1/16 of an inch.

6.7.6 Bucket (Pail) Shelves. Where bucket shelves are provided they shall be in compliance with Section 6.1.6 and 7.5.5 test requirements.

6.7.7 Feet. The bottoms of the four rails shall be made of, or covered with, slip-resistant material. The dimensions of the slip-resistant surface shall not be less than the dimensions of the projected area outlined by the cross section of the end of the rail. The tread surface may be a radius.

6.7.8 Articulated Joints. The joints, and the joint to side rail connections, shall be so constructed as to ensure sufficient strength and rigidity to conform to the requirements of this standard. The joints shall have set locking positions to allow set up at the proper angles designated by the manufacturer. All sharp points or edges or pinch points shall be covered or removed to protect the user. Each lock shall visibly indicate whether it is locked or unlocked.

6.7.9 Worktable Position. Use as a worktable shall be limited to working heights of 5 feet or less. The manufacturer shall supply suggestions for an appropriate decking for safe usage.

6.7.10 Telescoping Sections. The locks for any telescoping sections shall visibly indicate as to whether they are locked or unlocked.

6.7.11 Scaffold Position. Use as a scaffold shall be based on a one person usage (working load not to exceed duty rating of ladder including weight of user and all clothing, tools, and materials). The manufacturer shall supply or suggest an appropriate decking for safe usage. Working heights shall be limited to 6 feet or less. The height shall not exceed three times the minimum outside width of the bottom support in the scaffold position. Hand rails and toeboards are not required.

7. Test Requirements

7.1 General

7.1.1 The test methods depicted in this section represent the preferred methods to be followed in determining whether a ladder conforms to the requirements of this standard. Variations from the specific methods depicted in the various diagrams shall be acceptable provided such alternate means provide equivalent results and comply with the intent of the applicable preferred test method. However, where the supposed equivalent test methods yield different results, the preferred test methods shall determine whether or not the ladder is in conformance with the standard.

7.1.2 The test requirements were developed using statistical tolerances. Hence, where a single test result indicates noncompliance, the test may be repeated utilizing a statistically justifiable number of test samples to ultimately determine compliance or noncompliance with the standard.

7.1.3 Many of the tests required by the standard are inherently dangerous. The American National Standards Institute, the A14 Committee, the A14 Subcommittees, and the A14 Task Forces neither assume nor accept any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed, whether performed in whole or in part by the manufacturer, an outside laboratory or consultant, the user or owner of the product, or any other individual or organization, and whether or not any equipment, facility, or personnel for or in connection with the test is furnished by the manufacturer or by any other such individual, consultant, laboratory, or organization. Extreme care shall be exercised to avoid personal injury when setting up and conducting the tests and when disassembling the test gear at the conclusion of the tests.

7.1.4 Diligent effort and close attention to all details shall be exercised in setting up and conducting the tests. Subtle variations in test techniques may introduce significant testing errors that bias the testing program. Personnel inexperienced in ladder testing, even though otherwise professionally qualified, should be especially careful to follow the preferred test methods.

7.1.5 Design verification tests shall be conducted during the initial evaluation of a specific product design and thereafter whenever there is a change in the design, method of manufacture, or material. It is not intended that design verification tests shall be conducted on ladders that have been in use or subjected to prior damage, misuse, or abuse. Ladders subjected to design verification tests are not intended for subsequent use.

7.1.6 Quality control tests should be conducted during the manufacturing process employed to produce the ladder. Such tests normally shall not be conducted on every ladder manufactured or on ladders that have been in use or subjected to prior damage, misuse, or abuse. Certain quality control tests, such as dimensional verifications, hardness, chemistry, spectroscopic, and mechanical properties tests may be conducted on ladders subsequent to their use when done with

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extreme care by properly qualified professionals following applicable ASTM standards for such tests, where proper recognition is given to the influence on the test results of the prior use and the test method itself. Except where the quality control tests are destructive in nature, ladders subjected to quality control tests may be subsequently placed into field service.

7.1.7 The manufacturer, the actual owner, the user, or their agents, to evaluate the condition of the product following actual field service may conduct in-service tests in the field. Ladders that conform to the in-service use tests may continue to be employed.

Note: The tests with the full text in italics are advisory, not mandatory, when conducted for in-service testing purposes.

7.1.8 The development and ongoing implementation of overall quality control shall be the responsibility of each individual manufacturer.

7.1.9 Conformance to the design verification test requirements shall be determined 5 minutes after load removal, where applicable.

7.1.10 The test load shall be applied slowly, using care to minimize dynamic loading and eliminate impact loading during the test.

7.2 Combination Ladder Tests

Combination ladders shall comply with the test requirements for stepladders when in the stepladder position, and for extension ladders when in the extension ladder position. The 75-1/2° angle of inclination for extension ladders shall be modified when applied to combination ladders in their extension-ladder orientation to the extent necessary to permit the tread portion of the steps to be horizontal (level).

7.3 Single, Extension, Combination, and Articulated Ladder Tests

7.3.1 Horizontal Bending Test.
Note: This is a design verification test.

7.3.1.1 The ladder shall be placed in a flat horizontal position, as shown in Fig. 1a. When articulated, extension, and combination ladders are tested, the unit shall be opened to its maximum working length. The unit shall be loaded with the preload shown in Table 5. It shall be applied to the center of the rung nearest to the center of the test span over a 3-1/2 inch length of the rung, ensuring that the load is applied equally to both side rails, as shown in Fig. 1b. The preload shall be held for a minimum period of one minute and then unloaded.

After preloading, a deflection test load in accordance with Table 5 shall be applied in the same manner as the preload. Vertical measurements shall be taken of both rails before and during loading, and after the load is removed. The maximum average deflection of both side rails shall not exceed the value given in Table 6.

7.3.1.2 The ladder shall then be subjected for at least one minute to an increased load, equal to the ultimate test load in accordance with Table 5. The ladder shall sustain the ultimate test load without ultimate failure. The test load shall be sequentially applied at the three different rung locations: first to the center of the highest base rung below the overlap; second to the center of the fly rung in the center of the overlap or, if necessary, 6 inches higher than the center of the ladder span; and third to the center of the lowest fly rung above the overlap. When testing an articulated ladder, the test load shall be applied to the center of the rung immediately above the center of the test span. When the articulated ladder is intended to be climbed from either side, the horizontal bending test shall be conducted front and back. The end support bars shall be designed to permit longitudinal translation of either one or both supports during loading as the test unit deflects, yet still maintain the 6-inch overhang at each end.

7.3.2 Deflection Test.
Note: *This is both a design verification test and an in-service use test.*

The ladder shall be supported and the load shall be applied to the rung closest to the midpoint of the span, over a 3-1/2 inch bearing on the rung, as shown in Fig. 2a and b. All supporting and loading apparatus shall conform to that shown in Fig. 2a and 2b. The test results shall be recorded on a data sheet

Table 5
Horizontal Bending Test Loads (pounds)

Duty Rating and Type	Working Load	Preload	Deflection Test Load	Ultimate Test Load
Special duty - Type IAA	375	280	375	470
Extra heavy-duty - Type IA	300	225	300	375
Heavy-duty - Type I	250	188	250	310
Medium-duty - Type II	225	169	225	280
Light-duty - Type III	200	150	200	250

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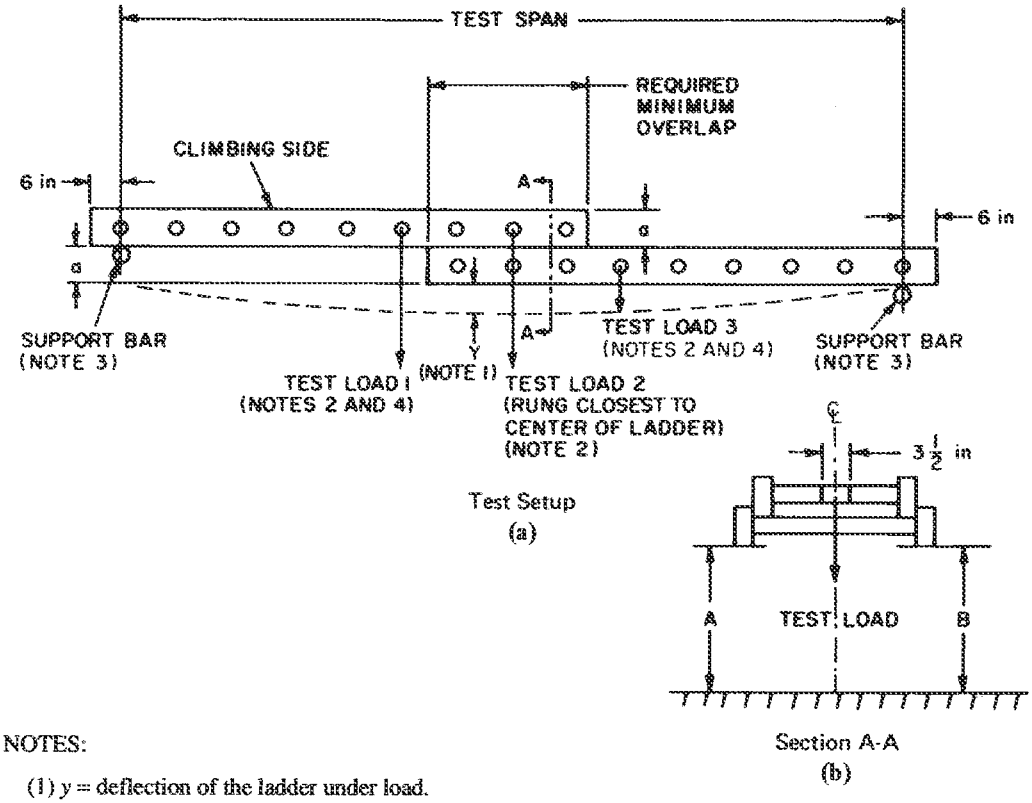
Figure 1
Horizontal Bending Test



NOTES:

(1) y = deflection of the ladder under load.

(2) The ultimate test load shall be applied at three different locations: (a) to the center of the highest base rung below the overlap (test load 1); (b) to the center of the fly rung in the center of the overlap or, if necessary, 6 inches higher than the center of the ladder span (test load 2); and (c) to the center of the lowest fly rung above the overlap (test load 3). The deflection test load, which is applied before the ultimate test load, shall be applied only to the center of the rung nearest the center of the test span (test load 2).

(3) The support bars shall have a nominal radius of 1 inch.

(4) This test is illustrated for a ladder design in which the fly section is behind the base section, shown here with the base section on the left. For the alternative design in which the base section is behind the fly section, the base should be on the right, and test load positions 1 and 3 would be reversed.

(5) Auxiliary means that do not increase the strength of the ladder may be used to ensure that the ladder locks remain engaged during the test to prevent translation of the fly section relative to the base section during the test.

that contains at least the minimum data shown in Fig. 3, or the equivalent.

The ladder shall be preloaded with a 30 lb. load for one minute before applying the test load. The test load shall be applied for a period of one minute, in accordance with Table 7.

Deflections shall be determined by measuring, at the midpoint between the supports, the vertical distance from the extreme outside edges of the widest section of both rails to the floor or other reference surface both before loading and while the full test load is applied. These measurements shall be entered on the data sheet (see Fig. 3). The test shall be repeated with the load applied to the other rail of the ladder. The twist angle between a line joining the loaded and unloaded rails and the horizontal shall be calculated from the trigonometric equation:

$$\alpha = arc\ sine \left(\frac{difference\ in\ deflection\ of\ rails}{outside\ width\ of\ widest\ section} \right)$$

$$= arc\ sine \left(\frac{B - A}{W} \right)$$

The ladder shall pass this test without exceeding the values of deflection and angle of twist shown in Table 8.

7.3.3 Simulated In-Use Inclined Load Test.
Note: This is a design verification test.

Table 6
Maximum Allowable Average Deflections for Horizontal Bending Test

Ladder Size (feet)	Maximum Working Length (Size less Minimum Overlap)* Two-Section (feet)	Three-Section (feet)	Maximum Average Deflection (inches)
12	9	—	3.6
14	11	—	5.2
16	13	—	6.8
20	17	—	10.0
24	21	—	13.2
28	25	—	16.4
32	—	26	17.4
32	29	—	19.6
36	—	28	20.6
36	32	—	22.8
40	—	30	22.6
40	35	—	26.0
44	—	34	26.0
44	39	—	29.2
48	—	38	29.2
48	43	—	32.4
52	—	40	31.2
52	46	—	35.6
56	—	44	34.4
56	50	—	38.8
60	—	48	38.6
60	54	—	42.0
64	—	52	41.2
68	—	56	44.5
72	—	60	47.9

*For single ladders use column for maximum working length for two-section extension ladder.

The ladder shall be extended to the maximum working length and supported as shown in Fig. 4. The load shall be applied equally to both side rails on the lowest fly rung above the overlap on extension ladders and at the first rung at midspan or above on all other ladders. The load shall be applied using two 3-1/2 inch straps, each located next to a rail and centrally loaded through an equalizer bar on the climbing side of the ladder. All supporting and loading apparatus shall conform to that shown in Fig. 4 or shall be such as to produce equivalent results.

The ladder shall be loaded in accordance with Table 9. The full load shall be applied for a period of one minute before release. The ladder shall sustain this load without ultimate failure. Permanent deformation (set) shall be allowed.

This test shall be used only for design verification. It shall not be employed for quality control or field inspection purposes.

7.3.4 Hardware Test Requirements.

7.3.4.1 Column and Hardware Load Test
Note: This is a design verification test.

7.3.4.1.1 Single and Extension Ladders. The test unit shall either be the shortest full-size ladder manufactured or a unit merely of sufficient length for test purposes. If a full-size ladder is used, the fly section shall be extended a minimum of one rung beyond the minimum working length of the ladder. Short test units shall consist of portions of the base and fly sections of the extension ladder with all the hardware or fittings attached.

The unit shall be placed at a 75-1/2° working angle, as shown in Fig. 5, with both locks engaged. A downward distributed load, in accordance with Table 10, shall be applied for a period of one minute, to the lowest fly rung above the overlap on extension ladders and to

Table 7
Deflection Test Loads

Duty Rating and Type	Deflection Test Load (pounds)
Special duty - Type IAA	85
Extra heavy-duty - Type IA	70
Heavy-duty - Type I	60
Medium-duty - Type II	55
Light-duty - Type III	50

Table 9
Simulated In-Use Inclined Load Test

Duty Rating and Type	Working Load (pounds)	Test Load (pounds)
Special duty - Type IAA	375	1200
Extra heavy-duty - Type IA	300	1000
Heavy-duty - Type I	250	1000
Medium-duty - Type II	225	900
Light-duty - Type III	200	800

Table 8
Deflections and Angles of Twist

Single* and Extension Ladders			Combination Ladders						
Maximum Working Length (Size less Minimum Overlap) (feet)				Maximum Deflection Y of Loaded Rail† (inches)		Twist Angle α ‡ (degrees)		Sine α	
Size of Ladder (feet)	Two-Section*	Three-Section	Maximum Working Length (feet)	Single Extension Articulated Ladders	Combination Ladder	Single Extension Articulated Ladders	Combination Ladder	Single Extension Articulated Ladders	Combination Ladder
—	—	—	7	—	1.00	—	2.1	—	0.03664
—	—	—	8	—	1.20	—	2.3	—	0.04013
—	—	—	9	—	1.40	—	2.5	—	0.04362
—	—	—	10	—	1.60	—	2.6	—	0.04536
14	11	—	11	1.00	1.80	2.90	2.8	0.05059	0.04885
15	12	—	12	1.25	2.15	3.00	3.1	0.05234	0.05408
16	13	—	13	1.50	2.35	3.10	3.3	0.05408	0.05756
17	14	—	14	1.75	2.50	3.20	3.4	0.05582	0.05931
18	15	—	15	2.00	2.80	3.30	3.5	0.05756	0.06105
20	17	—	17	2.50	3.10	3.50	3.6	0.06105	0.06279
22	19	—	19	3.00	3.40	3.70	4.0	0.06453	0.06976
24	21	—	—	3.50	—	3.90	—	0.06802	—
28	25	—	—	4.50	—	4.30	—	0.07498	—
32	29	26	—	5.50	—	4.70	—	0.08194	—
36	32	28	—	6.50	—	5.10	—	0.08889	—
40	35	30	—	7.50	—	5.50	—	0.09585	—
44	39	34	—	8.50	—	5.90	—	0.10279	—
48	43	38	—	9.50	—	6.30	—	0.10973	—
52	46	40	—	10.50	—	6.70	—	0.11667	—
56	50	44	—	11.50	—	7.10	—	0.12360	—
60	54	48	—	12.50	—	7.50	—	0.13053	—
64	—	52	—	13.50	—	7.90	—	0.13744	—
68	—	56	—	14.50	—	8.30	—	0.14436	—
72	—	60	—	15.50	—	8.70	—	0.15126	—

* For single ladder use column for maximum working length for two-section extension ladder.
† $Y = 0.25X - 2.5$, where Y = maximum deflection of loaded rail (inches) and X = maximum working length or size of ladder (feet).
‡ $\alpha = 0.10X + 1.50$, where α = twist angle (degrees) and X = maximum working length or size of ladder (feet).

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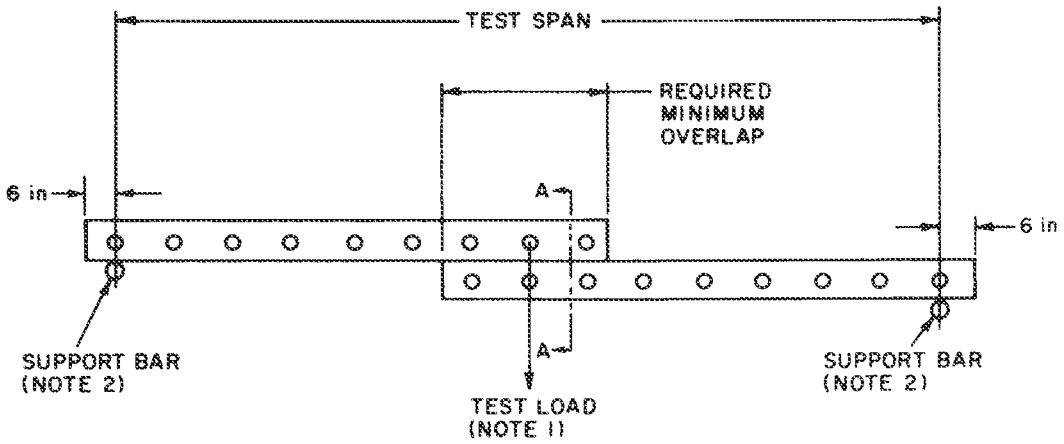
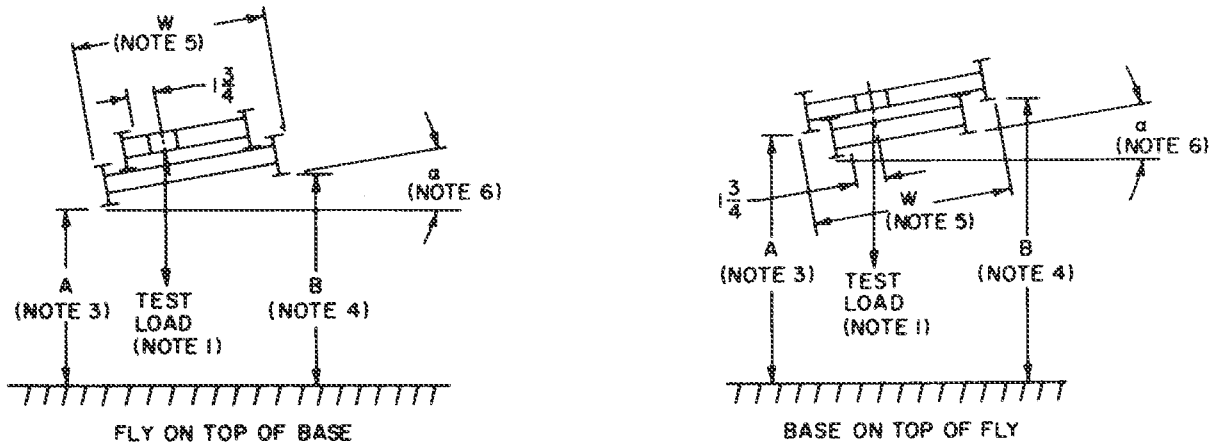
Figure 2
Deflection Test



Test Setup
(a)



Section A-A
(b)

NOTES:
(1) The test load shall be applied to the rung closest to the midpoint of the test span over a 3-1/2-inch bearing on the rung.
(2) The support bars shall have a nominal radius of 1 inch.
(3) A = vertical height of loaded rail.
(4) B = vertical height of unloaded rail.
(5) W = width of widest ladder section.
(6) α = angle of twist.
(7) Auxiliary means that do not increase the strength of the ladder may be used to ensure that the ladder locks remain engaged during the test to prevent translation of the fly section relative to the base section during the test.

Figure 3
Deflection Test Data Sheet

DATA SHEET

Company: _____
Date of test: _____
Recorded by: _____
Type of ladder: Single _____ Extension _____ Combination _____
Code name: _____
Ladder size: _____
Length of test span: _____
Width of widest section, *W*: _____
Rated load of ladder: 200 lbs _____ 225 lbs _____ 250 lbs _____ 300 lbs _____ 375 lbs _____

Vertical Readings	Deflection at No Load (inches)	Deflection at _____ lb Load (inches)	Actual Deflection due to Load (Column 2 – Column 1) (inches)	Difference in Actual Deflection, *B* – *A* (inches)
Right-hand loaded				
A				
B				
Left-hand loaded				
A				
B				

	Right rail loaded	Left rail loaded
Angle of twist $\alpha = \text{arc sine } \frac{B - A}{W}$ =	_____	_____
Allowable angle of twist (Table 8) =	_____	_____
Deflection of loaded side rail =	_____	_____
Allowable deflection (Table 8) =	_____	_____

Remarks:

NOTE: This is a suggested format for a data sheet used to record test results from the deflection test.

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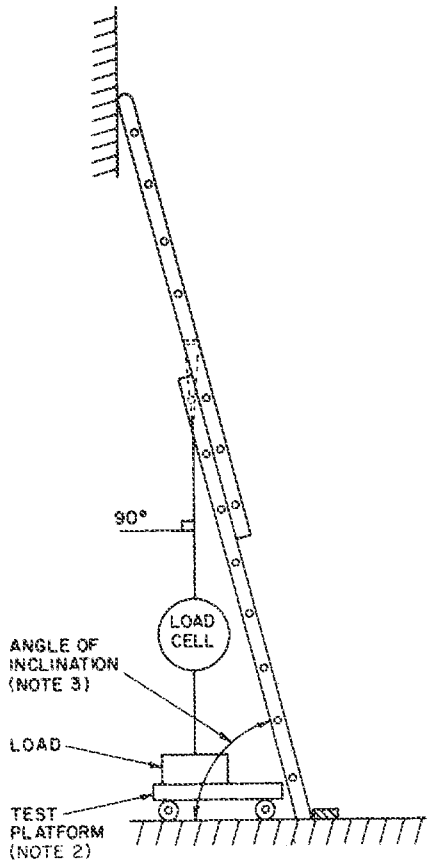
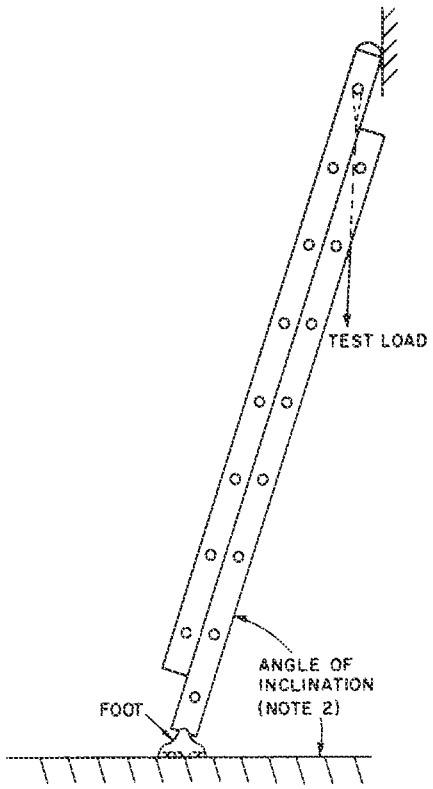
Figure 4
Inclined Load Test



NOTES:
(1) This illustration shows the test setup before the load is applied.
(2) The test platform follows the test load as the ladder deflects into the wall.
(3) The angle of inclination shall be 75-1/2°, except that for combination ladders in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).

Figure 5
Column and Hardware Load Test and Single Lock Load Test



NOTES:
(1) The fly section may be located either to the front or to the rear of the base section.
(2) The angle of inclination shall be 75-1/2°, except that for combination ladders in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).
(3) Both locks shall be engaged for the column and hardware load test (7.3.4.1); for the single lock load test (7.3.4.2), one lock shall be engaged and the other lock removed.

the top rung of single ladders. The load shall be applied equally to both side rails using two 3-1/2 inch straps, each located next to a rail and centrally loaded through an equalizer bar over the climbing side of the ladder. Permanent deformation in other parts of the ladder structure due to the test is not a test failure. However, the ladder shall still support the test load after the application of the load, even if the rung assumed permanent deformation (set).

7.3.4.1.2 Combination Ladders. The test unit shall be a full-size ladder. The extension section shall be extended a minimum of one rung or step beyond the minimum working length of the ladder. The unit, set up as an extension ladder as shown in Fig. 5, shall be placed against a vertical support, with both locks engaged at an angle of 75-1/2°.

