NFPA 1901 & 1906 Revision Highlights

Table of Contents

Preface

NFPA 1901 Standard for Automotive Fire Apparatus and NFPA 1906 Standard for Wildland Fire Apparatus are the guiding documents for apparatus design. As such, Fire Apparatus Manufacturers' Association member companies take a very active interest in their content. Changes made to these documents by the NFPA Apparatus Committee can have significant impact on safety, performance, and cost. The committee (comprised of fire chiefs, industry experts, and manufacturers) has been working on revisions over the last few years and the new versions will take effect on apparatus contracted for after January 1, 2016. In contrast to the 2009 standards updates, the document revisions this time around do not involve dramatic impacts to apparatus design.

Revision Highlights

Here are some highlights of changes included in the 2016 revisions:

Ultra-High Pressure

The use of ultra-high pressure in fire suppression has been promoted by the United States Air Force over the past few years. Recognizing that this technique is gaining popularity in certain applications, the committee defined pump discharge pressures up to 500 psi as "Normal Pressure",

between 500 and 1100 psi as "High Pressure", and over 1100 psi as "Ultra High Pressure (UHP)". A new chapter has been created establishing the minimum requirements of a UHP pumping system.

New Apparatus Familiarization

It is common for new apparatus deliveries to include some degree of familiarization by the apparatus manufacturer or the sales organization. This practice has now been included as a requirement in the standard, with guidance as to what should be covered and the qualifications of the instructor.

Safety Sign Standardization

Originally prompted by Chief Thomas Wood of Boca Raton, the FAMA technical committee developed a series of standardized safety signs covering the common hazards of fire apparatus operation. Chief Wood felt that firefighters were better served by having consistency in the safety messages between rigs, even if they came from different manufacturers. Many of the FAMA signs have been added as requirements in the standards, assuring that safety messages on future apparatus will be consistent across all manufacturers' products. The complete set of FAMA safety signs can be viewed and downloaded from the resource tab at www.FAMA.org.

FAMA Safety Guide

Another FAMA initiative was the creation of the FAMA Fire Apparatus Safety Guide. This guide, now in its second revision, covers safe practices common to all fire apparatus, and is a great resource for safety conscious fire departments. A copy of the FAMA Fire Apparatus Safety Guide will be required to accompany every new apparatus delivery. Fire departments may purchase extra copies of the guide through the FAMA website at www.FAMA.org.

Seat Belt Stalk Length

The ease with which firefighters can buckle their seat belts continued to be a topic of discussion at the committee meetings. One means of making it easier to buckle the belt is to increase the height of the buckle stalk. A higher stalk is easier to reach, but a stalk that is too high reduces the effectiveness of the belt in a crash. After studying the science the committee established a maximum buckle stalk length that it felt will improve accessibility without compromising performance.

Tiller Cab Integrity

In 2009 the standards were revised to mandate cab integrity criteria for large apparatus. The new revisions extend the criteria to tractor-drawn apparatus cabs, providing a similar level of protection for tiller drivers as is mandated for the occupants up front.

Stepping, Standing, and Walking Surfaces
The committee spent considerable time reviewing ways to improve the safety of firefighters climbing and walking on the apparatus. In addition to a few minor adjustments to step requirements, the main change is a requirement to more clearly designate walking surfaces on top of the apparatus. Just as most factory floors include yellow lines to indicate where to walk to stay clear of hazards; new apparatus will include lines of a contrasting color to identify designated walk areas.

Discharge Caps
Pressure relieving caps were introduced about ten years ago, and they have gained in popularity. These caps have grooves cut in the female threads that allow any trapped pressure to escape before the cap is spun off. The committee recognized this feature as a relatively inexpensive way to improve safety and felt these caps should be mandated as a standard for all discharge connections.

Aerial Platforms
Strength requirements for aerial platform handrails and gates have been established. This may drive some noticeable design changes to the traditional platform apparatus basket. Requirements for ladder belt attachments and attachment strength have also been added.

Powered Masts
A section has been added to define minimum standards for the strength and performance of powered masts used for elevating scene lights, antennas, or video cameras. All masts will need to withstand a 50 mph wind without the aid of guy wires with a safety factor 125 percent.

Crew Carriers
A task force within the committee created a new chapter establishing criteria for crew carriers used primarily to transport wildland firefighters. Mandated criteria include structural integrity of the body as well as requirements for seating, doors, compartmentation, and miscellaneous equipment.

