First Revision No. 51-NFPA 414-2017 [Detail]

4.2.2 Manuals.

~~The manufacturer shall supply at the time of delivery the following manuals in electronic format:~~

~~(1) Operator's manual~~

~~(2) Service manual~~

~~(3) Parts manual~~

~~These manuals shall cover the entire vehicle and shall be in accordance with 4.2.2.1 through 4.2.2.3.9.~~

4.2.2.1

The manufacturer shall supply at the time of delivery the following manuals in electronic format:

(1) Operator's manual

(2) Service manual

(3) Parts manual

4.2.2.2

These manuals shall cover the entire vehicle and shall be in accordance with ~~4.2.2.1~~4.2.2.3 through ~~4.2.2.3.9~~4.2.5.9.

Submitter Information Verification

Submitter Full Name: Jenna Vittorioso
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Oct 27 14:40:39 EDT 2017

Committee Statement

Committee Statement: These changes were made in order to comply with the NFPA MOS.
Response Message:

First Revision No. 36-NFPA 414-2017 [Section No. 2.2]

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 412, *Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Equipment,* ~~2014~~ 2020 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus,* 2016 edition.

NFPA 1961, *Standard on Fire Hose,* ~~2013~~ 2019 edition.

NFPA 1964, *Standard for Spray Nozzles,* ~~2013~~ 2018 edition.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 13:27:23 EDT 2017

Committee Statement

Committee Statement: The committee has updated edition dates and included the reference to NPFA 1917.
Response Message:

First Revision No. 45-NFPA 414-2017 [Section No. 2.4]

2.4 References for Extracts in Mandatory Sections.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations,* ~~2013~~ 2019 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus,* 2016 edition.

NFPA 1917, *Standard for Automotive Ambulances,* 2019 edition.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 12 10:15:19 EDT 2017

Committee Statement

Committee Statement: This change was made in order to update edition dates.
Response Message:

First Revision No. 1-NFPA 414-2017 [Section No. 3.3.7]

3.3.7* Angle of Approach.

~~The measure of the steepest ramp that a fully loaded vehicle can approach.~~ The smallest angle made between the road surface and the front tire to any projection of the apparatus in front of the front axle.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 12:41:52 EDT 2017

Committee Statement

Committee Statement: Definition as stated in fire department apparatus series of documents. Consistent with other apparatus definitions.
Response Message:

Public Input No. 8-NFPA 414-2017 [Section No. 3.3.7]

First Revision No. 2-NFPA 414-2017 [Section No. 3.3.8]

3.3.8* Angle of Departure.

~~The measure of the steepest ramp from which the fully loaded vehicle can depart.~~ The smallest angle made between the road surface and the rear tire to any projection of the apparatus behind the rear axle.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 12:47:08 EDT 2017

Committee Statement

Committee Statement: Definition used in fire department apparatus series of documents. Consistent with other apparatus definitions.
Response Message:

Public Input No. 9-NFPA 414-2017 [Section No. 3.3.8]

First Revision No. 30-NFPA 414-2017 [New Section after 3.3.12]

3.3.13 Boom.

An assembled section of an aerial device designed to discharge water/agent.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 12:09:59 EDT 2017

Committee Statement

Committee Statement: The committee has added this new definition in order to provide the end user with further clarification.
Response Message:

First Revision No. 3-NFPA 414-2017 [Section No. 3.3.14]

3.3.15* Center of Gravity.

The point ~~within a vehicle~~ at which ~~all of its weight can be~~ the entire weight of the fire apparatus is considered to be concentrated~~.~~ so that, if supported at this point, the apparatus would remain in equilibrium in any position. [**1901,** 2016]

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 12:47:59 EDT 2017

Committee Statement

Committee Statement: The committee has chosen to use the definition from the fire department apparatus series to maintain consistency.

Response Message:

Public Input No. 10-NFPA 414-2017 [Section No. 3.3.14]

First Revision No. 4-NFPA 414-2017 [Section No. 3.3.15]

3.3.16* Complementary Extinguishing Agent.

~~Agents~~ An agent that provides unique extinguishing capability beyond the primary chosen agent.

A.3.3.16 Complementary Extinguishing Agent.

These agents can extinguish by means of chemical reaction, cooling, or removal of oxygen and are applied to special fire situations such as three-dimensional running fuel fires.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 12:49:44 EDT 2017

Committee Statement

Committee Statement: The committee is adding "extinguishing" to the word and change definition to be consistent with 402.
Response Message:

Public Input No. 12-NFPA 414-2017 [Section No. 3.3.15]

First Revision No. 5-NFPA 414-2017 [Section No. 3.3.33]

3.3.34 In-Service ~~Condition~~ Fire Apparatus .

~~A state or condition of readiness for intended duty; usually an emergency vehicle properly serviced with all equipment properly loaded and ready for immediate response.~~ Any fire apparatus, including reserve apparatus, that is available for use under emergency conditions to transport personnel and equipment and to support suppression of fires and mitigation of other hazardous conditions.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 12:52:30 EDT 2017

Committee Statement

Committee Statement: The committee has made this change to word and definition in order to be consistent with fire department apparatus series.
Response Message:

Public Input No. 11-NFPA 414-2017 [Section No. 3.3.33]

First Revision No. 6-NFPA 414-2017 [Section No. 3.3.38]

3.3.39 Lightweight ~~Construction~~ .

~~Lightweight materials~~ Materials or advanced engineering or both practices, resulting in a weight saving without sacrifice of strength or efficiency.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 13:06:44 EDT 2017

Committee Statement

Committee Statement: The committee has made this change as the term "lightweight construction" is not used in the document however the term "lightweight" is used in the document.
Response Message:

Public Input No. 46-NFPA 414-2017 [Section No. 3.3.38]

Public Input No. 7-NFPA 414-2017 [Section No. 3.3.38]

First Revision No. 31-NFPA 414-2017 [New Section after 3.3.40.1]

3.3.41.2 Piercing Nozzle.

A nozzle designed to penetrate into an aircraft to discharge fire extinguishing agent(s).

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 12:12:34 EDT 2017

Committee Statement

Committee Statement: The committee has added this new text in order to provide the end user with further clarification.
Response Message:

First Revision No. 34-NFPA 414-2017 [New Section after 3.3.63]

3.3.65 Type A Aircraft Door.

A floor-level exit door with a rectangular opening not less than 1067 mm (42 in.) wide by 1829 mm (72 in.) high, with corner radii not greater than 178 mm (7 in.).

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 31 11:31:45 EDT 2017

Committee Statement

Committee Statement: The committee has added this new definition since this is part of a requirement within the main body of the document.
Response Message:

First Revision No. 7-NFPA 414-2017 [Section No. 3.3.69.1]

3.3.71.1* Fully Loaded Vehicle.

Consists of the fully assembled vehicle, complete with a full complement of crew, fuel, equipment, and fire-fighting agents.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 13:31:54 EDT 2017

Committee Statement

Committee Statement: The compartment weight allowance must be considered in the fully loaded configuration.

Response Message:

Public Input No. 32-NFPA 414-2017 [Section No. 3.3.69.1]

First Revision No. 8-NFPA 414-2017 [Section No. 4.1.1]

4.1.1*

The design criteria for the standard vehicles described by this document shall consider temperature extremes ranging from 0°C to 43.3°C (32°F to 110°F). For cold weather operation where temperatures range from -40°C to 0°C (-40°F to 32°F) or lower, some type of winterization system shall be specified by the purchaser. Vehicles shall comply with Table 4.1.1(a) , Table 4.1.1(b) , Table 4.1.1(c) , Table 4.1.1(d) , and other requirements in this chapter.

