TEST REPORT

On Behalf of

ZHEJIANG LEADER INDUSTRY & TRADE CO., LTD

FIBERGLASS EXTENSION LADDER

Model: AY-FL212, AY-FL216, AY-FL220

Prepared For : **ZHEJIANG LEADER INDUSTRY & TRADE CO., LTD**
2TH FLOOR BUILDING 6, NO. 8 LONGTAI ROAD, LONGSHAN TOWN YONGKANG JINHUA, ZHEJIANG PROVINCE, CHINA

Prepared By : **Eport (ShenZhen) Electronics Co., Ltd.**
Rm 5-508, Haibin City Plaza, 46 Section, Baoan District, Shenzhen, P. R. C

Date of Test	:	**October 08-November 22, 2023**
Date of Report	:	**November 23-24, 2023**
Report Number	:	**EPTC-LD-S2311772**

TEST REPORT

ANSI-ASC A14.2-2017

American National Standard for Ladders

– Portable Metal – Safety Requirements

Testing laboratory…… :	Eport (Shenzhen) Electronics Co., Ltd.
Address…… :	Rm 5-508, Haibin City Plaza, 46 Section, Baoan District, Shenzhen, P.R.C
Testing Location…… :	Eport (Shenzhen) Electronics Co., Ltd. Rm 5-508, Haibin City Plaza, 46 Section, Baoan District, Shenzhen, P.R.C
Applicant…… :	ZHEJIANG LEADER INDUSTRY & TRADE CO., LTD
Address…… :	2TH FLOOR BUILDING 6, NO. 8 LONGTAI ROAD, LONGSHAN TOWN YONGKANG JINHUA, ZHEJIANG PROVINCE, CHINA
Type of test object…… :	FIBERGLASS EXTENSION LADDER
Trademark…… :	N.A
Model/type reference…… :	AY-FL216
Rating (s) …… :	Max Load: 330 LBS IAA
Standard…… :	ANSI-ASC A 14.5-2017
Test Result…… :	Compliance with ANSI-ASC A 14.5-2017
Procedure deviation…… :	N.A.
Non-standard test method…… :	N.A.
Manufacturer…… :	ZHEJIANG LEADER INDUSTRY & TRADE CO., LTD
Address…… :	2TH FLOOR BUILDING 6, NO. 8 LONGTAI ROAD, LONGSHAN TOWN YONGKANG JINHUA, ZHEJIANG PROVINCE, CHINA

General remarks

This report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item(s) tested.

“(see appended table)” refers to a table appended to the report.

“(see remark #) refers to a remark appended to the report.

“(see Annex #) refers to a annex appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

Remark :

1. All models are the same material and load capacity(max. 330LBS).
2. All tests were carried out the model AY-FL216 unless their special;
3. Photo of samples: (See appendix 1 & appendix 2).

Possible case verdicts :	
Case does not apply to the verdict object …….. :	N (.A.)
Verdict object does meet the requirement ……:	P(ass)
Verdict object does not meet the requirement … :	F(ail)

Name and address of the testing laboratory: **Eport (Shenzhen) Electronics Co., Ltd.**
Rm 5-508, Haibin City Plaza, 46 Section, Baoan District, Shenzhen, P.R.C

Reported by : _____ November 24, 2023
Signature Date

Mark Zhang / Project Engineer
Name and Title

Approved by : _____ November 24, 2023
Signature Date

Eliza Chen / Manager
Name and Title

ANSI-ASC A14.5-2017			
Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
5	**General Requirements**		**P**
5.1	**Flare**		**P**
	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.		**P**
5.2	**Side rails**		**P**
	The design of the side rails shall be such as to ensure a product that will conform to the requirements of this standard.	Meet the standard requirement	**P**
5.3	**Rung and Step Spacing**		**P**
	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, articulated extendable, and combination ladders, the 12-inch spacing shall be maintained across hinged sections.	Meet the standard requirement	**P**
	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 inch below the top cap, provision should be made to restrict inadvertent stepping into the opening.		**N/A**
5.4	**Rung Connections**		**P**
	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, or fastened with a locking type bolt or other permanent means.		**P**
5.5	**Rungs, Steps, and Platform**		**P**
	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		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	function.		
5.6	**Hardware**		**P**
	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.		**P**
5.7	**Burrs, Bolts, Rivets, and Welds**		**P**
	All workmanship shall be free from burrs in excess of 1/64 inch.		**P**
5.8	**Angle of Inclination**		**N/A**
	The angle of inclination for single, extension, articulated, articulated extendable, telescoping, and combination ladders when used as a single ladder, shall be 75-1/2°. The angle of inclination for articulated, articulated extendable, and combination 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, articulated extendable, or combination ladders using steps, this angle may range from 70° to 75-1/2°, to the extent necessary to permit the step surface of the steps to be horizontal (level).		**N/A**
5.9	**Plastic Top Caps**		**N/A**
	Molded 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.		**N/A**
5.10	**Plastic Parts**		**P**
5.10.1	Plastic Components.		**P**
	Plastic components shall be manufactured in a controlled process yielding good commercial workmanship of the parts. Finished components shall meet specified dimensions, possess a minimum of shorts and voids, and be reasonably free from distortion or warping, discoloration and excessive sink marks or parting line flash.		**P**
5.10.2	Specifications		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Specifications of the particular plastics used are the responsibility of the manufacturer, who shall give consideration that certain requirements are achieved. If deemed necessary by the manufacturer, an expiration date will be molded into the product. Under these conditions, appropriate labeling on the product shall be provided informing the user of the location of the expiration date and the danger of the product collapsing if used after that date. Products and/or components shall be designed to exhibit satisfactory structural integrity, thermal stability and resistance to chemical exposure that could be expected in typical use environments. Unless labeled for indoor use only, it shall also exhibit resistance to corrosion (oxidation), outdoor weathering and meet the performance requirements of this standard.		**P**
5.10.3	Chemical Resistance		**P**
	Plastic materials produced by any method, including, but not limited to casting, hot molding, cold molding, laminated resinous products and sheet material should be tested for those chemical reagents identified by the manufacturer in accordance with ASTM D543. The type of conditioning depends on the end-use of the product. If the product being tested is intended for use in constant contact with various chemical reagents, the Immersion test method shall be used. If the product may be used in close proximity of, or will only see short exposure to reagents, the Mechanical Stress test method shall be used.		**P**
5.10.4	Weatherability		**P**
	If product is intended for outdoor use, adequate ultraviolet inhibitors shall be incorporated. One preferred system is a minimum of 0.25% by weight of HALS (Hindered Amino Light Stabilizer) and 0.12% antioxidant. All filled thermo-plastics shall have the appropriate coupling agents incorporated.		**P**
6.	**Specifications**		**P**
6.1	**Stepladders**		**N/A**
6.2	**Single and Extension Ladders**		**P**
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.		**N/A**