On-Board Pump and Roll Fire Fighting
Another major change to the wildland standard is the addition of an on-board pump and roll firefighting position. This optional feature is intended to allow departments in the fine-fuels flatlands regions to spray water from the back of the apparatus while being surrounded by a protective structure. For more details see the FAMA forum article in the February 2015 edition of Fire Apparatus Magazine.

Apparatus Safety through the Years

The following table provides a snapshot of common safety features and NFPA requirements going back in time. Determine the age of your in-service apparatus, and use the table to see the features or NFPA requirements that have been added since your apparatus was built. This will help you determine whether a new purchase or refurbishment should be considered.

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
General	Handrails	Handrail Grip Material	Grip material specified for handrails.		1996	X			X
General	Safety Signs	Warning Labels Specified	Safety improvement through increased identification of hazard areas.		1996	X			
General	Stepping and Walking Surfaces	Slip Resistance Criteria	Interior slip resistance criteria established. Exterior slip resistance criteria established. Testing of surfaces mandated. Documentation of slip resistance mandated.		1999	X			X
General	Steps	Folding Step Standards	Performance standards established. Safety and ergonomics improved.		1999	X			
General	Documentation	Statement of Exceptions	The manufacturer must provide a Statement of Exceptions specifically describing each aspect of the completed apparatus that is not fully compliant with the requirements of the standard at the time of delivery.	4.21	2009	X			
General	Apparatus Familiarization	Manufacturer provides apparatus familiarization	Apparatus manufacturers must provide familiarization on the operations of a new apparatus and aerial device upon delivery. The items that must be covered are detailed in the standard and include chassis, pump, generator, foam system, and aerial device.	4.18.6	2016	X	X		
General	Controls Labeling	Graphical Symbols Standardized	Apparatus manufacturers may use graphical symbols rather than words to describe controls, gauges, intakes, discharges, etcé If graphical symbols are used they must conform to the FAMA standard symbols.	4.10.5	2016	X			
General	Documentation	FAMA Apparatus Safety Guide	One copy of the FAMA Fire Apparatus Safety Guide must be provided with every apparatus. This guide provides safety instructions for operators of fire apparatus. Additional copies may be ordered at FAMA.ORG.	4.20.2.3	2016	X			
General	Safety Signs	Safety Signs Standardized	Standardized FAMA Safety Signs required for specific hazards throughout the apparatus. Provides consistency of safety messages between apparatus regardless of the manufacturer	4.9.4	2016	X			
Aerial	Plumbing	Pinable Waterway	Protects waterway in rescue operations.		1991	X		X	X
Aerial	Safety Interlocks	Safety Interlock Expansion	Unsafe operating conditions avoided. Automatic operation.		1991	X			
Aerial	Strength	Tip Load Standard	Uniform performance standard established. Increased minimum performance.		1991	X			X
Aerial	Ladder Testing	Expanded aerial and ground ladder testing standards	Uniform test standards. Third party test recommendations. Documentation and verification of performance.		1996	X		X	X
Aerial	Load Chart	Overload Documentation	Informs operator of potentially unsafe operating conditions.		1996	X			
Aerial	Plumbing	Waterway Performance	Improved range of stream. Faster fire knock-down. Fewer appliances required.		1996	X			X
Aerial	Safety Interlocks	Aerial Interlocks	Interlocks to reduce possibility of operator error. Safety ensured.		1996				
Aerial	Warning Device	Aerial Stabilizer Warning	Provides audible and visual warning of stabilizer movement and deployment.		1996	X			
Aerial	Breathing Air	Aerial Mounted Breathing Air Standards	Uniform construction standard. Low air warning system. Air duration improved. Serviceability improved.		1999	X	X		X
Aerial	Controls	Aerial Multiplex Systems	Aerial information display. Serviceability improved. Envelope control avoids collision damage.		1999	X	X	X	X