Table 4.1.1(a) Fully Loaded Vehicle Performance Parameters (SI Units)

-	Minimum Usable Capacity		
Performance Parameters	Vehicle Water Tank Capacity >454 to ≤1999 L	Vehicle Water Tank Capacity >1999 to ≤6000 L	Vehicle Water Tank Capacity >6000 L
Side slope stability (degrees)	30	30	30
Dynamic balance (kph), minimum speed on a (30 m) radius circle	40	35.5	35.5
Angle of approach (degrees)	25	30	30
Angle of departure (degrees)	30	30	30
Interaxle clearance (degrees)	12	12	12
Underbody clearance (cm)	33	46	46
Underaxle clearance at differential housing bowl (cm)	26.7	33.0 (26.7)	33
Diagonal opposite wheel motion (cm)	25.4	36	36
Wall-to-wall turning diameter	<Three times the vehicle's overall length	<Three times the vehicle's overall length	<Three times the vehicle's overall length
Maximum acceleration time from 0 to 80.5 kph (sec)	30	25	35
Top speed (kph)	≥113	≥113	≥113
Service brake:			
Stopping distance			
from 33 kph (m)	≤11	≤11	≤12
from 64 kph (m)	≤40 m	≤40 m	≤49 m
Percent grade holding of fully loaded vehicle:			
Ascending	≥50 percent	≥50 percent	≥50 percent
Descending	≥50 percent	≥50 percent	≥50 percent
Emergency brake stopping distance at 64 kph (m)	≤88	≤88	≤88
Parking brake:			
Percent grade holding for the parking brake			
Ascending	≥20 percent	≥20 percent	≥20 percent
Descending	≥20 percent	≥20 percent	≥20 percent
Evasive maneuver test, NATO Document AVTP 03-16W (kph)	40	40	40
"J" turn test at 46 m radius (kph)	48	48	48

Table 4.1.1(b) Fully Loaded Vehicle Performance Parameters (U.S. Customary Units)

-	Minimum Usable Capacity

Performance Parameters	Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity >528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
Side slope stability (degrees)	30	30	30
Dynamic balance (mph) minimum speed on a (100 ft) radius circle	25	22	22
Angle of approach (degrees)	25	30	30
Angle of departure (degrees)	30	30	30
Interaxle clearance (degrees)	9	12	12
Underbody clearance (in.)	13	18	18
Underaxle clearance at differential housing bowl (in.)	8.5	13 (10.5)	13
Diagonal opposite wheel motion (in.)	10	14	14
Wall-to-wall turning diameter	<Three times the vehicle's overall length	<Three times the vehicle's overall length	<Three times the vehicle's overall length
Maximum acceleration time from 0 to 50 mph (sec)	30	25	35
Top speed (mph)	≥70	≥70	≥70
Service brake:			
Stopping distance			
from 20 mph (ft)	≤35	≤35	≤40
from 40 mph (ft)	≤131	≤131	≤160
Percent grade holding of fully loaded vehicle:			
Ascending	≥50 percent	≥50 percent	≥50 percent
Descending	≥50 percent	≥50 percent	≥50 percent
Emergency brake			
stopping distance at 40 mph (ft)	≤288	≤288	≤288
Parking brake:			
Percent grade holding for the parking brake			
Ascending	≥20 percent	≥20 percent	≥20 percent
Descending	≥20 percent	≥20 percent	≥20 percent
Evasive maneuver test, NATO Document AVTP 03-16W (mph)	25	25	25
"J" turn test at 150 ft radius (mph)	30	30	30

Table 4.1.1(c) Agent System Performance Parameters (SI Units)

Performance Parameters	Minimum Usable Capacity: Vehicle Water Tank Capacity ≥454 to ≤1999 L	Minimum Usable Capacity: Vehicle Water Tank Capacity >1999 to ≤6000 L	Minimum Usable Capacity: Vehicle Water Tank Capacity >6000 L
1. Water tank percent of deliverable water			
a. On level ground	100 percent	100 percent	100 percent
b. On 20 percent side slope	85 percent	85 percent	85 percent

	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥454 to ≤1999 L**	**Vehicle Water Tank Capacity >1999 to ≤6000 L**	**Vehicle Water Tank Capacity >6000 L**
c. 30 percent ascending/descending grade	85 percent	85 percent	85 percent
2. Turret(s) discharge	Total flow rate can be achieved with handlines	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof
2a. Roof turret:			
a. Total minimum flow rate (L/min) OR	≥227	≥2839	≥4731
Individual flow rate of the roof turret, if used in combination with a bumper turret (L/min)	N/A	≥1892	≥3785
b. Stream pattern/distances:			
i. Straight/far point (m)	≥46	≥58	≥70
ii. Dispersed/far point (m)	≥15	≥20	≥21
iii. Dispersed/width (m)	≥9	≥11	≥11
2b. Extendable turret:			
a. Individual flow rate of the extendable turret if used in combination with a bumper turret (L/min)	N/A	≥1892	≥3785
b. Stream pattern/distances:			
i. Straight/far point (m)	N/A	≥58	≥58
ii. Dispersed/far point (m)	N/A	≥20	≥21
iii. Dispersed/width (m)	N/A	≥11	≥11
2c. Bumper turret:	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges
a. Flow rate (L/min)	≥227	≥946	≥946
b. Straight stream distance (m)	≥46	=46	≥46
c. Dispersed pattern distances:			
i. Far point (m)	≥15	≥15	≥15
ii. Width (m)	≥9	≥9	≥9
iii. Near point (m)	Within 9 m of front bumper	Within 9 m of front bumper	Within 9 m of front bumper
2d. Ground sweep nozzle:	Where specified	Where specified	Where specified
a. Flow rate (L/min)	N/A	≥378 to ≤1135	≥378 to ≤1135
b. Dispersed pattern distances:			
i. Far point (m)	N/A	≥9	≥9
ii. Width (m)	N/A	≥3.5	≥3.5
2e. Undertruck nozzle flow rate (L/min)	Where specified >57	Where specified >57	Where specified >57

	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥454 to ≤1999 L**	**Vehicle Water Tank Capacity >1999 to ≤6000 L**	**Vehicle Water Tank Capacity >6000 L**
2f. Piercing nozzle flow rate	Where specified	Where specified	Where specified
(L/min)	≥946	≥946	≥946
3. Number of water-foam handlines required per vehicle (select from following)	1	2	2
3a. Woven jacket water-foam handline:			
a. Nozzle flow rate (L/min)	≥360	≥360	≥360
b. Straight stream distance (m)	≥20	≥20	≥20
c. Dispersed stream pattern:			
i. Range (m)	≥6	≥6	≥6
ii. Width (m)	≥4.5	≥4.5	≥4.5
d. Hose inside diameter (mm)	≥38	≥38	≥38
e. Hose length (m)	≥46	≥46	≥46
3b. Reeled water-foam handline:			
a. Nozzle flow rate (L/min)	360 (≥227 for dual agent lines)	360 (≥227 for dual agent lines)	360 (≥227 for dual agent lines)
b. Straight stream distance (m)	≥20	≥20	≥20
c. Dispersed stream pattern:			
i. Range (m)	≥6	≥6	≥6
ii. Width (m)	≥4.5	≥4.5	≥4.5
d. Hose length (m)	≥46 (≥30 for dual agent lines)	≥46 (≥30 for dual agent lines)	≥46 (≥30 for dual agent lines)
4. Complementary agent			
a. Capacity (kg)	≥45	≥45	≥45
4a. Dry chemical handline:	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥2.3	≥2.3	≥2.3
b. Range (m)	≥7.5	≥7.5	≥7.5
c. Hose length (m)	≥30	≥30	≥30
4b. Dry chemical turret:	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥7 and ≤10	≥7 and ≤10	≥7 and ≤10
b. Range (m)	≥30	≥30	≥30
c. Width (m)	≥5	≥5	≥5
4c. Dry chemical extendable turret	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥5.5	≥5.5 and ≤10	≥5.5 and =10
b. Range (m)	≥30	≥30	≥30
c. Width (m)	≥5	≥5	≥5