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Clause	Requirement - Test	Result - Remark	Verdict
6.2.2	Extension Ladder Width. The minimum inside clear width of the base, fly or intermediate section shall not be less than 12 inches. The minimum inside clear width 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	Up to and including 28 Meet the requirement	P
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.	Special duty - Type IAA Two-Section Meet the requirement	P
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. **Table 1** **Single and Extension-Ladder Size** **Duty Rating and Type** / **Single Ladder (feet)** / **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 — –	Special duty - Type IAA Two-Section Meet the requirement	P
	Extension ladders shall be marked to indicate both the total length of sections and the maximum extended length or maximum working length.		P

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
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. **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		**P**
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.	Up to and including 32 Two Section Meet the requirement	**P**
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.	spring-action rope-operated	**P**
	A section incorporating locks that result in the elimination of a rung in the section or one not intended 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:		**N/A**
	Caution — This Ladder Section is not Designed for Separate Use		**N/A**
	*labels qualify as permanent markings provided they comply with Section 8.6.		**N/A**
	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.		**N/A**
6.2.8	Rope and Pulley.		**N/A**
6.2.8.1	Extension ladders 20 feet and longer shall be equipped with a rope and pulley.		**N/A**
	The pulley shall be attached to the ladder in such a manner as not to weaken either the rungs or the side rails.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Fastening means to secure the pulley shall not be construed as weakening the rungs, provided the rungs meet the applicable rung bending strength test.		**N/A**
	The pulley shall be not less than one inch in diameter, measured at the base of the sheave.		**N/A**
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.		**N/A**
	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.		**N/A**
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.		**P**
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.	Meet the requirement	**P**
	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.	Meet the requirement	**P**
	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	Meet the requirement	**P**
6.3	**Trestle (Double Front) and Extension Trestle Ladders**		**N/A**
6.4	**Platform Ladders**		**N/A**
6.5	**Combination Ladder**		**N/A**
6.6	**Step Stools (Ladder Type)**		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
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 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.)		**N/A**
6.6.2	Slope. Slop is the angle of ht 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 front section is not less than four inches (i.e. angle with respect to horizontal ≤ 71 1/2°), and the slope of the back section is not less than 2-1/2 inches (i.e. angle with respect to horizontal ≤ 78°), foreach12-inch length of side rail.		**N/A**
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.	Inside clear width at the top step:10.5 inches. Outside width at the top cap: 11.8 inches. From top to bottom the spread between the side rails increase are meet the requirement.	**N/A**
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.	Meet the standard requirement	**N/A**
6.6.5	Step width. The minimum width of the step or tread shall be 3 inches.	Meet the requirement	**N/A**

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

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
6.6.6	Back section. The back section may be designed with any type of rear braces as it meets the General and Test requirements (See Section 7)		**N/A**
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 ht projected area outlined by the cross section of the end of the rail.	Meet the requirement	**N/A**
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.	Meet the requirement	**N/A**
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 nt 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.	Meet the requirement	**N/A**
6.7	**Articulated and Articulated Extendable Ladders**		**N/A**
6.7.1	Size		**N/A**
	When the 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:		**N/A**