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Aerial	Controls	Aerial Tip Controls	Control ladder at tip for better firefighter control.		1999	X			X
Aerial	Controls	Short Jack Limitation	Range of operation defined. Narrow street and alley accommodation. Tip-over potential reduced.		1999	X			X
Aerial	Operation	Slide Mechanism	Smoother operation.Serviceability improved.Durability improved.		1999	X	X	X	X
Aerial	Operation	Tip Camera	Remote aerial observation possible. Observation of remote controlled fire streams. Safer observation of fire ground scene.		1999	X			X
Aerial	Plumbing	Remote Waterway Nozzle Controls	Remote control of tip mounted water nozzle. Risk to firefighters reduced.		1999	X			X
Aerial	Slip Resistance	Rung Surfaces	Firefighter Safety Improved. Consistent footing service. Slips during inclement weather avoided.		1999	X			
Aerial	Structure	Structural Safety Factors	Testing and inspection definition improved. Welding and weld inspection standards specified.		1999	X			
Aerial	Platform	Fall Protection Anchors	At least one attachment point shall be provided for each 250 lb. (114 kg) load rating of the platform. Anchorage points provided for fall protection harnesses shall be clearly labeled and rated for a minimum of 450 lb. (205kg)	19.7.6.6	2016	X			
Aerial	Platform	Guard Rail Strength	The continuous guard railing shall be capable of withstanding a force of 225 lbf (1000 N) applied at any point from any direction without permanent deformation. This ensures a strong railing to prevent failure.	19.7.6.2	2016	X			X
Aerial	Platform	Platform Gate Strength	Each gate shall be capable of withstanding a 1000 lb. force (4000 N) applied at the least favorable position in the least favorable direction, without opening outward	19.7.6.2.6	2016	X			X
Aerial	Lighting	Spotlight or Floodlight	The required spotlight or floodlight at the tip of the aerial must be tested and certified to a minimum lighting capacity in a manner that ensures comparable ratings between lighting suppliers	19.18.6	2016	X			X
Body	Body Mounting	Body Mounting Isolation	Body life extended by decreasing stress, vibration, and shock.		1991		X	X	X
Body	Compartment Doors	Compartment Door Hardware	Increased reliability, durability and safety.		1991	X		X	X
Body	Compartment Doors	Door Seals Improved	Weather resistance improved.		1991		X	X	X
Body	Compartments	Ventilation	Equipment kept drier. Equipment life extended.		1991			X	
Body	Equipment Mounting	Equipment Storage Devices	Organization of tools for rapid deployment.		1991			X	X
Body	Material	Stainless Steel Bodies	Corrosion resistance improved.		1991		X	X	X
Body	Multifunctional Bodies	Rescue-Pumper Combinations	Rescue response efficiency improved.		1991				X
Body	Service Access	Pump Enclosure Access Panels	Ease of maintenance and serviceability.		1991		X		
Body	Command Centers	Slide-Out Sections	Command center room increased.		1996	X			X
Body	Compartment Doors	Rollup Door Offerings	Equipment access improved. Door damage risk reduced.		1996	X	X		X
Body	Access	Handrails, Steps & Ladders	Access improved with build-in steps. Three-point access provided.		1999	X			X
Body	Body and Tank Integration	Shaped Tanks	Equipment storage space improved. Special equipment storage possible. Through-tank ladder storage.		1999	X			X
Body	Breathing Air	Enclosed SCBA Bottle Fill Station	Improved safety during cylinder refills.		1999	X			
Body	Equipment Mounting	Powered Equipment Racks	Ergonomic access to ladders, suction hose, etcé Compartments free for other uses.		1999	X			X
Body	Equipment Mounting	Through-Tank Ladder Storage	Ergonomic access to ladders. Allows high-side compartments both sides.		1999	X			
Body	Hose Storage	Lower Hose Bed Height	Ergonomics improved. Risk of injury reduced.		1999	X			