-	Minimum Usable Capacity		
Performance Parameters	Vehicle Water Tank Capacity ≥454 to ≤1999 L	Vehicle Water Tank Capacity >1999 to ≤6000 L	Vehicle Water Tank Capacity >6000 L
4d. Halogenated agent handline:	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥2.3	≥2.3	≥2.3
b. Range (m)	≥7.5	≥7.5	≥7.5
c. Hose inside diameter (mm)	≥25.4	≥25.4	≥25.4
d. Hose length (m)	≥30	≥30	≥30

Table 4.1.1(d) Agent System Performance Parameters (U.S. Customary Units)

-	Minimum Usable Capacity		
Performance Parameters	Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity gt; 528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
1. Water tank percent of deliverable water			
a. On level ground	100 percent	100 percent	100 percent
b. On 20 percent side slope	85 percent	85 percent	85 percent
c. 30 percent ascending/descending grade	85 percent	85 percent	85 percent
2. Turret(s) discharge	Total flow rate can be achieved with handlines	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof
2a. Roof turret:			
a. Total minimum flow rate (gpm) OR	≥60	≥750	≥1250
Individual flow rate of the roof turret, if used in combination with a bumper turret (gpm)	N/A	≥500	≥1000
b. Stream pattern/distances:			
i. Straight/far point (ft)	≥65	≥190	≥230
ii. Dispersed/far point (ft)	≥20	≥65	≥70
iii. Dispersed/width (ft)	≥15	≥35	≥35
2b. Extendable turret:			
a. Individual flow rate of the extendable turret if used in combination with a bumper turret (gpm)	N/A	≥500	≥1000
b. Stream pattern/distances:			
i. Straight/far point (ft)	N/A	≥190	≥190
ii. Dispersed/far point (ft)	N/A	≥65	≥70
iii. Dispersed/width (ft)	N/A	≥35	≥35
2c. Bumper turret:	Can be used as the primary turret and must follow roof turret flows	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥120 to ≤528 gal and ranges	Vehicle Water Tank Capacity gt; 528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
a. Flow rate (gpm)	≥60	≥250	≥250
b. Straight stream distance (ft)	≥65	≥150	≥150
c. Dispersed pattern distances:			
i. Far point (ft)	≥20	≥50	≥50
ii. Width (ft)	≥15	≥30	≥30
iii. Near point (ft)	Within 30 ft of front bumper	Within 30 ft of front bumper	Within 30 ft of front bumper
2d. Ground sweep nozzle:	Where specified	Where specified	Where specified
a. Flow rate (gpm)	N/A	≥100 to ≤300	≥100 to ≤300
b. Dispersed pattern distances:			
i. Far point (ft)	N/A	≥30	≥30
ii. Width (ft)	N/A	≥12	≥12
2e. Undertruck nozzle flow rate (gpm)	Where specified >15	Where specified >15	Where specified >15
2f. Piercing nozzle flow rate (gpm)	Where specified ≥250	Where specified ≥250	Where specified ≥250
3. Number of water-foam handlines required per vehicle (select from following)	1	2	2
3a. Woven jacket water-foam handline:			
a. Nozzle flow rate (gpm)	≥95	≥95	≥95
b. Straight stream distance (ft)	≥65	≥65	≥65
c. Dispersed stream pattern:			
i. Range (ft)	≥20	≥20	≥20
ii. Width (ft)	≥15	≥15	≥15
d. Hose inside diameter (in.)	≥1.50	≥1.50	≥1.50
e. Hose length (ft)	≥150	≥150	≥150
3b. Reeled water-foam handline:			
a. Nozzle flow rate (gpm)	95 (≥60 for dual agent lines)	95 (≥60 for dual agent lines)	95 (≥60 for dual agent lines)
b. Straight stream distance (ft)	≥65	≥65	≥65
c. Dispersed stream pattern:			
i. Range (ft)	≥20	≥20	≥20
ii. Width (ft)	≥15	≥15	≥15
d. Hose length (ft)	≥150 (≥100 for dual agent lines)	≥150 (≥100 for dual agent lines)	≥150 (≥100 for dual agent lines)
4. Complementary agent			
a. Capacity (lb)	≥100	≥100	≥100
4a. Dry chemical handline:	Where specified	Where specified	Where specified

-

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity gt; 528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
a. Discharge rate (lb/sec)	≥5	≥5	≥5
b. Range (ft)	≥25	≥25	≥25
c. Hose length (ft)	≥100	≥100	≥100
4b. Dry chemical turret:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥16 and ≤22 (>7)	≥16 and ≤22	≥16 and ≤22
b. Range (ft)	≥100	≥100	≥100
c. Width (ft)	≥17	≥17	≥17
4c. Dry chemical extendable turret:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥12	≥12 and ≤22	≥12 and ≤22
b. Range (ft)	≥100	≥100	≥100
c. Width (ft)	≥17	≥17	≥17
4d. Halogenated agent handline:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥5	≥5	≥5
b. Range (ft)	≥25	≥25	≥25
c. Hose inside diameter (in.)	≥1.00	≥1.00	≥1.00
d. Hose length (ft)	≥100	≥100	≥100

4.1.1.1

For cold weather operation where temperatures range from –40°C to 0°C (–40°F to 32°F) or lower, some type of winterization system shall be specified by the purchaser.

4.1.1.2

Vehicles shall comply with ~~Table 4.1.1(a)~~ Table 4.1.1.2(a) , ~~Table 4.1.1(b)~~ Table 4.1.1.2(b) , ~~Table 4.1.1(c)~~ Table 4.1.1.2(c) , ~~Table 4.1.1(d)~~ Table 4.1.1.2(d) , and other requirements in this chapter.