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

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	When the 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 Covered 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		**N/A**
6.7.2	Slope		**N/A**
	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 and articulated extendable 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 (i.e. angle with respect to horizontal ≤ 73 1/2°), and the slope of the back section is not less than 2 inches (i.e. angle with respect to horizontal ≤ 80 1/2°), for each 12-inch length of side rail.		**N/A**
	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.		**N/A**
6.7.3	Width and Spread		**N/A**
	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.		**N/A**
6.7.4	Steps and Rungs		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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.		**N/A**
6.7.5	Step Width and Rung Diameter		**N/A**
	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. 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.		**N/A**
6.7.6	Bucket (Pail) Shelves		**N/A**
	Where bucket shelves are provided they shall be in compliance with Section 6.1.6 and 7.5.5 test requirements.		**N/A**
6.7.7	Feet		**N/A**
	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.		**N/A**
6.7.8	Articulated Joints		**N/A**
	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 setlocking 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.		**N/A**
6.7.9	Worktable Position		**N/A**
	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.		**N/A**
6.7.10	Extendable Sections		**N/A**
	The lock tabs for any extendable sections shall visibly indicate whether they are locked or unlocked.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
6.7.11	Scaffold Position		**N/A**
	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		**N/A**
6.7.12	Overlap or Bearing Length		**N/A**
	No specific overlap between sections is required. The ladder shall meet all performance requirements.		**N/A**
7.	**Fiberglass Material Specifications for Ladders**		**P**
7.1	**General**		**P**
	The material shall be a fully cured composite consisting of a good commercial grade thermosetting polyester resin reinforced with glass fibers. Specification of the particular resin and reinforcements to be employed are the responsibility of the material manufacturer. However, the selection shall consider the following end-use requirements:		**P**
	Resins and reinforcements, or combinations thereof, other than those specified in this standard, may be used as long as the ladder meets the performance requirements established in Section 8.		**P**
	This option is allowed even when laboratory coupon test results do not comply with the values in Tables 5 and 6, with the provision that the minimum percent retention of condition-A coupon values shall be 75 percent after either wet or weather-cycle tests and shall be 60 percent after 150°F temperature tests.		**P**
7.2	**Manufacturing Process**		**P**
	A continuous open-end molding process, such as the pultrusion method of manufacture, may be used to make the composite. The product of any process, which meets the performance requirements in Section 8 of this standard, may be employed.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The material shall be smooth, clean, uniform in color, and reasonably free from conducting particles, foreign materials, pits, cracks, voids, chips, sink marks, delaminations, blisters, and scratches, in accordance with good commercial practice.	The materials is smooth, no pits, cracks, voids, chips, sink marks, delaminations, blisters, and scratches,	**P**
	The distribution of filler, additives, or glass fiber shall be in accordance with good commercial practice.		**P**
	The material shall be free of resin-rich and resin-starved areas, and there shall be no evidence of significant reinforcement shifting, wrinkles, bunching up, or density variation within a length.	The material is free of resin-rich and resin-starved areas, no evidence of significant reinforcement shifting, wrinkles, bunching up, or density variation within a length.	**P**
7.3	**Reinforcements**		**P**
	Glass-fiber reinforcements may consist of any combination of mat, roving, cloth, or fabric of type “E” glass with a silane or equivalent water-resistant finish.		**P**
	The amount, selection, distribution, and orientation of the glass reinforcements shall ensure compliance with the requirements of this standard. Effective process controls shall be employed.	Meet this standard requirement	**P**
	A complete enveloping surface layer continuous-strand mat, continuous-filament reinforcing mat, surface veil, nonwoven fibrous fabric, or equivalent material may be provided for added weathering resistance.		**P**
	It may consist of type “A,” “C,” or “E” glass, or a polyester staple fiber. Alternate materials or other techniques that provide an equivalent or greater weathering resistance may be employed.		**P**
	The reinforcement design shall provide bi-directional strength in the composite.		**P**
7.4	**Resin, Filler, and Additives**		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The resin shall be chosen after considering its structural, electrical, thermal, and outdoor weather-resistant characteristics.		**P**
	An ultraviolet screen or absorber shall be employed unless the specific resin system provides equivalent ultraviolet resistance.	Meet the requirement	**P**
	Fillers, lubricants, curing agents, and other additives shall be selected after considering their effect on the composite's electrical, thermal, outdoor weather resistance, water absorption, and structural properties.	Meet the requirement	**P**
7.5	**Color**		**P**
	The particular ingredients in the pigmentation employed shall be light stable and have no detrimental effect on the composite's weathering, thermal, electrical, or structural properties.	Meet the requirement	**P**
7.6	**Special Requirements**		**N/A**
	Composites may be modified for specific situations. Adverse environments involving conditions such as corrosion, high humidity, sunlight, cold, heat, or erosion may require a special resin, a unique enveloping material, an exterior finish, or a combination thereof. The resulting product shall meet the requirements in Section 8 of this standard.		**N/A**
	The specification of criteria for nonflammability may result in impairment of other properties.		**N/A**
7.7	**Product Cure**		**P**
	The composite shall be cured sufficiently to attain the physical and mechanical properties specified in section 7.9.		**P**
7.8	**Fabrication Properties**		**P**
	The material shall be capable of being bored, punched, drilled, and riveted without splitting or delaminating when these operations are performed in accordance with accepted tooling practice for glass-reinforced plastics.	The material be capable of being bored, punched, drilled, and riveted without splitting or delaminating	**P**
	A drift pin test, with the pin tapered to 1.04 times the whole diameter, shall be used to determine satisfaction of these requirements.		**P**
7.9	**Physical and Mechanical Properties**		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The laboratory tests specified in 7.9.1 through 7.9.5 are designed to measure the properties of ladder-rail composites.		**P**
	This standard addresses ladder rails, in particular.		**P**
	The intent expressed in this standard shall be applicable to other shapes and ladder components.		**P**
7.9.1	Typical Physical Properties.		**P**
	Density shall be 0.065 lb/in3 with a tolerance of ±10%, in accordance with American National Standard Test, ANSI/ASTM D792-2000.	Meet the requirement	**P**
	Water absorption shall be 0.75% maximum, in accordance with ASTM D229-2001, Testing Rigid Sheet and Plate Materials Used for Electrical Insulation.1	Meet the requirement	**P**
	Density may vary with composite design. These are average values based upon the composite's cross section.		**P**
7.9.2	Material Properties — Dry.When dry, the composite shall meet the mechanical properties specified in Tables 5 and 6. The test specimens shall be preconditioned in accordance with condition A of ASTM D709-2001, Specifications for Laminated Thermosetting Materials.2	Meet the requirement	**P**
7.9.3	Material Properties — Wet. Web specimens shall be immersed and maintained in boiling distilled water for a minimum of two hours, removed and immersed in distilled water maintained at room temperature, permitted to temperature stabilize, and tested wet.The mechanical properties of the wet composite shall meet the values established in Tables 5 and 6.	Meet the requirement	**P**
7.9.4	Material Properties — Elevated Temperature. Web or flange specimens, as required, shall be maintained for a minimum of 1/2 hour at an elevated temperature of 150°F and then tested at that temperature. The mechanical properties at 150°F shall meet the values established in Tables 5 and 6.	Further information concerning weathering is given in 7.9.5.1 through 7.9.5.3. Meet the requirement	**P**
7.9.5	Material Properties — Weathering. The mechanical properties of web coupon specimens prepared from the weathered samples shall meet the values established in Table 6 after 1000 hours of exposure to the weathering cycle.	Meet the requirement	**P**
7.10	**Electrical Properties**		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The electrical properties of the reinforced plastic materials shall be determined at the time of manufacture.		**P**
	Note: These tests do not reflect the electrical properties of reinforced plastic ladders owing to the wide variety of reinforced plastic composites, metals, and design possibilities employed in their construction. Consequently, these requirements refer only to the reinforced plastic rail. However, ladders constructed of reinforced plastic rails and metal rungs or steps are designed for use in certain electrical applications.		**-**
7.10.1	AC Dielectric Strength. A full section of 1-inch length of the rail material, as received, shall have a dielectric strength of at least 25,000 volts as determined by the short-time test method given in ASTM D149-2004.	Meet the requirement	**P**
7.10.2	DC Current Leakage. The dc current leakage shall not exceed 90 microamperes when a voltage of 90-kilovolts is applied to electrodes spaced 10 inches apart on a length of rail composite conditioned for 72 hours at 72°F and 60 percent relative humidity.	Meet the requirement	**P**
7.11	**Rail Tolerances**	Meet the requirement	**P**
7.11.1	Weight. The allowable deviation from nominal is ±10 percent.	Meet the requirement	**P**
7.11.2	Straightness. The allowable deviation is as follows: Web bow: 0.030 inch per foot of length. Flange bow: 0.050 inch per foot of length.	Meet the requirement	**P**
7.11.3	Twist. The allowable deviation from straight is 1/4° per foot of length; the maximum for the entire length is 5°.	Meet the requirement	**P**
7.11.4	Flatness. The allowable deviation is 0.008 inch per inch of dimension measured.	Meet the requirement	**P**
7.11.5	Angularity. The allowable deviation from 90° is ±2°.	Meet the requirement	**P**
7.11.6	Cut Lengths. The allowable deviation is -0 to +1/4 inch from the specified length.	Meet the requirement	**P**
7.11.7	Squareness of End Cut. The allowable deviation from square is ±1°.	Meet the requirement	**P**
7.11.8	Cross-Sectional Dimensions. The allowable deviations from the nominal dimensions are as follows:	Meet the requirement	**P**