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Body	Material	Composite Bodies	Plastic, polypropylene, and composites. Corrosion resistance. Lighter Weight.		1999		X	X	X
Body	Compartment Doors	Powered Doors and Door Locks	Security, reliability, and durability improved.		2003	X			X
Body	Hose Storage	Extendable Hose Storage	Improved ergonomics. Risk of injury reduced. Faster re-packing time.		2003	X			X
Body	Access	Lighted Handrails	Safety improved for night operation.		2004	X			X
Body	Hose Storage	Hose Storage Security	Prevents hose from falling off of truck during road travel.		2005	X			
Body	Ground Ladder Mounting	Requirements for Mounting of Ground Ladder Mounting	Provides clear definition for mounting of ground ladders. Protects against unnecessary wear or damage.		2009	X	X	X	
Body	Miscellaneous Equipment	Additional Safety Equipment	Requirements for additional safety equipment on all Fire Fighting Apparatus. Including AED's, Safety Vests, Traffic conesé		2009	X			
Body	Receiver Tubes	Receivers and anchor requirements	Increase in the Safety Factor. Increase in capability		2009	X	X	X	X
Body	Trailer Requirements	Trailer Standard	Trailers are identified as special units with some of their own criteria.		2009	X	X		X
Body	Visibility	Chevron Striping	Provides definition for conspicuity at the rear of the vehicle. Provides consistency for Fire Vehicle identification		2009	X			
Body	Access	Step Horizontal Reach	Climbing steps shall not be more 18 inches apart horizontally to limit how far a person needs to spread their legs while ascending or descending.	15.7.1.1	2016	X			
Body	Access	Yellow Line	Designated stepping areas will be marked with a yellow line around the perimeter unless railings make the area obvious. Ensures that fire fighters understand where it is reasonable for them to be walking on the apparatus.	15.7.1.6	2016	X			
Body	Tiller	Tiller Cab Integrity	Tiller cabs must meet the strength requirements of SAE J2422, Cab Roof Strength Evaluation ð Quasi-Static Loading Heavy Trucks	14.3.2.1	2016	X			X
Chassis	Brakes	Air Disk Brakes	Stopping distance reduced. Brake fade eliminated.		1990	X	X	X	X
Chassis	Engine	Mid-Engine Chassis	Cab noise level reduced. Cab room improved.		1990	X			
Chassis	Audible Warning Devices	Noise Levels Reduced	Sirens, speakers, and air horns off roof. Noise levels in the cab reduced. Crew communications improved.		1991	X			X
Chassis	Cab	Aluminum Cab Construction	Weight reduced. Payload increased. Durability improved.		1991	X		X	X
Chassis	Cab	Electric Windshield Wipers	Performance consistency improved over air driven units.		1991	X	X	X	X
Chassis	Cab	Noise Levels	Communication improved. Crew comfort improved.		1991	X			X
Chassis	Cab	Tilt Cab Design	Maintenance access improved.		1991		X		
Chassis	Occupant Protection	Enclosed Cab	Crew safety. Firefighter rehabilitation area. Working conditions improved. Crew comfort improved. Communication improved.		1991	X			X
Chassis	Steering	Tilt and Telescopic Steering Column	Steering ergonomics improved.		1991	X	X		X
Chassis	Suspension	Air Ride Suspension	Ride quality improved. Height adjusts to load. Body structure sees less shock.		1991	X		X	X
Chassis	Tire Chains	Automatic Engaging Tire Chains	Tire traction in adverse weather conditions improved through automated activation without stopping the vehicle or leaving the operator's position.		1991	X		X	X
Chassis	Tires	Truck Tire Improvements	Rubber compounds improved for greater tread wear. Casing life improved. Load capacities increased.		1991	X		X	X

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Chassis	Transmission	Electronic Transmission Controls	Shift performance improved. Service diagnostics provided. Engine communications capability.		1992	X	X	X	X
Chassis	Engine	Electronic Engine Controls	Electronically controlled pressure governor possible. Maintenance intervals increased. Higher horsepower and torque possible. Mechanical throttle linkage eliminated. Service diagnostics provided. Emissions reduced. Fuel economy improvement.		1994				X
Chassis	Brakes	ABS Mandated	Vehicle control improved during emergency braking.	-	1996	X		X	X
Chassis	Brakes	Auxiliary Brake Mandated	Stopping capability improved. Operator control improved. Brake life increased.		1996	X	X	X	X
Chassis	Occupant Protection	Equipment Mounting	Items in Cab Must be Secured Safety Improved during Crash		1996	X			
Chassis	Safety Interlocks	Chassis PTO Interlock	Improved safety with consistent performance of interlock functions.		1996	X			X
Chassis	Occupant Protection	Shoulder Harness Seat Belts	Type II shoulder harness required for outboard seating positions. Safety increased during crash.		1999	X			
Chassis	Steering	Steering Geometry	Steering cramp angles increased. Turning radius reduced. Bump steer reduced.		1999				X
Chassis	Suspension	Taper Leaf Front Springs	Improved ride quality.		1999	X	X	X	X
Chassis	Visibility	Rear Vision Monitors	Safety during backing improved. Blind spots reduced.		1999	X			
Chassis	Wheels	Hub Piloted Wheels	Wheel nut torque reduced. Centering of wheel improved. Wheel balance improvements reduce vibration.		1999	X	X		X
Chassis	Suspension	Independent Front Suspension	Ride quality improved. Cornering stability improved. Cab structure sees less shock.		2001	X		X	X
Chassis	Cab	SCBA Storage	Positive Engagement Designs Required Ensured SCBA Retention in Crash		2003	X			X
Chassis	Conspicuity	Door Reflective Material	Conspicuity of vehicle increased with doors open. Visibility of door access improved.		2003	X			
Chassis	Occupant Protection	Red or Orange Seat Belts	Visibility of belts increased. Seat belt compliance enforcement simplified.		2003	X			
Chassis	Occupant Protection	Seat-Integrated Seat Belts	Can improve ease of use		2003	X			
Chassis	Occupant Protection	Side Roll Protection	Risk of injury reduced during roll event.		2003	X			
Chassis	Seating	Head Clearance	Head clearance for suspension seats increased. Head clearance for fixed seats increased. Safety improved.		2003	X	X		X
Chassis	Seating	Helmet Storage	Designated Helmet Storage Safety Improved During Crash		2003	X			
Chassis	Seating	Seat Adjustment	Seat adjustment criteria. Seat adjustment time criteria.		2003	X			
Chassis	Brakes	Roll Stability Control	Brakes applied based on aggressive cornering. Reduces potential for roll-over.		2005	X			X
Chassis	Tires	Run-Flat Device	Allows safe steering control during tire blow-out		2005	X			
Chassis	Brakes	Electronic Stability Control	Brakes applied based on steering wheel inputs. Improves control of vehicle during emergency braking.		2007	X			X
Chassis	Occupant Protection	Dual-Retractor Seat Belts	Can improve ease of use		2008	X			
Chassis	Occupant Protection	Frontal Occupant Protection	Risk of injury reduced during frontal crash.		2008	X			
Chassis	Cab	Cab Integrity	Cab integrity standards mandated Roof Crush Integrity Front Cab Crush Integrity		2009	X			
Chassis	Exhaust	Diesel Particulate Filter	Eliminates exhaust smoke Cleaner Environment		2009	X			