A downward distributed load, in accordance with Table 10, shall be applied for a minimum period of 1 minute on a standard loading block (see Fig. 6) resting on the center of the highest fly rung or step, or by means of a 3-1/2-inch strap over the rung on the climbing side of the ladder. During the test, the tread portion of the steps on the front rail section shall be parallel

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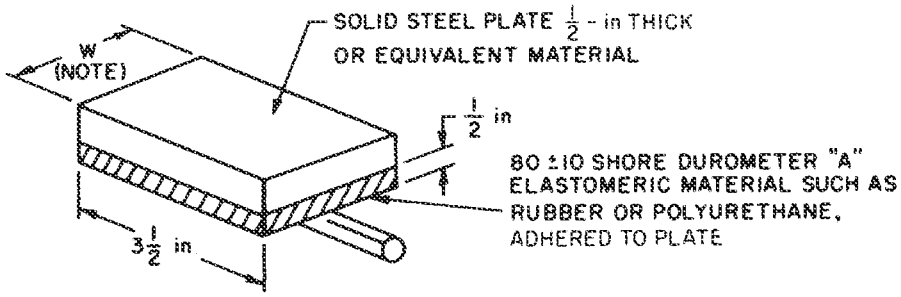
Table 10
Hardware Tests

Duty Rating and Type	Lock Tip Column and Hardware Test Load (pounds)	Single Lock Test Load (pounds)
Special duty - Type IAA	1500	1200
Extra heavy-duty - Type IA	1200	1000
Heavy-duty - Type I	1000	1000
Medium-duty - Type II	900	900
Light-duty - Type III	800	800

Figure 6
Standard Loading Block



NOTE: W = width of step or rung plus 1 inch.

to the ground. If the treads are used on the single or extension ladder section, these treads shall also be parallel to the ground. The unit shall withstand this test with no permanent deformation (set) or other visible weakening of the structure.

7.3.4.1.3 Articulated Ladders. The test unit shall be a full size ladder. If equipped with an extension section, it shall be extended a minimum of one rung or step beyond the minimum working length of the ladder. The unit shall be set up as an extension or single ladder and placed against a vertical support, with all locks engaged.

The ladder shall be placed at a 75-1/2° working angle. A downward distributed load, in accordance with Table 10, shall be applied for a period of one minute, equally to both side rails on the highest rung, using two 3-1/2-inch straps, each located next to a rail and centrally loaded through an equalizer bar over the climbing side of the ladder. Permanent deformation in other parts of the ladder structure due to the test is not a test failure. However, the ladder shall still support the test load after the application of the load, even if the rung assumes permanent deformation.

7.3.4.2 Single Lock Load Test
Note: This is a design verification test. Not applied to articulated ladders.

The test unit shall either be the shortest full-size ladder manufactured or a unit only of sufficient length for test purposes. If a full-size ladder is used, the fly section shall be extended one rung beyond the minimum working length of the ladder. Short test units shall consist of portions of the base and fly sections of the extension ladder with all the hardware or fittings attached.

The test unit shall be set, as shown in Fig. 5, at a 75-1/2° working angle, with one lock removed. For combination ladders in the extension ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).

A downward distributed load, in accordance with Table 10, shall be applied for a minimum period of one minute, equally to both side rails on the lowest fly rung above the overlap using two 3-1/2 inch straps, each located next to a rail and centrally

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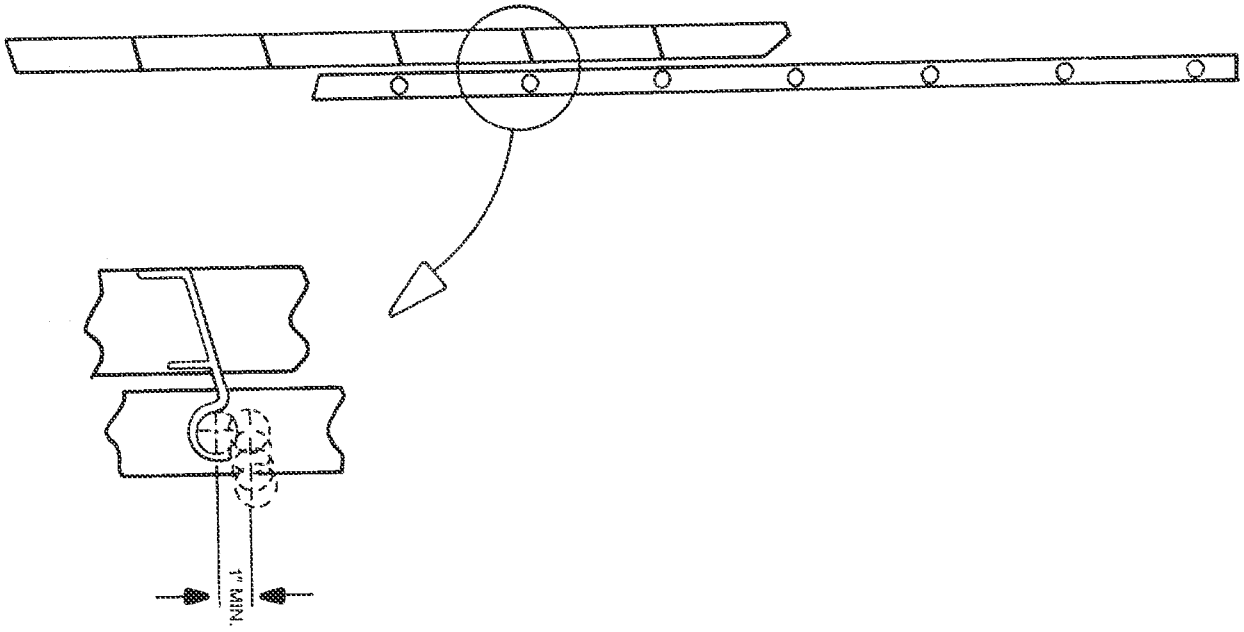
Figure 7
Lock Test



loaded through an equalizer bar over the climbing side of the ladder.

The locks shall withstand this test with no permanent deformation (set) or other visible weakening of the locks. Permanent deformation in other parts of the ladder structure including racking of the ladder structure due to the test is not a test failure. However, the ladder shall still support the test load after the application of the load, even if the rung assumes permanent deformation (set).

7.3.4.3 Lock Tip Load Test
Note: This is a design verification test. Not applied to articulated ladders.

The test unit shall be either the shortest full-size ladder manufactured or a unit only of sufficient length for test purposes. If a full-size ladder is used, the fly section shall be extended a minimum of one rung beyond the minimum working length of the ladder. Short test units shall consist of portions of the base and fly sections of the extension ladder, with the locks attached.

The test unit shall be set at a 75-1/2° working angle, as shown in Fig. 8a and b, with both locks partially engaged. For combination ladders in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level). The bottom end of the ladder shall be prevented from slipping by a block or equivalent means. The tip of each lock shall bear on the center of a steel test fixture placed over the top of a rung, as shown in Fig. 8a and b. During the test, each lock shall be prevented from pivoting by a means located adjacent to its pivot point, but which shall not in any way affect that portion of the lock under test.

A downward distributed load, in accordance with Table 10, shall be applied for a period of one minute, equally to both side rails on the lowest fly rung above the overlap, using two 3-1/2 inch straps, each located next to a rail and centrally loaded through an equalizer bar over the climbing side of the ladder. Permanent deformation in other parts of the ladder structure due to the test is not a test failure. However, the ladder shall still support the test load after the application of the load, even if the rung assumes permanent deformation (set).

7.3.4.4 Cyclic Rung-Lock Design Verification Test
Note: This is a design verification test. Not to be applied to articulated ladders, or ladders with fixed lock designs.

A machine equivalent to that pictured in Fig. 9 shall be used to operate the rung lock through the following cycle, as shown in Fig. 10:

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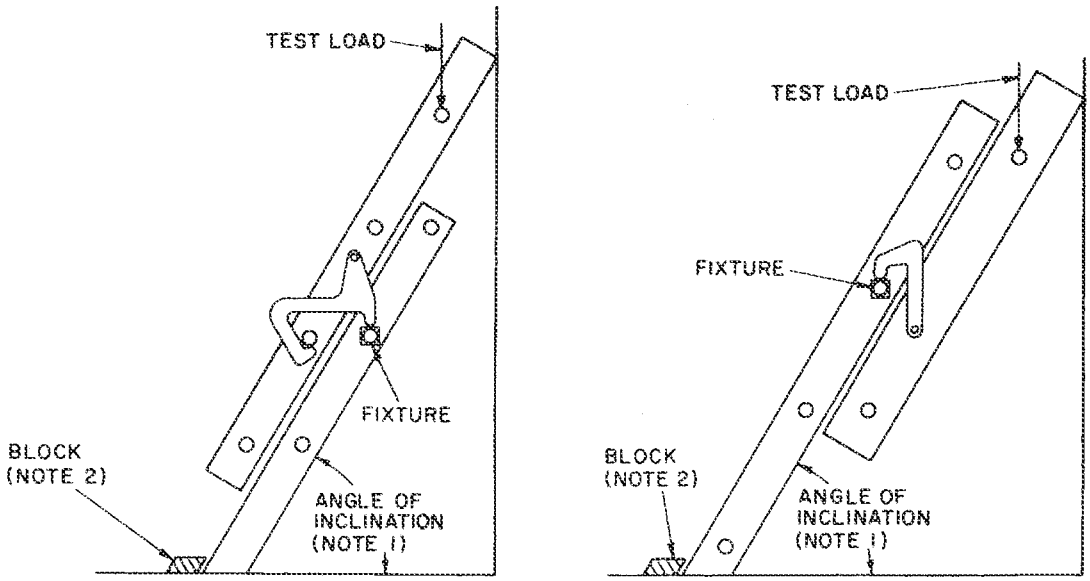
Figure 8
Lock Tip Load Test



NOTES:
(1) The angle of inclination shall be 75-1/2°, except that for combination ladder in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).
(2) A block or equivalent means shall be used to prevent the bottom of the ladder from slipping.

(1) One 6-inch upstroke to allow rung lock to engage rung

(2) Full 6-inch downstroke to lock rung lock on rung

(3) Full 12-inch upstroke to disengage rung lock

(4) Full 12-inch downstroke to return rung lock to starting position

Locks shall be tested with the ladder at a 75-1/2° angle. For combination ladders in the extension-ladder orientation, a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level). Spring-loaded locks shall be tested with the ladder in the vertical position.

The rung lock may be manually lubricated prior to or during the test. The stroke speed shall be 6 to 12 inches per second. A minimum of 6000 cycles shall be imposed. Any malfunction of the rung lock or fracture of its components, including springs, shall be considered as a failure to meet this requirement. The presence of wear that does not affect the proper functioning of the lock shall not constitute failure.

This test is not intended to apply to fixed-type locks used on extension or combination ladders.

7.3.4.5 Combination Ladder Lock Test. The ladder shall be placed in the horizontal bending test position (See Fig. 1) and the extension section moved forward until it disengages from the lock (See Fig. 7). The distance for such disengagement shall not be less than one inch.

7.3.5 Extension-Ladder Rung Bending Strength Test. **Note**: This is a design verification test.

The test shall be conducted on either a single section of the ladder or on a three-rung test sample taken from the maximum width portion of a like ladder section with a like rung. The test unit shall be supported and the load shall be applied as shown in Fig. 11a, using a standard loading block. The rung tested shall be unbraced.

A downward distributed load, in accordance with Table 11, shall be applied on the standard loading block for a period of 1 minute. Upon removal of the test load, the permanent deformation (set) shall be measured with a straight edge and a rule as shown in Fig. 11b. The allowable permanent deformation (set)

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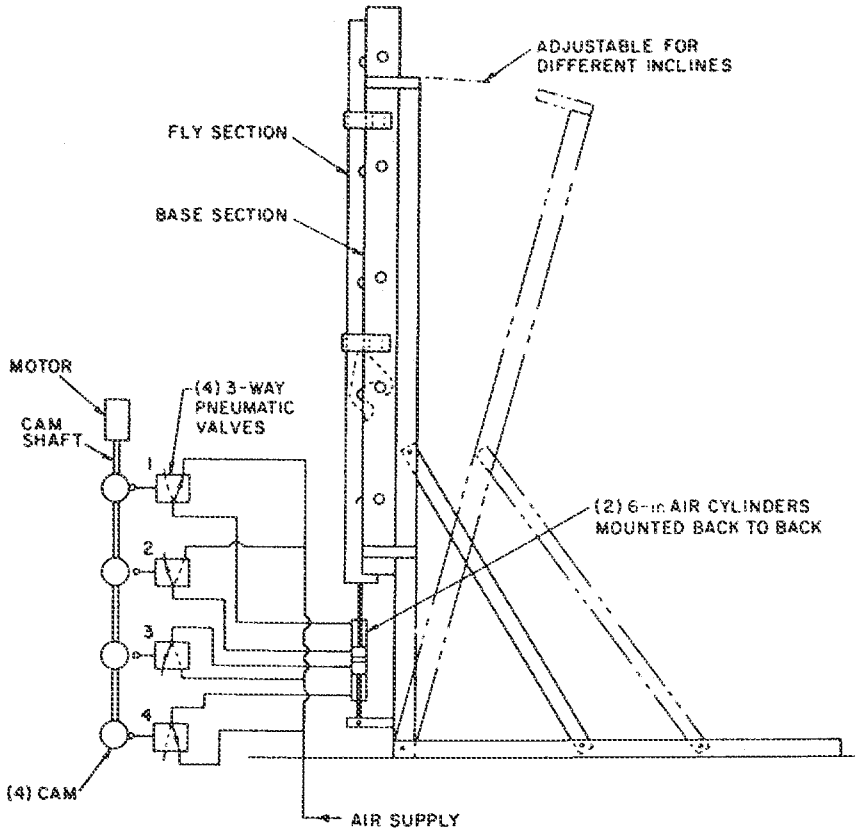
Figure 9
Cyclic Rung Lock Test Arrangement



	Air-Valve Position*			
Operating Cycle	No. 1	No. 2	No. 3	No. 4
Full upstroke	O	C	C	O
Full downstroke	C	O	O	C
One-half downstroke to latch	O	C	O	C
Downstroke to lock	C	O	O	C

*O means open to atmosphere; C means closed to pressure.

shall not exceed L/K for rung length (L) measured between the inside webs of the attached side rails, in accordance with Table 11 (K is a factor that varies with duty rating and Type). Other than buckling related to the allowable permanent deformation (set), there shall be no test failure.

7.3.6 Rung-to-Side-Rail Shear Strength Test.
Note: This is a design verification test.

The test unit shall consist either of a single section of the ladder or a three-rung section taken from a like ladder having the same rung cross-section and rung joint. The test unit shall be set at a working angle of 75-1/2° to horizontal. For combination ladders in the extension-ladder orientation, a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).

A downward distributed load, in accordance with Table 11, shall be applied for a minimum period of 1 minute, as shown in Fig. 11a, but resting on the widest like cross section braced and unbraced test rungs as near the side rail as possible. On removing the load, the unit shall show no indication of test failure either in the fastening means attaching the rung or in the side rail.

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Figure 10
Rung Lock Testing Cycle

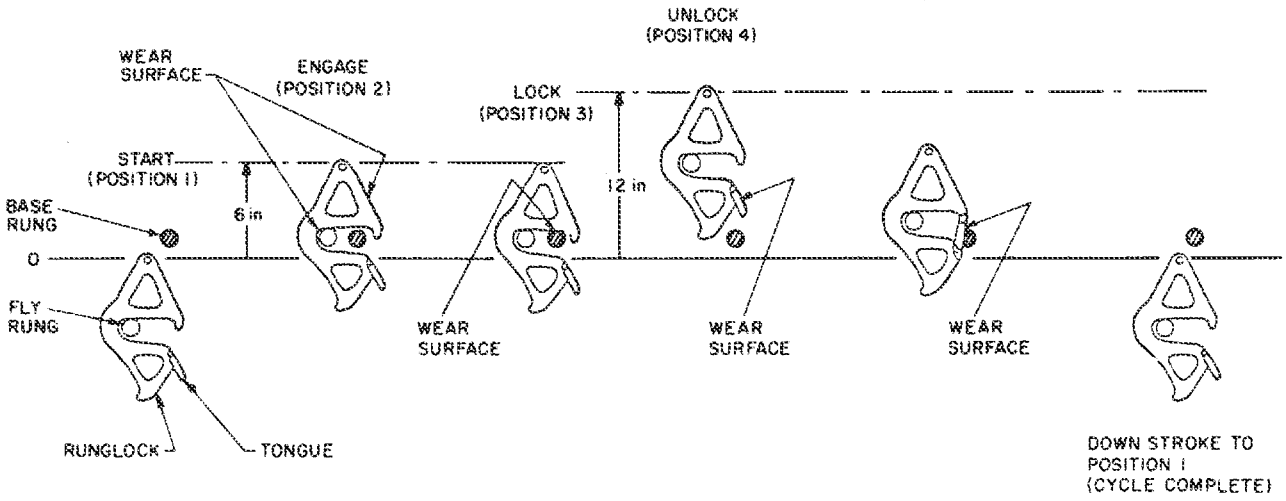
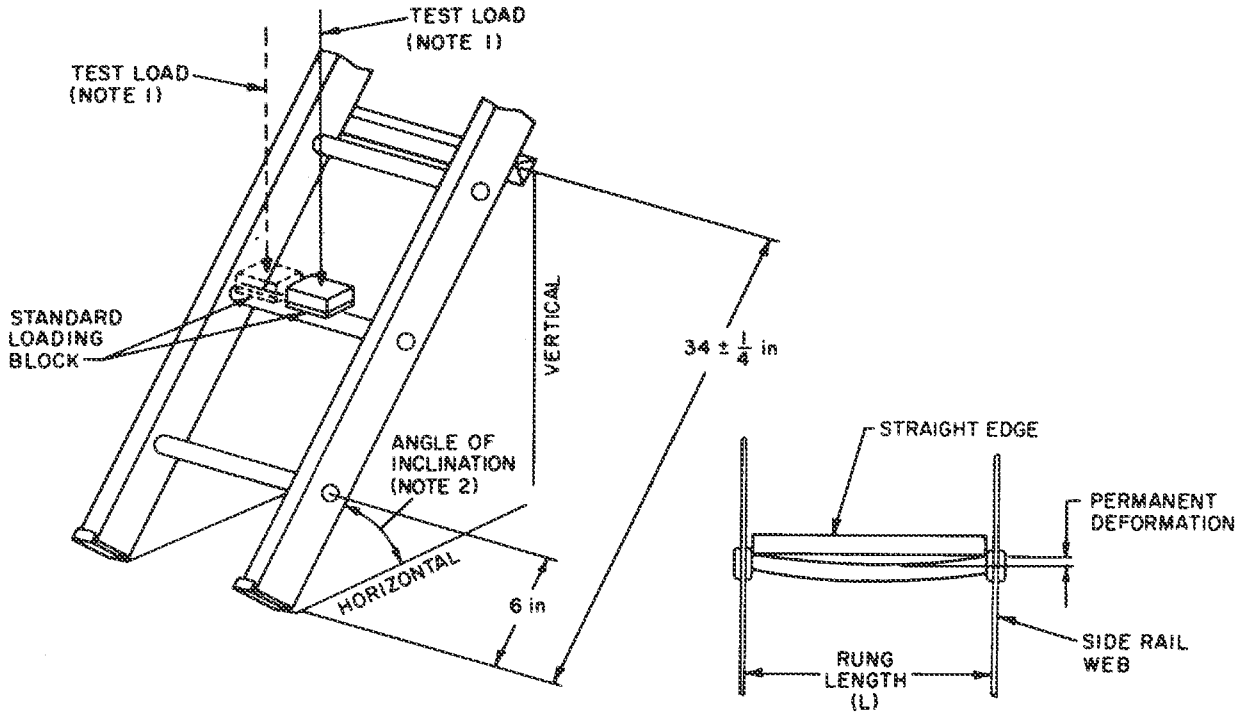


Figure 11
Rung Bending Test and Rung-to-Side-Rail Shear Strength Test



Test Setup
(a)

Reading Permanent Deformation
(b)

NOTES:

(1) The test load for the rung bending test (7.3.5) is indicated by a solid arrow; the test load for the rung-to-side-rail shear strength test (7.3.6) is indicated by the dashed arrow.

(2) The angle of inclination shall be 75-1/2°, except that for combination ladders in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).

Table 11
Step Bending, Rung Bending, Side-Rail Bending, Compression, and Shear Strength Tests

Duty Rating and Type	Test Load* (pounds)		Maximum Allowable Permanent Deformation (Set)
	Compression, Side-Rail Bending, and Shear Strength Tests	Rung and Step Bending Tests	*L / K*†
Special duty - Type IAA	1200	1000	*L / 25*
Extra heavy duty - Type IA	1200	1000	*L / 25*
Heavy duty - Type I	1000	900	*L / 50*
Medium duty - Type II	900	850	*L / 75*
Light duty - Type III	800	800	*L / 100*

* This test load is for use in the step bending, rung bending, compression, side rail bending, and shear strength tests.

† Values listed are for rung bending test only. L is the rung length in inches. The factor K varies with duty rating and type; K = 25 for Special duty and extra-heavy-duty ladders, 50 for heavy-duty ladders, 75 for medium-duty ladders, and 100 for light-duty ladders.

When a 3-foot test sample is used, the test shall be applied to the center rung. When single sections of a ladder are tested, the test load shall be applied to the third or fourth rung from the bottom.

7.3.7 Rung Torque Tests. The test unit shall consist of either an extension ladder with rungs or a short test sample comprising of at least one rung and two side rails in the case of the in-service test (7.3.7.2) or one rung and one side rail when employing the design verification test (7.3.7.1) (see Fig. 12a and b). The torque load, in accordance with Table 12, shall be applied in a clockwise and then counterclockwise direction, alternately, for 10 cycles at each torque test load increment. The rung joint shall be so secured to the side rails that this alternating torque load shall cause no relative motion between the rung and the side rails in excess of 9° (based on 1/16 inch maximum movement for a 1-1/4 inch diameter round rung), for both the design verification test (7.3.7.1) and the in-service test (7.3.7.2).

Torque test loads shall start at 300 inch-pounds and shall increase in 300 inch-pound increments until the maximum load application required to meet the requirements of Table 12 is reached.

7.3.7.1 Rung Torque Design Verification Test
Note: This is a design verification test.

The test unit shall consist of one rung and one side rail and shall be trimmed so that the rung extends 5 to 6 inches from the rung joint (see Fig. 12a). The rail itself shall extend 2 to 2-3/4 inches from each side of the joint. The surface that is visible in the area around the rung joint, consisting of the adjacent area of the rail, the rung joint itself, and the adjacent area of the rung, shall be coated with die bluing or similar material and allowed to dry. A reference line shall be scribed, running along the rung, across the rung joint, and onto the side rail. In the case of tubular rungs, a clamp shall be placed over the rung, and the torque shaft shall be slid through the pillow block into the cut end of the rung until it is within 5/8 inch of the rung joint. The rail shall be clamped in place with the hold-down plate. The rung clamps shall be located 3 inches from the rung joint and shall be tightened in place. All bolts shall be checked for tightness.

When solid rungs are tested, the test rung shall be inserted into a chuck, collet, or rung clamp, after which the rail shall be clamped in place with the hold-down plate and the rung chuck, collet, or rung torque tube clamp shall be tightened.

The load shall be applied with a torque wrench. The load at which the first movement is noted should be recorded, as well as the type of break (R-J for rung-to-joint movement; J-R for joint-to-rail movement; or R-J-R for rung-to-joint-to-rail movement).

7.3.7.2 Rung Torque In-Service Test
Note: *This is an in-service use test.*

The test unit shall consist of either a single section of the ladder or a short section comprising of at least one rung and two side rails (see Fig. 12b). The torque load shall be applied to a 3-1/2 inch wide block in the center of the rung, made of such material that the block will not deform the rung locally. The torque shall be applied, as described

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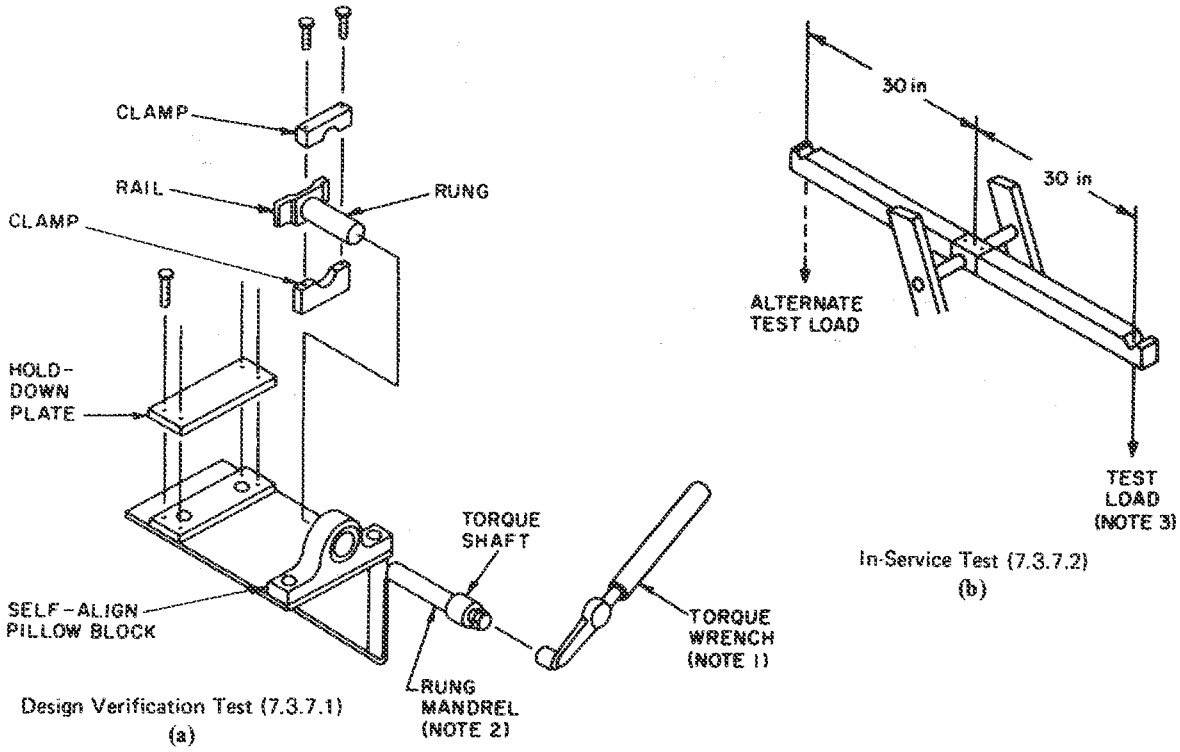
Table 12
Rung Torque Tests

Duty Rating and Type	Maximum Test Load	
	Design verification Torque Test* (inch-pounds)	In-Service Torque Test* (inch-pounds)
Special duty - Type IAA	600	900
Extra heavy duty - Type IA	600	900
Heavy duty - Type I	600	900
Medium duty - Type II	600	900
Light duty - Type III	600	900

* The test load (pounds) at a 30 inch moment arm is 20 pounds for the design verification torque test and 30 pounds for the in-service torque test. These values will vary with the moment arm selected.

