U. S. DEPARTMENT OF LABOR
JAMES J. DAVIS, Secretary
BUREAU OF LABOR STATISTICS
ETHELBERT STEWART, Commissioner

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SAFETY CODE SERIES

SAFETY CODE FOR THE CONSTRUCTION, CARE AND USE OF LADDERS

AMERICAN SOCIETY OF SAFETY ENGINEERS
SPONSOR

TENTATIVE AMERICAN STANDARD
Approved July 25, 1923, by
American Engineering Standards Committee

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NO. 351 WASHINGTON OCTOBER, 1923

SAFETY CODE FOR THE CONSTRUCTION, CARE, AND USE OF LADDERS.

INTRODUCTION.

On December 13, 1920, the American Engineering Standards Committee invited the American Society of Safety Engineers to act as sponsor for a ladder safety code. On December 17 the executive board of the society accepted this sponsorship, notifying the A. E. S. C. accordingly, on December 21. Under the rules of procedure of the A. E. S. C., the society then organized a sectional committee, consisting of the following members, as of the date of approval of the code:

Name and address.	Interest represented.	Sectional committee group.
Charles N. Young (*Chairman*), Globe Indemnity Co., Newark, N. J.	American Society of Safety Engineers.	Engineering societies.
Willard T. Hatch, Browne & Sharpe Mfg. Co., Providence, R. I.	American Society of Mechanical Engineers.	
W. E. Welch, Travelers Insurance Co., 30 East 42d St., New York City.	American Society of Safety Engineers.	
John A. Dickinson, Bureau of Standards, Washington, D. C.	U. S. Bureau of Standards.	Federal Government.
L. J. Markwardt, Forest Products Laboratory, Madison, Wis.	U. S. Department of Agriculture.	
James C. Cronin, Department of Labor and Industry, Harrisburg, Pa.	International Association of Industrial Accident Boards and Commissions.	State regulatory bodies.
Richard J. Cullen, State Labor Department, 124 East 28th St., New York City.	do.	
John G. Gamber, Fire Marshals' Association of North America, Springfield, Ill.	Fire Marshals' Association of North America.	
James L. Gernon, New York State Industrial Commission, 124 East 28th St., New York City.	International Association of Industrial Accident Boards and Commissions.	
R. McA. Keown, Industrial Commission of Wisconsin, Madison, Wis.	do.	
John P. Meade, Department of Labor and Industries, Boston, Mass.	do.	
William Newell, New York State Insurance Fund, 124 East 28th St., New York City.	New York State Insurance Fund, and American Society of Safety Engineers.	
A. E. Davidson, Chesebro-Whitman Co., 1167 First Avenue, New York City.	Chesebro-Whitman Co., and National Association of Building Owners and Managers.	
Herman B. Gaffers, John S. Tilley Ladders Co. (Inc.), Watervliet, N. Y.	John S. Tilley Ladders Co. (Inc.), and American Society of Safety Engineers.	Manufacturers of ladders.
J. C. A. Leppelman, Consolidated Pump Co., Toledo, Ohio.	National Ladder Manufacturers Association.	
M. C. Goodspeed (*Secretary*), General Electric Co., Erie, Pa.	General Electric Co., and American Society of Safety Engineers.	Employers as users of ladders.
Walter F. Ballinger, 329 South Broad St., Philadelphia, Pa.	National Federation of Construction Industries.	
F. B. Essex, R. P. Whitty Co., 1100 Fifteenth St. NW., Washington, D. C.	Associated General Contractors of America.	
Carl M. Hansen, Widener Building, Philadelphia, Pa.	National Association of Manufacturers.	

Name and address.	Interest represented.	Sectional committee group.
E. D. Haggerty, Employers' Mutual Insurance Co., 61 Broadway, New York City.	National Association of Mutual Casualty Companies.	Insurance interests.
L. L. Hall, National Bureau of Casualty & Surety Underwriters, 120 West 42d St., New York City.	National Bureau of Casualty & Surety Underwriters.	
Sydney V. James, Underwriters Laboratories, 207 East Ohio St., Chicago, Ill.	Underwriters Laboratories	
H. G. Wiberg, Lumber Mutual Casualty Insurance Co., 66 Broadway, New York City.	Lumber Mutual Casualty Insurance Co., and American Society of Safety Engineers.	
H. A. Schultz, United States Steel Corp., 71 Broadway, New York City.	National Safety Council	General interests.
Fred W. Baer, Room 105, American Federation of Labor Building., Washington, D. C.	International Association of Fire Fighters.	Employees as users of ladders.
John Donlin, Building Trades Department, American Federation of Labor Building, Washington, D. C.	American Federation of Labor	