Table 4.1.1.2(a) Fully Loaded Vehicle Performance Parameters (SI Units)

-	Minimum Usable Capacity		
Performance Parameters	Vehicle Water Tank Capacity ≥454 to ≤1999 L	Vehicle Water Tank Capacity >1999 to ≤6000 L	Vehicle Water Tank Capacity >6000 L
Side slope stability (degrees)	30	30	30
Dynamic balance (kph), minimum speed on a (30 m) radius circle	40	35.5	35.5
Angle of approach (degrees)	25	30	30
Angle of departure (degrees)	30	30	30
Interaxle clearance (degrees)	12	12	12
Underbody clearance (cm)	33	46	46
Underaxle clearance at differential housing bowl (cm)	26.7	33.0 (26.7)	33
Diagonal opposite wheel motion (cm)	25.4	36	36
Wall-to-wall turning diameter	<Three times the vehicle's overall length	<Three times the vehicle's overall length	<Three times the vehicle's overall length
Maximum acceleration time from 0 to 80.5 kph (sec)	30	25	35
Top speed (kph)	≥113	≥113	≥113
Service brake:			
Stopping distance			
from 33 kph (m)	≤11	≤11	≤12
from 64 kph (m)	≤40 m	≤40 m	≤49 m
Percent grade holding of fully loaded vehicle:			
Ascending	≥50 percent	≥50 percent	≥50 percent
Descending	≥50 percent	≥50 percent	≥50 percent
Emergency brake stopping distance at 64 kph (m)	≤88	≤88	≤88
Parking brake:			
Percent grade holding for the parking brake			
Ascending	≥20 percent	≥20 percent	≥20 percent
Descending	≥20 percent	≥20 percent	≥20 percent
Evasive maneuver test, NATO Document AVTP 03-16W (kph)	40	40	40
“J” turn test at 46 m radius (kph)	48	48	48

Table 4.1.1.2(b) Fully Loaded Vehicle Performance Parameters (U.S. Customary Units)

-	Minimum Usable Capacity		
Performance Parameters	Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity >528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
Side slope stability (degrees)	30	30	30

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity >528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
Dynamic balance (mph) minimum speed on a (100 ft) radius circle	25	22	22
Angle of approach (degrees)	25	30	30
Angle of departure (degrees)	30	30	30
Interaxle clearance (degrees)	9	12	12
Underbody clearance (in.)	13	18	18
Underaxle clearance at differential housing bowl (in.)	8.5	13 (10.5)	13
Diagonal opposite wheel motion (in.)	10	14	14
Wall-to-wall turning diameter	<Three times the vehicle's overall length	<Three times the vehicle's overall length	<Three times the vehicle's overall length
Maximum acceleration time from 0 to 50 mph (sec)	30	25	35
Top speed (mph)	≥70	≥70	≥70
Service brake:			
Stopping distance			
from 20 mph (ft)	≤35	≤35	≤40
from 40 mph (ft)	≤131	≤131	≤160
Percent grade holding of fully loaded vehicle:			
Ascending	≥50 percent	≥50 percent	≥50 percent
Descending	≥50 percent	≥50 percent	≥50 percent
Emergency brake			
stopping distance at 40 mph (ft)	≤288	≤288	≤288
Parking brake:			
Percent grade holding for the parking brake			
Ascending	≥20 percent	≥20 percent	≥20 percent
Descending	≥20 percent	≥20 percent	≥20 percent
Evasive maneuver test, NATO Document AVTP 03-16W (mph)	25	25	25
“J” turn test at 150 ft radius (mph)	30	30	30

Table 4.1.1.2(c) Agent System Performance Parameters (SI Units)

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥454 to ≤1999 L	Vehicle Water Tank Capacity >1999 to ≤6000 L	Vehicle Water Tank Capacity >6000 L
1. Water tank percent of deliverable water			
a. On level ground	100 percent	100 percent	100 percent
b. On 20 percent side slope	85 percent	85 percent	85 percent

-

	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥454 to ≤1999 L**	**Vehicle Water Tank Capacity >1999 to ≤6000 L**	**Vehicle Water Tank Capacity >6000 L**
c. 30 percent ascending/descending grade	85 percent	85 percent	85 percent
2. Turret(s) discharge	Total flow rate can be achieved with handlines	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof
2a. Roof turret:			
a. Total minimum flow rate (L/min) OR	≥227	≥2839	≥4731
Individual flow rate of the roof turret, if used in combination with a bumper turret (L/min)	N/A	≥1892	≥3785
b. ~~Stream~~ Entrained stream pattern/distances:			
i. Straight/far point (m)	≥46	≥58	≥70
ii. Dispersed/far point (m)	≥15	≥20	≥21
iii. Dispersed/width (m)	≥9	≥11	≥11
2b. Extendable turret:			
a. Individual flow rate of the extendable turret if used in combination with a bumper turret (L/min)	N/A	≥1892	≥3785
b. ~~Stream~~ Entrained stream pattern/distances:			
i. Straight/far point (m)	N/A	≥58	≥58
ii. Dispersed/far point (m)	N/A	≥20	≥21
iii. Dispersed/width (m)	N/A	≥11	≥11
2c. Bumper turret:	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges
a. Flow rate (L/min)	≥227	≥946	≥946
b. Straight entrained stream distance (m)	≥46	≥46	≥46
c. Dispersed pattern distances:			
i. Far point (m)	≥15	≥15	≥15
ii. Width (m)	≥9	≥9	≥9
iii. Near point (m)	Within 9 m of front bumper	Within 9 m of front bumper	Within 9 m of front bumper
2d. Ground sweep nozzle:	Where specified	Where specified	Where specified
a. Flow rate (L/min)	N/A	≥378 to ≤1135	≥378 to ≤1135
b. Dispersed pattern distances:			

-

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥454 to ≤1999 L	Vehicle Water Tank Capacity >1999 to ≤6000 L	Vehicle Water Tank Capacity >6000 L
i. Far point (m)	N/A	≥9	≥9
ii. Width (m)	N/A	≥3.5	≥3.5
2e. Undertruck nozzle	Where specified	Where specified	Where specified
flow rate (L/min)	>57	>57	>57
2f. Piercing nozzle flow rate	Where specified	Where specified	Where specified
(L/min)	≥946	≥946	≥946
3. Number of water-foam handlines required per vehicle (select from following)	1	2	2
3a. Woven jacket water-foam handline:			
a. Nozzle flow rate (L/min)	≥360	≥360	≥360
b. Straight entrained stream distance (m)	≥20	≥20	≥20
c. Dispersed entrained stream pattern:			
i. Range (m)	≥6	≥6	≥6
ii. Width (m)	≥4.5	≥4.5	≥4.5
d. Hose inside diameter (mm)	≥38	≥38	≥38
e. Hose length (m)	≥46	≥46	≥46
3b. Reeled water-foam handline:			
a. Nozzle flow rate (L/min)	360 (≥227 for dual agent lines)	360 (≥227 for dual agent lines)	360 (≥227 for dual agent lines)
b. Straight entrained stream distance (m)	≥20	≥20	≥20
c. Dispersed entrained stream pattern:			
i. Range (m)	≥6	≥6	≥6
ii. Width (m)	≥4.5	≥4.5	≥4.5
d. Hose length (m)	≥46 (≥30 for dual agent lines)	≥46 (≥30 for dual agent lines)	≥46 (≥30 for dual agent lines)
4. Complementary agent			
a. Capacity (kg)	≥45	≥45	≥45
4a. Dry chemical handline:	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥2.3	≥2.3	≥2.3
b. Range (m)	≥7.5	≥7.5	≥7.5
c. Hose length (m)	≥30	≥30	≥30
4b. Dry chemical turret:	~~Where specified~~ ≥454 and ≤1999 L	~~Where specified~~ >1999 and ≤6000 L	~~Where specified~~ Above >6000 L
a. ~~Discharge~~ Powder discharge rate (kg/sec)	≥7 and ≤10	≥7 and ≤10	≥7 and ≤10