Figure 12
Rung Torgue Test



NOTES:

(1) An equivalent method may be used to apply torque.

(2) The testing of a hollow rung is illustrated. The rung mandrel is put inside the hollow rung being tested to keep it from collapsing.

(3) The load may be applied by means of a dead weight or a force gage. The moment arm shown may be replaced by a pipe wrench or the equivalent.

(4) Shim the test unit as required, so that the run neutral axis is approximately coincident with the pillow block centerline.

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above, using a test bar whose moment arm may vary as long as the required torque test load in inch-pounds is obtained. In no case, however, shall the moment arm be less than 18 inches.

Both sets of rung joints and the immediately adjacent areas of the rung and side rail shall be coated with a die marking material, and a line shall be scribed along the rung, across the rung joint, and onto the side rail at both rung joint locations.

The rung shall be so secured to the side rails that the alternating torque load shall cause no relative motion between the rung and the side rails. Both rung joints in the assembly shall meet this requirement. Fig. 12b illustrates typical methods that are acceptable alternates for performing this test.

7.3.8 Side Sway Test.

Note: *This is both a design verification and an in-service use test.*

The test unit shall consist of a single ladder, a section from an extension ladder, a section of an articulated ladder, including a mid-span joint, or both the stepladder portion and the single or extension ladder portion of a combination ladder. This test shall be conducted for all sections of an extension ladder. The sections from a combination ladder shall be individually tested.

The test section shall be placed on edge, resting on level supports located 6 inches from each end of the ladder, as shown in Fig. 13. The side rail shall be in an approximately horizontal plane, and the rungs shall be in the vertical plane and perpendicular to the ground.

A preload of 30 pounds shall be applied at the center of the span, held for a period of one minute, and unloaded. This establishes the zero-reference for deflection measurements. A test load, in accordance with Table 7, shall then be applied for a minimum period of one minute to the center of the span over a 3-1/2 inch length of the bottom side rail.

The load shall be applied by hanging weights from the bottom of the lower rail. Care shall be taken to ensure that the load is centered with respect to the width of the rail.

The maximum deflection of the midpoint of the lower side rail, measured to a reference surface, shall not exceed the deflection listed in Table 13.

Each section shall withstand this test without any permanent deformation (set) in excess of 1/1000 of the effective span of the side rails.

Table 13
Maximum Allowable Deflection for Side Sway Test — Midspan Deflection of Lower Side Rail

Test Section Length X* (feet)	Maximum Deflection Y* (inches)	
	Straight and Extension	Combination Ladders
4	0.84	0.84
5	0.88	0.88
6	0.92	0.92
7	0.96	0.96
8	1.00	1.00
9	1.04	1.04
10	1.08	1.08
12	1.16	—
14	1.24	—
16	1.32	—
18	1.40	—
20	1.48	—
22	1.56	—
24	1.64	—
26	1.72	—
28	1.80	—
30	1.88	—

*$Y = 0.04X + 0.68$, where Y = maximum allowable midspan deflection in the side sway test (inches) and X = ladder test section length (feet).

7.3.9 Side-Rail Cantilever Bending Tests.

7.3.9.1 Static Side-Rail Cantilever Bending Test

Note: This is a design verification test.

The test unit shall consist of a single ladder section or the base section of an extension ladder, articulated or combination ladder; any safety shoes or spikes affixed to the section shall be removed before the test is conducted. The test unit shall be placed on edge with the rungs in a vertical plane, as shown in Fig. 14a and b. For articulated ladders built with a stabilizer bar across the bottom of the front rail, the test unit shall be placed on edge with the rungs in a vertical plane as shown in Fig. 14c. The lower side rail shall be clamped to a support and shall be unsupported from the bottom end to the midpoint of the lowest rung. If the rung has a flat surface, that surface shall be parallel to the edge of the support.

The test load shall be applied by means of a weight, in accordance with Table 14, for a minimum period of one minute, to the extreme bottom end of the upper side rail, as shown in Fig. 14a. The load shall be centrally applied to a 2-inch long block resting on the full width of the side rail and held in place by a clamp. The load attachment point on the clamp shall not be more than 2 inches

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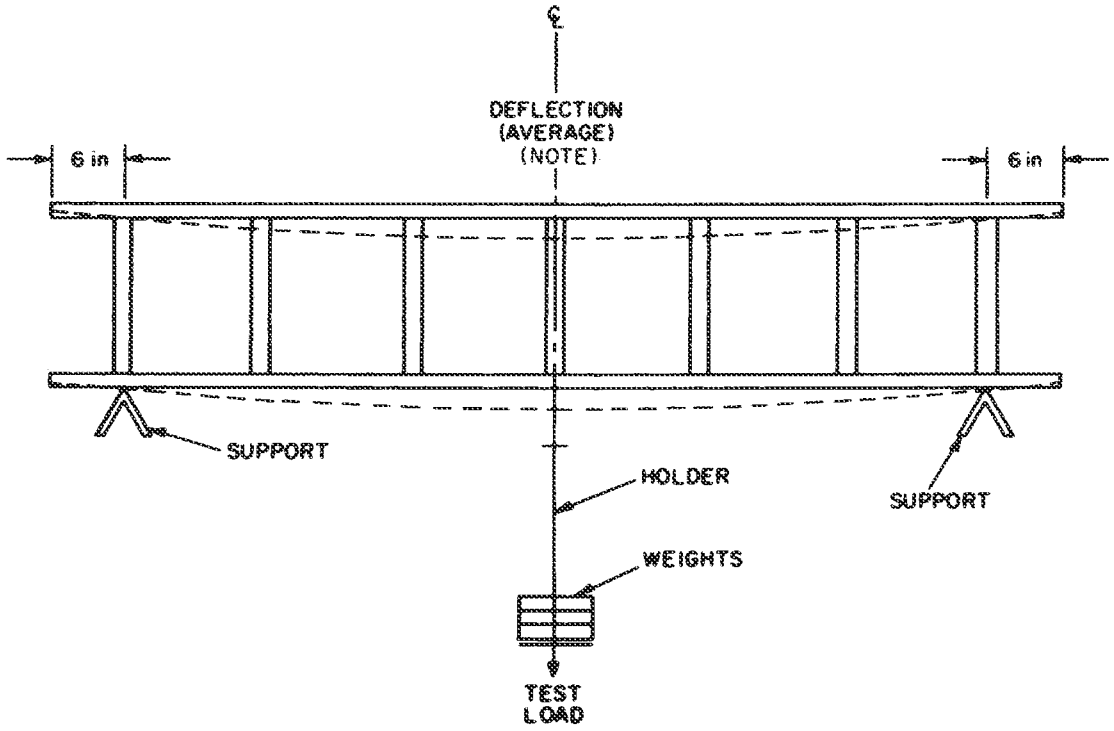
Figure 13
Side Sway Test



NOTE: The deflection is the difference between the height of the lower edge of the ladder side when unloaded (solid line) and when loaded (dotted line).

Table 14
Static Side-Rail Cantilever Bending Test Load

	Section or Base Section of Articulated or Combination Ladder		Articulated Ladder with Stabilizer Bar*
Duty Rating and Type	Working Load (pounds)	Test Loads (pounds)	Test Loads (pounds)
Special duty - Type IAA	375	600	–
Extra heavy duty - Type IA	300	500	1000
Heavy duty - Type I	250	400	800
Medium duty - Type II	225	300	600
Light duty - Type III	200	200	400

* Stabilizer bar which joins both rails.

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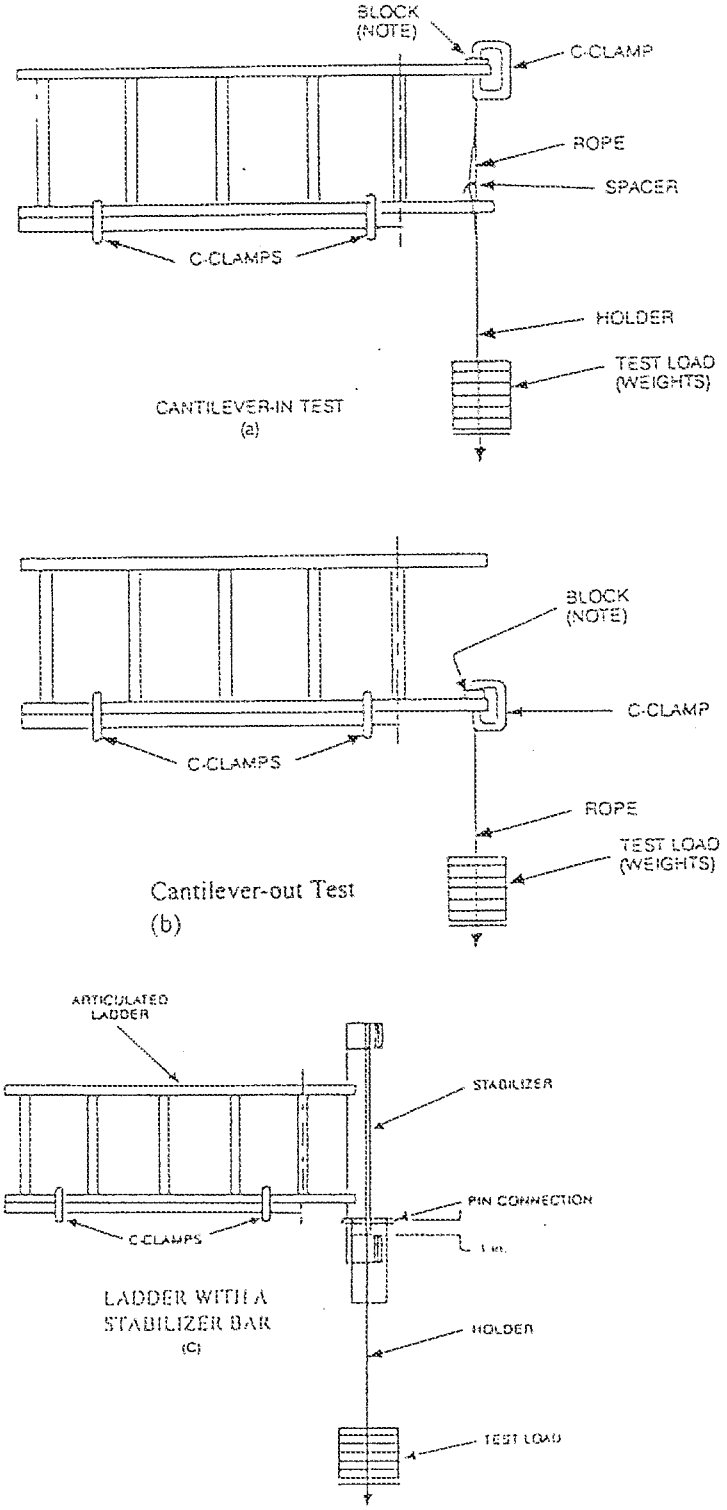
Figure 14
Static Side-Rail Cantilever Bending Test



Note: The block shall be a minimum of 1/4" and a maximum of 1-inch thick, and shall be 2-inches long measured along the side rail, and a minimum width equal to the full width of the side rail including side rail flanges.

below the underside of the web of the rail being tested. The weight shall be suspended so that it is acting through the vertical neutral axis of the side rail. The allowable permanent deformation (set) of the upper side rail shall not exceed 1/4 inch.

The test load shall then be applied to the extreme bottom end of the lower side rail in a like manner, as shown in Fig. 14b. Ladders with a stabilizer bar shall have their test load applied to the extreme bottom end of the lower stabilizer bar as shown in Fig. 14c. The allowable permanent deformation (set) of the lower side rail shall not exceed 1/4 inch.

Provided the ladder continues to support the test load, permanent deformation (set) or ultimate failure of any ladder components as a result of the tests, except for the limitation on the maximum allowable permanent deformation (set) of the upper and lower side rails, shall not constitute test failure.

7.3.9.2 Side-Rail Cantilever Dynamic Drop Test
Note: This is a design verification test.

The test unit shall be the longest extension ladder for each base section rail size and the longest single ladder for each rail size. An extension ladder shall be opened one foot for the drop test. Ladder feet shall remain on the section, but each foot shall be taped so the bottom surface makes an angle of 90° with the rail length.

The test ladder shall be placed in a horizontal position with the rungs vertical. The fly section shall be supported 6 inches from the very top of the fly section (including caps), so that the lower rail of the base section is 36 inches from a concrete floor. (See Fig. 15a). When testing a ladder with a stabilizer bar, see Fig. 15b for setup.

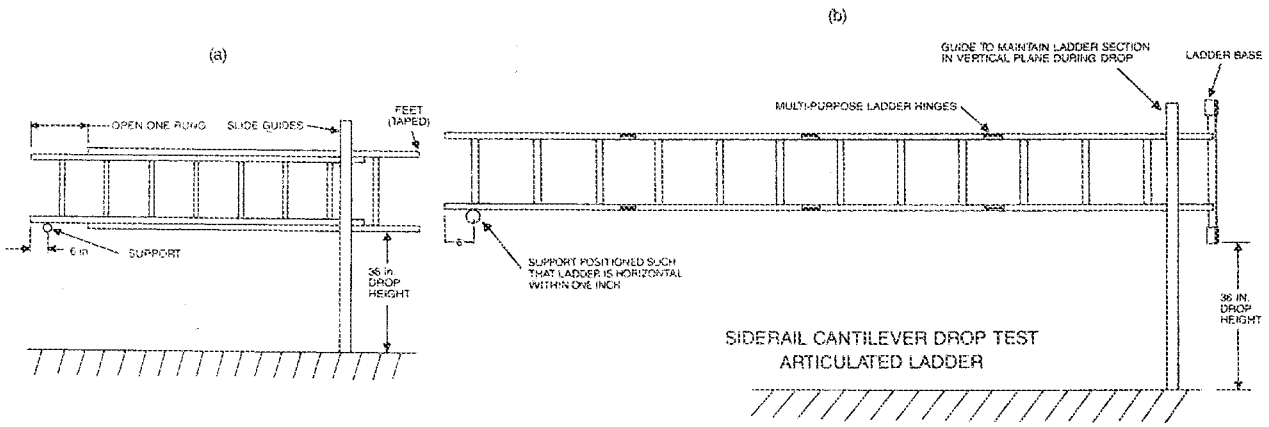
To perform the drop test, both rails of the base section shall be guided in a vertical plane during a free-fall drop. The allowable permanent deformation (set) of the lower side rail shall not exceed 1/4 inch.

7.3.10 Ladder Section Twist Test.
Note: This is a design verification test.

The test unit shall consist of a ladder base section of any length, supported over a 7-foot test span. The ladder shall be placed in a flat horizontal position and supported at each end, as shown in Fig. 16. The horizontal support for the ladder on one end shall be fixed. An initial preload of 600 inch-pounds, applied in a clockwise direction, shall be used to establish a reference for angular deflection. The ladder shall be unloaded after the application of 600 inch-pounds and the angular deflection set to 0 degrees to establish a datum. A torque of 1200 inch-pounds shall then be applied, using one of the two methods described in Fig. 16 (note 2). The torque shall be applied first in a clockwise direction, and the angle of twist shall be recorded with respect to the 0 degree datum. Then apply a 1200 inch-pound torque in the counterclockwise direction and record the angle of twist using the same 0 degree datum. Neither measurement shall be greater than the values in Table 15. Attention shall be given to ensure that the ladder is tightly clamped onto the test fixtures during this test.

When testing an articulated ladder, this test shall be repeated with a joint at mid-span. If more than one joint design is used, each shall be tested. No permanent deformation to any component, which would interfere

Figure 15
Side-Rail Cantilever Dynamic Drop Test



NOTES: This test evaluates the result of inward-cantilever dynamic loading of the ladder.

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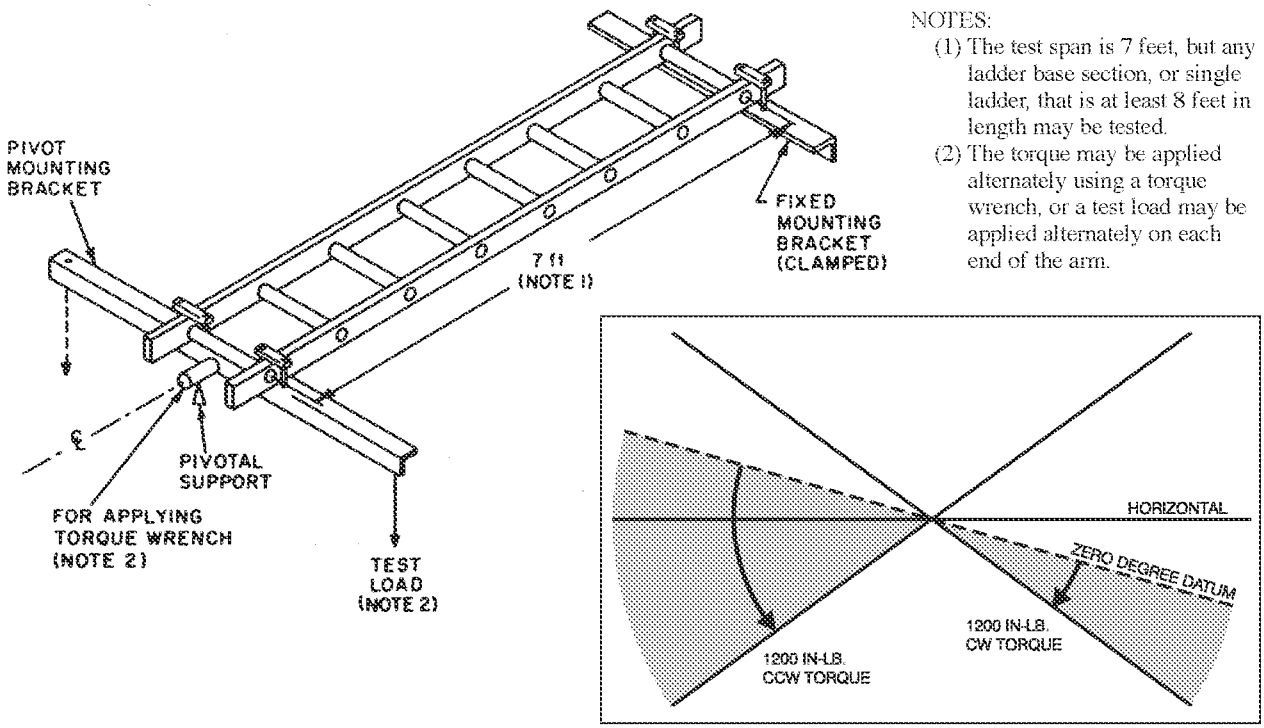
Figure 16
Ladder Twist Test (Single, Extension, or Articulated Ladders)



NOTES:
(1) The test span is 7 feet, but any ladder base section, or single ladder, that is at least 8 feet in length may be tested.
(2) The torque may be applied alternately using a torque wrench, or a test load may be applied alternately on each end of the arm.

Table 15
Ladder Section Twist Test

Duty Rating and Type	Working Load (pounds)	Maximum Allowable Angle of Twist θ (degrees)
Special duty - Type IAA	375	14
Extra heavy duty - Type IA	300	14
Heavy duty - Type I	250	18
Medium duty - Type II	225	20
Light duty - Type III	200	22

with the smooth operation of the joint, is permissible.

7.3.11 Foot Slip Test.
Note: This is a design verification test.

Single, extension, combination and articulated ladders shall be tested for slip resistance as shown in Fig. 17. The test unit shall be a 16-foot model (or longest available if only shorter versions are manufactured). The test surface shall be A-C plywood, which shall be pre-sanded using 320 fine wet/dry sandpaper. The "A" side of the plywood shall be placed in contact with the bottom of the ladder. The surface that the top of the ladder rests against shall also be A-C plywood, similarly treated.

A dead load, in accordance with Table 16, shall be centrally applied to the third highest rung. A horizontal test load force, in accordance with Table 16, statically applied centrally to the bottom of the ladder at 1 inch above the test surface, shall not cause movement in excess of 1/4 inch across the test surface.

7.3.12 Multisection Extending Force Test.
Note: This is a design verification test.

The test unit shall be a complete extension ladder or an articulated ladder with an extendible section where no hinge is employed. The unit shall be set in a vertical position, at the minimum working length of the ladder. The base section may be braced or otherwise held to maintain vertical alignment.

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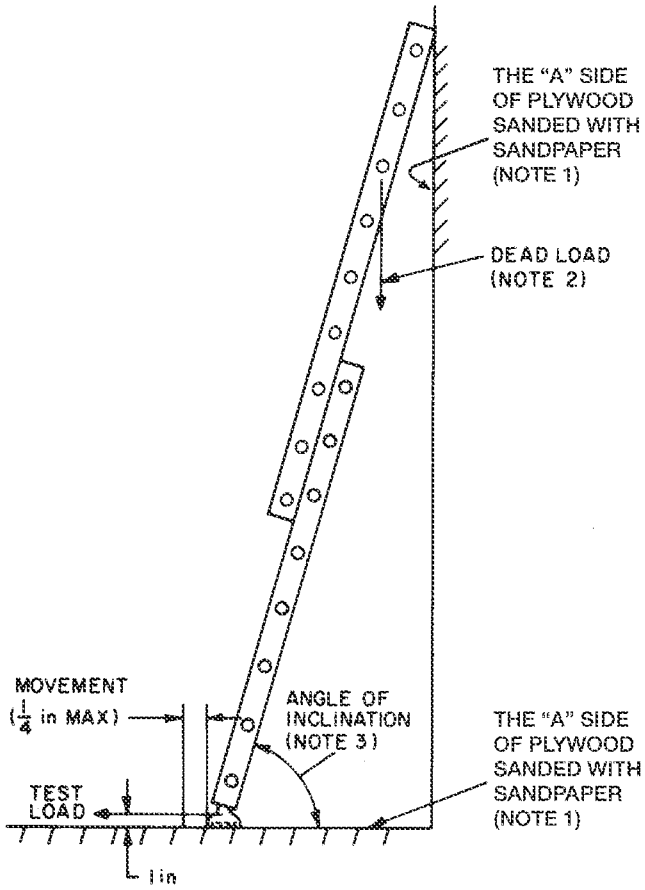
Figure 17
Foot Slip Test



NOTES:

(1) The grain of the plywood shall be parallel to the direction of loading; the grain on the vertical sheet under the upper end of the fly section shall run in a vertical direction, and the grain on the horizontal sheet under the base section shall be parallel to the direction of the test load.

(2) The dead load shall be applied on the third highest rung.

(3) The angle of inclination shall be 75-1/2°, except that for combination ladders in the extension-ladder orientation a slightly modified angle shall be used so that the tread portions of the steps are horizontal (level).

A measured downward force shall be applied to the rope if the ladder has a rope and pulley system installed. The force shall be smoothly applied to cause vertical extension of the extending section(s) of two feet or more, at a rate of 1/2 to 1 foot per second. For those ladders not equipped with a rope and pulley, the measured force shall be applied vertically to the bottom rung of the fly section.

The maximum measured force that occurs during each pull shall be recorded. Three test pulls shall be done for each ladder, and the maximum forces shall be averaged for the three pulls. This average maximum shall not exceed two times the weight of the extending section(s).

Table 16
Foot Slip Test

Duty Rating and Type	Dead Load (pounds)	Horizontal Test Load (pounds)
Special duty - Type IAA	200	50
Extra heavy duty - Type IA	200	50
Heavy duty - Type I	200	50
Medium duty - Type II	200	50
Light duty - Type III	200	50

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Table 17
Articulated Ladder Tests

Duty Rating and Type	Working Load (pounds)	Scaffold Bending Strength Test Load (pounds)	Dynamic Joint Lock Tests Cyclic Horizontal Test Load (pounds)	
			Scaffold Position *	Straight & Stepladder Position
Extra Heavy Duty - Type IA	300	1200	50	75
Heavy Duty - Type I	250	1000	42	63
Medium Duty - Type II	225	1000	38	57
Light Duty - Type III	200	1000	34	50

* The scaffold position cyclic load is applied in both the push and pull direction.

7.4 Articulated Ladder Tests

Note: These are design verification tests.

This standard does not cover Type IAA articulated ladders. Articulated ladders shall comply with the test requirements for stepladders when in the stepladder mode, for trestle ladders when in the trestle ladder mode, for straight ladders when in the straight ladder mode, and with the test requirements 7.4.1 when in the scaffold or worktable position. In addition, it shall comply with the additional joint tests 7.4.2 through 7.4.5. If the ladder design includes extendable sections all tests shall be conducted with those sections, fully extended. The tests shall be conducted with the ladder on a test surface of A-C plywood, which shall be pre-sanded using 320 fine wet/dry sandpaper. The "A" side of the plywood shall be placed in contact with the feet of the ladder.

7.4.1 Scaffold Bending Strength Test. When set up in all scaffold positions recommended by the manufacturer, the ladder shall be capable of withstanding, without test failure, a test load as indicated in Table 17. The load is to be applied for 1 minute to the center of the standing area of the scaffold on the manufacturer's recommended decking material, or a steel plate 6" wide and 3/8" thick, extending the length of the scaffold top, as shown in Fig. 18. The feet of the ladder shall rest on the "A" side of AC plywood, which shall be pre-sanded with 320 fine wet/dry sandpaper.

7.4.2 Cyclic Joint Test. A pair of joints shall be cycled from the closed position to fully open and back to the closed position for 6,000 cycles. The test sample shall be a pair of hinges and the ladder sections directly above and below the hinges. The hinges are to be locked and unlocked in each of its locking positions during every cycle. The use of additional lubricant on the joints or hinges during the test, and the use of machine to cycle the hinges is not permissible. Clamp either the top or lower ladder section to a fixed member, such as a table, and cycle the opposite ladder section through each hinge position. Following this test, the ladder shall meet the requirements of the 7.3.1 Horizontal Bending Test, 7.3.3 Inclined Load Test, 7.4.3 Unlocked Joint Test, and 7.4.5 Dynamic Joint Lock Tests.