The sectional committee gratefully acknowledges the helpful cooperation of the following consultants, many of whom have sat with the committee at its invitation and several of whom have at some time been members thereof:

C. R. Alling, National Board of Fire Underwriters, Chicago, Ill.
H. S. Betts, U. S. Department of Agriculture, Washington, D. C.
W. D. Brush, U. S. Department of Agriculture, Washington, D. C.
Harry Bloch, Dayton Safety Ladder Co., Dayton, Ohio.
W. H. Cameron (*member*), National Bureau of Casualty & Surety Underwriters, New York City.
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W. Graham Cole, Southern Pine Association, New Orleans, La.
C. B. Connelly, Department of Labor and Industry, Harrisburg, Pa.
Claude E. Connally, Department of Labor, Oklahoma City, Okla.
W. P. Elstrom, American Telephone & Telegraph Co., New York City.
Fred J. Hartman, Department of Labor and Industry, Harrisburg, Pa.
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G. E. Sanford, General Electric Co., West Lynn, Mass.
Jos. R. Scheftel, Surestep Ladder Corp., Long Island City, N. Y.
Frank Scott, Hamlin & Co., New York City.
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M. Van Siclen, Bureau of Mines, Washington, D. C.
W. J. Venning, Aetna Life Insurance Co., New York City.
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James W. Welsh, American Electric Railway Association, New York City.
S. J. Williams, National Safety Council, Chicago, Ill.
T. A. Wilson, Bureau of Labor and Statistics, Little Rock, Ark.
H. M. Wolfiin, Industrial Accident Commission, San Francisco, Calif.

The initial draft of this code was prepared by M. C. Goodspeed, safety engineer, General Electric Co., and was revised three times by a small working committee before it became necessary to bring the sectional committee together. This procedure made it possible

for the sectional committee to finish its work in four meetings. Between the second and third meetings the tentative draft was submitted to more than 75 State departments and other interested bodies for criticism.

The code in its present form is the net result of this work and was approved by the sectional committee, by letter ballot, June 12, 1923; executive committee, American Society of Safety Engineers, June 13, 1923; American Engineering Standards Committee, July 25, 1923.

SECTION NO. 1.—GENERAL REQUIREMENTS.

10. Scope, application, and compliance.

(*a*) *Scope.*—The rules set forth in this standard shall apply to every establishment or working condition which by reason of the nature of the condition, operation, or process requires the use of the equipment covered by these rules.

(*b*) *Application.*—The employer shall furnish suitable equipment for the condition or work to be performed. Employees shall use equipment when employed under conditions or for work which require same.

(*c*) *Compliance.*—The method to be pursued to assure that "ladders" which meet the specifications and tests prescribed by these rules will be used shall be determined by the proper administrative authority.

The word "shall" where used is to be understood as mandatory and "should" as advisory.

11. Purpose.

The purpose of this code is to provide reasonable safety for life, limb, and health. In cases of practical difficulty or unnecessary hardship the enforcing officers or body may grant exceptions from the literal requirements of this code or permit the use of other devices or methods, but only when it is clearly evident that equivalent protection is thereby secured.

Where materials or devices are available which have been subjected to examination by some properly qualified body and found to conform with the general requirements of this code, such materials or devices should be used in preference to others which have not been so examined regarding their suitability for the given purpose.

In order to avoid the necessity for repetition of such examination by different examiners, frequently with inadequate facilities for such work, and to avoid the confusion which would result from conflicting reports as to the suitability of devices recommended for a given purpose, it is necessary that such examination should be made under standard conditions and the record made generally available through promulgation through organizations properly equipped and qualified for experimental testing, inspection of the run of goods at factories, and service-value determination through field inspections and whose findings are subject to appeal to the Forest Service of the United States Department of Agriculture.

NOTE.—To secure the uniform application of this code, enforcing officers are urged to consult the committee which formulated it, through the American Society of Safety Engineers or the American Engineering Standards Committee, at 29 West Thirty-ninth Street, New York, before rendering decisions on disputed points.

SECTION NO. 2.—DEFINITIONS.

20. A ladder is an appliance designed for use in ascending or descending at an angle exceeding fifty (50°) degrees, with the horizontal, usually consisting of two side pieces called side rails, joined at short intervals by cross pieces called steps.

(*a*) The term *fixed* ladder shall mean a ladder substantially fastened in a fixed position.

(*b*) The term *portable* ladder shall mean a ladder consisting of but one section and which may be used at various locations.

(*c*) The term *extension* ladder shall mean a ladder consisting of two or more sections traveling in guides or brackets so arranged that it may be adjusted to variable lengths.