	Thickness: ±5% or ±0.010 inch, whichever is greater. Width: ±1% or ±0.030 inch, whichever is greater, when measured at right angles to the web.	Meet the requirement	**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Depth: ±1% or ±0.030 inch, whichever is greater, when measured adjacent and parallel to the web.	Meet the requirement	**P**
7.12	**Flexural Modulus Requirement**		**P**
	The apparent flexural modulus of the composite when tested in full section shall be 2.8x 106 psi (pound-force per square inch) minimum. This value shall be based upon testing in horizontal bending a centrally loaded beam on a nominal span-to-depth ratio of 36.5 to 1. This ratio should not be less than 32 to 1 or more than 40 to 1. Nominal dimensions shall be employed in all calculations.		**P**
	A 375-pound load is used when testing Type-IAA ladders; a 300-pound load is used when testing Type-IA ladders; a 250-pound load for Type I ladders; a 225-pound load for Type II ladders; and a 200-pound load for Type III ladders. A lower or higher maximum test load may be employed where section design or endpoint application requires such a change.	Type- IAA 375-pound	**P**
7.13	**Process Control Requirements — Rail**		**P**
	The producer shall monitor his process by periodically deflecting lengths of rail under a specified load and measuring the deflection. If the deflection is less than the specified value and there is no test failure, the lot is acceptable.		**P**
7.13.1	Single and Extension-Ladder Rail Bending Strength Test. The rail shall be tested with the X-X axis1 horizontal (web vertical) and should be laterally supported during test at intervals of 12 inches. The span shall be the maximum length of a rail based upon the endpoint application, less nominally 1 foot. A load shall be applied that induces a bending moment simulating the bending moment encountered in use, thus ensuring that the rail meets the strength requirements of this standard for the maximum length and required overlap.		**P**
7.13.2	Tensile Strength Test.The rail shall have a minimum tensile strength of 30,000 psi when tested in bending with the Y-Y axis2 horizontal, flanges turned down, and laterally unsupported. The test span shall be four feet with a minimum six-inch overhang at each support.		**P**
7.13.3	Compressive Strength Test. The rail shall have a minimum compressive strength of 20,000 psi when tested in bending with the Y-Y axis horizontal, flanges turned up, and laterally unsupported. The test span shall be four feet with a minimum six-inch overhang at each support		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
7.13.4	Flexural Modulus Test.		
	Two rails shall be tested in a loading fixture in which the flanges point inward (toward each other) and lateral restraints are provided on a uniform 12-inch spacing each side of center.		**P**
7.13.4.1	Single and Extension Ladders.The procedure, load, and basic equation specified in 7.12 shall apply. Twice the bending moment described in 7.13.1 shall be employed, as two rails are used. This test method shall be used only until a ladder manufacturer can build and test a ladder rail according to the requirements of 7.12. This procedure obviates the need to perform the bending strength test described in 7.13.1.		**P**
7.13.4.2	Stepladders. The procedure, load, and basic equation specified in 7.12 shall apply. The test span length should provide a span-to-depth ratio limit between 32 to 1 and 40 to 1. The rail deflection shall be determined on the basis of these assumptions, employing the required minimum apparent flexural modulus of 2.8 X 106 psi. The rails in this test shall not deflect more than this amount. This procedure obviates the need to perform the bending strength test described in 7.13.1.		**N/A**
7.13.4.3	Alternate Methods. Other methods of evaluating the flexural modulus may be employed provided they are adequately correlated with the procedure given in 7.12.		**N/A**
7.14	**Quality Control Requirements**		**P**
	Quality control shall be at least the equivalent of the testing recommendations set forth in Appendix C.		**P**
8	**Test Requirements**		**P**
8.1	**General**		**P**
8.1.1	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.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.1.2	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.		**P**
8.1.3	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.		**P**
8.1.4	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.		**P**
8.1.5	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.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.1.6	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 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.		**P**
8.1.7	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.		**P**
8.1.8	The development and ongoing implementation of overall quality control shall be the responsibility of each individual manufacturer.		**P**
8.1.9	Conformance to the design verification test requirements shall be determined 5 minutes after load removal, where applicable.		**P**
8.1.10	The test load shall be applied slowly, using care to minimize dynamic loading and eliminate impact loading during the test.		**P**
8.1.11	Structural Plastics.		**P**
	Note: These are design verification tests for structural plastic components of ladders. These tests are not required for plastic ladder components that are non-structural.		**-**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.1.11.1	**Accelerated Weathering Tensile Tests for Plastic Components**. For the material tensile strength test, tensile coupons of the material shall be prepared and shall comply with ASTM D638. Half of the coupons shall be tested “as received" without any special conditioning. The other half of the coupons shall be tested after exposure to accelerated weathering as defined in Appendix C - “Accelerated Weathering Test Procedure,” for 1,000 hours. Failure occurs when elongation after 1,000 hours is 70% or less of the elongation of the “as received” material. An alternate failure criterion to this 1,000 hour/70% elongation requirement is when the toughness (area under the stress-strain curve) after weathering is less than 70% of the “as received” toughness.		**P**
8.1.11.2	**Cold Impact Test for Plastic Components.** Plastic and reinforced plastic structural components shall be subjected to a cold impact test. The component may be tested as part of a completely assembled product or as a separate component. If tested as a component, the part shall be supported to simulate its assembled (in use) state. The component (or fully assembled product, if applicable) shall be conditioned for 24 hours at -20°F and then be subjected to a 5 ft.-lb. impact from a 1.18 lb., 2" diameter guided steel ball while the component is still at or below the specified temperature. The component shall be positioned so that the plane of impact is perpendicular to the direction of impact. This test shall be performed at any location(s) on the structural component where material type, thickness, bracing, etc. would be suspected of yielding lesser performance. The tested surfaces shall show no signs of through cracking after impact.		**P**
8.2	**Combination Ladder Tests**		**N/A**
	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).		**N/A**
8.3	**Single, Extension, Combination, Articulated and Articulated Extendable Tests**		**P**
8.3.1	Horizontal Bending Test.		**P**
8.3.1.1	Deflection		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The ladder shall be placed in a flat horizontal position, as shown in Fig. 1a. When extension, combination, articulated and articulated extendable ladders are tested, the unit shall be opened to its maximum working length. 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. The unit shall be loaded with the preload shown in Table 10. It shall be applied to the center of the rung nearest to the midpoint 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. Vertical measurements shall be taken of each rail. A deflection test load in accordance with Table 10 shall be applied in the same manner as the preload. Vertical measurements shall be taken of each rail during loading. The deflection of each rail shall be determined as the difference in the vertical measurements. The average deflection shall be determined as the average of the left and right rail deflections. The average deflection shall not exceed the value given in Table 11.		**P**
	Articulated (6-hinge) ladders shall repeat the entire test protocol with the ladder turned over (i.e. so that the central hinge pair faces the opposite direction).		**P**
8.3.1.2	Ultimate Load		**P**
	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 10. The ladder shall sustain the ultimate test load without ultimate failure. 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.		**P**
	When testing extension and combination ladders, the test load shall be sequentially applied at 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.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	When testing an articulated ladder, the test load shall be applied to the center of the rung immediately above the midpoint of the test span.		**P**
	When testing an articulated extendable ladder, the test load shall be applied at four different rung locations: first to the center of the rung immediately above the midpoint of the test span; second to the center of the rung where the inner and outer rungs overlap; third to the center of the rung immediately below where the inner and outer rungs overlap; and fourth to the center of the rung immediately above where the inner and outer rungs overlap, as shown in Fig. 1c.		**P**
	When articulated, articulated extendable, or telescoping ladders have rungs that are symmetric front to back or if the proper climbing side cannot be readily determined from the rung orientation, the horizontal bending test shall be conducted front and back. If the design of the extendable sections of articulated extendable ladders are different, both sections shall be tested.		**P**
8.3.2	Deflection Test		**P**
	The ladder shall be supported and the load shall be applied to the rung closest to the midpoint of the test span, over a 3-1/2 inch width of 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 that contains at least the minimum data shown in Fig. 3, or the equivalent.		**P**
	The ladder shall be preloaded with a 30-pound for one minute before applying the test load. The test load shall be applied for a period of one minute, in accordance with Table 12.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Deflections shall be determined by measurements taken at the ladder location where there is the greatest vertical deflection. For certain ladder styles this may not be at the location where the test load is applied to the rung. As shown in Figures 2b, each side rail vertical measurement from the floor or other reference surface is taken at the extreme outside edge of the ladder width. Each side rail position shall be measured after the preload is removed and before applying the test load, and again 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: $\alpha = \text{arc sine } (\frac{difference\ in\ deflection\ of\ rails}{outside\ width\ of\ widest\ section})$ $= \text{arc sine } (\frac{B-A}{W})$ The ladder shall pass this test without exceeding the values of deflection and angle of twist shown in Table 13.		**P**
8.3.3	Simulated In-Use Inclined Load Test		**P**