7.4.3 Unlocked Joint Test. A test of the internal joint friction shall be conducted with the test ladder in the straight ladder mode. With all joints locked and dry (no lubricant other than that used during manufacture), and telescoping sections fully retracted (if provided), the ladder shall be set at an angle of 75-1/2° with the top leaning against a vertical wall. The ladder shall be oriented such that the mid-span joints, when unlocked, allow the ladder to fold toward the wall. The mid-span joints shall then be unlocked, and a 5 pound vertical load applied over a 3-1/2 inch wide area at the center of the lowest rung. The ladder shall fold toward the wall and no longer remain straight. Folding of the ladder at less than 5 pounds is also acceptable.

7.4.4 Single Joint Lock Test. The test unit shall be a full-length ladder set in the single or extension ladder mode, at a 75-1/2° working angle, with one hinge at midspan unlocked.

A downward distributed load, in accordance with Table 10, shall be applied for a period of one minute equally to both side rails on the lowest rung above the unlocked hinge. The load shall be applied using two 3-1/2 inch straps, each located next to a rail and centrally loaded through an equalizer bar over the climbing side of the ladder.

The ladder shall withstand this test without ultimate failure. Permanent deformation shall be allowed.

7.4.5 Dynamic Joint Lock Tests. Each test in this section (7.4.5) shall be conducted on a new and unused ladder, as well as a ladder subjected to the cyclic joint test (7.4.2). The use of additional lubricant during the test is not permissible.

7.4.5.1 Dynamic Joint Lock Test for the Scaffold Position This test is for articulated ladders that have approved uses (by the manufacturer) in a scaffold position as shown in Figure 18b. The ladder shall be set up

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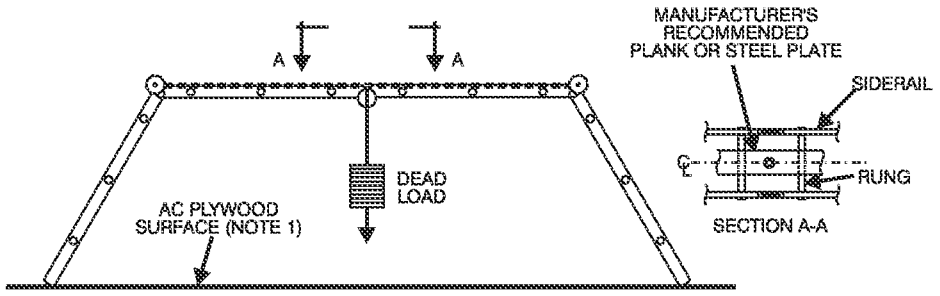
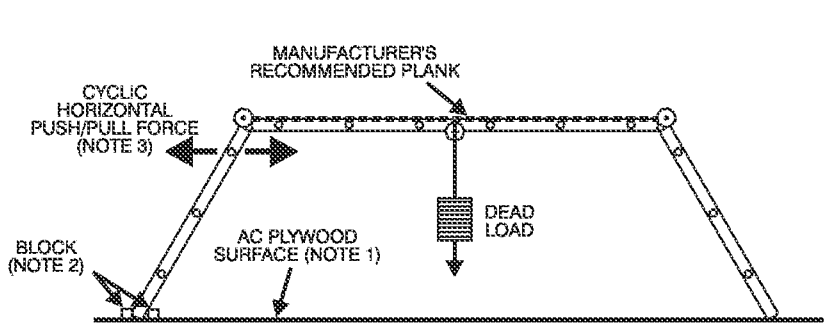
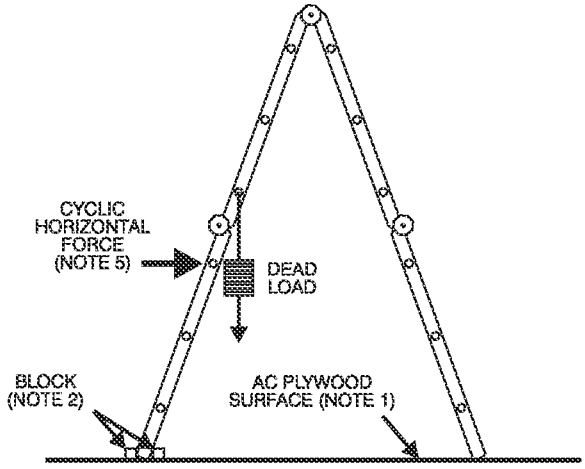
Figure 18
Scaffold Bending Strength and Dynamic Joint Lock Tests



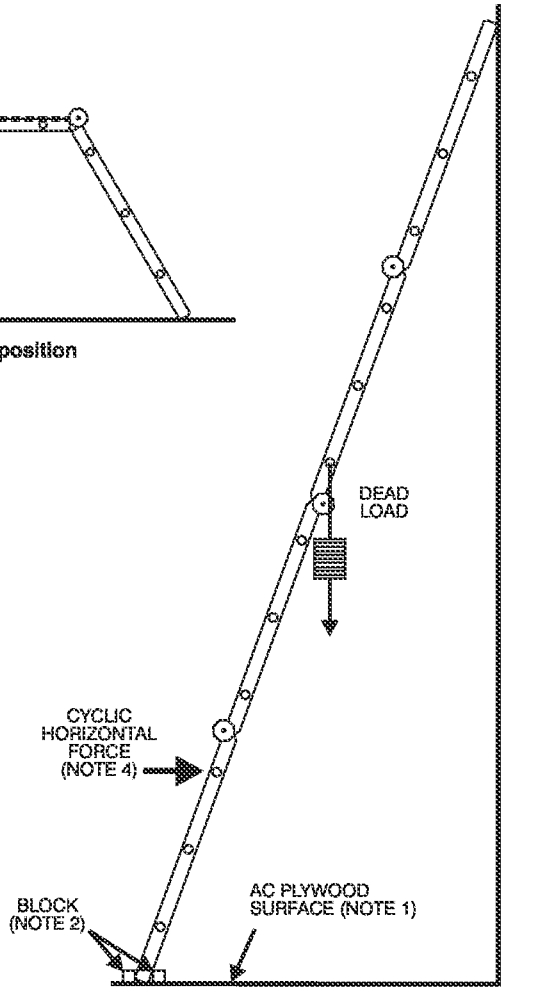
a)Scaffold bending strength test



b) Dynamic joint lock test- scaffold position



c) Dynamic joint lock test- stepladder position



d) Dynamic joint lock test- straight ladder position

NOTES:
(1) The ladder shall be placed on the A side of A/C plywood, sanded with 320 fine wet/dry sandpaper.
(2) A block or equivalent means shall be used to prevent the bottom of the feet from sliding, but the feet shall not be clamped or otherwise restrained.
(3) The horizontal force is applied in both the push and pull directions during cycling.
(4) The horizontal force is applied toward the support wall and then removed during cycling.
(5) The horizontal force is applied toward the center of the ladder and then removed during cycling.

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in the scaffold position with the telescoping sections extended to maximum length (if applicable) and the manufacturer's recommended scaffold plank in place. A dead load equal to the duty rating of the ladder, comprised of lead weights or the equivalent to maximize the density of the loading medium, shall be suspended at the center of the plank, as shown in Figure 18, in a manner that equalizes the load to both side rails. A horizontal force, in accordance with Table 17, shall be applied in both the push and pull direction to the middle of the first rung below the hinge joint. The feet of the ladder closest to the application of the horizontal force shall be blocked from sliding, but not otherwise restrained. The feet furthest from the application of the horizontal force shall not be blocked or restrained (see Figure 18b). The horizontal push/pull force shall be cycled for 6,000 cycles at a rate of 50-70 cycles per minute. The cycling shall consist of applying the specified horizontal force first in the push direction, then in the pull direction, and then repeating. The ladder shall not collapse, and all of the locks shall be in their locked position at the completion of the test.

7.4.5.2 Dynamic Joint Lock Test for the Straight Ladder Position. This test is for articulated ladders that have approved use (by the manufacturer) in the straight ladder position. The ladder shall be opened to a straight position, with the telescoping sections extended to maximum length (if applicable). The ladder shall be set at an angle of 75-1/2°. A dead load equal to the duty rating of the ladder comprised of lead weights or the equivalent, to maximize the density of the loading medium, shall be suspended to the rung closest to midspan, or the first rung above midspan if the two closest rungs are equidistant, as shown in Figure 18d. The load shall be applied in a manner that equalizes the load to both side rails. A horizontal force, in accordance with Table 17, shall be applied toward the upper support wall to the middle of the third rung above the floor. The feet of the ladder shall be blocked from sliding, but not otherwise restrained. The top of the ladder shall not be blocked or restrained (see Fig. 18d). The horizontal force shall be cycled for 6,000 cycles at a rate of 50-70 cycles per minute. Cycling shall consist of applying the specified horizontal force toward the upper support wall, then removing the force, and then repeating. The ladder shall not collapse, and all of the locks shall be in their locked position at the completion of the test.

7.4.5.3 Dynamic Joint Lock Test for the Stepladder Position. This test is for articulated ladders that have approved use (by the manufacturer) in the stepladder position. The ladder shall be set in the stepladder position, with the telescoping sections extended to maximum length (if applicable). A dead load equal to the duty rating of the ladder comprised of lead weights or the equivalent to maximize the density of the loading medium, shall be suspended to the highest standing level, as shown in Figure 18c, in a manner that equalizes the load to both side rails. To the same side of the ladder, a horizontal force, in accordance with Table 17, shall be applied toward the center of the ladder to the middle of the third rung above the floor. The feet of the ladder closest to the application of the horizontal force shall be blocked from sliding, but not otherwise restrained. The feet furthest from the application of the horizontal force shall not be blocked or restrained (see Fig. 18c). The horizontal force shall be cycled for 6,000 cycles at a rate of 50-70 cycles per minute. Cycling shall consist of applying the specified horizontal force toward the center of the ladder, then removing the force, and then repeating. The ladder shall not collapse, and all of the locks shall be in their locked position at the completion of the test.

7.5 Step, Trestle (Double Front), Extension Trestle, Platform, Combination, Articulated Ladder and Step Stool Tests

7.5.1 Compression Test.
Note: This is a design verification test.

A load test of the entire ladder or step stool shall be made with the ladder or stool in an open position, as shown in Fig. 19 and 20. A uniformly distributed load, in accordance with Table 11, shall be applied for a minimum period of one minute to the ladder top cap or platform. A combination ladder shall be tested in its stepladder position, with the test load applied uniformly to the top cap, or to the top step when no top cap is used. Trestle ladders, articulated ladders which permit their use as a double front stepladder and the base section of extension trestle ladders shall be subjected to twice the test loads in Table 11, by applying the test load simultaneously to both sections of the ladder, at the top cap of each section, or to the top step when no top cap is used. The unit shall withstand the load without test failure.

7.5.2 Side-Rail Bending Test.
Note: This is a design verification test.

The resistance to side-rail bending shall be tested by placing a load, in accordance with Table 11, over a 3-1/2 inch width on the middle step adjacent to one side rail of the ladder for a minimum period of one minute, with the ladder in an open position, as shown in Fig. 19 and 20. The next higher step shall also be tested. A combination or articulated ladder shall be tested while erected in its stepladder position. The ladder shall withstand the load without test failure.

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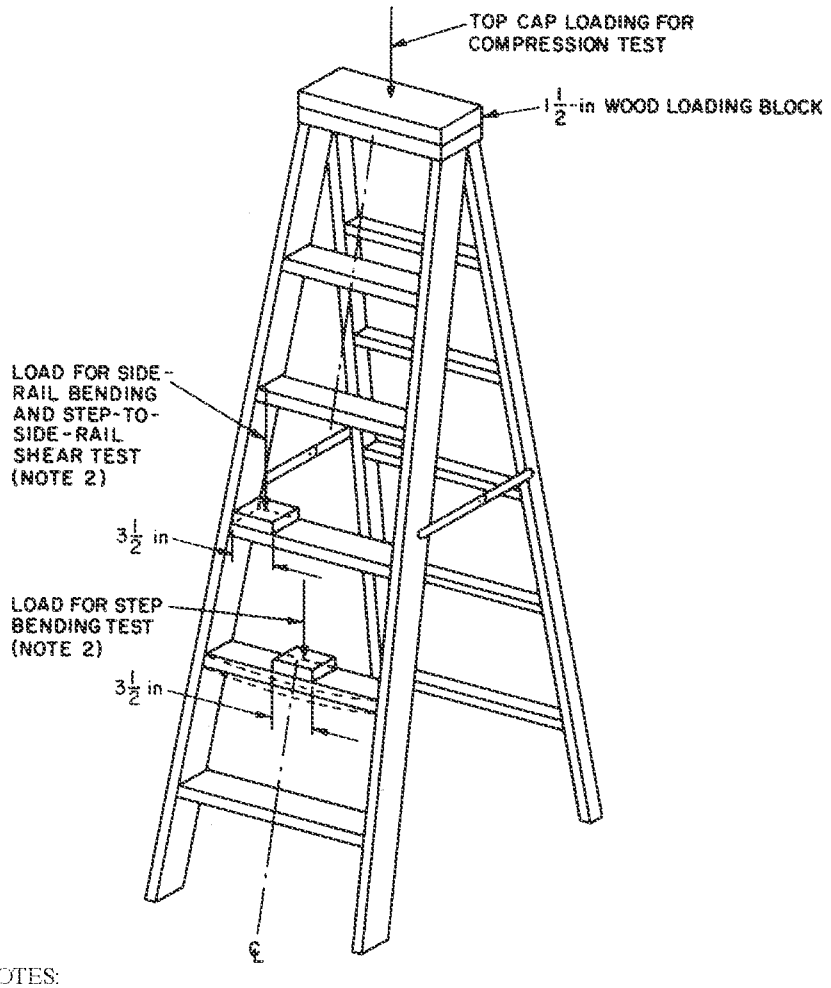
7.5.3 Step or Platform Bending Test.
Note: This is a design verification test.

The strength of the step, rung, or platform section shall be tested by applying a load, in accordance with Table 11, for a minimum period of 1 minute, over a 3-1/2 inch length across the full width of the step, rung, or platform and on the center of the longest or bottom step or rung with the ladder in the open position, as shown in Fig. 19 and 20. The test load shall also be applied to the longest like step or rung without braces, as well as to steps, rungs, or platforms of different designs or material specifications. The test load shall also be applied to the top cap of a step stool. The step, rung, platform or step stool top shall withstand the load without test failure or permanent deformation (set), in excess of 1/100 of the clear length of the step, rung, or platform between the side rails (between inside flanges) or of the overall length of the stool top cap.

7.5.4 Step-to-Side-Rail Shear Strength Test.
Note: This is a design verification test.

The shear strength of the step- or rung-to-side rail joint shall be measured by applying a test load, in accordance with Table 11, for a minimum period of one minute, over a 3-1/2 inch width of the step or rung. The test load shall be applied on the longest braced and unbraced steps with the least fastening. The same test load shall be applied to steps or rungs of different cross sectional design or materials. The

Figure 19
Compression, Step Bending, Side-Rail Bending, and Step-to-Side-Rail Shear Tests



NOTES:
(1) This test setup is illustrated for a stepladder.
(2) Typical locations for the test loads are shown; see 7.5.1, 7.5.2, 7.5.3, and 7.5.4 as to the placement of the loads.

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test load shall be applied as near the side rail as possible with the ladder in a fully opened position, with the spreaders or hinges locked, as shown in Fig. 19 and 20. The test load shall also be applied to the top cap of a step stool, over a 3-1/2 inch wide area across the front-to-back depth of the top cap adjacent to one side rail. When the load is removed, the unit shall show no indication of test failure in the fastening means attaching the step, rung, or top cap to the side rail or test failure of any other component.

7.5.5 Bucket (Pail) Shelf Test.
Note: This is a design verification test.

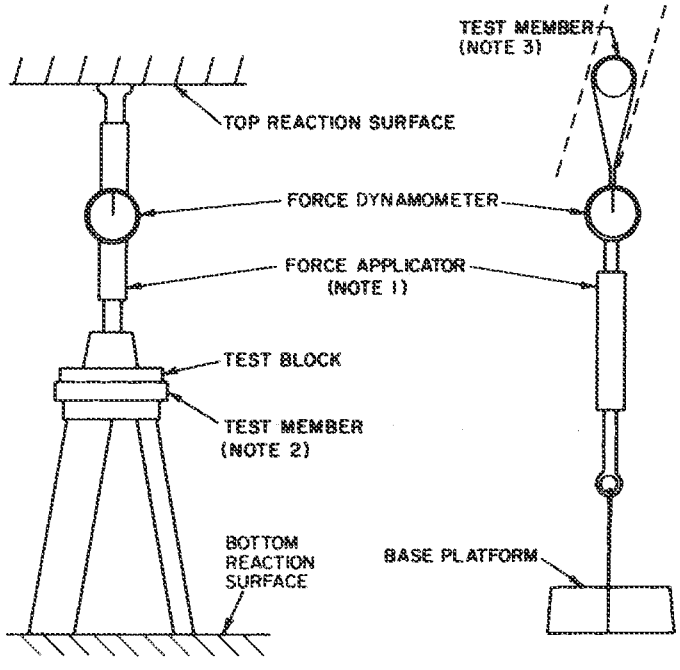
The bucket shelf shall be constructed so that it supports a distributed load of 100 pounds, applied to the shelf for a minimum period of one minute, with the ladder in an open position with the spreaders locked. The bucket shelf shall withstand the load without ultimate failure.

7.5.6 Front Stability Test.
Note: This is a design verification test.

The ladder shall be set in the open position on a level floor; a combination ladder shall be opened to its stepladder position. A uniformly distributed load, in accordance with Table 18, comprising lead weights or the equivalent to maximize the density of the loading medium, shall be applied to the second highest step, rung, or platform (the highest proper standing level), as shown in Fig. 21. (For an extension trestle ladder, the load shall be applied to the second highest extension-section rung.)

The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 18, applied at the geometric center of the stepladder top cap, at a distance of not more than 1/2 inch above its top surface, towards the front of the ladder, as shown in

Figure 20
Methods (Other Than Dead Weight) for Applying Test Loads



Top-Loading Method
(a)

Bottom-Loading Method
(b)

NOTES:
(1) Hydraulic, pneumatic, or mechanical means may be used to apply the load.
(2) The top loading method is illustrated for the compression test, where it is applied to the top of the ladder, but it can also be used for the other tests.
(3) The bottom loading method is illustrated for the rung bending test, but it can also be used for the other tests.

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Fig. 21. The pulling force shall be applied to the top horizontal guardrail member of platform ladders, to the apex of the base section of trestle and extension trestle ladders, and to the top cap of combination ladders or to the top step when no top cap is used. Step stools shall be loaded with the distributed load on the top cap, and the pulling force shall be applied to the top cap also. The test surface shall be such as to ensure that the ladder does not slip or slide during the test.

During this test, the minimum load that causes the ladder to tip over shall not be less than the value shown in Table 18. Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position.

7.5.7 Side Stability Test.
Note: This is a design verification test.

The side stability of a ladder shall be measured with the ladder set in an open position on a level floor. A uniformly distributed load, in accordance with Table 18, comprising lead weights or the equivalent to maximize the density of the loading medium, shall be applied to the second highest step, rung, or platform, as shown in Fig. 21. (For an extension trestle ladder, the load shall be applied to the second highest extension-section rung.)

The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 18, applied to the side of the front rail, at the geometric center of the stepladder top cap, at a distance of not more than 1/2 inch above its top surface, as shown in Fig. 21. The pulling force shall be applied to the top horizontal guard rail member of platform ladders, to the apex of the base section of trestle and extension trestle ladders, and to the top cap of combination ladders or to the top step when no top cap is used. Step stools shall be loaded with the distributed load on the top cap, and the pulling force shall be applied to the top cap also. The test surface shall be such as to ensure that the ladder does not slip or slide during the test.

During this test, the minimum load that causes the ladder to tip over shall not be less than the value shown in Table 18. The test shall be run with the force applied to both sides, and the values shall be averaged to obtain the minimum load. Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position.

7.5.8 Rear Stability Test.
Note: This is a design verification test.

The rear stability of a ladder shall be measured by placing the ladder in an open position on a level floor. A uniformly distributed load, in accordance with Table 18, comprising lead weights or the equivalent to maximize the density of the loading medium, shall be placed on the second highest step, rung, or the platform (the highest proper standing level), as shown in Fig. 21. (For an extension trestle ladder, the load shall be applied to the second highest extension-section rung.)

The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 18, applied to the geometric center of the stepladder top cap, at a distance of not more than 1/2 inch above its top surface, in a rearward direction, as shown in Fig. 21. The pulling force shall be applied to the top horizontal guard rail member of platform ladders, to the apex of the base section of trestle and extension trestle ladders, and to the top cap of combination ladders or to the top step when no top cap is used. Step stools shall be loaded with the distributed load on the top cap, and the pulling force shall be applied to the top cap also. The test surface shall be such as to ensure that the ladder does not slip or slide during the test.

During the test, the minimum load to cause the ladder to tip over shall not be less than the value shown in Table 18. Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position.

Table 18
Stability Test Loads (pounds)

Duty Rating and Type	Distributed Dead Load	Front Pulling Force	Side Pulling Force	Rear Pulling Force		
				Platform Ladders	Other Ladders and Step Stools	Torsional Stability Pulling Force
Special duty - Type IAA	200	25	20	35	45	35
Extra heavy duty - Type IA	200	25	20	35	45	30
Heavy duty - Type I	200	25	20	35	45	30
Medium duty - Type II	200	25	20	35	45	25
Light duty - Type III	200	25	20	35	45	20

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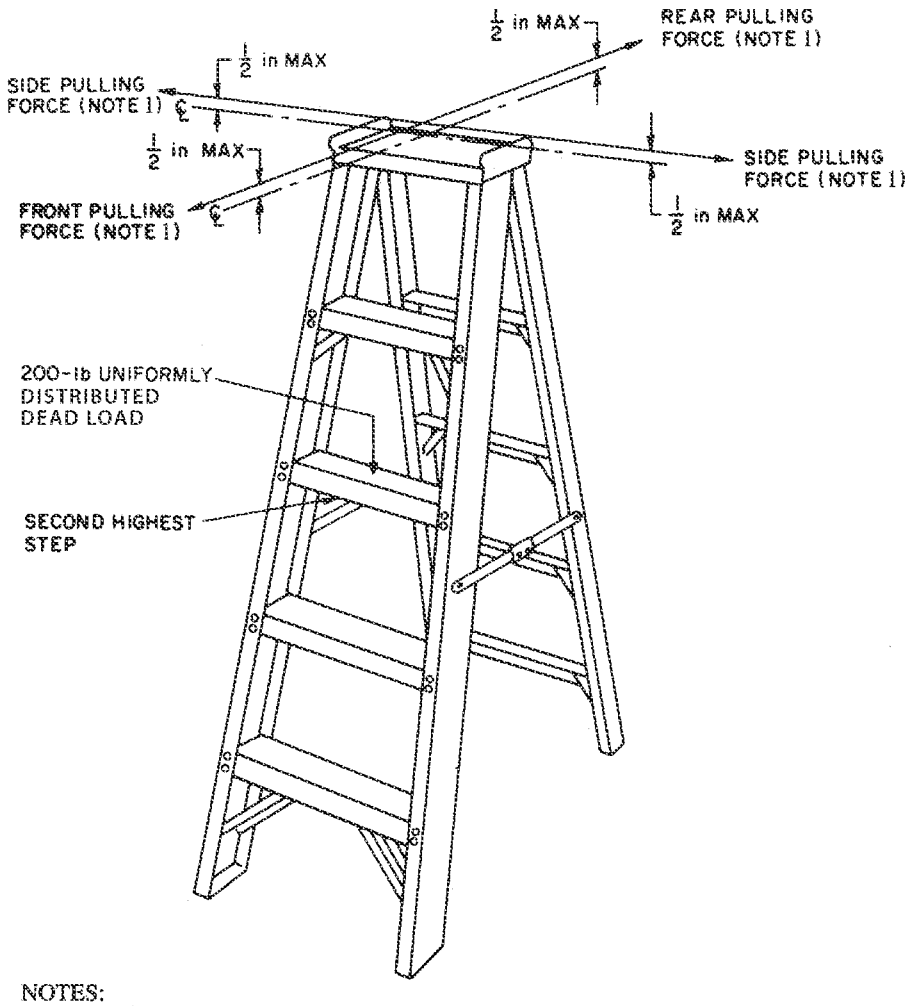
Figure 21
Front, Side, and Rear Stability Tests



NOTES:
(1) The pulling force shall be applied at a maximum distance of 1/2 inch above the top of the stepladder.
(2) This test is illustrated for a stepladder.

7.5.9 Torsional Stability Test.
Note: This is a design verification test.

The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. A 200-pound distributed dead load, comprising lead weights or the equivalent to maximize the density of the loading medium, shall be applied to the ladder top cap, platform, or top step when no top cap is used, as shown in Fig. 22.

A horizontal force, in accordance with Table 18, directed to the rear of the ladder, shall be applied to the ladder top cap at a distance of 18 inches from the vertical centerline of the ladder, as shown in Fig. 22. For articulated ladders, the horizontal force shall be applied as close as possible to the apex hinge. The force shall be maintained perpendicular to the moment arm, at the final load position, with a tolerance of ±10°, during the test. The test shall be conducted on dry, uncoated, vinyl flooring (see Section 4).

Relative movement in excess of one inch of the ladder with respect to the floor, any damage or visible weakening of the ladder structure or component, or any significant visible major damage from permanent deformation (set) of the test unit upon release of the test force shall constitute failure to meet this requirement. Minor permanent deformation (set) of individual ladder components, such as diagonal braces or rear horizontal braces, of less than 1/8 inch, shall not constitute test failure.

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Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position. This test is not applicable to ladder-type step stools, platform ladders less than 3 feet in size, and other step-type ladders less than 5 feet in size.

7.5.10 Racking Test

Note: This is a design verification test.

7.5.10.1 The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. Both front feet shall be individually blocked to prevent movement relative to the floor, as shown in Fig. 23a. A 100-pound distributed dead load shall be applied to the bottom step or rung, no part of the load shall contact either of the two front rails during the test.