(*d*) The term *fire* ladder shall mean a ladder used exclusively for fire purposes, excluding equipment of organized fire departments.

(*e*) The term *step* ladder shall mean a ladder having flat treads and so constructed as to be self-supporting.

(*f*) The term *trolley* ladder shall mean a ladder traveling on fixed horizontal guides.

(*g*) The term *sectional* ladder shall mean a ladder consisting of two or more sections so constructed that the sections, when combined, will function as a single ladder.

(*h*) The term "A" ladder or *trestle* ladder shall mean a ladder consisting of two (2) portable ladders hinged at the top to form equal angles with the base.

(*i*) The term *extension trestle* ladder shall mean a ladder consisting of an "A" or *trestle* ladder with an additional parallel side portable ladder, which is adjustable perpendicularly and is provided with a device to lock it into place.

SECTION NO. 3.—MATERIALS.

30. Wood side rails.

(*a*) Wood side rails shall be of thoroughly seasoned material, free from shakes, large checks, and decay.

Very low density or exceptionally lightweight pieces shall be excluded.

Cross grain having a slope of deviation from straight grain of more than one in twelve (1:12) shall not be permitted.

Knots shall not exceed one-half (½) inch in diameter and shall not be nearer than one-half (½) inch to the edge of the side rail or three (3) inches to the rung.

(*b*) Wood side rails shall be dressed on all sides, sharp edges eliminated, and free from splinters.

(*c*) Wood side rails shall be of red, white, or Sitka spruce or other species the equivalent thereto in strength.

All minimum dimensions of wood side rails specified in this code refer to the woods of Group III of this rule.

Table 1 gives a list of native woods, classified into four groups on the basis of the mechanical properties considered from the standpoint of use for ladder construction. The species of Groups I to IV (Table 1) may be substituted for spruce in side rails in sizes as follows:

TABLE 1.—CLASSIFICATION OF VARIOUS SPECIES OF WOODS FOR USE IN LADDERS.

GROUP I.

aa. Group I woods may be not more than ten (10) per cent smaller than spruce in *each* cross section dimension.

Ash:
- Commercial white.
- Biltmore (*Fraxinus biltmoreana*).
- Blue (*Fraxinus quadrangulata*).
- Green (*Fraxinus lanceolata*).
- White (*Fraxinus americana*).

Beech (*Fagus atropunicea*).
Birch:
- Sweet (*Betula lenta*).
- Yellow (*Betula lutea*).

Elm, cork (*Ulmus racemosa*).
Fir, Douglas (dense [1]) (*Pseudotsuga taxifolia*).
Hickory:
- Shellbark (*Hicoria laciniosa*).
- Mocker nut (*Hicoria alba*).
- Pignut (*Hicoria glabra*).
- Shagbark (*Hicoria ovata*).
- Bitternut (*Hicoria minima*).
- Nutmeg (*Hicoria myristicaeformis*).
- Pecan (*Hicoria pecan*).
- Water (*Hicoria aquatica*).

Hornbeam (*Ostrya virginiana*).
Locust [2] (*Robinia pseudacacia*).
Locust, honey (*Gleditsia triacanthos*).
Maple:
- Red (*Acer rubrum*).
- Sugar (*Acer saccharum*).

Oak:
- Commercial red and white.
- Laurel (*Quercus laurifolia*).
- Red (*Quercus rubra*).
- Spanish (*Quercus digitata*).
- Water (*Quercus nigra*).
- Willow (*Quercus phellos*).
- Yellow (*Quercus velutina*).
- Bur (*Quercus macrocarpa*).
- Chestnut (*Quercus prinus*).
- Cow (*Quercus michauxii*).
- Post (*Quercus minor*).
- Swamp white (*Quercus platanoides*).
- White (*Quercus alba*).

Osage orange [2] (*Toxylon pomiferum*).
Persimmon (*Diospyros virginiana*).
Pine, southern yellow (dense [1]).

GROUP II.

bb. Group II wood may be not more than five (5) per cent smaller than spruce in *each* cross-section dimension.

Ash:
- Oregon (*Fraxinus oregona*).
- Pumpkin (*Fraxinus profunda*).

Cedar,[2] Port Orford (*Chamaecyparis lawsoniana*).
Cucumber-tree (*Magnolia acuminata*).

[1] Dense Douglas fir and southern yellow pine must contain at least one-third (⅓) summerwood, as measured along an average radial line on one end of the piece.

[2] The sapwood of all species is particularly nondurable and should not be used under conditions favorable to decay. Where great resistance to decay is required the heartwood of these species is especially recommended.