	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.		**P**
	The ladder shall be loaded in accordance with Table 14. 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.		**P**
	For Articulated (6-hinge) ladders the entire test protocol shall be repeated with the ladder turned backwards (i.e. turned around so that the central hinge pair faces away from the support surface and the loaded ladder bends in the opposite direction). A separate ladder may be used for each test load application.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	This test shall be used only for design verification. It shall not be employed for quality control or field inspection purposes.		**P**
8.3.4	Hardware Test Requirements		**P**
8.3.4.1	Column and Hardware Load Test		**P**
8.3.4.1.1	Single and Extension Ladders.		**P**
	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.		**P**
8.3.4.1.2	Combination Ladders		**N/A**
8.3.4.1.3	Articulated and Articulated Extendable Ladders		**N/A**
8.3.4.2	Single Lock Load Test		**P**
	Note: This is a design verification test. Not applied to articulated or articulated extendable 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.		**P**
	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).		**P**
	A downward distributed load, in accordance with Table 15, 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 loaded through an equalizer bar over the climbing side of the ladder.		**P**
	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).		**P**
8.3.4.3	Lock Tip Load Test		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Note: This is a design verification test. Not applied to articulated or articulated extendable 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.		**P**
	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.		**P**
	A downward distributed load, in accordance with Table 15, shall be applied for a period of 1 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).		**P**
8.3.4.4	Cyclic Rung-Lock Test		**P**
	Note: This is a design verification test. Not to be applied to articulated, articulated extendable 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: (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		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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.		**P**
	The rung lock may be manually lubricated prior to or during the test. The stroke speed shall be six 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.		**P**
8.3.4.5	Combination Ladder Lock Test		**N/A**
	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.		**N/A**
8.3.5	Rung Bending Strength Test.		**P**
	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.		**P**
	A downward distributed load, in accordance with Table 16, 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) shall not exceed L/K for rung length (L) measured between the inside webs of the attached side rails, in accordance with Table 16 (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. The test load shall also be applied to the longest rungs of different design or material specifications.		**P**
8.3.6	Rung-to-Side-Rail Shear Strength Test		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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).		**P**
	A downward distributed load, in accordance with Table 16, shall be applied for a minimum period of one 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.		**P**
	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. The test load shall also be applied to the longest rungs of different design or material specifications.		**P**
8.3.7	Rung Torque Tests		**P**
	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 17, 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°, for both the design verification test (8.3.7.1) and the in-service test (8.3.7.2)		**P**
	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 17 is reached.		**P**
8.3.7.1	Rung Torque Design Verification Test		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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.		**P**
	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.		**P**
	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-tojoint- to-rail movement).		**P**
8.3.7.2	Rung Torque In-Service Test		**P**
	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 above, using a test bar whose moment arm may vary as long as the required torque test load in inch pounds is obtained, but in no case, however, shall the moment arm be less than 18 inches.		**P**
	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.		**P**
	Both rung joints in the assembly shall meet the pass/fail requirement. Figure 12 illustrates typical methods that are acceptable alternates for performing this test.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	If the In-Service test protocol in this section is used as a design verification test, the torque applied shall be twice that listed in Table 12 for the design verification torque.		**P**
8.3.8	Side Sway Test		**P**
	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, an entire articulated ladder if the sections are not intended to be separated by the user, all separable sections of an articulated extendable ladder with different designs, a fully extended telescoping ladder, 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.		**P**
	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.		**P**
	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 12, 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.		**P**
	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.		**P**
	The deflection of the midpoint of the lower side rail, measured to a reference surface, shall not exceed the deflection listed in Table 18.		**P**
	Each section shall withstand this test without any permanent deformation (set) in excess of 1/1000 of the effective span of the side rails.		**P**
8.3.9	Side-Rail Cantilever Bending Tests.		**P**
8.3.9.1	Static Side-Rail Cantilever Bending Test		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The test unit shall consist of a single ladder section or the base or bottom section of an extension, articulated, articulated extendable, combination ladder, or any other section intended for separate climbing use; 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.		**P**
	The test load shall be applied by means of a weight, in accordance with Table 19, 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 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.		**P**
	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.		**P**
	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.		**P**
8.3.9.2	Side-Rail Cantilever Dynamic Drop Test		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The test unit shall be the longest extension or combination ladder for each base section rail size, and the longest single, articulated, articulated extendable, or telescoping ladder for each rail size. An extension or combination ladder shall be opened one foot for the drop test. An articulated or articulated extendable ladder shall be opened to its longest single ladder size. 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.		**P**
	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.		**P**
	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.		**P**
8.3.10	Ladder Section Twist Test.		**P**
	The test unit shall consist of a ladder base section of any length, supported over a seven-foot test span. If the longest base or articulated extendable ladder section is too short to provide a 7 foot test span, the longest possible test span shall be used. 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 15a. For test spans less than 7 feet in length, the maximum allowable angle of twist shall be reduced by a factor of L/7, where L is the length of the test span in feet. Attention shall be given to ensure that the ladder is tightly clamped onto the test fixtures during this test.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	When testing an articulated ladder or articulated extendable ladder, this test shall be repeated with an articulated joint at mid-span. If more than one articulated joint design is used, each shall be tested. No permanent deformation to any component, which would interfere with the smooth operation of the joint, is permissible.		**P**
8.3.11	Foot Slip Test		**P**
	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 the Plywood Test Surface designated in Section 4, which shall be sanded with new 320 grit sandpaper (garnet or aluminum oxide) and the dust removed with dry compressed air or a clean dry broom. Tests shall be conducted with the ladder feet placed on a clear area of the plywood face (i.e. NOT placed on areas of defects – e.g. pin knots, patches, etc.) The surface that the top of the ladder rests against shall also be the Plywood Test Surface , similarly treated. The ladder feet to be tested shall be cleaned with soap and water, rinsed clean of soap residue, and dried before testing.		**P**
	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.		**P**
8.3.12	Multisection Extending Force Test		**P**
	The test unit shall be a complete extension ladder or an articulated ladder with an extendable 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.		**P**
	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.		**P**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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).		**P**
8.4	**Articulated Ladder Tests**		**N/A**
	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 8.4.1 when in the scaffold or worktable position. In addition, it shall comply with the additional joint tests 8.4.2 through 8.4.5. 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 the Plywood Test Surface designated in Section 4, and shall be sanded with new 320 grit sandpaper (garnet or aluminum oxide) and the dust removed with dry compressed air or a clean dry broom. Tests shall be conducted with all ladder feet placed on a clear area of the plywood face (i.e. NOT placed on areas of defects – e.g. pin knots, patches, etc.). The ladder feet to be tested shall be cleaned with soap and water, rinsed clean of soap residue, and dried before testing.		**N/A**
8.4.1	Scaffold Bending Strength Test		**N/A**
	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 22. 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. All feet of the ladder shall rest on the Plywood Test Surface.		**N/A**
8.4.2	Cyclic Joint Lock Test		**N/A**
8.4.2.1	Articulated Joint		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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 8.3.1 Horizontal Bending Test, 8.3.3 Inclined Load Test, 8.4.3 Unlocked Joint Test, and 8.4.5 Dynamic Joint Lock Tests.		**N/A**
8.4.2.2	Lock Tab		**N/A**
	A full articulated extendable ladder shall be erected in the straight ladder mode with the extendable sections fully retracted (shortest straight ladder mode configuration). The ladder shall be positioned vertically and supported in such a way to prevent movement of the lowermost outer section and allow the inner unsupported sections (i.e. the rest of the ladder) to move downward at least . inch. The cycle can be performed manually or by machine. Use of lubrication is prohibited except for the lubrication applied at time of manufacture.		**N/A**