A vertical pulling force shall be applied to the rear of the ladder top cap, top guardrail or top step when no top cap is used, so as to lift both rear feet and provide a 3-inch clearance between the rear feet and the floor. A 4-pound pre-load shall then be applied at the bottom of one rear side rail; after which the ladder shall be unloaded to establish a no-load reference point. A 6-pound lateral pulling force shall be applied at the bottom of one rear rail, using a force gage or the equivalent, as shown in Fig. 23b, and the lateral displacement of the rear rail shall be measured relative to its no-load position. The maximum lateral displacement shall not exceed the value given in Table 19.

Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position. This test is not applicable to ladder type step stools.

7.5.10.2 Ladders with Plastic Top Caps. A high temperature and a low temperature racking test shall be required for ladders with plastic top caps. The high temperature test shall be performed with the stepladder at 140°F±5°F with 50 percent greater rack allowable than in the room temperature test. The low temperature test shall be performed at a temperature of -20°F±5°F with no fracture permitted.

7.5.11 Rail Cantilever Bending Tests

7.5.11.1 Front Rail Static Cantilever Bending Test

Note: This is a design verification test.

The front rail cantilever bending strength of a ladder or step stool shall be measured by applying an edgewise load to the bottom end of a front side rail.

Use appropriate means to ensure that the test load is applied to the lower end of the side rail, such as removing, prior to testing, slip-on feet or feet extending below the end of the rail, or using special purpose test fixtures to load the side rail appropriately. The test unit shall be opened and placed on its side, with the steps perpendicular to the ground, as shown in Fig. 24. Combination ladders shall be opened to their stepladder position. The lower side rail shall be clamped to a support and shall be unsupported from the bottom end of the rail to the

Table 19
Maximum Allowable Racking Deflection (inches)

Ladder Size (feet)	Deflection†			
	Type-IAA (Y=1.35X)	Type-I and I-A (Y=1.35X + 3.9)	Type-II (Y=1.35X + 7.9)	Type-III (Y=1.35X + 7.9)
3	4.05	7.95	11.95	11.95
4	5.40	9.30	13.30	13.30
5	6.75	10.65	14.65	14.65
6	8.10	12.00	16.00	16.00
7	9.45	13.35	17.35	--
8	10.80	14.70	18.70	–
10	13.50	17.40	21.40	--
12	16.20	20.10	24.10	–
14	--	22.80	--	--
16	--	25.50	--	--
18	–	28.20	–	–
20	--	30.90	--	--

† Y = lateral racking deflection (inches) during a 6 pound pull; X = ladder size (feet).

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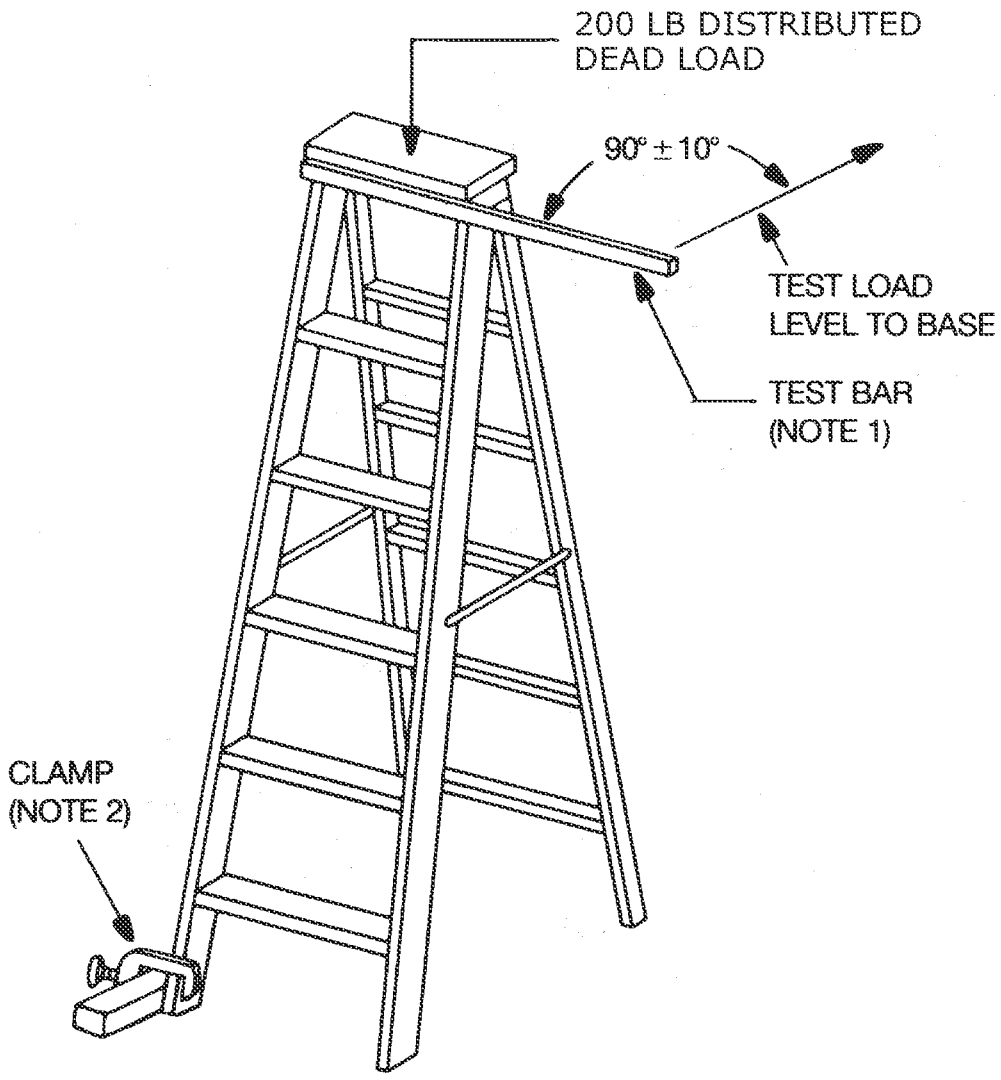
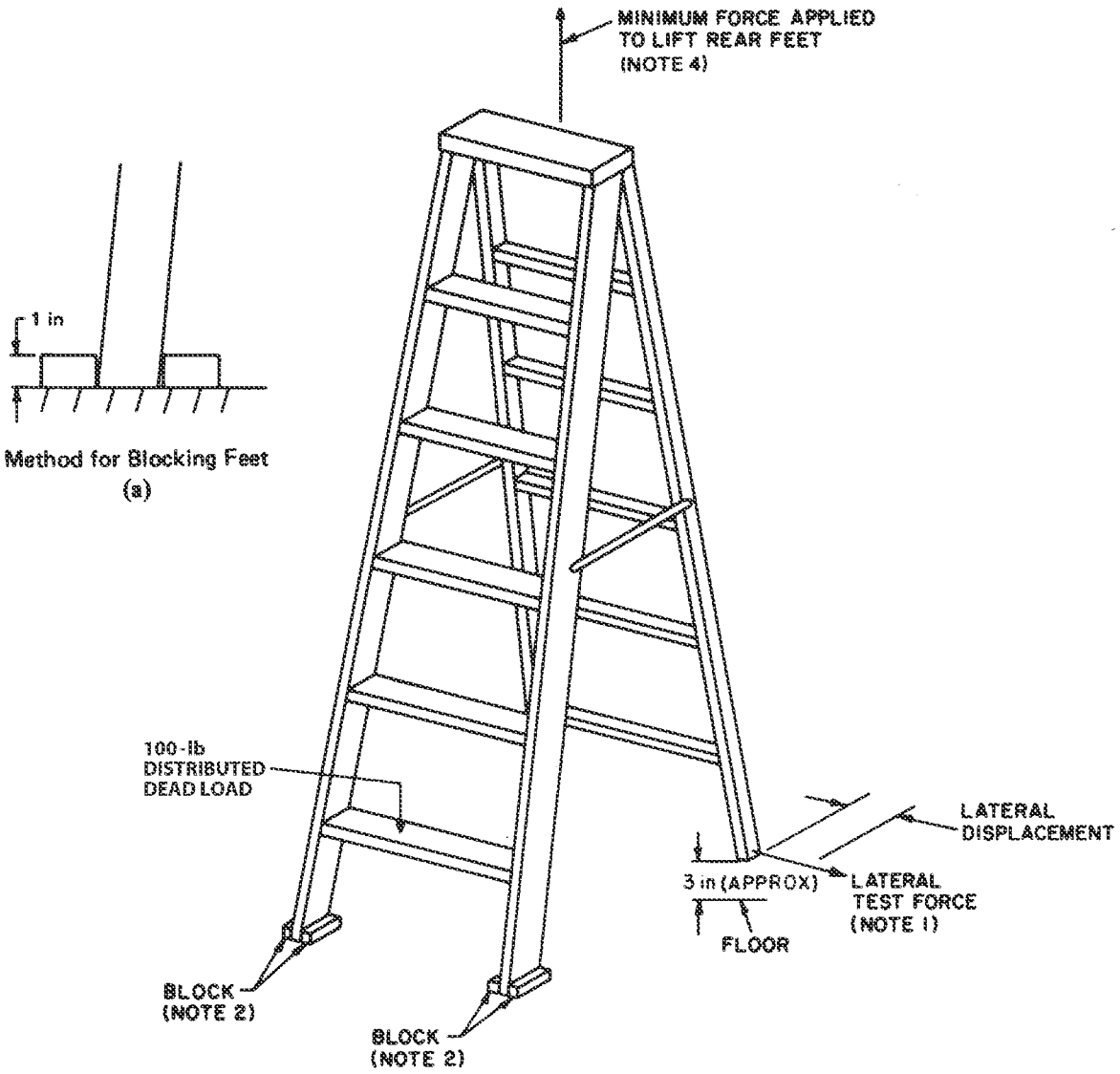
Figure 22
Torsional Stability and Rail Torsion and Spreader Tests



NOTES:
(1) The test bar is clamped to the top cap.
(2) The clamp is used only for the Rail Torsion and Spreader tests in 7.5.12.
(3) The test surface shall be dry, unwaxed vinyl flooring (see Section 4).
(4) This test is illustrated for a stepladder.

Figure 23
Racking Test



NOTES:

(1) The lateral force shall be applied using a force gage or the equivalent. The force shall be applied parallel to the bottom of the front section. The lateral displacement of the rear section shall be measured parallel to the direction the lateral force is applied.

(2) Blocks fixed to the test surface are used to resist rail rotation.

(3) This test is illustrated for a stepladder.

(4) The vertical lifting force shall be applied by a member bearing against the rear center of the ladder top cap, and shall be attached to a 5/16-inch minimum diameter rope at least 3 feet long with the rope secured against motion in any direction at least 3 feet above the ladder top.

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Table 20
Static Cantilever Bending Tests

Duty Rating and Type	Working Load (pounds)	Front Rail Cantilever Test Loads (pounds)	Rear Rail Cantilever Test Loads (pounds)
Special duty - Type IAA	375	375	250
Extra heavy duty - Type IA	300	300	200
Heavy duty - Type I	250	250	175
Medium duty - Type II	225	200	150
Light duty - Type III	200	150	125

top of the bottom step. The top surface of the step shall be parallel to the edge of the support.

The test load shall be applied by means of a weight, in accordance with Table 20, for a minimum period of 1 minute, to the extreme bottom end of the upper side rail (see Fig. 24a). The load shall be centrally applied to a 2-inch long block resting on the full width of the side rail and held in place by a C-clamp; the load attachment point on the C-clamp shall not be more than 2 inches below the underside of the web of the rail being tested. The weight shall be suspended so that it is acting through the vertical neutral axis of the side rail. The maximum allowable permanent deformation (set) of the upper side rail is 1/4 inch. The test load shall then be applied to the extreme bottom end of the lower side rail in a like manner (see Fig. 24b). The maximum allowable permanent deformation (set) of the lower side rail is 1/4 inch.

Provided the ladder continues to support the test load, permanent deformation (set) or ultimate failure of any ladder components as a result of the tests, except for the limitation of the maximum allowable permanent deformation (set) of the upper and lower side rails shall not constitute test failure.

7.5.11.2 Rear Rail Static Cantilever Bending Test
Note: This is a design verification test.

The rear rail cantilever bending strength shall be measured by applying an edgewise load to the bottom end of a rear side rail. Use appropriate means to ensure that the test load is applied to the lower end of the side rail, such as removing, prior to testing, slip-on feet or feet extending below the end of the rail, or using special purpose test fixtures to load the side rail appropriately. The test unit shall be opened and placed on its side, with the horizontal rear braces perpendicular to the ground, as shown in Fig. 24. The lower side rail shall be clamped to a support and shall be unsupported from the bottom end of the rail to the top of the bottom horizontal brace. Guides shall be used which have a nominal clearance between the rear section rails to prevent lateral movement of the section when the test load is applied. The test load shall be applied by means of a weight, in accordance with Table 20, for a minimum period of 1 minute, to the extreme bottom end of the upper side rail (see Fig. 24a). The load shall be centrally applied to a 2-inch long block resting on the full width of the rail and held in place by a C-clamp; the load attachment point on the C-clamp shall not be more than 2 inches below the underside of the web of the rail being tested. The weight shall be suspended so that it acts through the vertical neutral axis of the rear rail — lower horizontal brace assembly, so as to avoid introducing twisting into the rear rail. The maximum permanent deformation (set) of the upper side rail is 1/4 inch. The test load shall then be applied to the extreme bottom end of the lower side rail, in a like manner (see Fig. 24b). The allowable permanent deformation (set) of the lower side rail shall not exceed 1/4 inch.

Provided the ladder continues to support the test load, permanent deformation (set) or ultimate failure of any ladder components as a result of the tests, except for the limitation on the maximum allowable permanent deformation (set) of the upper and lower side rails, shall not constitute test failure.

7.5.11.3 Front and Rear Rail Dynamic Drop Test
Note: This is a design verification test.

The test unit shall be the tallest ladder for each rail size, with the same bottom bracing for each unit tested. The stepladder shall be tested in a closed position, with the ladder horizontal so that the steps are vertical. The top of the ladder shall be supported 6 inches from its top so that the bottom of the lower rail is 24 inches from a concrete floor, as shown in Fig. 25.

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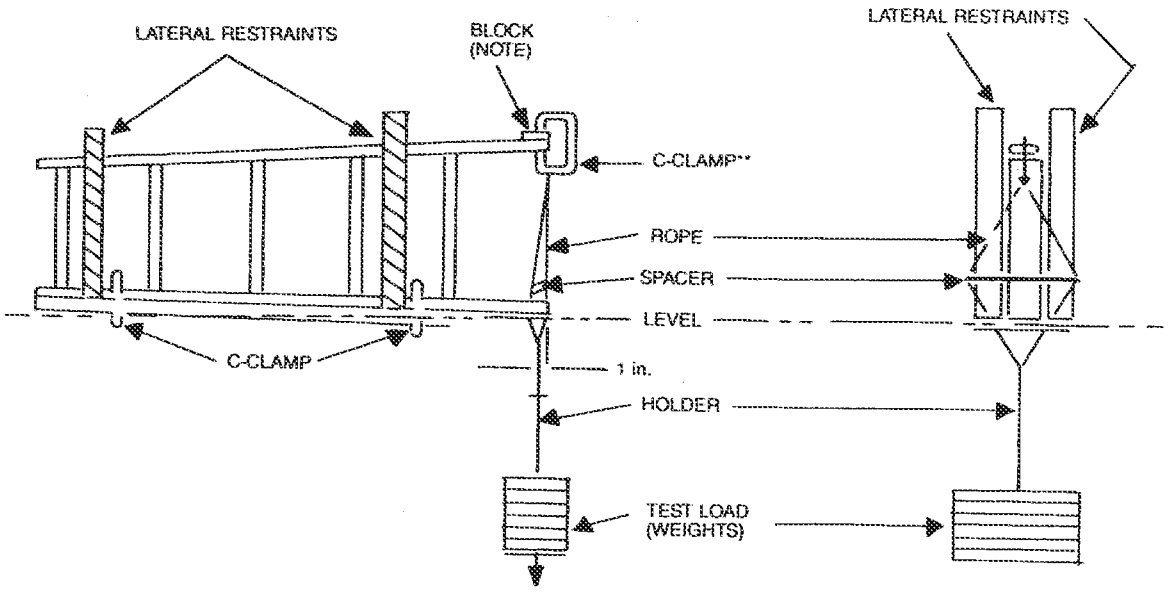
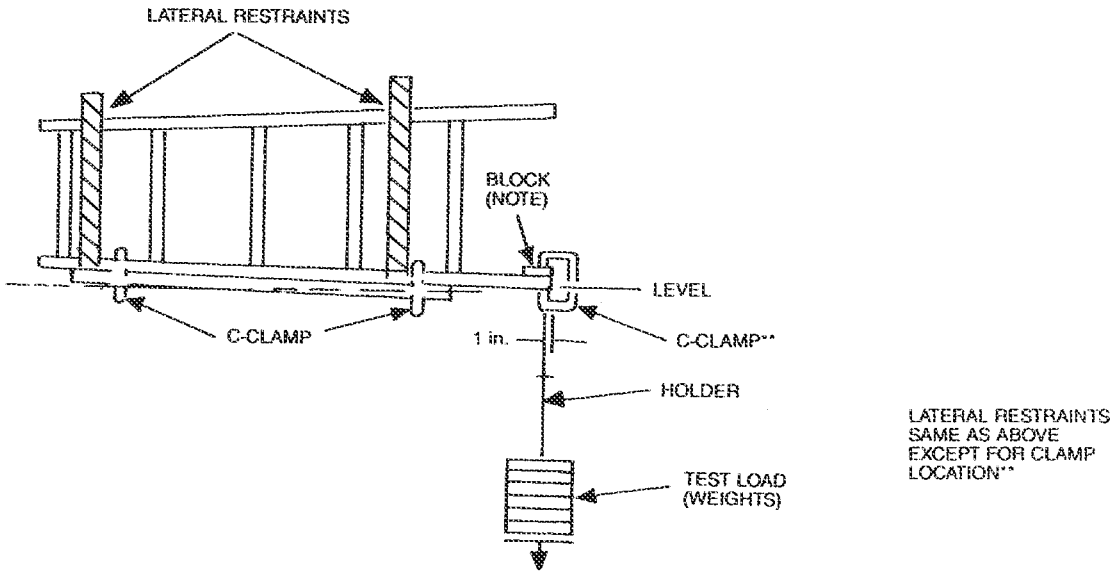
Figure 24
Rail Static Cantilever Test



CANTILEVER-IN TEST
(a)



CANTILEVER-OUT TEST
(b)

Note: The block shall be a minimum of 1/4" and a maximum of 1-inch thick, and shall be 2-inches long measured along the side rail, and a minimum width equal to the full width of the side rail including side rail flanges.

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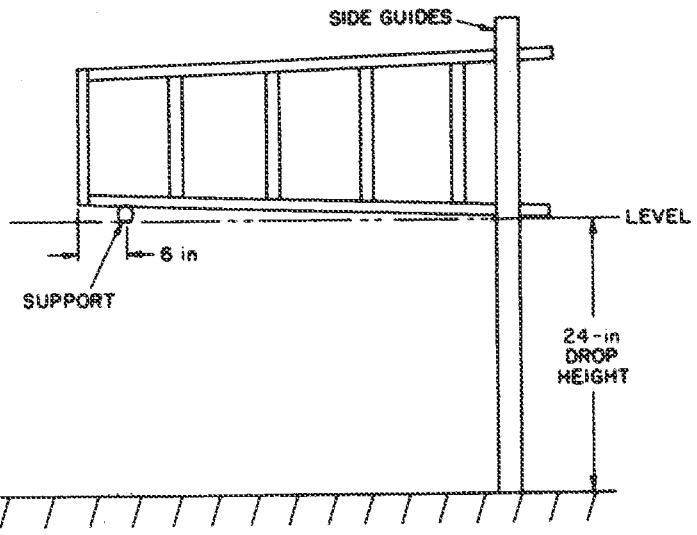
Figure 25
Dynamic Drop Test



NOTE: This test is for cantilever in only. It is performed with the ladder closed.

To perform the drop test, the front and rear rails shall be guided in a vertical plane, during a free-fall drop. The maximum allowable permanent deformation (set) of the lower side rail is 1/4 inch.

7.5.12 Rail Torsion and Spreader Test.
Note: This is a design verification test.

The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. A 200-pound distributed dead load, comprising lead weights or the equivalent to maximize the density of the loading medium, shall be applied to the ladder top cap, platform, or top step when no top cap is used. A horizontal force, directed to the rear of the ladder, shall be applied to the ladder top cap at a distance specified in Table 21 from the vertical centerline of the ladder, as shown in Fig. 22. For articulated ladders, the horizontal force shall be applied as close as possible to the apex hinge. The force shall be perpendicular to the moment arm, with a tolerance of ±10°, when the test load is reached. The front side rail, opposite from the side where the horizontal force is applied, shall be blocked from movement. The test shall be conducted on dry, uncoated vinyl flooring (see Section 4).

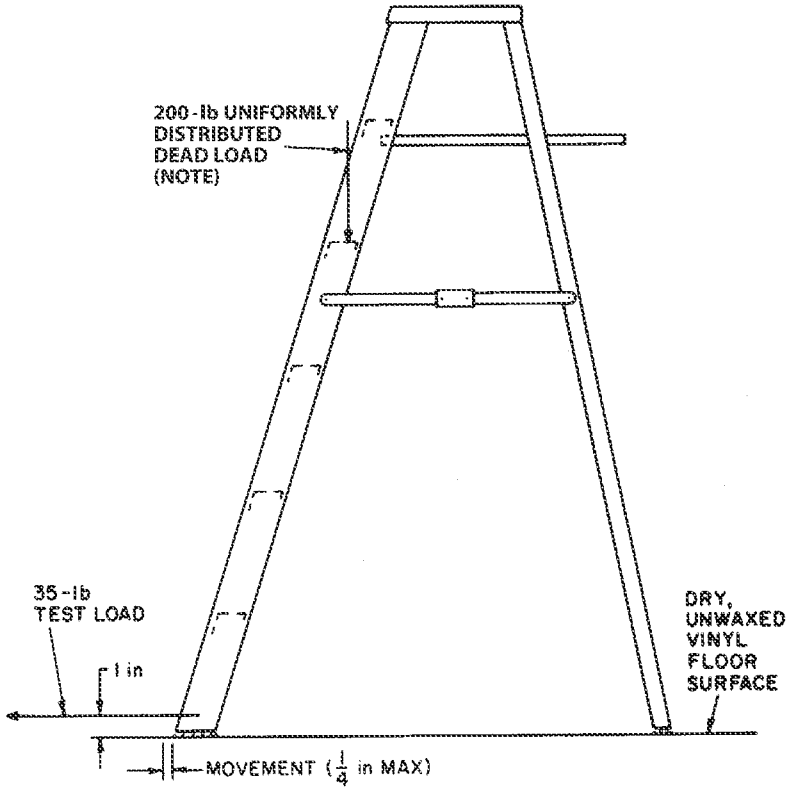
The test unit shall withstand a horizontal force of not less than the value given in Table 21, without the spreaders unlocking, any damage or visible weakening of the ladder or components, or any significant visible major permanent deformation (set) of the test unit upon release of the test force. Minor permanent deformation (set) of individual ladder components, such as diagonal braces or rear horizontal braces, of less than 1/8 inch shall not constitute test failure.

Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position. This test is not applicable to step stools.

Table 21
Rail Torsion and Spreader Test

Duty Rating and Type	Working Load (pounds)	Rail Torsion Test Force (pounds)	Distance from Vertical Centerline (inches)
Special duty - Type IAA	375	75	36
Extra heavy duty - Type IA	300	125	18
Heavy duty - Type I	250	100	18
Medium duty - Type II	225	75	18
Light duty - Type III	200	50	18

Figure 26
Stepladder Slip Test



NOTE: The 200-pound distributed dead load shall be placed on the second highest step.

7.5.13 Stepladder Slip Test.
Note: This is a design verification test.

Stepladders shall be tested for slip resistance as shown in Fig. 26. The test unit shall be a 6-foot stepladder, fully opened and spreaders locked. When testing an articulated ladder, the test unit shall be a 6-foot ladder or the shortest size greater than 6-foot, fully opened and all hinges locked. A uniformly distributed load of 200 pounds shall be placed on the second highest step. A horizontal pulling force of 35 pounds, statically applied centrally to the bottom of the ladder at a distance of 1 inch above the test surface, shall not cause any movement in excess of 1/4 inch across the test surface. The test surface shall be dry, uncoated, vinyl flooring (see Section 4).

7.5.14 Stepladder Plastic Top Cap Reference Material Tests.

7.5.14.1 Plastic tops from the initial lot of moldings, which were employed for performance tests, shall be employed to perform the following tests, and the results shall be recorded and retained for future reference.

7.5.14.2 Ten (10) top caps shall be weighed and both the mean and standard deviation determined.

7.5.14.3 The specific gravity or density of the minimum and maximum section thickness' of plastic top caps shall be determined. The sample size shall be ten (10) and the mean and standard deviation for each set of samples shall be computed.

7.5.14.4 A differential scanning calorimetric test shall be performed to catalog the material for future reference.

7.5.14.5 An infrared analysis of the material shall be performed and the results shall be retained.

7.5.14.6 The Heat Deflection Temperature (HDT) at 264 psi shall be at least 120°F in accordance with ASTM D648-82. (Re-approved 1988).

7.5.14.7 For the material tensile strength test, Type I tensile coupons of the material shall be prepared and shall comply with ASTM D638-91.

Half of the coupons shall be tested as received without any special conditioning, and the other half shall

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be tested after exposure to accelerated weathering as defined by Sec. 7.9.5.1 "Accelerated Weathering Test Procedure," of ANSI A14.5 for 1,000 hours. Failure occurs when elongation after 1,000 hours is 70% or less than the elongation of the "as received" material. Alternate criteria is when the area under the stress-strain curve "after weathering" is less than 70% of the "as received"' curve area.

7.5.14.8 For the cold impact test, a full size sample of the top cap shall be subjected to a 5 ft.-lb. impact from a 1.18 lb., 2" diameter guided steel ball after being conditioned for 24 hours at -20°F. The top cap, where the design permits, shall be placed on a flat horizontal surface and impact applied to the geometric center of the top cap. Where top cap geometry precludes complete support on a flat horizontal surface the requirement shall be achieved by equivalent means of positioning. One such method is to position the top cap so that it is supported as close to its sides as possible resting on 1/4 inch thick steel plates supporting the underside of the top cap across the full width of the top (front to back) so that the top of the cap rests in a horizontal plane within ±2° in any direction. The top cap shall show no signs of cracking after impact.