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Chassis	Exhaust	Exhaust Temperature Mitigation	Exhaust tailpipe temperatures reduced		2009	X			
Chassis	Occupant Protection	Seat Belt Length	Minimum belt length established. Accommodates large fire fighters with bunker gear on.		2009	X			
Chassis	Occupant Protection	Seat Belt Warning Device	Display shows who is belted and who is not.Visible to Driver or Officer		2009	X			
Chassis	Occupant Protection	Vehicle Data Recorder	Provides Fire Chief with a record of who is wearing their seat belts and how they are driving.		2009	X			
Chassis	Tires	Tire Pressure Monitor	Method of tire pressure monitoring required. Safety improved through correct tire pressure.		2009	X			
Chassis	Vehicle Stability	Rollover Stability Standards	Minimum standards set for roll stability or the vehicle must be equipped with electronic stability control.		2009	X			X
Chassis	Visibility	Mirror Remote Adjustment	Mirrors must be adjustable from Driver position. Improved safety and convenience		2009	X			
Chassis	Brakes	Brake System Capability	All fire apparatus, including those with an axle rated greater than 29,000 lb., shall comply with 49 CFR 571.121. This ensures that apparatus heavy rear axles meet the same stopping distance requirements as lighter apparatus must.	12.3.1.6	2016	X			X
Chassis	Cab	SCBA Storage	Hands-Free Designs Easier Release Functions Strap-Free Designs	14.1.9	2016	X			X
Chassis	Seating	Buckle Stalk Length	Stalk length limited to 4 inches to improve fit of belts across the torso.	14.1.3.2.3	2016	X			
Chassis	Vehicle Stability	Vertical Center of Gravity	Requirement added that the chassis manufacturersô maximum CG guidance should not be exceeded. This ensures that small commercial chassis apparatus will not be too top heavy.	4.13.1.1	2016	X			X
Electrical	Batteries	Battery Conditioner	Battery life improved. Maintenance requirements reduced. Consistent battery condition maintained.		1991	X		X	X
Electrical	Circuits	Electromagnetic Interference Suppression	Systems less susceptible interference from communication equipment.		1991		X	X	X
Electrical	Generators	PTO and Hydraulic Generator Interlocks and Indicators	Generator and equipment life increased because interlocks ensure generator output is correct Improved safety through consistent used of indicators and interlocks. Improved safety because interlocks prevent unexpected or improper operation. Hydraulic generators must operate at all engine speeds or have speed control systems.		1991	X			X
Electrical	Audible Warning Devices	Siren Standards	Audible warning standards established.		1996	X			
Electrical	Generators	Generator Instrumentation	Generator and equipment life increased because user can monitor power output.		1996	X	X		
Electrical	Lights, Scene	Scene Light Standards	Scene lighting increased for improved firefighter safety.		1996	X			X
Electrical	Lights, Warning	Optical Warning Light Standards	Warning light visibility improved to 360 degrees around vehicle.		1996	X			X
Electrical	Lights, Work	Control, Indicator, and Work Area Lighting	Night visibility improved. Work area lighting provided.		1996	X			X
Electrical	Line Voltage	Cord Reel Distribution Box	Receptacles not mounted on a horizontal surface and at least 2" from ground. Power on indicator light visible for 360 degrees. Circuit protection sized for the box receptacles.		1996	X		X	X
Electrical	Line Voltage	Equipment Ratings by Location	Equipment must be rated for its use and location (power ratings, wet/dry environments).		1996	X		X	X
Electrical	Line Voltage	Line Voltage Standards	Installation methods specified for generators and wiring. National Electrical Code (NEC) requirements specified for improved safety and quality. Frequency and voltage ranges specified for consistent power quality.		1996	X	X	X	X