-	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥454 to ≤1999 L**	**Vehicle Water Tank Capacity >1999 to ≤6000 L**	**Vehicle Water Tank Capacity >6000 L**
b. ~~Range~~ Powder range (m)	≥30	≥30	≥30
c. ~~Width~~ Powder width (m)	≥5	≥5	≥5
d. Stream range (m)	See 2a/2c	See 2a/2c	See 2a/2c
e. Stream width (m)	≥5	≥5	≥5
4c. Dry chemical extendable turret	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥5.5	≥5.5 and ≤10	≥5.5 and ≤10
b. Range (m)	≥30	≥30	≥30
c. Width (m)	≥5	≥5	≥5
4d. Halogenated agent handline:	Where specified	Where specified	Where specified
a. Discharge rate (kg/sec)	≥2.3	≥2.3	≥2.3
b. Range (m)	≥7.5	≥7.5	≥7.5
c. Hose inside diameter (mm)	≥25.4	≥25.4	≥25.4
d. Hose length (m)	≥30	≥30	≥30

Table 4.1.1.2(d) Agent System Performance Parameters (U.S. Customary Units)

-	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥120 to ≤528 gal**	**Vehicle Water Tank Capacity >528 to ≤1585 gal**	**Vehicle Water Tank Capacity >1585 gal**
1. Water tank percent of deliverable water			
a. On level ground	100 percent	100 percent	100 percent
b. On 20 percent side slope	85 percent	85 percent	85 percent
c. 30 percent ascending/descending grade	85 percent	85 percent	85 percent
2. Turret(s) discharge	Total flow rate can be achieved with handlines	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof	Total flow rate can be achieved using a roof turret, extendable turret, bumper turret, or a combination thereof
2a. Roof turret:			
a. Total minimum flow rate (gpm) OR	≥60	≥750	≥1250
Individual flow rate of the roof turret, if used in combination with a bumper turret (gpm)	N/A	≥500	≥1000
b. ~~Stream~~ Entrained stream pattern/distances:			
i. Straight/far point (ft)	≥65	≥190	≥230
ii. Dispersed/far point (ft)	≥20	≥65	≥70
iii. Dispersed/width (ft)	≥15	≥35	≥35
2b. Extendable turret:			

-

Performance Parameters	Minimum Usable Capacity Vehicle Water Tank Capacity ≥120 to ≤528 gal	Vehicle Water Tank Capacity >528 to ≤1585 gal	Vehicle Water Tank Capacity >1585 gal
a. Individual flow rate of the extendable turret if used in combination with a bumper turret (gpm)	N/A	≥500	≥1000
b. ~~Stream~~ Entrained stream pattern/distances:			
i. Straight/far point (ft)	N/A	≥190	≥190
ii. Dispersed/far point (ft)	N/A	≥65	≥70
iii. Dispersed/width (ft)	N/A	≥35	≥35
2c. Bumper turret:	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges	Can be used as the primary turret and must follow roof turret flows and ranges
a. Flow rate (gpm)	≥60	≥250	≥250
b. Straight entrained stream distance (ft)	≥65	≥150	≥150
c. Dispersed pattern distances:			
i. Far point (ft)	≥20	≥50	≥50
ii. Width (ft)	≥15	≥30	≥30
iii. Near point (ft)	Within 30 ft of front bumper	Within 30 ft of front bumper	Within 30 ft of front bumper
2d. Ground sweep nozzle:	Where specified	Where specified	Where specified
a. Flow rate (gpm)	N/A	≥100 to ≤300	≥100 to ≤300
b. Dispersed pattern distances:			
i. Far point (ft)	N/A	≥30	≥30
ii. Width (ft)	N/A	≥12	≥12
2e. Undertruck nozzle flow rate (gpm)	Where specified >15	Where specified >15	Where specified >15
2f. Piercing nozzle flow rate (gpm)	Where specified ≥250	Where specified ≥250	Where specified ≥250
3. Number of water-foam handlines required per vehicle (select from following)	1	2	2
3a. Woven jacket water-foam handline:			
a. Nozzle flow rate (gpm)	≥95	≥95	≥95
b. Straight entrained stream distance (ft)	≥65	≥65	≥65
c. Dispersed entrained stream pattern:			
i. Range (ft)	≥20	≥20	≥20
ii. Width (ft)	≥15	≥15	≥15

-	Minimum Usable Capacity		
Performance Parameters	**Vehicle Water Tank Capacity ≥120 to ≤528 gal**	**Vehicle Water Tank Capacity >528 to ≤1585 gal**	**Vehicle Water Tank Capacity >1585 gal**
d. Hose inside diameter (in.)	≥1.50	≥1.50	≥1.50
e. Hose length (ft)	≥150	≥150	≥150
3b. Reeled water-foam handline:			
a. Nozzle flow rate (gpm)	95 (≥60 for dual agent lines)	95 (≥60 for dual agent lines)	95 (≥60 for dual agent lines)
b. Straight entrained stream distance (ft)	≥65	≥65	≥65
c. Dispersed entrained stream pattern:			
i. Range (ft)	≥20	≥20	≥20
ii. Width (ft)	≥15	≥15	≥15
d. Hose length (ft)	≥150 (≥100 for dual agent lines)	≥150 (≥100 for dual agent lines)	≥150 (≥100 for dual agent lines)
4. Complementary agent			
a. Capacity (lb)	≥100	≥100	≥100
4a. Dry chemical handline:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥5	≥5	≥5
b. Range (ft)	≥25	≥25	≥25
c. Hose length (ft)	≥100	≥100	≥100
4b. Dry chemical turret:	~~Where specified~~ ≥120 and ≤528 gal	~~Where specified~~ >528 and ≤1585 gal	~~Where specified~~ Above >1585 gal
a. ~~Discharge~~ Powder discharge rate (lb/sec)	≥16 and ≤22 (>7)	≥16 and ≤22	≥16 and ≤22
b. ~~Range~~ Powder range (ft)	≥100	≥100	≥100
c. ~~Width~~ Powder width (ft)	≥17	≥17	≥17
d. Stream range (ft)	See 2a/2c	See 2a/2c	See 2a/2c
e. Stream width (ft)	≥17	≥17	≥17
4c. Dry chemical extendable turret:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥12	≥12 and ≤22	≥12 and ≤22
b. Range (ft)	≥100	≥100	≥100
c. Width (ft)	≥17	≥17	≥17
4d. Halogenated agent handline:	Where specified	Where specified	Where specified
a. Discharge rate (lb/sec)	≥5	≥5	≥5
b. Range (ft)	≥25	≥25	≥25
c. Hose inside diameter (in.)	≥1.00	≥1.00	≥1.00
d. Hose length (ft)	≥100	≥100	≥100

Supplemental Information

File Name	Description	Approved

FR-8_4.1.1.docx	For production use
Table_4.1.1498507774210.pdf	Please see the attached document that was submitted with PI that the committee used to create FR 8.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 13:39:51 EDT 2017

Committee Statement

Committee Statement: The committee agrees with the submitters proposed changes, however the committee has added additional text to what the submitter proposed. The current nozzles on the market that entrain dry chemical into the water stream only use round water dispersed patterns. The round shape surrounds the powder to get it to properly mix in the water. A flat dispersed pattern does not entrain the powder into the water stream. There has been questions from the user community on the width requirement, if the number in the table is for the powder or water. These proposed changes clarify these requirements.