Elm:
  Slippery (*Ulmus pubescens*).
  White (*Ulmus americana*).
Fir, Douglas (coast type) (*Pseudotsuga taxifolia*).
Hemlock, western (*Tsuga heterophylla*).
Larch, western (*Larix occidentalis*).
Maple, broadleaf, (*Acer macrophyllum*).
Pine, Norway (*Pinus resinosa*).
Pine, southern yellow.

GROUP III.

cc. Group III woods may be substituted for spruce in required spruce sizes.

Alder, red (*Alnus oregona*).
Cedar,[2] Alaska (*Chamaecyparis nootkatensis*).
Cypress,[2] bald (*Taxodium distichum*).
Fir, Douglas (Rocky Mountain type) (*Pseudotsuga taxifolia*).
Fir, true:
  Noble (*Abies nobilis*).
  White (*Abies concolor*).
  Silver (*Abies amabilis*).
Gum, black (*Nyssa sylvatica*).
Hackberry (*Celtis occidentalis*).
Holly, American (*Ilex opaca*).
Magnolia (evergreen) (*Magnolia foetida*).
Maple, silver (*Acer saccharinum*).
Pine, western white (*Pinus monticola*).
Poplar, yellow (*Liriodendron tulipifera*).
Spruce:
  Red (*Picea rubens*).
  Sitka (*Picea sitchensis*).
  White (*Picea canadensis*).
Sycamore (*Platanus occidentalis*).

GROUP IV.

dd. Group IV woods shall be not less than five (5) per cent larger than spruce in *each* cross-section dimension.

Arborvitae,[2] western red (*Thuja plicata*).
Aspen (*Populus tremuloides*).
Aspen, large-tooth (*Populus grandidentata*).
Basswood (*Tilia americana*).
Buckeye, yellow (*Aesculus cotandra*).
Butternut (*Juglans cinerea*).
Cedar,[2] incense (*Libocedrus decurrens*).
Chestnut[2] (*Castanea dentata*).
Cottonwood:
  Black[2] (*Populus trichocarpa*).
  Common (*Populus deltoides*).
Pine:
  Lodgepole (*Pinus contorta*).
  Sugar (*Pinus lambertiana*).
  Western yellow (*Pinus ponderosa*).
  White (*Pinus strobus*).
  Jeffrey (*Pinus jeffreyi*).

NOTE.—The common and scientific names of species used conform to Division of Forestry Bulletin No. 17, Check List of the Forest Trees of the United States, with such modifications as have been since adopted by the United States Forest Service.

31. Wood steps.

(*a*) Wood rungs, treads, or cleats shall be of thoroughly seasoned material, free from knots, shakes, large checks, and decay. Very low density or exceptionally lightweight pieces shall be excluded. Cross grain having a slope of deviation from straight grain of more than one in twenty (1:20) shall not be permitted.

[2] The sapwood of all species is particularly nondurable and should not be used under conditions favorable to decay. Where great resistance to decay is required the heartwood of these species is especially recommended.

(*b*) Wood treads shall be of species permitted for side rails, rule 30.

(*c*) Wood rungs or cleats shall be of white ash or the equivalent thereto in strength and wear. Species of Group I (Table 1, rule 30), with the exception of Douglas fir and southern yellow pine, may be substituted for white ash in like sizes. Douglas fir and southern yellow pine shall not be used for rungs.

32. Metal parts.

All metal parts or fittings of ladders shall be mild steel, wrought iron, malleable cast iron, or other equivalent malleable metal, unless otherwise specified in this code.

SECTION NO. 4.—TESTS.

40. Strength.

The following test should be applied to portable and extension ladders to insure adequate rigidity and proper construction. Rail sections should, if necessary to pass these tests, be increased above the minimum specifications provided by this code, which are given as absolute minimums rather than as an expression of the best practice.

With each side rail supported horizontally at two points, the distance specified in the table from each end, the ladder should retain a static load of two hundred (200) pounds impressed on center of middle step for ten (10) minutes, with a maximum total deflection not greater than shown by the following table, and without taking a permanent set or developing cracks or other defects.

Length of extended ladder (feet).	Distance of supports from ends (inches).	Total deflection (inches).
12	3	2¾
14	3	4½
16	3	6¾
18	3	9½
20	3	11½
22	3	14
24	3	16½
26	3	19
28	3	21½
30	3	23½
32	6	24
34	6	26
36	6	29
38	6	34
40	6	37
42	9	39
44	9	41
46	9	44
48	9	48
50	9	54
52	12	55
54	12	58
56	12	64

NOTE.—Care should be taken in testing to see that, with the ladder supported as indicated, the maximum load will not cause the ends of the ladder to slip from the supports.