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Electrical	Line Voltage	Line Voltage Testing	Test criteria established for wiring, power supplies, and equipment. Equipment tested as installed to validate installation and improve reliability. Power supplies tested for two hours with the fire pump operating to validate operation as used.		1996	X		X	X
Electrical	Low Voltage Power	Alternator Minimum Idle Capacity	Electrical system capacity at idle ensured.		1996	X	X	X	X
Electrical	Low Voltage Power	Electrical Load Management	Electrical system overload prevented. Battery condition preserved. Maintenance frequency reduced. Diagnostic capability and serviceability improved. Electrical system failure frequency reduced.		1996	X	X	X	X
Electrical	Wiring	Function Coding of Chassis Wiring	Diagnostics and serviceability improved.		1996		X		
Electrical	Wiring	Wiring Methods and Techniques Weather-Proof Connections	Failure rates reduced. Serviceability improved.		1996	X	X	X	X
Electrical	Circuits	Multiplex Control Systems	Wire harnesses simplified. Diagnostic capability. Flexible configuration of systems. Fewer connections. Serviceability and troubleshooting improvement. Reliance on relays reduced. Safety interlock capability improved.		1999		X	X	X
Electrical	Lights, Warning	LED Lighting	Visibility increased. Power requirements reduced. Replacement interval reduced.		1999	X		X	X
Electrical	Line Voltage	Cord Reel Conductor Size	Reduces the possibility of a load not operating properly due to low voltage.		1999	X		X	X
Electrical	Generators	Generator Design	Size reduced. Noise levels reduced. Power ratings based on temperature for more consistent performance.		2003	X	X		X
Electrical	Generators	Inverter Requirements	Power will be available for equipment because inverters cannot be load managed and must operate for two hours minimum.		2003	X			X
Electrical	Generators	Generator Size Calculation	Method to determine the minimum size generator required to power desired loads.		2009	X			X
Electrical	Generators	Generator Testing	Recording the voltage and frequency at the lowest allowedengine speed verifies the generator operates properly at thisengine RPM.		2009	X	X	X	X
Electrical	Generators	Generator Testing	Third party testing of portable generators (attached to fixed wiring on the vehicle) provides verification that the generator operates as stated.		2009	X	X	X	X
Electrical	Generators	Low Oil Shutdown	Safety shutdown to prevent damage or catastrophic failure of the generator		2009	X	X	X	X
Electrical	Generators	Output Waveforms	If the AC power output waveform is generated electronically, it may be a modified or pure sine wave. Some equipment may not operate properly with a modified sine wave. The appendix provides information on equipment that may not operate properly.		2009			X	X
Electrical	Line Voltage	GFCI Receptacles	GFCI protected circuit requirements and information when choosing whether or not to specify GFCI outlets.		2009	X			X
Electrical	Line Voltage	Line Voltage Testing	Added testing for proper operation of transfer switches.		2009	X	X		X
Electrical	Line Voltage	Line Voltage Testing	Added testing to verify equipment enclosure grounding.		2009	X	X		X
Electrical	Line Voltage	Load Balancing	Balancing the fixed and variable 120V loads between the legs of the power source during design increases the likelihood that the loads will be balanced in the field. Balanced loads are more likely to utilize the full capacity of the power source.		2009	X	X		X