Response Message:

Public Input No. 26-NFPA 414-2017 [Section No. 4.1.1]

First Revision No. 20-NFPA 414-2017 [Section No. 4.3.1.1]

4.3.1.1

The actual gross vehicle weight of a fully ~~staffed,~~ loaded~~, and equipped~~ vehicle ~~for service~~ shall not exceed the manufacturer's ~~tested~~ gross vehicle weight rating as recorded on the vehicle information data plate.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:17:35 EDT 2017

Committee Statement

Committee Statement: These changes were made for document consistency.
Response Message:

First Revision No. 9-NFPA 414-2017 [Section No. 4.4.2.3.1]

4.4.2.3.1

The cooling system shall be designed so that the stabilized engine coolant temperature remains within the engine manufacturer's prescribed limits under all operational conditions and at all ambient temperatures identified in 4.1.1 that might be encountered at the operational airport.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 13:57:45 EDT 2017

Committee Statement

Committee Statement: Referring back to 4.1.1 provides more specific temperature ranges that are already considered standard in the document
Response Message:

Public Input No. 25-NFPA 414-2017 [Section No. 4.4.2.3.1]

First Revision No. 10-NFPA 414-2017 [New Section after 4.12.4.8]

4.12.4.9 FLIR.

4.12.4.9.1

The FLIR sensor shall be able to detect long wave (8 µm to 12 µm) infrared (IR) energy.

4.12.4.9.2

The sensor array resolution shall be a minimum of 640 horizontal pixels by 480 vertical pixels.

4.12.4.9.3

The camera shall have a high-contrast filter that will show low-contrast objects in a dynamic thermal scene.

4.12.4.9.4

The camera shall provide an industry standard composite (with automatic gain and level control) or digital video output.

4.12.4.9.5

The camera shall have a minimum horizontal (HFOV) and vertical field of view (VFOV) of 27 degrees (±4 degrees) and 18 degrees (±4 degrees), respectively.

Submitter Information Verification

Submitter Full Name: Ken Holland
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Submittal Date: Tue Aug 29 14:12:14 EDT 2017

Committee Statement

Committee Statement: In order to increase the performance requirements of the FLIR cameras based on the findings in the FAA report DOT/FAA/TC-17/27 the cross reference to chapter 11 of AC 150/5210-19A had to be removed and the individual requirements listed out separately. This research program proves the benefit of a higher resolution camera with a high contrast filter.

Response Message:

Public Input No. 30-NFPA 414-2017 [New Section after 4.12.4.8]

First Revision No. 11-NFPA 414-2017 [Section No. 4.12.4.8]

4.12.4.8*

A low-visibility enhanced vision system shall be installed in the vehicle consisting of ~~an~~ a FLIR system that meets or exceeds the following requirements as outlined in FAA Advisory Circular No. 150/5210-19A:

(1) Chapter 1, Section 2, Subsection b, Part (1) Vision Enhancement

(2) Chapter 2, Full Sections 6, 7, 10, ~~11,~~ and 12

Submitter Information Verification

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City:
State:
Zip:
Submittal Date: Tue Aug 29 14:24:24 EDT 2017

Committee Statement

Committee Statement: In order to increase the performance requirements of the FLIR cameras based on the findings in the FAA report DOT/FAA/TC-17/27 the cross reference to chapter 11 of AC 150/5210-19A had to be removed and the individual requirements listed out separately. This research program proves the benefit of a higher resolution camera with a high contrast filter.

Response Message:

Public Input No. 29-NFPA 414-2017 [Section No. 4.12.4.8]

First Revision No. 12-NFPA 414-2017 [Section No. 4.12.5.1]

4.12.5.1

The following equipment shall be provided in or on the cab, as applicable:

(1) Heater/defroster

(2) Driver's suspension seat with vertical, fore, and aft adjustment, with seat belt [The use of a nonsuspension driver's seat ~~shall be~~ is permitted where recommended by the manufacturer; the vertical adjustment ~~shall~~ does not apply to commercial vehicles with a capacity of <1999 L (528 gal).]

(3) Crew seats with individual retractable seat belts

(4) Windshield washers ~~appropriate for removing foam~~

(5) Windshield wipers ~~appropriate for removing foam~~

(6) Siren

(7) Horn

(8) A means or provision that is designed to protect driver and crew from overhead glare and light from the sun

(9) Outside rearview mirrors, as specified in 4.3.2.3

(10) Interior lighting

(11) Provisions for mounting at each crew seat position self-contained breathing apparatus (SCBA) of the type specified by the purchaser

(12) Low-visibility FLIR meeting suggested specifications contained in Section D.4 or equivalent

Submitter Information Verification

Submitter Full Name: Ken Holland
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Street Address:
City:
State:
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Submittal Date: Tue Aug 29 14:26:15 EDT 2017

Committee Statement

Committee Statement: The committee removed unenforceable terms, NFPA MOS, and unnecessary language.
Response Message:

Public Input No. 48-NFPA 414-2017 [Section No. 4.12.5.1]

First Revision No. 32-NFPA 414-2017 [Section No. 4.13.8]

4.2.4.5

Vehicle numbering, lettering, and minimum 20.3 cm (8 in.) wide reflective striping shall be provided in accordance with ASTM D4956.

4.2.4.5.1

A graphic design meeting the reflectivity requirements of this subsection shall be permitted to replace all or part of the required striping, provided the design or combination thereof covers a minimum of the same perimeter length required in ~~4.13.8~~ 4.2.4.5 .

4.2.4.5.2

Striping shall be placed on at least 60 percent of the perimeter length of each side, width, and rear.

4.2.4.5.3

At least 40 percent of the perimeter width of the front of the vehicle shall have reflective striping.

4.2.4.6

Where specified, at least 50 percent of the rear-facing vertical surfaces, visible when facing from the rear of the vehicle, shall be equipped with retroreflective material.

4.2.4.6.1

Where chevrons are used, each stripe in the chevron shall be a single color alternating between two high-contrast colors. [**1917:** 6.25.6.1]

4.2.4.6.2

Each stripe shall be 152 mm (6 in.) in width. [**1917:** 6.25.6.2]

4.2.4.6.3

Where Battenburg markings are used, each box in the Battenburg markings shall be 92,903 mm^2 (144 $in.^2$). [**1917:** 6.25.6.3]

4.2.4.6.4

All retroreflective material shall conform to the requirements of ASTM D4956, *Standard Specification for Retroreflective Sheeting for Traffic Control* , Section 6.1.1, for Type I Sheeting. [**1917:** 6.25.7]

4.2.4.6.5

All retroreflective materials that are colors not listed in ASTM D4956, *Standard Specification for Retroreflective Sheeting for Traffic Control* , Section 6.1.1, shall have a minimum coefficient of retroreflection of 10 with an observation angle of 0.2 degrees and an entrance angle of −4 degrees. [**1917:** 6.25.8]

4.2.4.6.6

Any printed or processed retroreflective film construction shall conform to the standards required of an integral colored film as specified in ASTM D4956, *Standard Specification for Retroreflective Sheeting for Traffic Control* , Section 6.1.1. [**1917:** 6.25.9]

Submitter Information Verification

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Submittal Date: Wed Aug 30 12:15:01 EDT 2017

Committee Statement

Committee Statement: The committee is moving this section of text to the renumbered section as this is a more appropriate location for this text. No changes to the requirements have been made, just renumbering/moving has occurred. The committee is also adding new requirements, extracted from NFPA 1917, on reflective striping requirements which is to fall in line with the text that was moved as noted in the revision.