SECTION NO. 5.—SPECIFICATIONS.

50. Side rails.

(*a*) Wood side rails shall have a minimum dressed cross section of the following dimensions, unless otherwise specified in paragraph (*b*) of this rule or in section No. 6 of this code, for the types of ladders therein designated:

Length of extended ladder (feet).	Dimension of side rails at center.	
	Thickness (inches).	Depth (inches).
Up to and including 19	1½	2½
Over 19, up to and including 23	1½	2¾
Over 23, up to and including 25	1⅝	2¾
Over 25, up to and including 27	1¾	2¾
Over 27, up to and including 30	1¾	2¾
Over 30, up to and including 33	1¾	3
Over 33, up to and including 38	1⅞	3¼
Over 38, up to and including 42	1⅞	3½
Over 42, up to and including 45	1⅞	3½
Over 45, up to and including 52	1⅞	3¾
Over 52, up to and including 55	1⅞	3¾

If it is desired to use a rail section either dimension of which is less than is specified in this table, such section shall develop an actual working stress not exceeding 1,600 pounds per square inch when tested by the following formula applying to rectangular sections:

$$S=\frac{3\ LD\ (P+\ W/16)}{2\ B\ (D^3-d^3)}=\frac{1.5\ LD\ (25\ +W/16)}{B\ (D^3-0.67)}$$

where

P=25 pounds, which is the normal component on each rail of a load of 200 pounds at center of ladder, equally distributed between the rails, when foot of ladder is moved out of the perpendicular by one-quarter (¼) of its length.

W=weight of ladder in pounds.

L =length of ladder, in inches.

B =net thickness of each side rail, in inches (deducting depth of gain, if any, for flat treads).

D =depth of side rail, in inches.

d =diameter of hole drilled for rung (d^3 shall be taken as not less than 0.67, regardless of the method of step fastening used).

(*b*) Wood side rails of cleat ladders shall be not less than three-eighths (⅜) inch greater in thickness and one-half (½) inch greater in depth than is specified under paragraph (*a*) above, but no such ladder shall be less than one and five-eighths (1⅝) inches thick and three and five-eighths (3⅜) inches in depth, two by four (2 x 4) inches nominal.

(*c*) Metal side rails shall be of medium soft steel or wrought iron not less than nine-sixteenths (9/16) of a square inch in cross section for lengths twelve (12) feet and under, and not less than three-fourths (¾) of a square inch in cross section for lengths over twelve (12) feet, with a minimum thickness not less than three-eighths (⅜) inch, or other materials and shapes equivalent thereto in strength.

(*d*) Weight of side rails shall be not more than two and one-half (2½) pounds per foot in length.

(*e*) The inside width between side rails shall be not more than thirty-two (32) inches and not less than ten (10) inches at a point not more than four (4) feet below top end of side rail. Top end of side rails may be brought together. With spread rails the minimum rate of spread shall be one-quarter (¼) inch at each succeeding step.

51. Steps.

Steps may be either rungs, treads, or cleats. A uniform step spacing shall be used. This spacing should be twelve (12) inches. Steps shall have the following dimensions or be of equivalent strength.

(*a*) RUNGS.

(1) Wood rungs shall have the following minimum dimensions, length of rung to be measured between supports:

Length of rung (inches).	Center diameter (inches).	Tenon diameter (inches).
Up to and including 18	1⅛	1
Over 18 up to and including 21	1 3/16	1
Over 21 up to and including 24	1¼	1
Over 24 up to and including 28	1 5/16	1
Over 28 up to and including 32	1⅜	⅞

(2) Metal rungs of solid round stock shall have a minimum center diameter of five-eighths (⅝) inch and tenon diameter of one-half (½) inch.

(3) Metal rungs of angle section shall have minimum dimensions of ¾ x ¾ x ⅛ inches

(4) "U" sections shall, in general, be considered as the equivalent of a "rung" and shall meet all of the requirements of same.

(*b*) TREADS.

(1) Wood treads shall have the following minimum dimensions:

Length of side rails (feet).	Thickness (inches).	Width (inches).
Up to and including 10	¾	3½
Over 10 up to and including 16	¾	4
Over 16 up to and including 20	⅞	4

(2) Metal treads shall have a width as specified for wood treads. In cross section metal treads shall be a channel or equivalent section equal in strength to the specifications for wood treads.

(*c*) CLEATS.

(1) Wood cleats shall have the following minimum dimensions:

Length of cleat (inches).	Thickness (inches).	Width (inches).
Up to and including 20	11/16	2¼
Over 20 up to and including 30	11/16	3¼

52. Step fastening.

(*a*) Rungs shall be fastened securely at both ends.