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Electrical	Line Voltage	Transfer Switch Neutral Conductor	Removes a potential path for back feed and meets the requirements of National Electric Code.		2009	X	X		X
General	Composite Materials	Plastic, Polypropylene, and Composite Components	Lighter weight. Durability improvement. Maintenance improvement. Corrosion resistance.		1991	X	X	X	X
General	Conspicuity	Reflective Striping	Visibility of vehicle increased. Risk of crash reduced.		1991	X			
General	Paint	Paint Process System Improvement	Harder finish. U.V. protection improvements. Adhesion qualities improved.		1991			X	
General	Steps	Step Performance Criteria	Step height criteria established. Step size criteria established. Minimum load capacity.		1991	X			
General	Equipment Mounting	Interior Equipment Mounting and Storage	Interior equipment mounting criteria. Interior storage compartment performance criteria. Crew safety improved during crash.		1996	X		X	X
Pump	Foam	Class A Foam Systems	Superior fire knockdown over plain water (2 to 3 times faster).Reduced water consumption and damage.Faster cleanup.Rekindle risk reduced.Environmental damage reduced.Faster recovery of visibility.		1991	X	X	X	X
Pump	Foam	Compress Air Foam Systems (CAFS)	Superior fire knockdown over plain water (3 to 5 times faster). Reduced water consumption and damage. Faster cleanup. Rekindle risk reduced. Environmental damage reduced. Faster recovery of visibility. Firefighter fatigue reduced. Exposure protection enhanced.		1991	X			X
Pump	Foam	Foam Agents & Additives	Improved chemical properties. More efficient heat absorption. Overall reduction in proportioning rates. Longer shelf life. No environmental damage. Reduced maintenance.		1991	X	X	X	X
Pump	Foam	In-Tank Foam Cells	Reduced firefighter fatigue. Maximize space requirements in hose bed and compartments. Improved accessibility for plumbing to pump and proportioning equipment.		1991	X			X
Pump	Plumbing	Flanged Pump Connections	Improved safety. Serviceability improved. Pipe thread connection eliminated. Extended system life.		1991	X	X	X	
Pump	Plumbing	Flexible Hose Used in Pump Compartment	Improved water flow efficiency by eliminating plumbing elbows. Plumbing flexibility improved.		1991		X	X	X
Pump	Plumbing	Inlets and Outlets Increased	Higher pump flow rates possible.		1991				X
Pump	Plumbing	Remote Electrically Actuated Valves	Remote pump panel possible. Smaller more efficient pump panels. Controlled operation.		1991				X
Pump	Plumbing	Slow Close Valves	Pressure spikes avoided. Improved operator safety. Stress on plumbing components reduced.		1991	X			X
Pump	Plumbing	Thermal Relief Valve	Improved safety. Pump component protection. Enhanced engine cooling.		1991	X			X
Pump	Pressure & Flow Indicators	Digital Flow Indication Devices	Accuracy improved. Easier to read.		1991	X			X
Pump	Pump Controls	Pressure Governor	Pressure control improved. Water stream protected from variation.		1991	X			X

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Pump	Pump Controls	Top-Mount Pump Panel	Safety of operator away from traffic. Safety of operator away from hose. Visibility for pump operator improved Service access to pump and plumbing improved.		1991	X	X		X
Pump	Testing	Hydrostatic Testing Requirements	Plumbing system integrity verified. Safety factors increased.		1991	X		X	
Pump	Water Tank	Polypropylene Water and Foam Tanks	Lighter weight. Longer lasting. Maintenance requirements reduced. Corrosion resistant.		1991	X	X	X	X
Pump	Pump	Pump Transmissions Improved	Accommodates torque from higher performance engines. Handles torque reversals from transmission mounted retarders.		1994			X	X
Pump	Pump Controls	Enclosed Top-Mount Pump Panel	Safety of operator away from traffic. Safety of operator away from hose. Visibility for pump operator improved. Service access to pump and plumbing improved. Crew comfort improved. Crew communication improved.		1994	X			X
Pump	Foam	Foam Proportioning System Enhancements	Accuracy and performance improved. Broader operating range. Easier to use. Reliability improved.		1996	X	X	X	X
Pump	Plumbing	Stainless Steel Plumbing	Corrosion resistant. Increased life of plumbing system. Maintenance requirements reduced.		1996			X	
Pump	Primer	Oil-Less or Biodegradable Pump Primer	Meets EPA requirements. Environmentally safe.		1996	X	X		X
Pump	Pump	Improved Transmission PTO Designs	Allows flexible body designs. Pump and roll options. Ability of PTO to drive larger pumps.		1996				X
Pump	Pump	Pump Service Access	Minimum pump access established. Improved serviceability. Less downtime.		1996		X		
Pump	Pump Controls	Pump Engage Inter-locks	Multiple indicators to verify pump engagement. Pump panel throttle lockout. Ability to preset pressure. Improved safety.		1996	X			X
Pump	Pump Controls	User-Friendly Pump Panels	Simplified operation. Operator efficiency. Training time reduced. Crew safety improved.		1996	X	X		X
Pump	Safety Interlocks	Pump Interlock	Interlocks to ensure that pump is engaged. Safety Ensured		1996		X		
Pump	Water Tank	Dump Chutes	Chutes required on rear and both sides of apparatus. Safety improved by providing more flexibility to operator. Speed of operations improved during water shuttle operations.		1996	X			X
Pump	Foam	Foam System Testing	Improved safety and accuracy.		1999	X			X
Pump	Pump Controls	Rear Mount Pump Panel	Safety of operator away from traffic. Service access to pump and plumbing improved.		1999				
Pump	Pressure Indicators	Intake and Discharge Gauge Accuracy Test	Improved safety & accuracy.		2003	X	X		
Pump	Pressure Indicators	Analog Vacuum Gauges with Larger graduations & displays	Improved accuracy. Easier to use during drafting operations.		2006				X
Pump	Water Tank	Spill Proof Tank Overflows/Vents	Improved safety preventing water spillage onto the highways		2007	X			
Pump	Pump	Industrial Fire Pumps Curves for Pumps over 3000gpm	Provides defined performance criteria for larger flow pumps		2009				X