Response Message:

Public Input No. 49-NFPA 414-2017 [Section No. 4.13.8]

Public Input No. 45-NFPA 414-2017 [Section No. 4.2.4]

First Revision No. 13-NFPA 414-2017 [Section No. 4.17.4.1]

4.17.4.1

The foam concentrate proportioning system shall provide a means of controlling the ratio of end-user-specified foam concentrate to the quantity of water in the foam solution being discharged from all orifices used for aircraft fire-fighting operations.

Submitter Information Verification

Submitter Full Name: Ken Holland
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Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 16:36:13 EDT 2017

Committee Statement

Committee Statement: The committee understands what the submitter is attempting to accomplish, and believes the text they have proposed does just that.

Response Message:

Public Input No. 2-NFPA 414-2017 [Section No. 4.17.4.1]

First Revision No. 14-NFPA 414-2017 [Section No. 4.19.6 [Excluding any Sub-Sections]]

If the primary turret is of the extendable type, it shall meet the following design and functional requirements:

(1) The primary turret shall meet the requirements of 4.3.1.3 and 4.3.1.5 while in the stowed position.

(2) The vehicle shall achieve a 20 percent side slope, with the extendable turret fully elevated and the nozzle rotated uphill at maximum horizontal rotation while discharging at maximum flow rate.

(3) The vehicle shall be provided with an interlock or warning system and placards in full view of the driver/operator to provide the operational limitations during all phases of operation.

(4) Flow rates shall be in accordance with ~~Table 4.1.1(c)~~ Table 4.1.1.2(c) and ~~Table 4.1.1(d)~~ Table 4.1.1.2(d) for major vehicles.

(5) The primary turret shall meet the primary water-foam agent turret discharge requirements of ~~Table 4.1.1(c)~~ Table 4.1.1.2(c) and ~~Table 4.1.1(d)~~ Table 4.1.1.2(d) for the applicable vehicle class while in the bedded position.

(6) The primary turret shall meet the foam-quality standard of NFPA 412 for the applicable foam applicator and foam type.

(7) The primary turret shall function during ARFF operations without the need for outriggers or other ground contact stabilizers that would render the vehicle immobile or hinder its maneuverability.

(8) The primary turret shall have a deployment time from the bedded position to the maximum height and start the application of agent within 30 seconds.

(9) The high rise, telescoping, and/or articulating movement of the boom/tower shall be accomplished with not more than two adjacent lever controls and be permitted to be manual or automated for preselected positioning of the elevation and reach.

(10) If automated, these functions shall be provided with a manual override positioning capability.

(11) The primary turret shall be capable of applying agent to any interior area of the most current wide-body jet, so as not to impede evacuation and for safety considerations of the vehicle operator.

(12) The device shall be capable of positioning the nozzle within 0.6 m (2 ft) of ground level in front of the vehicle and be capable of applying agent to the interior of the aircraft through cargo bay door openings, passenger doorways, and emergency exits on the type of aircraft being protected while the aircraft is in either the gear-up or gear-down landing position.

(13) The primary turret shall have a range of motion so as to permit positioning of the nozzle to direct a fire-fighting agent stream at least 90 degrees to the longitudinal axis of the fuselage for interior fire extinguishment.

(14) The turret/boom mechanism shall be capable of providing for horizontal movement along the aircraft of at least 30 degrees left and right of the vehicle centerline so as not to require repositioning or movement of the ARFF vehicle.

(15) This horizontal rotation shall be accomplished without the deployment of stabilizers or outriggers that might cause a delay in positioning or emergency movement of the rescue vehicle.

(16) The primary turret shall have backup systems to allow for override of the single-lever boom control and hydraulic system (or other power source) if the primary system becomes disabled.

(17) The driver/operator shall be able to see the boom, as it is rising to its maximum height, from a seated position by means of a camera or direct line of sight.

(18) A means of visually identifying the boom extension available shall be provided either by an external marking on the boom or a display in the cab visible to the vehicle operator.

Submitter Information Verification

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Submittal Date: Tue Aug 29 17:02:26 EDT 2017

Public Input No. 36-NFPA 414-2017 [Section No. 4.19.6 [Excluding any Sub-Sections]]

Committee Statement

Committee Statement: The committee understands what the submitter is attempting to accomplish, however the committee believes that the text they have provided is sufficient.

Response Message:

First Revision No. 41-NFPA 414-2017 [Sections 4.19.6.5, 4.19.6.6, 4.19.6.7]

4.19.6.5

Where remote color optics are specified the following shall apply :

(1) They shall be capable of permitting overall fire scene surveillance when fully extended and provide the driver/operator with the detail needed for placement of the ~~penetration~~ piercing device on the aircraft hull for ~~piercing~~ penetration .

(2) The camera and associated lighting shall be designed and installed for exterior environmental operating conditions encountered by ARFF vehicles.

(3) A monitor 178 mm (7 in.) or larger shall be ~~cab-mounted~~ cab-mounted and viewable from the driver/operator position.

4.19.6.6

Where a ~~skin penetrator~~ piercing nozzle /agent applicator is specified, it shall be movable in conjunction with the water-foam nozzle to allow placement of the nozzle control and be capable of the minimum water-foam flow rate and pattern requirements of ~~Table 4.1.1(c)~~ Table 4.1.1.2(c) and ~~Table 4.1.1(d)~~ Table 4.1.1.2(d) .

4.19.6.7*

The ~~penetrating~~ piercing nozzle shall be capable of a minimum flow rate of 946 L/min (250 gpm).

Submitter Information Verification

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City:
State:
Zip:
Submittal Date: Fri Sep 01 14:30:54 EDT 2017

Committee Statement

Committee Statement: The committee has made these changes for document consistency.
Response Message:

First Revision No. 42-NFPA 414-2017 [Sections 4.19.6.11, 4.19.6.12]

4.19.6.11

The ~~penetrating~~ piercing nozzle shall be capable of piercing the aircraft fuselage over the wing area at angles up to 30 degrees left or right of the vehicle centerline in the event that the interior fire is located in this area.

4.19.6.12

The extendable turret with ~~penetrating~~ piercing nozzle shall have the ability to perform a multi-axis, multifunction boom operation with penetration and agent flowing at the penetration point (above the windows and below the overhead stowage bins) of a single passenger deck aircraft in less than 45 seconds.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 14:36:17 EDT 2017

Committee Statement

Committee Statement: The committee has made these changes for document consistency.
Response Message:

First Revision No. 15-NFPA 414-2017 [Section No. 4.24.1 [Excluding any Sub-Sections]]

Where specified, a turret shall have an auxiliary agent discharge mounted parallel to the foam solution discharge, or entrained within the foam solution discharge stream ~~and controlled the same way and with the same travel requirements as the turret~~ .

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 18:08:03 EDT 2017

Committee Statement

Committee Statement: The committee understands what the submitter is attempting to accomplish here, however they believe the textual changes they have made better serves the end user.

Response Message:

Public Input No. 28-NFPA 414-2017 [Section No. 4.24.1 [Excluding any Sub-Sections]]

First Revision No. 16-NFPA 414-2017 [Section No. 5.2.1.10]

5.2.1.10

Each door shall be equipped with a restraint device(s) to prevent the door from ~~being sprung open by wind or jet blast~~ exceeding its intended range of motion .

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 18:17:52 EDT 2017

Committee Statement

Committee Statement: The committee has made this change as in order to provide further clarification to the requirement, and believes this change will address what the submitter was attempting to do by deleting this section.