(*b*) "U" sections on old construction may be fastened on the outside of the wall by using two (2) five-eighths (⅝) inch diameter through bolts on each end.

(*c*) "U" sections on new construction shall be built into the structure a minimum of eight (8) inches with not less than three (3) inches of the inner ends bent at right angles.

(*d*) Wood treads shall be inset in the side rails not less than three-sixteenths (3/16) inch, nailed or screwed, and further secured to the side rails with metal brackets, bolts, rods, or the equivalent.

(*e*) Metal treads shall be flanged downward not less than two (2) inches at each end of tread and secured by two (2) bolts or rivets to each side rail.

(*f*) Wood cleats shall be housed into rails one-half (½) inch and shall be nailed to each rail with two (2) tenpenny wire nails and bolted with one (1) carriage bolt one-quarter (¼) inch minimum diameter with washer under head and nut.

53. Splice plates.

(*a*) Splice plates shall be of the same width as the material for side rails and should be placed on outside of side rails. Bolts or rivets shall be countersunk on the inside of the rail. All splice plates shall be chamfered at the ends and shall be made of metal not less than three-eighths (⅜) inch in thickness.

(*b*) When metal rails are used the length of the splice plates shall be not less than four (4) times the width of the side rails and not less than three (3) bolts or rivets shall be used each side of joint. Bolts or rivets shall not be less than one-half (½) inch or more than five-eighths (⅝) inch in diameter.

(*c*) Where side rails are of wood the length of the splice plates shall be not less than eight (8) times the width of the side rail and not less than four (4) bolts or rivets shall be used on each side of the joint.

SECTION NO. 6.—CONSTRUCTION.

60. Fixed ladders.

(*a*) Fixed ladders may have either parallel or spreading sides.

(*b*) Fixed ladders in other than vertical position shall have side rails increased in section to provide for possible increase in stress.

(*c*) Fixed ladders shall be firmly secured in position in accordance with rule 71.

61. Portable ladders.

(*a*) Portable ladders over thirty (30) feet in length shall not be used.

(*b*) All portable ladders should be built with spread side rails. The width between side rails at base shall in no case be less than eleven and one-half (11½) inches for ladders up to and including ten (10) feet in length. For longer ladders this width shall be increased at least one-quarter (¼) inch for each additional foot of length.

(*c*) Rectangular wood side rails may have an end depth of not less than two and one-quarter (2¼) inches and shall have center cross section to conform to rule 50.

(*d*) Portable pole ladders shall be built with minimum dimensions of side rails as follows:

Length of side rail (feet).	Dimensions of side rails.			
	Bottom.		Top.	
	Thickness (inches).	Depth (inches).	Thickness (inches).	Depth (inches).
Up to and including 12.....	1½	2¾	1⅜	2½
Over 12 up to and including 18..	1⅝	3	1⅜	2¾
Over 18 up to and including 22..	1¾	3½	1½	2¾
Over 22 up to and including 30..	1⅞	3⅜	1⅝	3

(*e*) *Nonslip bases.*—All portable ladders should be equipped with nonslip bases when such bases will decrease the danger of slipping.

NOTE.—The conditions under which nonslip bases will prevent slipping are subject to such variation that dependence should not be placed on them as a substitute for care in placing or lashing or someone to hold the ladder, especially upon oily metal or concrete surfaces.

(*f*) Hooked tops which will fit over shaftings, etc., shall be used on portable ladders where working conditions permit.

62. Extension ladders.

(*a*) Side rails of extension ladders when fully extended shall conform to dimensions under rule 50 for such extended length.

NOTE.—As a matter of information, on two-piece extension ladders it is customary to allow 3-foot lap up to approximately 38 feet, a 4-foot lap for 40 and 44 feet extended lengths, and a 5-foot lap for 46 feet and up. For 3-section ladders 4 feet is allowed at each lap for 46 feet and up of extended length.

(*b*) The minimum distance between side rails at base of bottom section of extension ladders shall be as follows:

Length of ladder extended (feet).	Distance (inches).
Up to and including 23	14½
Over 23 up to and including 36	17
Over 36 up to and including 55	20

(*c*) Bottom section of extension ladders may be made with spread side rails.

(*d*) Each ladder shall be equipped with two (2) automatic locks of an approved type. Locks shall be of such construction as to make the extension ladder equal in strength to a ladder constructed of continuous side rails.

(*e*) All parts of the lock shall be of malleable iron or other approved material, except spring and bushing which shall be of noncorrosive material.

(*f*) Locking devices other than as specified herein may be used after being approved for such service.