Category	Feature	Feature Change	Benefit	NFPA 1901 2016 Edition Requirement	Approximate Year Introduced	Safety	Service	Durability	Performance
Pump	Aux Pump	Pump Capacity Label	A rating label showing the rated flow and pressure capacities of the auxiliary pump system shall be supplied at the pump operatorôs location.	17.3	2016				X
Pump	High Pressure Pump	Pressure Limit	If the pump is a high-pressure pump system, the pump shall be equipped with a means that will limit the pump discharge pressure at the maximum discharge pressure capability rating. If a relief valve is provided that discharges to atmosphere, it shall be directed away from the pump operatorôs position.	17.7.6	2016	X			X
Pump	High Pressure Pump	Thermal Relief Valve	If the pump is a high-pressure pump, the pump shall be equipped with an automatic thermal relief valve to protect the pump that releases away from the pump operator or into the tank.	17.9.7.2	2016				X
Pump	Plumbing	Intake and Discharge Cap Relief	Caps must relieve pressure before getting to the ends of the threads, or have integral bleeder valves.	16.7.4.3	2016	X			
Pump	Pump Controls	Pump and Roll Discharge Gauge in Cab	If the apparatus is designed for pump-and-roll operations using the chassis engineï driven pump, a second discharge pressure gauge shall be mounted in the driving compartment in view of the driver.	16.12.2.3.4	2016	X			
Pump	Safety Interlocks	Pump Engage Inter-locks	Where the pump is driven by the chassis engine and automatic transmission through a split shaft PTO, an interlock system shall be provided to prevent the pump drive system from being shifted out of the ñpump engagedò pumping mode of operation when the chassis transmission is in pump gear.	16.1	2016	X			
Pump	Safety Interlocks	Throttle Ready Interlock	An interlock system shall be provided to prevent advancement of the engine speed at the pump operatorôs panel unless the apparatus has ñThrottle Readyò indication	16.10.11.4	2016	X			
Pump	Water Tank	Algae Growth	Water tanks exposed to sunlight shall be opaque to prevent light from entering, with the exception of the water level visual indicator panel, if equipped	18.2.2	2016		X	X	

About FAMA

The Fire Apparatus Manufacturers' Association (FAMA) is comprised of over 115 member companies that design, manufacture and market automotive fire apparatus and related equipment in the United States and Canada. Established in 1946, FAMA members have been committed to the development of technologically advanced fire apparatus and fire suppression equipment, and have worked tirelessly to improve the safety, performance and functionality of such equipment. This "White Paper" report was prepared by FAMA, through the input of its member companies, for the benefit of all North American Fire Service agencies that provide public fire protection to citizens in their communities. The report is organized into sections that summarize specific improvements and added features related to aerial, body, chassis, electrical, pump, and general. The report will be updated periodically as changes are incorporated into the NFPA 1901 Standard for Automotive Fire Apparatus, NFPA 1906 Standards for Wildland Fire Apparatus or when technological advances provide substantial improvements in the safety and functionality of fire apparatus.