7.6 Labeling Tests

7.6.1 General. The following procedures are designed to evaluate the suitability of primary hazard (danger and caution), safety use instruction (safety first), and product data information (notice) labels for application to ladders, and the performance of printed labels applied to surfaces representative of those employed in the intended application.

Unless otherwise specified, the labels are applied to the appropriate surfaces and conditioned for 24 hours at 73°F (±5°F) and 50% relative humidity (±5%). Satisfactory results are needed on 3 samples for each test to fulfill the requirements. It is not intended that the tests shall be conducted on a progressive basis to 1 set of test samples. After each environmental test, the samples should be conditioned at 73°F (±5°F) and 50% relative humidity (±5%) for 24 hours before subsequent tests are conducted.

7.6.2 Tests

Note: These tests are all design verification tests and should be performed on standard substrates rather than on actual ladders. These substrates shall be aluminum extrusions, 6061-T6 or the equivalent in mechanical properties, of 0.045 to 0.070 inch nominal thickness.

Labels shall be mounted using a 4-1/2 pound weighted roller and then cured for 24 hours before being subjected to test.

7.6.2.1 Adhesion Test. The test shall be conducted on a new label that has not been subjected to the other tests in 7.6.2, according to ASTM D903-49 (1978), Test for Peel or Stripping Strength of Adhesive Bonds.[1] A minimum force of 30 ounces shall be required to remove the label.

7.6.2.2 Scratch Resistance Test. The label shall resist defacement or removal when a flat metal blade 1/32 inch thick, held at a right angle to the test panel, is scraped across it. This test shall be run on labels before and immediately after the water immersion test.

7.6.2.3 Water Immersion Test. Applied labels shall be immersed in water, label side down, with the water level a minimum of 1/8 inch above the label, for 48 hours at 75°F. No significant change shall occur in the legibility of the labels or in their adhesion to the ladder surface (as evidenced by delaminating or curling) following the test.

7.6.2.4 Oven Aging Test. Applied labels shall be placed in an oven maintained at a temperature of 158°F (70° C) for 240 hours. No significant change shall occur in the legibility of the labels or in their adhesion to the ladder surface (as evidenced by delaminating or curling) following the test.

8. Selection, Care, and Use

8.1 General

8.1.1 For maximum serviceability and safety, and to eliminate unnecessary damage to equipment and goods, users shall employ safe practices in the use and care of ladder equipment. The guidelines discussed in this section constitute the most appropriate and proper procedures for the care and use of ladders.

8.1.2 A comparison of studies within A14 jurisdiction, by government bodies, by other researchers, and in the ILO[2] publications CIS-12, Ladders, indicates a close correlation between major accident causes and the failure to follow guidelines like those provided in this section.

8.1.3 The major causes of falls from self-supported portable ladders are lack of stability and sliding. The major causes of falls from non-self-supporting portable ladders are lateral sliding at the top support, outward sliding at the lower base support, and human

[1] Available from the American Society for Testing and Materials.

[2] Available from the International Occupational Safety and Health Information Centre, International Labour Office, CH 1211, Geneva 22, Switzerland.

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Table 22
Summary of Significant Accident Causes

Ladder Design	Cause of Accident	Possible Factors Involved in Accident: Base Support or surface	Top Support	Set-Up	User Location	Ladder Selection and Condition
Self-supporting (stepladder)	Stability	Soft Uneven Unstable surface Slipper surface Differences in firmness of surface Slope of surface	Not applicable	Unlocked spreaders One or more feet unsupported Used unstable or insuffficient supports Ladder not close enough to work location User's physical condition	Above "highest standing level" label Reaching out too far, particularly laterally Climbing onto ladder from above Handling heavy loads or unstable objects Applying side load	Too short (size) Incorrect ladder type (IA, I, II, or III) Incorrect style ladder (for example, platform or single versus stepladder) Use of improper equipment (for example, ladder versus scaffold)
	Sliding	Uneven surface Low friction Unstable surface Ice snow or wet surface Slippery surface	Not applicable	Used as a non-self-supporting ladder Ladder not close enough to work location Worn, missing or contaminated feet	Reaching out too far Stepping off ladder Applying side load	Use of improper equipment (for example, ladder versus scaffold) Removal or deterioration of slip-resistant ladder feet
Non-self-supporting (extension and single)	Human slip	Not applicable	Not applicable	Pitch (angle) too steep (especially with flat rungs) User's physical condition or shoes	Descending	Dirty, oily, or icy step surfaces Use of improper equipment (for example, ladder versus scaffold)
	Lateral sliding (left or right) at top support	Uneven surface Differences in firmness of surface Unstable surface	Uneven surface Slippery surface Unstable surface (pole, tree, corner of building, and the like) Ice, snow, or wet surface Insufficient top support	Not tied off Not held at base Inadequate or excessive extension above top support Ladder not close enough to work location Pitch (angle) too steep Feet unsupported or unstable Extension locks not engaged	Getting on or off ladder to roof Reaching out too far laterally Applying side load	Too short or too long (size) Not extended far enough (too steep) Use of improper equipment (for example, ladder versus scaffold)
	Outward sliding at lower base support	Unstable surface Low friction Loose surface Ice, snow, or wet surface Slippery surface	Overextension above top support	Used unstable or insufficient supports Pitch (angle) too flat Ladder not footed Ladder not tied off or blocked Worn, missing or slippery feet Improper selection of feet or slip-resistant bearing surfaces Extension locks not engaged	Above "highest standing level" label Sliding tendency increases above ladder working length midpoint Careless climbing onto or off of ladder (from or to roof, and the like) Applying side load	Wrong floor or slip-resistant bearing surface Too long (size) or extended too far Use of improper equipment (for example, ladder versus scaffold)

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slip. Table 22 provides a summary of significant accident causes.

8.1.4 Proper selection of a ladder is essential for ensuring safety and reducing the potential for accidents.

8.1.5 Proper use of a ladder will contribute significantly to safety. Factors contributing to falls include: haste, sudden movements, lack of attention during use, ladder condition (worn or damaged), user's age or physical condition, or both, and the footwear employed by the user.

The user's excessive weight or size does not increase the likelihood of falls. However, improper climbing posture creating user clumsiness on the ladder may cause falls.

8.1.6 The safe useful life of the ladder is dependent upon its proper in-service care. In-service use test methods (see Section 7, including the italicized advisory in-service use tests) are available for evaluating the ladder's condition. While ladders are designed for extended service, it is necessary to provide periodic in-service care and maintenance to ensure their continued safe use. Ladders are not designed or intended to possess an infinite safe useful life.

8.1.7 The information provided in the balance of this section principally addresses stepladders and extension ladders. The principles, however, are applicable to all self-supporting and non-self-supporting portable ladders.

8.2 Selection

8.2.1 Ladder Selection. Portable ladders are designed for one-man use to meet the requirements of the man, the task, and the environment. This section covers the factors involved in making the proper ladder selection. Product information data necessary for proper ladder selection is found on the ladder rail.

8.2.1.1 Duty Rating. Ladders have been designed in five duty classifications:

Duty Rating	Ladder Type	Working Load (pounds)
Special Duty	IAA	375
Extra Heavy-Duty	IA	300
Heavy-Duty	I	250
Medium-Duty	II	225
Light-Duty	III	200

8.2.1.2 Loading and Service. Users shall give consideration to the length required, the working load, the duty rating, and frequency of use to which the ladder will be subjected. Users shall not overload a ladder.

The following criteria shall be used when purchasing or using a ladder:

(1) Special Duty. For users requiring a 375-pound working load or duty rating, such as industry, utilities, contractors, and the like.

(2) Extra Heavy-Duty. For users requiring a 300-pound working load or duty rating, such as industry, utilities, contractors, and the like.

(3) Heavy-Duty. For users requiring a 250-pound working load or duty rating, such as industry, utilities, contractors, and the like.

(4) Medium-Duty. For users requiring a 225-pound working load or duty rating, such as painters, offices, light maintenance, and the like. Medium duty ladders shall not be used with ladder jacks or scaffold planks, or both, with the exception of articulated ladders used in a scaffold position as described in section 6.7.11.

(5) Light-Duty. For users requiring no more than a 200-pound working load or duty rating, such as general household use. Light duty ladders shall not be used with ladder jacks or scaffold planks, or both, with the exception of articulated ladders used in a scaffold position as described in section 6.7.11.

Table 23
Ladder Size, Working Length, and Height (feet)

Extension Ladder Size	Maximum Working Length	Height to Top Support on Wall	Height to Roof Eave with 1- to 3-Foot Extension *
16	13	To 12-1/2	9-1/2–11-1/2
20	17	12-1/2–16-1/2	13-1/2–15-1/2
24	21	16-1/2–20	17–19
28	25	20–24	21–23
32	29	24–28	25–27
36	32	28–31	28–30
40	35	32–34	31–33

* Extend ladder approximately three feet above roof for access.

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8.2.1.3 Proper Size

8.2.1.3.1 Extension Ladders. Selection of proper extension-ladder size requires knowledge of the vertical height or elevation to the top support point. Where the top support is a roof eave, additional working length is needed to permit the required 1- to 3-foot extension beyond this point. The highest standing level shall also be considered, although the actual dimension will change as the ladder is extended. The nominal relationships between size, working length, and height to the top support point are given in Table 23.

8.2.1.3.2 Stepladders. The highest standing level is constant for a specific stepladder. Typical relationships are as follows:

Stepladder Size (feet)	Recommended Highest Standing Level
4	1 foot, 11 inches
5	2 feet, 10 inches – 2 feet, 11 inches
6	3 feet, 10 inches
7	4 feet, 9 inches – 4 feet, 10 inches
8	5 feet, 9 inches – 5 feet, 10 inches
10	7 feet, 8 inches – 7 feet, 9 inches
12	9 feet, 7 inches – 9 feet, 8 inches

The maximum work height is then established by adding the user's height and safe reach to the highest standing level dimension.

8.2.1.3.3 User On-Ladder Location. There are situations in which the user of a particular size ladder creates a gap in the height that can be reached by the user. For example, extension ladders of 28-foot size and longer cannot be used to work on a wall below a certain height because the user would be too far out from the wall. Usually the lower portion of the wall can be reached from the ground, which means up to a height of about seven feet. When this 28-foot extension ladder is closed to 14 feet, then working on a wall below 10 feet becomes a problem.

These conditions create a gap between seven and 10 feet in height where another ladder selection is recommended. To work in this zone, a shorter non-self-supporting ladder or a self-supporting ladder such as a stepladder should be considered.

8.2.1.3.4 Work Site Restrictions on Working Length. In cases where the work site imposes a height restriction on the non-self-supporting ladder's working length, the user may find that longer ladders are not capable of erection at the proper angle of inclination of 75-1/2°. To safeguard against bottom sliding, select a shorter extension ladder or single ladder.

8.2.2 Self-supporting vs. Non-self-supporting ladders. In choosing between a self-supporting and a non-self-supporting ladder, an important factor to consider is the bottom and top support conditions. A stepladder requires level support for four rails. If such support is lacking or is not convenient, and if a top support is available, an extension ladder might be a better choice. In addition, the top support allows the opportunity to secure or tie off the top to increase stability.

8.2.3 Two Person Ladders. Manufacturers do design and offer certain ladders intended for use by more than one person. These products shall be so identified on their labels and markings.

8.2.4 Ladders Designed for Special Purposes. Certain ladders are designed, specified, and identified, as special purpose ladders (see Section 4).

8.3 Rules for Ladder Use

8.3.1 Intended Use. Ladder use shall be restricted to the purpose for which the ladder is designed.

8.3.1.1 Ladders shall not be climbed by more than one person at a time unless designed to support more than one person.

8.3.1.2 Self-supporting ladders shall not be used as single ladders or in the partially closed position.

8.3.1.3 Unless specifically designed for a cantilever operation, a non-self-supporting ladder shall not be used to climb above the top support point.

8.3.1.4 Combination ladders, when used as self-supporting stairway ladders, shall not be climbed on their back sections.

8.3.1.5 A ladder jack system shall not be used by more than two persons (see 8.3.19).

8.3.2 Climbing and Working Locations. The user shall climb or work with the body near the middle of the step or rung. The user shall not step or stand higher than the step or rung indicated on the label marking the highest standing level of a ladder. The user shall not step or stand on:

(1) A ladder top cap and the top step of a step or trestle ladder, or the bucket or pail shelf of a self-supporting ladder.

Note: This restriction is not applicable to top steps located 18 inches under the top cap.

(2) The rear braces of a self-supporting ladder unless they are designed and recommended for that purpose by the manufacturer.

(3) The top step of the extension section of an extension trestle ladder.

(4) The top cap or top step of a combination ladder when it is used as a self-supporting ladder.

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8.3.3 Angle of Inclination. Portable non-self-supporting ladders should be erected at a pitch of 75-1/2° from the horizontal for optimum resistance to sliding, strength of the ladder, and balance of the climber. A simple rule for setting up a ladder at the proper angle is to place the base a distance from the wall or upper support equal to one-quarter the effective working length of the ladder (the "quarter length rule"). Effective working length is measured by the distance along the side rails from the bottom of the ladder to the upper support point. Combination ladders should be erected so that the step surfaces are in a horizontal plane.

8.3.4 Footing Support. The ladder base shall be placed with a secure footing on a firm, level support surface. Ladder levelers may be used to achieve equal rail support on uneven surfaces. Devices such as shoes, spurs, spikes, combinations thereof, or similar devices of substantial design should be installed where required for slip resistance and bearing area. Where ladders with no safety shoes, spurs, spikes, or similar devices are used, a foot ladder board or similar device may be employed. Ladders shall not be used on ice, snow, or slippery surfaces unless suitable means to prevent slipping are employed. Ladders shall not be placed on boxes, barrels, or other unstable bases to obtain additional height.

8.3.5 Top Support. The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment. Such an attachment should be substantial and large enough to support the ladder under load. It should be used when the ladder top support is a pole, light standard, building corner, or in tree-type operations (pruning, fruit picking, and the like). When it is necessary to support the top of a ladder at a window opening, a device should be attached across the back of the ladder, extending across the window, to provide firm support against the building walls or window frames.

8.3.6 Side Loading. Portable ladders are not designed for excessive side loading, and such abuse of the ladder shall be avoided. The ladder shall be kept close to the work. The user shall not overreach, but shall descend and relocate the ladder instead. When using a ladder, the user shall never push or pull unless the ladder is properly secured.

8.3.7 Climbing Ladders. When ascending or descending the ladder, the user shall face the ladder and maintain a firm hold on the ladder. The user shall not climb onto a ladder from the side, from one ladder to another, or from a swing-stage to a ladder, unless the ladder is secured against sideways motion or has been tied to the structure. The user shall not climb a broken or bent ladder or a ladder that does not comply with 8.4.1.

8.3.8 Electrical Hazards. Users are cautioned to take proper safety measures when ladders are used in areas containing electrical circuits. These precautions should prevent any contact or possible contact with an energized, uninsulated circuit or conductor in order to avoid electrical shock or short circuit. Metal ladders and wood ladders with side-rail metal reinforcement wires shall not be used where they would come in contact with exposed energized electric wires.

All ladders should be kept away from electric power lines unless they are specifically designed for that application. Ordinary precautions should be employed as would be taken when using any tool that may become a conductor of electricity. Users are cautioned to be particularly careful when manipulating any ladder around an overhead electrical power line.

8.3.9 Improper Use. A ladder shall not be used as a brace, skid, lever, guy or gin pole, gangway, platform, scaffold plank, material hoist, or for any other use for which it was not intended, unless the manufacturer specifically recommends such use. Ladders shall not be erected on scaffolds to gain additional height, unless specifically designed for the application.

8.3.10 Getting on or off ladder at upper levels. Ladder should extend approximately three feet above the upper access level. The ladder shall be tied to the upper access level before climbing onto or off the ladder at the upper level. The user shall take care when getting on or off the ladder at the upper level in order to avoid tipping the ladder over sideways or causing the ladder base to slide.

8.3.11 Fastening Together. Ladders and ladder sections, unless so designed, shall not be tied or fastened together to provide a longer length. Ladders and ladder sections shall not have their length increased by other means unless specifically designed for the means employed.

8.3.12 Doorways. Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked open, locked, or guarded.

8.3.13 Setup and Adjustment of Ladders.

8.3.13.1 Extension Ladders. Adjustment of extension ladders shall only be made by the user when standing at the base of the ladder so the user may observe when the locks are properly engaged. The user shall check that the rope is tracking correctly in the pulley. Adjustments of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and shall not be attempted. Adjustments shall not be made while anyone is standing on the ladder. The user shall ensure that both upper and lower ladder support points are contacting firm support surfaces.

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8.3.13.2 Stepladders. The user shall ensure that the stepladder is fully opened, with spreaders locked and all feet contacting a firm level support surface.

8.3.14 Erection of Extension Ladders. Extension ladders shall always be erected so that the top section (fly section) is above and resting on the bottom section (base section) with the rung locks engaged. The top section may be located in front of or behind the bottom section, depending upon the design. The ladder shall never be used in a reverse position where the top end of the fly section becomes the lower end of the ladder, and the lower end of the base section becomes the upper end of the ladder. Where extension ladders have been previously used as single ladders, care should be exercised to ensure that the sections are properly reassembled and that the interlocking guides or brackets are properly engaged between the sections before further use.

8.3.15 Relocating Ladders. A ladder shall not be relocated while anyone is on it.

8.3.16 Bracing of Stepladders. The bracing on the rear rails of stepladders is designed solely for increasing stability and not for climbing. This does not apply to the stepladders provided with steps for climbing on both front and rear sections.

8.3.17 Use of individual sections of sectional ladders and sections of extension trestle ladders. Middle and top sections of sectional ladders should not be used for bottom sections, unless so designed, and identified by the manufacturer. Extension sections of extension trestle ladders should not be used as single ladders, unless so designed, and identified, by the manufacturer.

8.3.18 Hooks. When service conditions warrant, hooks may be attached at, or near the top of, portable ladders to give added security. (Such hooks are used for upper support in cable strand or roofing applications.)

8.3.19 Ladder Jacks. Only special duty (Type IAA), extra-heavy duty (Type IA), and heavy-duty (Type I) ladders shall be used in conjunction with ladder jacks, stages, or planks. Medium duty (Type II) and light-duty (Type III) ladders shall never be used with ladder jacks. For additional information on ladder jack systems, see American National Safety Requirements for Scaffolding, ANSI A10.8-2001.

8.3.20 High Static Electrical Fields. Ladders specifically designed to permit grounding or dissipation of static electricity should be used around high static electrical fields to assist in preventing shocks to the user.

8.4 Care

8.4.1 Inspection. A thorough ladder inspection shall be made when the ladder is originally purchased, received, and put into service. The ladder shall be inspected periodically, preferably before each use. Working parts and rung/step-to-side rail connections shall be checked. Where structural damage or other hazardous defect is found, the ladder shall be taken out of service and either discarded or repaired by a competent mechanic.

8.4.1.1 Tipping Over, and Other Impact Damage. The ladder shall be inspected for side rail dents or bends, or excessively dented rungs. All rung/step-to-side rail connections shall be checked, as well as hardware connections, rivets (for shear), and all other components.

8.4.1.2 Exposure to Fire. If ladders are exposed to excessive heat, as in the case of fire, their strength may be reduced. After such exposure the ladder shall be inspected visually for damage and tested for deflection and strength characteristics. More information is provided in Section 7. In doubtful cases, refer to the manufacturer.

8.4.1.3 Corrosive Substances. If ladders are subjected to certain acids or alkali materials, they may experience chemical corrosion and a reduction in strength. Consult the manufacturer or a qualified person prior to use.

8.4.1.4 Oil and Grease. Ladders should be free of oil, grease, or slippery materials on climbing or gripping surfaces.

8.4.1.5 Ropes and Pulleys. Ropes, cables, and pulleys should be inspected frequently, checked to ensure that they operate properly, and replaced if they are worn or defective.

8.4.2 Damaged Ladders. Broken or bent ladders shall be marked and taken out of service until they are repaired by a competent mechanic or destroyed in such a manner as to render them useless. The user shall not attempt to repair a defective side rail.

8.4.3 Proper Handling. Ladders, like any tool, must be handled with care and not be subjected to dropping, jarring, or misuse. They are designed for the purpose intended. Therefore, any variation from this purpose constitutes a misbandling of the equipment.

8.4.4 Transporting. Ladders transported on road, street, and highway motor vehicles shall be properly supported. Overhang of the ladders beyond supporting points should be limited. Supporting points should be of a material such as wood or rubber-covered iron pipe, to minimize chafing and the effects of road shock. Securing the ladder to each support point will greatly reduce damage due to road shock.

8.4.4.1 Truck Racks. Ladders shall be secured to the truck rack in a manner that will avoid chafing from relative horizontal and vertical motion. The

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ladder feet, when present, should be secured from pivoting about the ladder while the vehicle is in motion. The ladder truck rack shall be designed to positively secure the ladder into a fixed position, and the rack should be designed to fit the particular ladder being fixed to the truck. If these requirements are not satisfied, excessive wear of the ladder will occur, which will cause premature deterioration of the ladder and reduce its service life. Improperly designed and used truck racks may damage side rails, steps or rungs, feet, and other ladder parts, owing to vehicle vibration and road shock.

8.4.5 Storage. Ladders should be stored in or on racks designed to protect the ladder when it is not in use. These racks should have sufficient supporting points to avoid sagging. Materials shall not be placed on the ladder while it is in storage.

8.4.6 Maintenance. Proper ladder maintenance ensures the safe condition of the ladder. Hardware, fittings, and accessories should be checked frequently and kept in proper working condition. All pivotable connections and the rung-lock cam surfaces should be lubricated frequently (See also 8.4.1.4). All bolts and rivets shall be in place and secure before using a ladder, and no ladder should be used if any bolts or rivets are missing or if the joints between the steps (or rungs) and the side rails are not tight. Ladders with safety shoes or padded feet which are excessively worn shall be taken out of service until repaired.

9. Labeling/Marking Requirements

9.1 General Requirements

9.1.1 Primary hazard "DANGER" and "CAUTION" markings shall conform to the general design principles (and where labels are used) to the design and color principles of these requirements as provided in Appendixes "A" and "B" for the kinds of ladders in this standard. Appendix B refers to "THE SAFETY INSTRUCTIONS AND PRODUCT DATA INFORMATION" labels/markings.

9.1.2 Marking shall be legible and readily visible.

9.1.3 The preferred location for markings, unless otherwise specified, is 4-1/2 to 6 feet from the bottom of the ladder on the outside of the rails.

9.1.4 Marking No. 00 shall be placed on all portable ladders.

9.1.5 Markings shall be positioned so that other parts of the ladder shall not damage the label/marking when the ladder is open, closed or extended.

9.1.6 Where compliance with 9.1.3 is not possible due to the size or design of the ladder, markings shall be in the most prominent locations available. When rail space is limited, such as on step stools or ladders constructed of tubular side rails, markings may be located under top caps or steps when accompanied by markings similar to Marking No. 00D or Marking No. 00E in prominent locations.

9.1.7 The labels/markings in the Appendicies shall be considered as illustrations only. For example, Marking No. 5 can have fly section either over or under base section. Also, illustrations in this standard may not be optimum size — see appendix for size notes.

9.1.8 Exception. Modification of these marking requirements within the design or color principles of Section 9.1, including equivalent wording and symbols to accommodate material, finish and construction features shall be permitted.

9.2 Product Data Information Markings

9.2.1 The product data information markings in 9.2.2 shall appear on the ladder.

9.2.2 The following information is required:

(1) Ladder size.
(2) Type and duty rating.
(3) Maximum working length (if extension ladder).
(4) Highest standing level.
(5) Total length of sections (if extension ladder).
(6) Model number or name.
(7) Manufacturer or distributor name (may be logo).
(8) Manufacturing plant if multi-plant organization (may be coded).
(9) Month and year of manufacture.
(10) ANSI standard compliance.

9.2.3 Typical Presentation. Product data information markings may be presented as provided by the labels/markings and instructions in Appendix B (See Marking No. 23).

9.3 Specific Labeling/Marking Requirements

9.3.1 Stepladder.

9.3.1.1 Marking No. 1 shall meet the general requirements of location and positioning to avoid damage to the label/marking.

9.3.1.2 Marking No. 2 or Marking No. 24 shall be located on the top cap of stepladders. An equivalent marking for plastic top caps is to mold into the top cap "DANGER: DO NOT STAND OR SIT" in bold or raised letters at least 1/4 inch high.

9.3.1.3 Marking No. 3 shall be located on the first step below the top cap when this step is 18 inches or less from the top and may be omitted when the

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first step is more than 18 inches from the top cap.

9.3.1.4 The placement of Markings No. 2 or No. 24, and No. 3 shall be such as to assure best viewing position and to accommodate design, construction features and materials and finishes.

9.3.1.5 Marking No. 4 shall met the general requirements in Section 9.1.

9.3.2 Extension and Single Ladders.

9.3.2.1 Marking No. 5 and No. 6 shall meet the general requirements for location.

9.3.2.2 Marking No. 6 shall be used on all extension ladders and single ladders constructed of metal.

9.3.2.3 Marking No. 7 shall be placed in lieu of Marking No. 8, on the inside of the right rail of single ladders and the right rail of the fly section of extension ladders, with the arrow pointing to the second or third rung, depending upon which rung is 22 inches or more from the top of the section.

9.3.2.4 Marking No. 8 shall be placed in lieu of Marking No. 7 on the second or third rung from the top of single ladders or fly section of extension ladder depending upon which rung is 22 inches or more from the top of the section.

9.3.2.5 In lieu of embossed letters, marking No. 9 shall be placed on extension ladder sections not designed for separate use if the ladder is not equipped with permanent means to preclude separation of ladder sections.