(*g*) The ladder shall be equipped with a metal shackle and pulley.

63. Fire ladders.

(*a*) Fire ladders shall be painted red and plainly marked "For fire purposes only."

(*b*) Fire ladders shall be built in accordance with rule 60 or rule 61, as installation requires.

64. Stepladders.

(*a*) Stepladders over twenty (20) feet in length shall not be used.

(*b*) Stepladders shall have side rails of the following minimum solid cross section or a section equivalent thereto in strength.

Length of side rail (feet).	Front section.	
	Thickness (inches).	Depth (inches).
Up to and including 10	1⅛	2⅝
Over 10 up to and including 12	1⅛	3
Over 12 up to and including 16	1⅛	3¼
Over 16 up to and including 20	1	3½

(*c*) Stepladders shall be so constructed that when in the open position the front section shall have a minimum slope of three and one-half (3½) inches and the back section a minimum slope of two (2) inches, for each twelve (12) inch length of side rail.

Stepladders shall be so constructed that when in the open position the front section shall have level treads.

(*d*) The minimum width between side rails at top step, inside to inside, shall be not less than twelve (12) inches with a spread of at least one (1) inch for each foot of length of stepladder.

(*e*) An automatic locking device or spreader to hold the front and back sections securely in open position shall be a component of each stepladder. This device shall have all sharp points covered to protect the user.

(*f*) The back section of the stepladder if provided with steps shall be built as per dimensions required by rule 50. If not provided with steps the back section shall be built with side rails and bracing necessary to provide for all possible stresses in this section.

65. Trolley ladders.

(*a*) Ladders over twenty (20) feet in length should not be used.

(*b*) Side rails shall have a minimum cross section of the following dimensions:

Length of side rails (feet).	Thickness (inches).	Depth (inches).
Up to and including 10.....	¾	3
Over 10 up to and including 20.....	¾	3½

(*c*) Locking devices shall be provided on all trolley ladders to prevent them from accidentally moving under the weight of the operator.

(*d*) *Tracks.*—Tracks shall be iron, wood, steel or a combination of these materials.

Tracks for the top end of ladders shall be fastened securely to the ceiling or into framework and shall be so constructed that it is impossible for the wheels to jump the track. Tracks shall be so designed as to provide for all possible strains to which they will be subjected.

Tracks for the bottom end of ladders shall be securely fastened and properly designed to provide for any strains to which they may be subjected.

(*e*) *Wheel carriages.*—Wheel carriages shall be so designed as to provide for all strains to which they may be subjected.

The wheel carriage for the top end of the ladder shall be securely fastened to the top of the ladder with metal brackets bolted either to the side rails or to the top step. When bolted to the top step this step shall be secured to the side rails with metal braces additional to those otherwise provided. This wheel carriage shall be so designed that a loose or broken wheel will not allow the ladder to drop.

The wheel carriage for the bottom end of the ladder shall be securely fastened.

(*f*) *Wheels.*—The wheels at the upper end of the ladder shall have a minimum wheel base of eight (8) inches.

When wheels are used at the bottom of the ladder there shall be at least one wheel supporting each side rail.

66. Sectional ladders.

(*a*) The number of sections shall not exceed eight (8), and whenever four (4) sections or more are used in any combination same shall be securely braced.

(*b*) The connection joint shall be not less than one (1) foot. The grooved ends of the sections shall be reinforced with a metal plate of not less than No. 18 United States gauge properly secured thereto and a rivet above the groove extending through the depth of the rail or equivalent.

(*c*) The minimum cross section and distance between side rails shall be as follows:

Number of sections.	Side rails.		
	Cross section.		Distance (inches).
	Thickness (inches).	Depth (inches).	
Up to and including 4 sections.....	1⅛	2¾	13
Over 4 sections up to and including 6.	1⅛	3¼	20
Over 6 sections up to and including 8.	1⅛	3¾	24

(*d*) If the length of sections exceeds six feet four inches (6′ 4″) the side rail cross section shall be increased to correspond.

67. Trestle ladders and extension trestle ladders.

(*a*) Trestle ladders over twenty (20) feet in length should not be used.

(*b*) Base sections over twenty (20) feet in length shall not be used in connection with extension trestle ladders.

(*c*) Side rails of base ladders shall have a minimum cross section of the following dimensions:

Length of side rails (feet).	Thickness (inches).	Depth (inches).
Up to and including 12.....	1⅛	2⅝
Over 12 up to and including 16.....	1⅛	2¾
Over 16 up to and including 20.....	1⅛	3¼

(*d*) The extension section shall be built to conform with the specifications for portable ladders, rule 61, except that it shall have parallel side rails.