	The cycle starts with one lock engaged and one disengaged and the full weight of the unsupported ladder sections resting on the lock. Release the engaged lock to the full extent of its travel, allowing the unsupported ladder sections to fall a minimum of . inch. Raise the unsupported ladder sections back to their starting position and engage the same lock that was engaged at the beginning of the cycle. This completes one cycle. After 6,000 cycles, the lock must continue to operate consistent with the manufacturer's instructions. The ladder must pass the Single Joint Lock Test (7.4.4.2) with the cyclic tested lock engaged. Each different design of locking mechanism shall be tested. For designs where both locks are released simultaneously, the test shall be performed with both locks engaged to begin the cycle. For articulated extendable ladders that can only be used in the self-supporting (stepladder) mode, the test shall be conducted with the ladder in the closed position. See Figure 28.		**N/A**
8.4.3	Unlocked Joint Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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.		**N/A**
8.4.4	Single Joint Lock Test.		**N/A**
	The test unit shall be a fully extended ladder set in the single or extension ladder mode, at a 75-1/2° working angle.		**N/A**
8.4.4.1	Articulated Joint		**N/A**
	Unlock one hinge at the midspan pair of articulated joints. A downward distributed load, in accordance with Table 15, 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.		**N/A**
8.4.4.2	Lock Tab		**N/A**
	For an articulated extendable ladder, unlock one lock tab at the lowest pair of extendable section lock tabs. A downward distributed load, in accordance with Table 15, shall be applied for a period of one minute equally to both side rails on the lowest rung above the unlocked lock tab. 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 test shall also be repeated on one lock tab at the highest pair of extendable section lock tabs. The test shall be conducted on each lock tab of different material or design. For articulated extendable ladders that can only be used in the self-supporting (stepladder) mode, the test shall be conducted in the self-supporting (stepladder) mode. The ladder shall withstand this test without ultimate failure. Permanent deformation shall be allowed. See Figure 29.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.4.5	Dynamic Joint Lock Tests		**N/A**
	Each test in this section (8.4.5) shall be conducted on a new and unused ladder, as well as a ladder subjected to the Cyclic Joint Lock Test (8.4.2). The use of additional lubricant during the test is not permissible.		**N/A**
8.4.5.1	Dynamic Joint Lock Test for the Scaffold Position		**N/A**
	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 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 22, 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.		**N/A**
8.4.5.2	Dynamic Joint Lock Test for the Straight Ladder Position		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	This test is for articulated and articulated extendable ladders that have approved use in the straight ladder position. This test also applies to telescoping ladders. The ladder shall be opened to a straight position, with the extendable sections extended to maximum length. 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 22, 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. 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.		**N/A**
8.4.5.3	Dynamic Joint Lock Test for the Stepladder Position		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	This test is for articulated and articulated extendable ladders that have approved use in the stepladder position. The ladder shall be set in the stepladder position, with the extendable sections extended to maximum length. 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 22, 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. 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.		**N/A**
8.5	**Step, Trestle (Double Front), Extension Trestle, Platform, Combination, Articulated, Articulated Extendable Ladder and Step Stool Tests**		**N/A**
8.5.1	Compression Test		**N/A**
	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, articulated ladder, and fully extended articulated extendable 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, articulated, and articulated extendable 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 16 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.		**N/A**
8.5.2	Side-Rail Bending Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The resistance to side-rail bending shall be tested by placing a load, in accordance with Table 16, 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 ladder may be repositioned with a preload applied, not to exceed the duty rating, before the load is increase to the full test load. The next higher step shall also be tested. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in its stepladder position. The ladder shall withstand the load without test failure.		**N/A**
8.5.3	Step or Platform Bending Test		**N/A**
	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.		**N/A**
8.5.4	Step-to-Side-Rail Shear Strength Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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 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.		**N/A**
8.5.5	Bucket (Pail) Shelf Test		**N/A**
	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.		**N/A**
8.5.6	Front Stability Test		**N/A**
	The ladder shall be set in the open position on a level floor. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in 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.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 23, 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 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, to the uppermost horizontal member of articulated and articulated extendable 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.		**N/A**
	During this test, the minimum load that causes the ladder to tip over shall not be less than the value shown in Table 23 Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position		**N/A**
8.5.7	Side Stability Test		**N/A**
	The side stability of a ladder shall be measured with the ladder set in an open position on a level floor. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in its stepladder position. A uniformly distributed load, in accordance with Table 23, 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.		**N/A**
	The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 23, 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, to the uppermost horizontal member of articulated and articulated extendable 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.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	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.		**N/A**
8.5.8	Rear Stability Test		**N/A**
	The rear stability of a ladder shall be measured by placing the ladder in an open position on a level floor. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in its stepladder position. A uniformly distributed load, in accordance with Table 23, 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.		**N/A**
	The ladder shall then be subjected to a horizontal pulling force, in accordance with Table 23, 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, to the uppermost horizontal member of articulated and articulated extendable 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.		**N/A**
	During the test, the minimum load to cause the ladder to tip over shall not be less than the value shown in Table 23. Ladders equipped with a bucket shelf shall be tested with the bucket shelf in the in-use position		**N/A**
8.5.9	Torsional Stability Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in its stepladder position. 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.		**N/A**
	A horizontal force, in accordance with Table 23, directed to the rear of the ladder, shall be applied to the ladder top cap at a distance of 23 inches from the vertical centerline of the ladder, as shown in Fig. 22. For articulated and articulated extendable 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 the Plywood Test Surface designated in Section 4, and shall be sanded with new 320 grit sandpaper (garnet or aluminum oxide) and the dust removed with dry compressed air or a clean dry broom. Tests shall be conducted with all ladder feet placed on a clear area of the plywood face (i.e. NOT placed on areas of defects – e.g. pin knots, patches, etc.). The ladder feet to be tested shall be cleaned with soap and water, rinsed clean of soap residue, and dried before testing.		**N/A**
	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.		**N/A**
	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.		**N/A**
8.5.10	Racking Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.5.10.1	The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. A combination ladder, articulated ladder, or fully extended articulated extendable ladder shall be tested while erected in its stepladder position. 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.		**N/A**
	A vertical pulling force shall be applied to the rear of the ladder top cap, or at the rear of the uppermost horizontal member 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 hall 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 gauge 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 24.		**N/A**
	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.		**N/A**
8.5.10.2	Ladders with Plastic Top Caps	No Top Caps	**N/A**
	A high temperature and a low temperature racking test following the same protocol shall be required for ladders with plastic top caps. For the high temperature test, the top cap shall be conditioned at a temperature at or above 140° F for a minimum of 6 hours. It is permissible for the test to be performed at a lower ambient temperature, provided that the surface temperature of the top cap remains at or above 140° F throughout the test. For the high temperature test a 50 percent greater racking deflection is allowed than in the room temperature test. For the low temperature test, the top cap shall be conditioned at a temperature at or below -20°F for a minimum of 6 hours. It is permissible for the test to be performed at a higher ambient temperature, provided that the surface temperature of the top cap remains at or below -20° F throughout the test. Allowable racking deflection shall not exceed the values given in Table 24 and no fracture of the top cap is permitted.		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
8.5.11	Rail Cantilever Bending Tests		**N/A**
8.5.11.1	Front Rail Static Cantilever Bending Test		**N/A**
	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. All sections intended for separate climbing use shall be tested. Articulated extendable ladders shall be fully extended to their highest stepladder mode position, or alternatively the extendable section shall be removed and tested separately.		**N/A**
	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, articulated, and articulated extendable 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 top of the bottom step. The top surface of the step shall be parallel to the edge of the support.		**N/A**
	The test load shall be applied by means of a weight, in accordance with Table 25, 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 two 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.		**N/A**
	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.		**N/A**
8.5.11.2	Rear Rail Static Cantilever Bending Test		**N/A**