9.3.2.6 Marking No. 10 shall meet the general requirements in Section 9.1.

9.3.3 Step Stool.

9.3.3.1 Markings No. 11 and No. 12 shall conform to the general requirements in Section 9.1.

9.3.4 Trestle (Double Front) Ladder.

9.3.4.1 Marking No. 2 or marking No. 24 shall be located on the top cap. An equivalent marking for plastic top caps is to mold into the top cap "DANGER: DO NOT STAND OR SIT" in bold or raised letters at least 1/4 inch high.

9.3.4.2 Marking No. 3 shall be located on the first step below the top cap on each side when this step is 18 inches or less from the top and may be omitted when the first step is more than 18 inches from the top cap.

9.3.4.3 The placement of markings No. 2 or No. 24, and No. 3 shall be such as to assure best viewing position and to accommodate design, construction features, materials and finishes.

9.3.4.4 Marking No. 13 and No. 14 shall meet the general requirements in Section 9.1.

9.3.5 Extension Trestle Ladder.

9.3.5.1 Markings No. 6, No. 7 and No. 8 shall be used on the extension section as required for single section straight ladders.

9.3.5.2 Marking No. 13 and No. 15 shall meet the general requirements in Section 9.1.

9.3.5.3 Markings shall meet the requirements of Sections 9.3.4.1 through 9.3.4.3 for the trestle sections.

9.3.5.4 In lieu of embossed letters, marking No. 9 shall be placed on the extension section if not designed for separate use if the ladder is not equipped with permanent means to preclude separation of ladder sections.

9.3.6 Platform Ladder.

9.3.6.1 Marking No. 1 shall meet the general requirements of location and positioning to avoid damage to the label/marking.

9.3.6.2 Marking No. 2 or No. 24 shall be located on the top cap or highest cross member above the platform. An equivalent marking for plastic top caps is to mold into the top cap "DANGER: DO NOT STAND OR SIT" in bold or raised letters at least 1/4 inch high.

9.3.6.3 Marking No. 18 shall conform to the general requirements in Section 9.1

9.3.7 Combination Ladder.

9.3.7.1 In the stepladder mode, Markings No. 1 and No. 3 shall meet the requirements set forth for stepladders.

9.3.7.2 In the single or extension ladder mode, Marking No.5, No. 6, No. 7 and No. 8 shall meet the requirements set forth for single and extension ladders.

9.3.7.3 Marking No. 16 and No. 17 shall meet the general requirements in Section 9.1.

9.3.7.4 In lieu of embossed letters, marking No. 9 shall be placed on the extension section if not designed for separate use if the ladder is not equipped with permanent means to preclude separation of ladder sections.

9.3.8 Articulating Ladders.

9.3.8.1 Markings No. 5, No. 6 and No. 19 shall meet the general requirements in Section 9.1.

9.3.8.2 Marking No. 20 and No. 21 shall be in a

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predominate location as near to the center hinge as possible.

Exception: Since the definition of marking allows for stamping and embossing, a combination of stamping, embossing and color coding shall be permitted to meet the precautionary warning intent of this marking.

9.3.8.3 Marking No. 22 shall be located on the outside of one of the side rails when the ladder is in the folded (storage) position.

9.3.8.4 In lieu of embossed letters, marking No. 9 shall be placed on the ladder sections if not designed for separate use if the ladder is not equipped with permanent means to preclude separation of the ladder sections.

10. Revision of American National Standards Referred to in this Document

When the American National Standards referred to in this document are superseded by a revision approved by the American National Standards, Inc., the revision shall apply.

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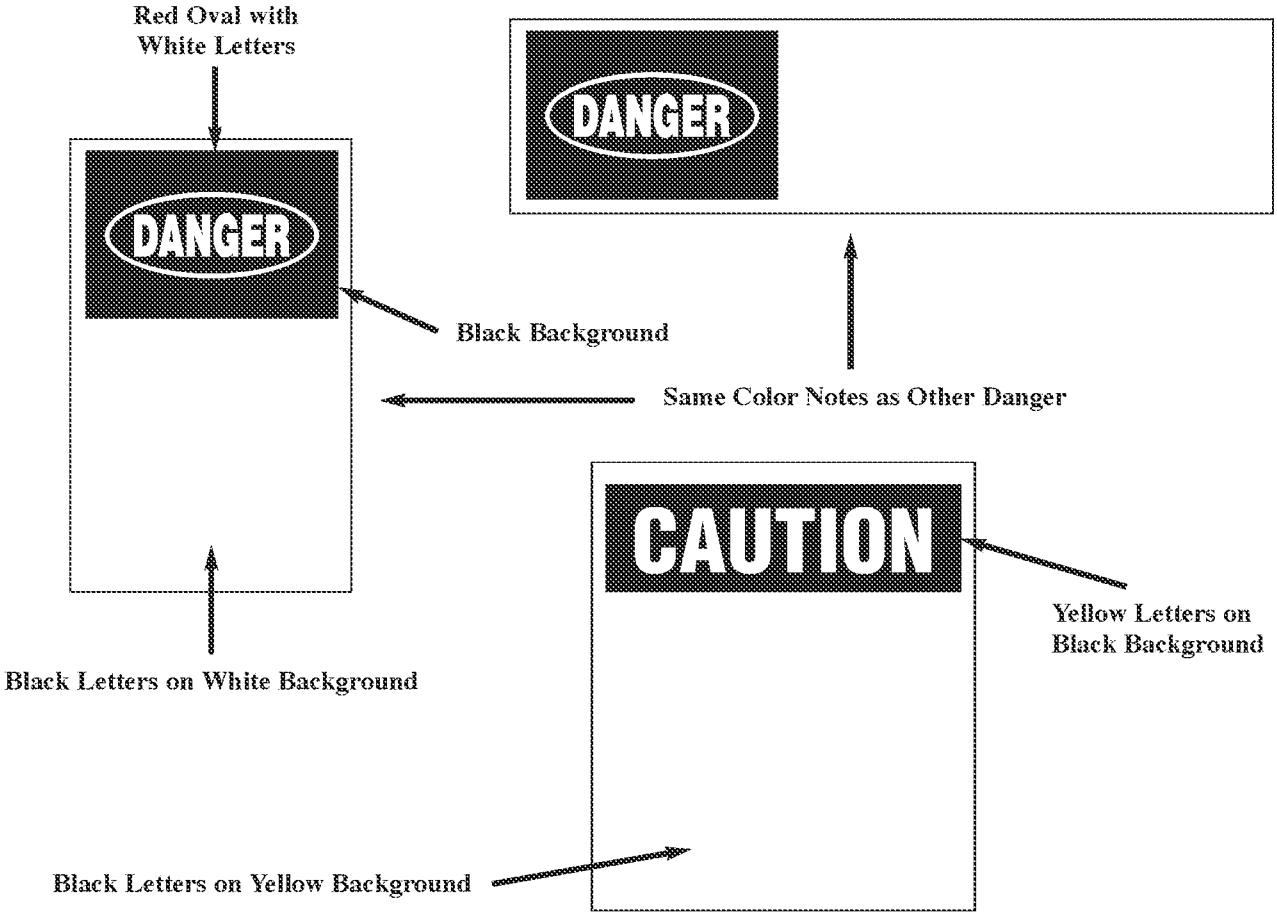
Notes

Appendicies

(These Appendicies are included for information purposes only.)

Appendix A

Note: The following are the preferred design and color principles for the primary hazard "DANGER" and "CAUTION" labels/markings for the kinds of portable metal ladders cited in this standard. These labels/markings are illustrations of typical labels/marking. Minimum recommended text size for the caution and warning labels shown is nine point (capital letters are approximately .08").



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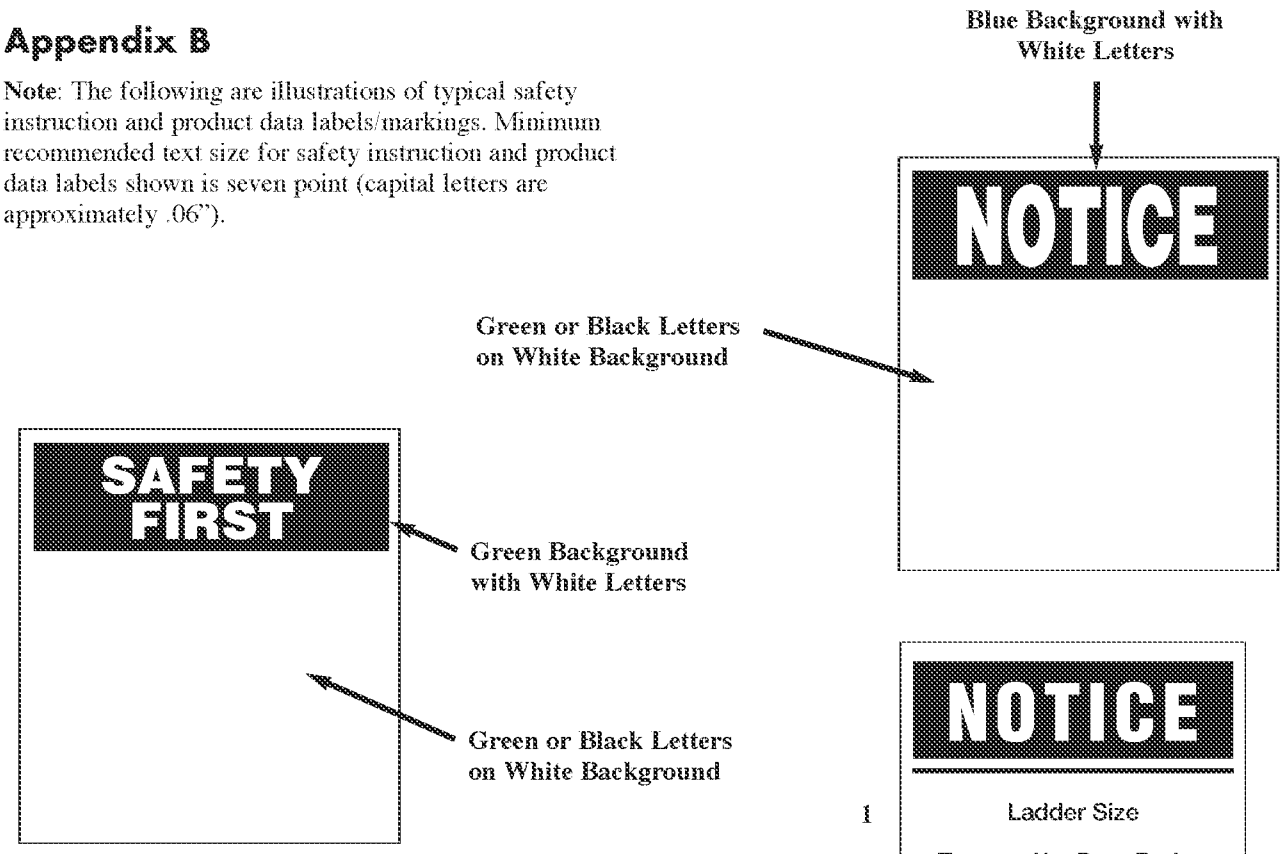
Appendix B

Note: The following are illustrations of typical safety instruction and product data labels/markings. Minimum recommended text size for safety instruction and product data labels shown is seven point (capital letters are approximately .06").



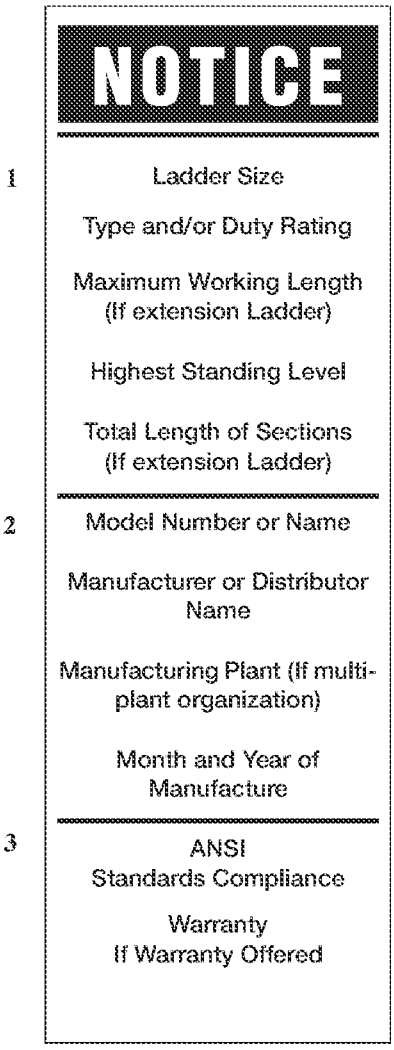
Typical Presentation of Product Data Information Markings

A typical method would be to present the notice and three panels as one label or marking. This method would mean the month and year data, for economic use of preprinted labels, would have to be entered by ink stamp for the 1-label approach. Permanent inks should be sought — and are available — for such applications. In fact, if this information is stamped, the rest of the marking can be a label or similarly stamped, as long as the 1-label effect is maintained.

The three panels are also designed to be divided between panels No. 1 and 2 and panels No. 2 and 3. Panel No. 1 should be presented as one unit either in a label or other marking, since this product information is most critical in selecting the right ladder. Such information provides the necessary elements of a sound purchase that allows the user to match his needs and requirements to the capabilities of the ladder.

Panel No. 2, if separated, may be stamped, embossed, or otherwise marked, including a label which provides for ink stamping of month and year data. An effort should be made to avoid the placement of other Markings between panels which are separated. In fact, the information in panel No. 2 may be placed elsewhere if it is first placed as required by 9.2. Additionally, the optional character of panel No. 3 may eliminate its use or incorporate its information in either panel No. 1 or 2.

Manufacturer's and distributor's name may be a logo. Manufacturing plant (if multi-plant organization) may be coded.



Marking No. 23
Preferred Notice Presentation

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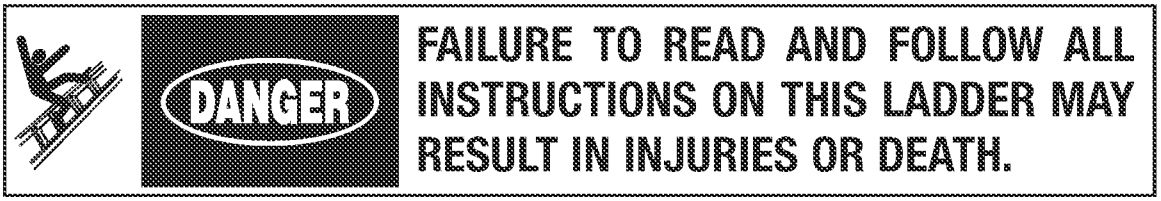
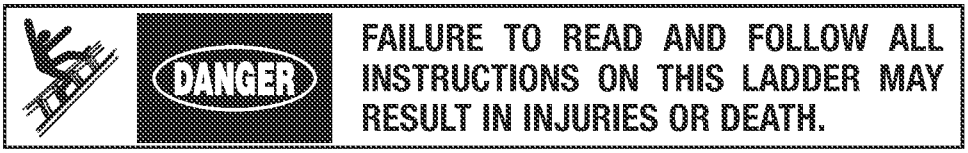
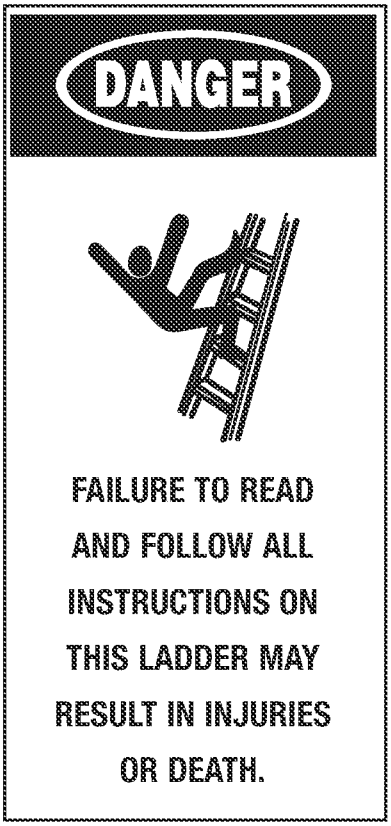


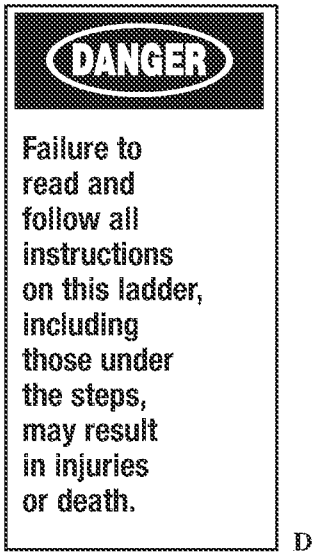
A



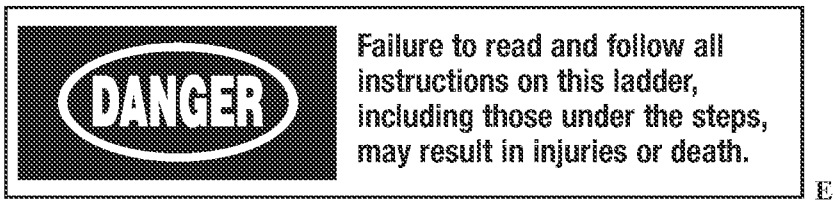
B



C



D



E

Marking No. 60 (A, B, C, D, E)

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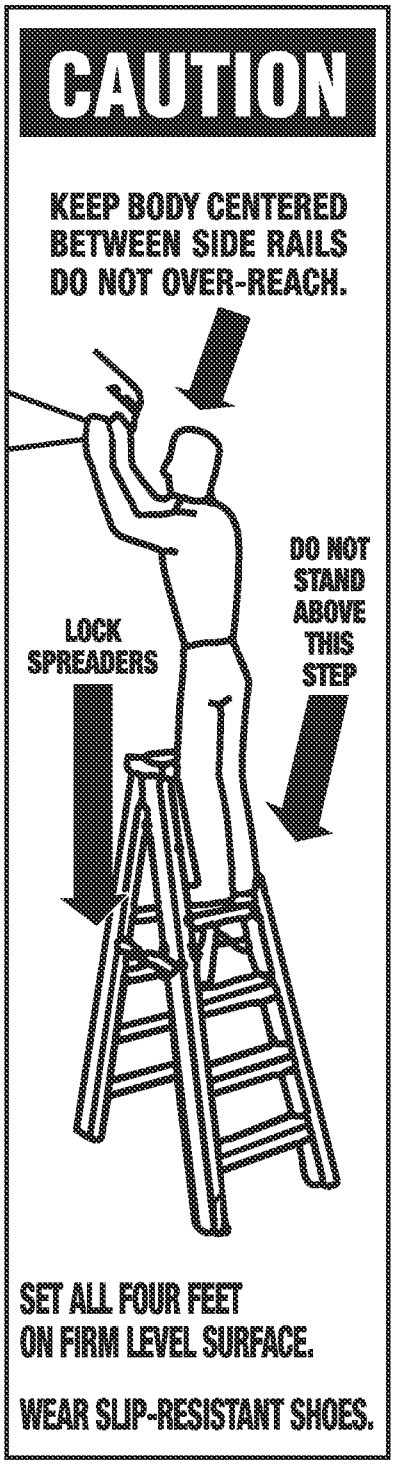


Marking No. 1

Marking No. 2

Marking No. 3

SAFETY FIRST

STEPLADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: Ladders are designed to support one person plus materials and tools not more than the working load on the notice sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IAA	SPECIAL DUTY	375 lbs.
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.
II	COMMERCIAL-MEDIUM	225 lbs.
III	HOUSEHOLD-LIGHT	200 lbs.

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts, and bolts are tight; steps, spreaders, and braces secure; spreaders and pail shelf function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint, and other slippery material. Keep your shoes clean, leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Make sure ladder is fully open, spreaders are secure, pail shelf in position.
3. Place on firm level surface with a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol, or are physically impaired.
2. To protect children, do not leave ladder set up and unattended.
3. Face ladder when climbing up or down; keep body centered between side rails.
4. Maintain a firm grip. Use both hands in climbing.
5. Never climb ladder from the side unless ladder is secured against side-wise motion.
6. Do not overreach; move ladder when needed.
7. Do not "walk" or "jog" ladder when standing on it.
8. Do not stand, climb or sit on braces, spreaders, pail shelf, back section, or above second step from top of ladder.
9. Do not overload. Ladders are meant for one person. Do not use as brace, platform or plank.
10. Keep ladder close to work; avoid pushing or pulling off to the side of ladders.

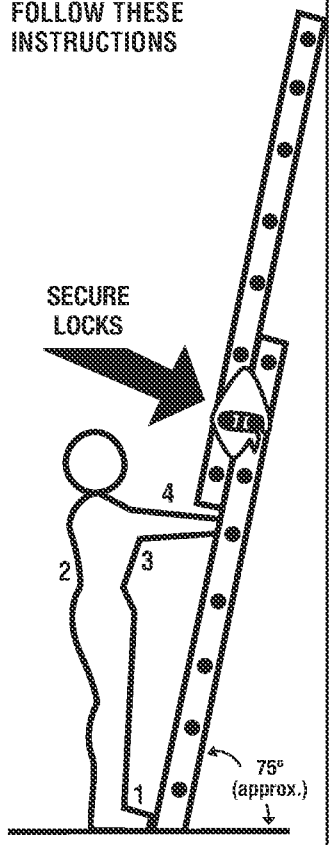
PROPER CARE AND STORAGE

1. Store ladder in safe and dry place.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 4

CAUTION

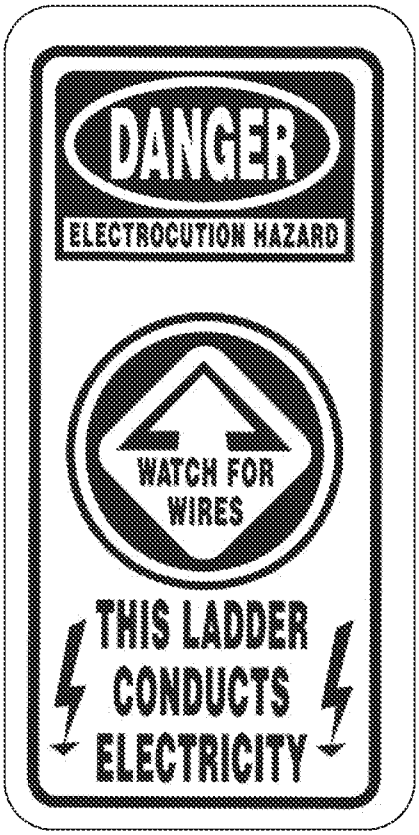
SET UP LADDER PROPERLY TO REDUCE SLIP AND OVERLOAD HAZARDS. FOLLOW THESE INSTRUCTIONS



① PLACE TOES AGAINST BOTTOM OF LADDER SIDE RAILS.
② STAND ERECT
③ EXTEND ARMS STRAIGHT OUT
④ PALMS OF HANDS SHOULD TOUCH TOP OF RUNG AT SHOULDER LEVEL

1. DO NOT OVER-REACH. KEEP BODY CENTERED BETWEEN SIDE RAILS
2. EXTEND LADDER APPROXIMATELY THREE FEET ABOVE ROOF FOR ACCESS

Marking No. 5



Marking No. 6

Marking No. 7

Marking No. 8

Marking No. 9

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SAFETY FIRST

EXTENSION AND SINGLE LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: Ladders are designed to support one person plus materials and tools not more than the working load on the notice sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IAA	SPECIAL DUTY	375 lbs.
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.
II	COMMERCIAL-MEDIUM	225 lbs.
III	HOUSEHOLD-LIGHT	200 lbs.

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent, or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts, and bolts are tight, rungs secure, ladder extension locks and feet functioning (if necessary, lubricate); rope properly attached and in good condition.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Secure base when raising extension and never set up ladder when it is extended.
3. Set single or extension ladder at proper 75-1/2 degree angle by bracing ladder base a distance equal to 1/4 total working length of ladder away from base of vertical support. If distance is less than 3 ft., place base of ladder a minimum of 3 ft. from vertical support.
4. Set ladder on firm ground. Do not lean sideways. Do not use on ice or snow or slippery surface without non-skid devices or securing feet.
5. Erect ladder so that approximately 3 ft. extends above roof line or working surface; tie top at support points.
6. Extend top section only from ground, never by "bouncing" or from the roof.
7. Do not over-extend. Maintain minimum overlap of 34" for ladders up to 32', 46" for ladder over 32' up to 36', 58" for ladders over 36' up to 48', and 70" for ladders over 48' up to 60'.
8. Place on firm level surface with a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or on scaffolds or tie or fasten ladders together to gain additional height.
9. Do not place in front of door opening toward ladder.
10. Where possible use second person to hold ladder.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol, or are physically impaired.
2. To protect children, do not leave ladder set-up and unattended.
3. Securely engage ladder locks before climbing. Check that top and bottom ends of ladder rails are firmly supported.
4. Face ladder when climbing up or down; keep body centered between side rails. Move ladder as needed.
5. Maintain a firm grip. Use both hands when climbing.
6. Do not climb onto a ladder from the side unless ladder is secured against side-wise motion, or climb from one ladder to another.
7. Do not stand closer than 3 ft. from the top. Never climb above the top support point.
8. Do not use ladder in high winds.
9. Never use ladder as a platform, plank or hoist. Never use ladder on a scaffold. Do not overload. Ladders are meant for one person.
10. Keep ladder close to work, avoid pushing or pulling off to side of ladder.
11. Never drop or apply an impact load to ladder.
12. Do not "walk" or "shift" ladder when standing on it.

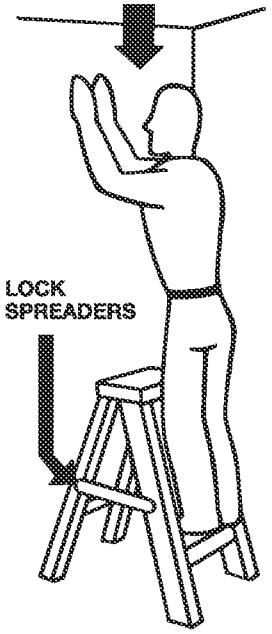
PROPER CARE AND STORAGE

1. Hang ladder on racks in dry place at intervals of 6 feet for support.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 10

CAUTION

KEEP BODY CENTERED BETWEEN SIDE RAILS.
DO NOT OVER-REACH.