(*e*) Trestle ladders and base ladders shall be constructed with side rails spread as specified in rule 50 (*e*) and with a base spread when open as specified in rule 64 (*c*).

(*f*) Bearings shall be equivalent in strength, wear, and construction to the specifications for steps, rule 51. Bearings shall not exceed sixteen (16) inches on centers. Top of side rails shall be cut on bevel, or other means shall be provided to prevent them from spreading.

(*g*) A locking device or spreader, to hold the front and back base ladders securely in an open position, shall be a component part of each ladder.

(*h*) The locking device for securing the extension section to the base shall be of an approved design.

SECTION NO. 7.—INSTALLATION.

70. Clearances.

(*a*) Distance from front of rungs to nearest permanent object on the climbing side of the ladder shall be not less than thirty (30) inches. Distance from back of rungs to nearest permanent object shall be a minimum of six and one-half (6½) inches. There shall be a clear width of at least fifteen (15) inches from centers on either side across the front of the ladder. (Ladders equipped with cage (basket) or the equivalent shall be excepted.)

71. Fastenings.

(*a*) Fastenings shall be made of material equivalent in strength to the rails and shall be of sufficient length to allow a minimum distance, as per rule 70, between buildings and rungs of ladder. Fastenings shall be made to the permanent structure either by building in or by through bolts, rivets, or expansion bolts grouted or leaded.

(*b*) The maximum distance between fastenings or braces shall not be in excess of ten (10) feet in ladders over fifteen (15) feet in length, or other provision giving equivalent security shall be provided.

72. Pitch.

(*a*) The pitch of a fixed ladder shall not be such that a man's position is necessarily below the ladder when climbing, unless a cage guard is provided.

(*b*) Portable ladders shall not be used with a pitch such that the horizontal distance from wall to foot of ladder shall exceed one-quarter (¼) length of ladder unless it is braced, fastened, or held so as to prevent slipping.

73. Maintenance.

(*a*) Each ladder should be serially numbered or otherwise identified.

(*b*) A system of regular inspection should be maintained.

SECTION NO. 8.—ACCESSORIES.

80. Cages.

(*a*) A cage or basket guard should be placed on permanent fixed ladders of twenty (20) feet or more in length.

(*b*) Cages when used shall extend from top of ladder to a point seven (7) feet above the base, with bottom flared four (4) inches, or portion of cage opposite ladder shall be carried to the base.

(*c*) Cages shall be substantially built and securely fastened to the ladder. The inside shall be clear of projections.

(*d*) Cage shall extend not less than twenty (20) inches nor more than twenty-four (24) inches from face of ladder. Cage should be not less than twenty-four (24) inches in width.

81. Landings.

(*a*) All ladder landings shall be equipped with standard hand rails and toe guards so arranged as to give the safest possible access to the ladder. Such platforms shall be not less than twenty-four (24) inches in width.

82. Landing extension.

(*a*) Ladders to landings should extend a distance of at least forty-five (45) inches above the landing, preferably being goose-necked. The rungs may be omitted above a roof. Where a man must step a greater distance than eighteen (18) inches from ladder to roof, tank, etc., a landing shall be provided. Top rung shall not be below roof or landing.

83. Breaks.

(*a*) If fixed ladders are used to ascend to heights exceeding thirty (30) feet, landing platform should be provided for each thirty (30) feet or fraction thereof.

SECTION NO. 9.—OPERATION.

90. Safe practices.

(*a*) Ladders for use by individuals or under supervision shall be utilized as follows:

Crowding on ladders shall not be tolerated.

Portable ladders shall be so placed that both side rails shall have secure footing.

Portable ladders shall be placed in position with neither too small nor too great an angle (see also rule 72 (*b*)).

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

Ladders should be provided with a board across the top before placing against window frames.

Ladders should be "faced" when ascending or descending, and both hands free for use.

Short ladders shall not be spliced together to provide long sections.

(*b*) Ladders with weakened, broken or missing steps, or broken side rails shall not be used.

(*c*) Ladders made by fastening cleats across a single rail shall not be used.

(*d*) Ladders for building construction more than two (2) stories in height, or where traffic is heavy, shall be separately designated for ascent and descent.

(*e*) Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous. Do not use."

(*f*) Ladders should be stored in such manner as to provide ease of access or inspection, and to prevent danger of accident when withdrawing a ladder for use.

(*g*) Ladders stored in horizontal position should be supported at a sufficient number of points to avoid sagging and permanent set.

(*h*) Ladders should be kept coated with suitable preservative material. Linseed oil covered with shellac is preferable for wood ladders.

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