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Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The rear rail cantilever bending strength shall be measured by applying an edgewise load to the bottom end of a rear side rail. A combination ladder, articulated ladder, or fully extended articulated extendable ladder with rear sections not designed for climbing shall be tested while in its stepladder position. 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 25, 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.		**N/A**
	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.		**N/A**
8.5.11.3	Front and Rear Rail Dynamic Drop Test		**N/A**

ANSI-ASC A14.5-2017			
Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The test unit shall be the tallest ladder for each rail size, with the same bottom bracing for each unit tested. Stepladder, combination, articulated, and fully extended articulated extendable ladders 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.		**N/A**
	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.		**N/A**
8.5.12	Rail Torsion and Spreader Test		**N/A**
	The test unit shall be placed on a level floor, in the fully opened position, with the spreaders properly set. Articulated extendable ladders shall be fully extended to the highest stepladder mode position, with all locks 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 and articulated extendable ladders, the horizontal force shall be applied as close as possible to the apex hinge.		**N/A**
	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 the Plywood Test Surface designated in Section 4, and shall be sanded with new 320 grit sandpaper (garnet or aluminum oxide) and the dust removed with dry compressed air or a clean dry broom. Tests shall be conducted with all ladder feet placed on a clear area of the plywood face (i.e. NOT placed on areas of defects – e.g. pin knots, patches, etc.). The ladder feet to be tested shall be cleaned with soap and water, rinsed clean of soap residue, and dried before testing.		**N/A**