SET ALL FOUR FEET ON FIRM LEVEL SURFACE.

WEAR SLIP-RESISTANT SHOES.

Marking No. 11

SAFETY FIRST

STEP STOOL — FOR YOUR SAFETY READ CAREFULLY

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent or broken step stool. All parts must be in good working order.
2. Make sure all rivets and joints, nuts and bolts are tight; steps, spreaders, and braces are secure; spreaders function properly.
3. Keep step stool clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy step stool if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let step stools of any material come in contact with live electrical wires.
2. Make sure step stool is fully open and spreaders secure.
3. Place on firm surface and a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward step stool.

PROPER CLIMBING AND USE

1. DO NOT USE STEP STOOLS if you tire easily, are subject to fainting spells, are using medicine or alcohol or are physically impaired.
2. To protect children, do not leave step stool set up and unattended.
3. Face step stool when climbing up or down. Keep body centered between side rails.
4. Do not overreach, move step stool when needed.
5. Do not "walk" or "jog" step stool when standing on it.
6. Do not overload. Step stools are meant for one person. Do not use as brace, platform or plank.
7. Keep step stool close to work; avoid pushing or pulling off to the side of step stool.

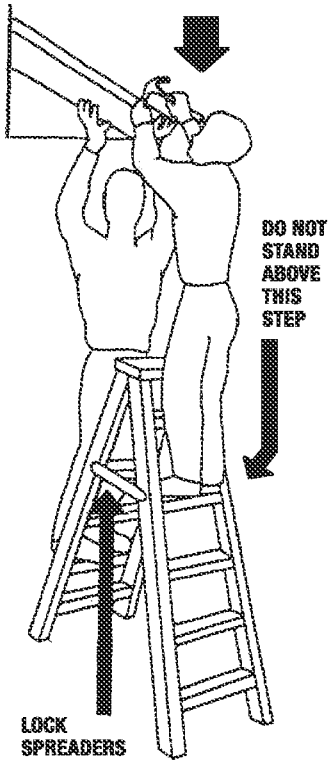
PROPER CARE AND STORAGE

1. Store step stool in safe and dry place.
2. Properly secure and support step stool while in transit.
3. Never store materials on step stool.
4. Keep step stool clean and free of all foreign materials.

Marking No. 12

CAUTION

KEEP BODY CENTERED BETWEEN SIDE RAILS.
DO NOT OVER-REACH.



SET ALL FOUR FEET ON FIRM LEVEL SURFACE.

DO NOT EXCEED WORKING LOAD PER SIDE.

WEAR SLIP-RESISTANT SHOES.

Marking No. 13

SAFETY FIRST

TRESTLE LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: This ladders is designed to support, simultaneously, one person on each side, whose weight including materials and tools is not more than the working load on the NOTICE sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IAA	SPECIAL DUTY	375 lbs.
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts, and bolts are tight; rungs, spreaders, and braces are secure; spreaders function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCT ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Make sure ladder is fully open and spreaders secure.
3. Place on a firm surface and a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol or are physically impaired.
2. To protect children, do not leave ladder set up and unattended.
3. Face ladder when climbing up or down; keep body centered between side rails.
4. Maintain a firm grip. Use both hands in climbing.
5. Never climb ladder from the side unless ladder is secured against side-wise motion.
6. Do not overreach, move ladder when needed.
7. Do not "walk" or "jog" ladder when standing on it.
8. Do not stand, climb or sit on braces, spreaders, or above second rung from top of ladder.
9. Do not overload. Do not use as brace, platform or plank.
10. Keep ladder close to work; avoid pushing or pulling off to the side of ladders.

FOR SCAFFOLD USE

1. Follow instructions on scaffold plank.
2. Do not place plank above second rung from top.
3. Secure plank to ladder before each use.
4. Secure or guy ladder to prevent excessive movement.
5. Use properly secured third ladder to access plank.

PROPER CARE AND STORAGE

1. Store ladder in safe and dry place.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 14

PGR2026-00044
TRICAM EX1018

SAFETY FIRST

EXTENSION TRESTLE LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: This ladder is designed to support, simultaneously, one person on each side, whose weight including materials and tools is not more than the working load on the NOTICE sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.

INSPECTION

1. Inspect upon receipt and before each use. Never climb a damaged, bent or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts and bolts are tight, rungs, spreaders, and braces are secure; spreaders, trestle hinge, extension ladder locking device function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Make sure ladder is fully open and spreaders secure.
3. Place on firm level surface and a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.
4. Always attach guy lines to insure stability before climbing on extension section or positioning plank. See other labels for guy line instructions. IMPORTANT! STEEL CABLE CONDUCTS ELECTRICITY. DO NOT USE IF WORKING NEAR ELECTRICAL CURRENT. USE HEMP GUY LINES INSTEAD.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol or are physically impaired.
2. To protect children, do not leave ladder set up and unattended.
3. Face ladder when climbing up or down; keep body centered between side rails.
4. Maintain a firm grip. Use both hands in climbing.
5. Never climb ladder from the side unless ladder is secured against side-wise motion.
6. Do not over reach, move ladder when needed.
7. Do not "walk" or "jog" ladder when standing on it.
8. Do not stand, climb or sit on braces, spreaders, or above second rung from top of trestle section when used without extension portion.
9. Do not overload. Do not use as a brace, platform or plank.
10. Keep ladder close to work; avoid pushing or pulling off to side of ladder.
11. Do not use this ladder in high winds or storms.

FOR SCAFFOLD USE

1. Follow instructions on scaffold plank.
2. Do not place plank above second rung from top.
3. Secure plank to ladder before each use.
4. Secure or guy ladder to prevent excessive movement.
5. Use properly secured third ladder to access plank.

PROPER CARE AND STORAGE

1. Store ladder in safe and dry place.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 15

SAFETY FIRST

COMBINATION LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: Ladders are designed to support one person plus materials and tools per side on 2-man stepladders or only one person, plus materials and tools on step or single ladders not more than the working load on the notice sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IAA	SPECIAL DUTY	375 lbs.
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.
II	COMMERCIAL-MEDIUM	225 lbs.
III	HOUSEHOLD-LIGHT	200 lbs.

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent or broken ladder; all working parts must be in good working order.
2. Make sure all rivets and joints, nuts and bolts are tight; feet, steps and rungs secure; spreaders function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Place on a firm, level surface with a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, are subject to fainting spells, are using medicine or alcohol or are physically impaired.
2. To protect children, do not leave ladder set-up and unattended.
3. Face ladder when climbing up or down; keep body centered between side rails.
4. Maintain a firm grip. Use both hands in climbing.
5. Do not overreach, move ladder when needed.
6. Do not "walk" or "jog" ladder when standing on it.
7. Do not overload. Do not use as brace, platform or plank.
8. Keep ladder close to work; avoid pushing or pulling off to the side of ladders.

AS A STEPLADDER

1. Make sure ladder is fully open and spreaders are secure.
2. Do not stand, climb or sit on pail shelf, braces or back section, or higher than 2nd step from ladder top.

AS A SINGLE OR EXTENSION LADDER

1. Set single or extension ladder at proper angle (75-1/2 degrees) by placing ladder base a distance equal to 1/4 total working length of ladder away from base of vertical support. If distance is less than 3 ft., place base of ladder a minimum of 3 ft. from vertical support.
2. Do not stand closer to the top than 3 ft. from the top. Never climb above support point.

AS AN EXTENSION LADDER

1. Extend top section only from ground, never by "bouncing" or from the roof.
2. Securely engage ladder locks before climbing. Check that top and bottom ends of ladder rails are firmly supported.

PROPER CARE AND STORAGE

1. Store ladder in safe and dry place.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 16

CAUTION

MANUFACTURER'S INSTRUCTIONS AND/OR GRAPHICS DEPICTING LOCKING MECHANISMS

MANUFACTURER'S GRAPHICS SHOWING USES/POSITIONS

Marking No. 17

PGR2026-00044
TRICAM EX1018

SAFETY FIRST

PLATFORM LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: Ladders are designed to support one person plus materials and tools not more than the working load on the notice sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IAA	SPECIAL DUTY	375 lbs.
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.
II	COMMERCIAL-MEDIUM	225 lbs.

INSPECTION

1. Inspect upon receipt and before each use; never climb a damaged, bent or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts and bolts are tight; steps, rungs, spreaders, braces, and platforms are secure; spreaders and platform hinge function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCTS ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Make sure ladder is fully open, spreaders and/or platform are secure.
3. Place on a firm level surface with a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.
4. If equipped with casters, lock in proper position before climbing.
5. If equipped with outriggers, position per manufacturer's instructions before climbing.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol, or are physically impaired.
2. To protect children, do not leave ladder set up and unattended.
3. Face ladder when climbing up or down; keep body centered between side rails.
4. Maintain a firm grip. Use both hands in climbing.
5. Never climb ladder from the side unless ladder is secured against side-wise motion.
6. Do not overreach; move ladder when needed.
7. Do not "walk" or "jog" ladder when standing on it.
8. Do not stand, climb or sit on braces, spreaders or any surface higher than the platform.
9. Do not overload. Ladders are meant for one person. Do not use as brace, platform, or plank.
10. Use extreme caution when pushing or pulling anything while on the ladder.

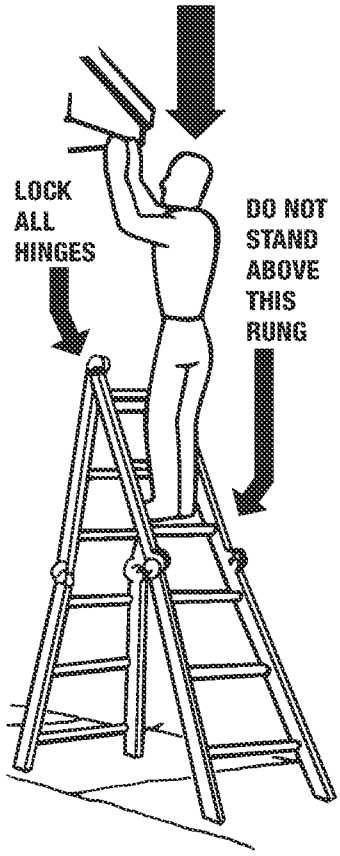
PROPER CARE AND STORAGE

1. Store ladder in safe and dry place.
2. Properly secure and support ladder while in transit.
3. Never store materials on ladder.
4. Keep ladder clean and free of all foreign materials.

Marking No. 18

CAUTION

KEEP BODY CENTERED BETWEEN SIDE RAILS. DO NOT OVER-REACH.



SET ALL FOUR FEET ON FIRM LEVEL SURFACE.

WEAR SLIP-RESISTANT SHOES.

Marking No. 19

DANGER

THE LOCKING MECHANISM MUST BE ENGAGED BEFORE USING LADDER.

MANUFACTURER'S INSTRUCTIONS FOR USE

HINGE OPERATION

MANUFACTURER'S GRAPHIC DRAWING

LOCKED

MANUFACTURER'S GRAPHIC DRAWING

UNLOCKED

ADDITIONAL INSTRUCTIONS FOR PROPER CARE AND USE OF THE LOCK/HINGE MECHANISM ACCORDING TO THE TYPE EACH MANUFACTURER EMPLOYS IN THE LADDER.

Marking No. 20

DANGER

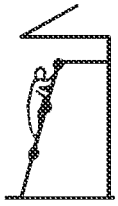
USE LADDERS ONLY IN POSITIONS SHOWN.

USE IN ANOTHER POSITION MAY RESULT IN DEATH OR SERIOUS INJURY.

STRAIGHT LADDER

STEP LADDER

DOUBLE LADDER



OVERHANG LADDER

SHORT STEP LADDER

ADDITIONAL POSITIONS MAY BE ADDED ACCORDING TO THE CAPABILITIES OF EACH PRODUCT THAT MEET APPLICABLE TEST PROTOCOLS AND SPECIFICATIONS OF THIS STANDARD.

Marking No. 21

SAFETY FIRST

ARTICULATED LADDER — FOR YOUR SAFETY READ CAREFULLY

PROPER SELECTION

1. Select ladder of proper length to reach working height.
2. IMPORTANT: Ladders are designed to support one person plus materials and tools per side on 2-man stepladder positions or only one person plus materials and tools on all other positions not more than the working load on the notice sign on this ladder.
3. Select ladders within the following:

TYPE	DUTY RATING	WORKING LOAD
IA	INDUSTRIAL-EXTRA HEAVY	300 lbs.
I	INDUSTRIAL-HEAVY	250 lbs.
II	COMMERCIAL-MEDIUM	225 lbs.
III	HOUSEHOLD-LIGHT	200 lbs.

INSPECTION

1. Inspect upon receipt and before each use. Never climb a damaged, bent or broken ladder. All parts must be in good working order.
2. Make sure all rivets, joints, nuts and bolts are tight; feet, steps and rungs are secure; all hinges function properly.
3. Keep ladder clean, free from grease, oil, mud, snow, wet paint, and other slippery material. Keep your shoes clean; leather soles should not be used.
4. Never make temporary repairs of damaged or missing parts.
5. Destroy ladder if broken, worn or if exposed to fire or chemical corrosion.

PROPER SET-UP

1. DANGER! METAL CONDUCT ELECTRICITY! Do not let ladders of any material come in contact with live electrical wires.
2. Upon receipt lubricate all hinges with light machine oil, TRIFLOW® or similar substance and again at least once a year depending on use.
3. Securely engage ladder hinges before climbing. Proper operation of hinges is as follows:

A. To Lock
MANUFACTURER'S SPECIFIC INSTRUCTIONS HERE

B. To Unlock
MANUFACTURER'S SPECIFIC INSTRUCTIONS HERE.

4. NOTE: FOR LADDERS HAVING HINGES EQUIPPED WITH LOCKING DOGS: It may be difficult to unlock hinges if there is pressure on the locking dog. To relieve the pressure, simply jiggle one half of the ladder back and forth until locking dog can be moved without force.
5. Adjust all hinges before climbing or using ladder. Never release hinge locks or attempt to reposition hinges while working on the ladder.
6. Place on firm level surface with a secure footing. Do not use on slippery surfaces. Do not place on boxes, unstable bases or scaffolds to gain additional height. Do not place in front of door opening toward ladder.
7. Where possible, use second person to hold ladder.
8. Set single or extension ladder at proper (75-1/2) degree angle by placing ladder base a distance equal to 1/4 total working length of ladder away from base of vertical support.
9. Erect ladder so that approximately 3 ft. extends above roof line or working surface; tie top at support points.

PROPER CLIMBING AND USE

1. DO NOT USE LADDERS if you tire easily, or are subject to fainting spells, or are using medicine or alcohol or are physically impaired.
2. To protect children, do not leave ladder set up and unattended.
3. Make sure all hinges are securely locked before climbing. Check that top and bottom ends of ladder rails are firmly supported.
4. CAUTION: A 2" x 10" construction grade lumber plank or better must be used in all approved horizontal positions where indicated.
5. Face ladder when climbing up or down; keep body centered between side rails.
6. Maintain a firm grip. Use both hands in climbing.
7. Never climb ladder from the side unless ladder is secured against side-wise motion, or climb from one ladder to another.
8. Do not stand closer to the top than 3 ft. from the top. Never climb above the top support point.
9. Do not use ladder in high winds or storms.
10. Never pull the hinge release levers and operate hinges when standing on the ladder.
11. Cover up hinges during messy work. Obstacles in hinge will destroy its function.
12. Do not over reach, move ladder when needed.
13. Do not "walk" or "jog" ladder when standing on it.
14. Do not overload.
15. Keep ladder close to work; avoid pushing or pulling off to the side of ladders.

PROPER CARE AND STORAGE

1. Keep hinges free of foreign materials that would destroy its function.
2. Store ladder in safe and dry place.
3. Keep ladder clean and free of all foreign materials.
4. Lubricate mechanism of hinges regularly.

Marking No. 22

NOTICE

Ladder Size

Type and/or Duty Rating

Maximum Working Length (If extension Ladder)

Highest Standing Level

Total Length of Sections (If extension Ladder)

Model Number or Name

Manufacturer or Distributor Name

Manufacturing Plant (If multi-plant organization)

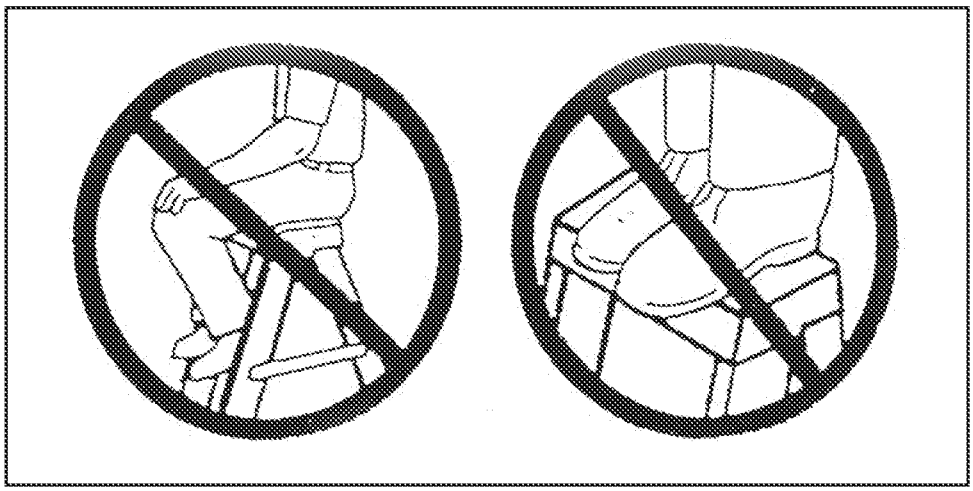
Month and Year of Manufacture

ANSI Standards Compliance

Warranty If Warranty Offered

Marking No. 23

PGR2026-00044
TRICAM EX1018



Marking No. 24

Appendix C

The interpretation below represents the committee's view of understanding properly the use of labels/marking in the appendices of this standard.

Preface

Over the years, there have been a number of interpretations of various requirements within the A14 ladder standards. One which keeps reappearing and has required periodic revisiting is the labeling/marking requirements as these relate to the illustrations of more detailed and apparently specific labels/markings in the appendix following Appendix B. To clarify this issue as definitively as possible the following interpretation, reviewed and approved by the A14 standards committee, is provided:

Interpretation

While the requirements in the body of the portable ladder standards for labels/marking are keyed to specifically numbered markings, the referred to labels/markings are illustrations only and not intended to be exact renditions of the labels/markings placed on portable ladders. As illustrations, the labels/markings, except for technical information in the text, are not required to be exact duplications of those following Appendix B. The graphics of the labels/markings including figures of users, arrows pointing out locations or direction, formatting text with the use of numbers or alphabet or both, and style of expression need not be followed exactly but rather is left to the discretion of the developer of the label/marking or as ordered by a label/marking buyer. Such text or verbiage can be added or presented more cogently as long as the broad general intent of the label/marking is achieved without changing the basic technical information thus meeting the requirements of the standard for label/marking.

Underscoring the above position is the description of labels/markings as illustrations. Use of the word illustration has been specifically chosen, based upon its meaning, which is defined as an example and explanation. Coupled with this definition — and lending emphasis to it — is the placement of the label/marking illustrations in the appendix since appendices are not part of the standard but explanations and elaboration of the standard, and its applicable requirements. In the traditional structuring and development of standards the use of the appendix was also specifically chosen as a recognized means of stating through illustration and explanation how requirements of the standard can be implemented. The use of labels/markings appendix and the illustrations contained therein is construed in the broadest sense as offering designers or buyers general guidance, rather than dictating exact duplication, in creating signs or labels/markings for portable ladders.

ANSI-ASC A14 Comment / Request for Interpretation Form

This form shall serve as the official form for comments/requests for interpretation on A14 Standards. It shall be the responsibility of those wishing to comment on a proposed standard to complete all sections of this form. The appropriate Sub-Committee will review all comments received. A notice of action taken will be forwarded to those issuing substantive comments/requests.

Please complete the information below

Date_____

Standard #_____ Title_____

Name_____

Organization/Company_____

Address_____

City_____ State_____ Zip_____

Phone _____ Fax_____

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A request for comment/interpretation shall not be processed if it:

(a) Involves a determination of compliance to the applicable Standards in the areas of a design, installation, or product, or equivalency of protection.

(b) Involves a review of plans or specifications, or requires judgment or knowledge that can only be acquired as a result of on-site inspection.

(c) Involves tests that clearly and decisively provide the requested information.

(d) Involves subjects that were not previously considered by the Committee or that are not addressed in the Standard.

(e) Involves product evaluation judgments concerning safe work practices.

(f) Involves issues in litigation or in preparation for litigation.

I confirm that the comment/interpretation request is not for a lawsuit that is involved in litigation or is not for a matter that is being prepared for litigation.

Signed _____

Only one comment per form – please copy this form for additional comments/request for interpretation!

Comment: (Please be specific)_____

Rationale: (Each comment must include a rationale)_____

Please mail or fax to: ALI Headquarters, 401 N. Michigan, Chicago, Illinois, 60611 • Fax: 312.673.6929

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Notes

AMERICAN LADDER INSTITUTE

A National Trade Association

401 North Michigan Avenue
Chicago, Illinois 60611
Telephone: 312-644-6610
FAX: 312-673-6929
www.americanladderinstitute.org

APPENDIX B

Copy of website entitled "Commonly Used Statistics," U.S. Department of Labor, Occupational Safety and Health Administration, accessed 17 June 2024, available at https://www.osha.gov/data/commonstats. (3 Pages)

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

Commonly Used Statistics

Federal OSHA coverage

Federal OSHA is a small agency; with our state partners we have approximately 1,850 inspectors responsible for the health and safety of 130 million workers, employed at more than 8 million worksites around the nation — which translates to about one compliance officer for every 70,000 workers.

Federal OSHA has 10 regional offices and 85 local area offices.

OSHA budget

FY 2023 Appropriations: $632,000,000
FY 2022 Appropriations: $612,000,000
FY 2021 Appropriations: $591,233,000

OSHA inspections

FY 2023 total federal inspections: 34,267

Worker fatalities

There were 5,486 fatal work injuries in 2022 (3.7 fatalities per 100,000 full-time equivalent workers). Learn about key findings.

Most frequently violated standards

Preliminary Top 10 most frequently cited OSHA standards violated in FY 2022

The following are the preliminary top 10 most frequently cited standards by Federal OSHA in fiscal year 2022 (October 1, 2021, through September 30, 2022):

1. **Fall Protection, construction** (29 CFR 1926.501) [related safety resources]
2. **Hazard Communication, general industry** (29 CFR 1910.1200) [related safety resources]
3. **Ladders, construction** (29 CFR 1926.1053) [related safety resources]

4. **Respiratory Protection, general industry** (29 CFR 1910.134) [related safety resources]
5. **Scaffolding, construction** (29 CFR 1926.451) [related safety resources]
6. **Control of Hazardous Energy (lockout/tagout), general industry** (29 CFR 1910.147) [related safety resources]
7. **Powered Industrial Trucks, general industry** (29 CFR 1910.178) [related safety resources]
8. **Fall Protection Training, construction** (29 CFR 1926.503) [related safety resources]
9. **Eye and Face Protection, construction** (29 CFR 1926.102) [related safety resources]
10. **Machinery and Machine Guarding, general industry** (29 CFR 1910.212) [related safety resources]

- The final top 10 most frequently cited OSHA standards violated in FY 2023 will be available in April 2024.
- To search the top violations of an industry with a specific NAICS code, see https://www.osha.gov/ords/imis/citedstandard.html
- To search and view the industry profile for violations of any specific OSHA standard, see https://www.osha.gov/ords/imis/industryprofile.html

OSHA is Making a Difference

- In roughly half a century, OSHA and our state partners, coupled with the efforts of employers, safety and health professionals, unions and advocates, have had a dramatic effect on workplace safety.
- Worker deaths in America are down—on average, from about 38 worker deaths a day in 1970 to 15 a day in 2022.
- Worker injuries and illnesses are down—from 10.9 incidents per 100 workers in 1972 to 2.7 per 100 in 2022.

Occupational Safety and Health Administration
200 Constitution Ave NW
Washington, DC 20210
1-800-321-OSHA
1-800-321-6742
www.osha.gov

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APPENDIX C

Copy of website entitled "OSHA's Top 10 Most Frequently Cited Standards," U.S. Department of Labor, Occupational Safety and Health Administration, accessed 17 June 2024, available at https://www.osha.gov/top10citedstandards. (3 Pages)

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

NOTE: Generally, OSHA does not post the top ten violations until after the first week in April, so as to allow the prior fiscal year's inspection data to finalize past the close of the fiscal year (September 30th).

Top 10 Most Frequently Cited Standards

for Fiscal Year 2023 (Oct. 1, 2022, to Sept. 30, 2023)

The following is a list of the top 10 most frequently cited standards following inspections of worksites by federal OSHA for all industries. OSHA publishes the list to alert employers about these commonly cited standards so they can take steps to find and fix recognized hazards addressed in these and other standards before OSHA shows up. Workers suffer preventable injuries, illnesses, and deaths related to the hazards addressed in these standards.

1. **Fall Protection, construction** (29 CFR 1926.501) [related safety resources]
2. **Hazard Communication, general industry** (29 CFR 1910.1200) [related safety resources]
3. **Ladders, construction** (29 CFR 1926.1053) [related safety resources]
4. **Scaffolding, construction** (29 CFR 1926.451) [related safety resources]
5. **Powered Industrial Trucks, general industry** (29 CFR 1910.178) [related safety resources]
6. **Control of Hazardous Energy (lockout/tagout), general industry** (29 CFR 1910.147) [related safety resources]
7. **Respiratory Protection, general industry** (29 CFR 1910.134) [related safety resources]
8. **Fall Protection Training, construction** (29 CFR 1926.503) [related safety resources]
9. **Eye and Face Protection, construction** (29 CFR 1926.102) [related safety resources]
10. **Machinery and Machine Guarding, general industry** (29 CFR 1910.212) [related safety resources]

- To search an OSHA standard, see this webpage: OSHA Law and Regulations

- To search the top violations of an industry with a specific NAICS code, see this webpage: Frequently Cited OSHA Standards
- To search and view the industry profile for violations of any specific OSHA standard, see this webpage: Industry Profile for an OSHA Standard

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