ANSI-ASC A14.5-2017			
Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	The test unit shall withstand a horizontal force of not less than the value given in Table 26, without the spreaders or any other locking mechanism 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.		**N/A**
	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. If the ladder is intended to be climbed from either side and the design of each side is different, both sides shall be tested.		**N/A**
8.5.13	Stepladder Slip Test		**N/A**
	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 the Plywood Test Surface designated in Section 4, and shall be sanded with new 320 grit sandpaper (garnet or aluminum oxide) and the dust removed with dry compressed air or a clean dry broom. Tests shall be conducted with all ladder feet placed on a clear area of the plywood face (i.e. NOT placed on areas of defects – e.g. pin knots, patches, etc.). The ladder feet to be tested shall be cleaned with soap and water, rinsed clean of soap residue, and dried before testing.		**N/A**
8.6	**Labeling Tests**		**P**
8.6.1	General		**P**
	The following procedures are designed to evaluate the suitability of primary hazard (danger and warning), 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		**P**

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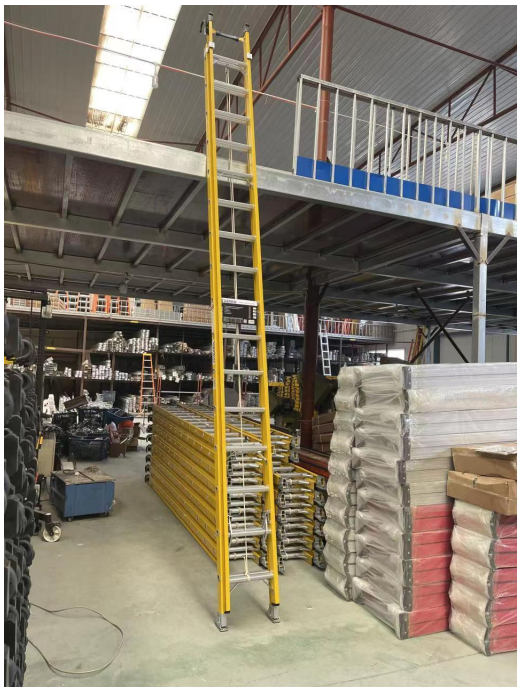
Clause	**Requirement - Test**	**Result - Remark**	**Verdict**
	Unless otherwise specified, the labels are applied to the appropriate surfaces and conditioned for 24 hours at 73°F (±5°F) and 50% relative humidity (±5%). Satisfactory results are needed on 3 samples for each test to fulfill the requirements. 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.		**P**
8.6.2	Tests		**P**
	These tests are all design verification tests and should be performed on standard substrates rather than on actual ladders. These substrates shall be fiberglass pultrusions, classified as GCPF, of 1/8 inch nominal thickness.		**P**
	Labels shall be mounted using a 4-1/2 pound weighted roller and then cured for 24 hours before being subjected to test.		**P**
8.6.2.1	Adhesion Test		**P**
	The test shall be conducted on a new label that has not been subjected to the other tests in 8.6.2, according to ASTM D903-93, Test for Peel or Stripping Strength of Adhesive Bonds.1 A minimum force of 30 ounces shall be required to remove the label.		**P**
8.6.2.2	Scratch Resistance Test		**P**
	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.		**P**
8.6.2.3	Water Immersion Test		**P**
	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.		**P**
8.6.2.4	Oven Aging Test		**P**
	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.		**P**

Appendix 1

The whole views of “FIBERGLASS EXTENSION LADDER”
Model: AY-FL216



Appendix 2

The whole views of “STEEL LADDER”

Other Models

------End of report------