Response Message:

Public Input No. 16-NFPA 414-2017 [Section No. 5.2.1.10]

First Revision No. 17-NFPA 414-2017 [Section No. 5.2.1.11.5]

~~5.2.1.11.5~~

~~Where equipped with a primary turret having manual controls above the cab roof, the cab roof shall be designed with a quick access to the primary turret(s).~~

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 18:23:05 EDT 2017

Committee Statement

Committee Statement: Roof turrets should not be considered on an AIAV as the place most likely is occupied by the stored platform. If a turret is considered, this should be a bumper type.

Response Message:

Public Input No. 17-NFPA 414-2017 [Section No. 5.2.1.11.5]

First Revision No. 18-NFPA 414-2017 [Section No. 5.2.2]

5.2.2 Equipment.

The following equipment shall be provided in or on the cab, as applicable:

(1) Heater/defroster

(2) Driver's suspension seat with vertical, fore, and aft adjustment, with seat belt [The use of a nonsuspension driver's seat ~~shall be~~ is permitted where recommended by the manufacturer; the vertical adjustment ~~shall~~ does not apply to commercial vehicles with a capacity of <1999 L (<528 gal).]

(3) Crew seats with individual retractable seat belts

(4) Windshield washers ~~appropriate for removing foam~~

(5) Windshield wipers ~~appropriate for removing foam~~

(6) Siren

(7) Horn

(8) A means or provision that is designed to protect driver and crew from overhead glare and light from the sun

(9) Outside rearview mirrors, as specified in 4.3.2.3

(10) Interior lighting

~~Provisions for mounting at each crew seat position self-contained breathing apparatus (SCBA) of the type specified by the purchaser~~

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 18:34:52 EDT 2017

Committee Statement

Committee Statement: The committee has chosen to delete this requirement as they believe it is what the submitter was attempting to do, and that was to ensure that an SCBA mount is not included on the drivers seat. Also for document consistency.

Response Message:

Public Input No. 18-NFPA 414-2017 [Section No. 5.2.2]

First Revision No. 44-NFPA 414-2017 [Section No. 5.5.1 [Excluding any Sub-Sections]]

The docking platform of the vehicle shall be sized to allow a Type A aircraft door to be fully opened and stowed , allowing fire fighters and their equipment access to the aircraft.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 12 10:12:03 EDT 2017

Committee Statement

Committee Statement: For safety of vehicle operator and aircraft occupants, including potential damage to aircraft and vehicle, the final docking should not be accomplished by driving the vehicle against the aircraft. The corresponding annex text is also being deleted.

Response Message:

Public Input No. 15-NFPA 414-2017 [Section No. 5.5.1 [Excluding any Sub-Sections]]

First Revision No. 43-NFPA 414-2017 [New Section after 5.5.1.3]

5.5.1.4

The docking process itself shall be done without causing damage to the vehicle or the fuselage.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 12 09:54:13 EDT 2017

Committee Statement

Committee Statement: The committee believes that this is an important aspect of the operation that needs to be mentioned.
Response Message:

First Revision No. 19-NFPA 414-2017 [Section No. 5.7.3]

5.7.3 ~~GVW.~~ Gross Vehicle Weight (GVW).

The actual gross vehicle weight of a fully ~~staffed,~~ loaded~~, and equipped~~ vehicle ~~ready for service~~ shall not exceed the manufacturer's ~~tested~~ gross vehicle weight rating as recorded on the vehicle information data plate.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:05:10 EDT 2017

Committee Statement

Committee Statement: "Loaded" can be misleading as to the weight allowed on the steps and platform.
Response Message:

Public Input No. 22-NFPA 414-2017 [Section No. 5.7.3]

First Revision No. 29-NFPA 414-2017 [Section No. 5.8.1.5]

5.8.1.5

Obstacles within the 90 degree horizontal line of vision to the right or left shall not create an obstruction of more than ~~5~~ 7 degrees per obstruction.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 11:45:28 EDT 2017

Committee Statement

Committee Statement: Refers to 4.3.2.2 which states 7° not 5°. Not sure which one is correct but they should match up.
Response Message:

Public Input No. 23-NFPA 414-2017 [Section No. 5.8.1.5]

First Revision No. 21-NFPA 414-2017 [Section No. 6.2.2]

6.2.2

The cooling system shall be certified by the ~~vehicle~~ engine manufacturer to satisfy all ~~operational~~ conditions at all ambient temperatures encountered at the ~~operational~~ airport for both the engine and the transmission.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:20:02 EDT 2017

Committee Statement

Committee Statement: The committee believes the engine manufacturer is responsible for certifying the cooling system
Response Message:

Public Input No. 24-NFPA 414-2017 [Section No. 6.2.2]

First Revision No. 47-NFPA 414-2017 [Section No. 6.3]

6.3 Prototype Vehicle Tests.

Where the vehicle is fitted with an extendable turret, the test shall be conducted with the extendable turret in the stowed position.

6.3.1

Changes to a vehicle design that qualify the vehicle for prototype testing shall include the following:

(1) Changes in engine horsepower

(2) Changes in drive train

(3) Chassis/suspension

(4) Water pump

(5) Primary fire-fighting system

6.3.2

Where the vehicle is fitted with an extendable turret, the test shall be conducted with the extendable turret in the stowed position.

6.3.3* Rated Water and Foam Tank Capacity Test.

6.3.3.1

Test equipment shall consist of the following:

(1) Calibrated sight gauge

(2) Liquid volume measuring device accurate to within ±1.0 percent

(3) Alternative: A stopwatch and a scale capable of measuring the total vehicle weight accurate to within ±1.0 percent

6.3.3.2

The rated water and foam tank capacity shall be determined as follows:

(1) Park the vehicle on level ground.

(2) If necessary, attach a calibrated site gauge to both the water tank and the foam tank.

(3) Fill the water piping up to a level even with the bottom of the tank. Do not record the water quantity used.

(4) While filling both tanks with a liquid volume measuring device, correlate and record the amount of water added to each tank with the site gauge calibrations. When the tanks are filled to the top, record the total liquid capacity for each tank.

(5) Alternative: After completion of (3), record the weight of the vehicle. Fill the water tank and foam tank and record the weight of the vehicle.

(6) Add dye to the foam tank.

(7) Set the agent system to discharge at the specified foam solution rate, and adjust the system discharge pressure to the recommended pressure.

(8) Starting with tanks that are completely full, discharge at maximum rate through the primary turret(s) until the agent pump(s) shows a drop in discharge pressure, and then stop immediately. Verify that dye is apparent in the discharge stream throughout the test. Record the discharge time if using the weight measurement method.

(9) Alternative: Record the weight of the vehicle after discharging. Calculate the pump-out capacity of the water tank using the weight of the water plus the foam discharged, the foam proportioning rate, and the discharge time, as previously verified.

(10) Measure the amount of liquid remaining in both tanks and convert to liters (gallons) using the conversion established in ~~6.3.1.2(5)~~ 6.3.3.2(5) . Subtract the amount remaining from the total capacity to determine the amount pumped out. Record the total amount of liquid pumped out of the tanks.

(11) Refill the water tank only (not the foam tank). Discharge the water tank as in ~~6.3.1.2(8)~~ 6.3.3.2(8) . Verify that dye is apparent throughout the test. Measure and record the additional amount of liquid discharged from the foam tank. Fill the water tank and discharge as many times as necessary to eliminate all usable liquid from the foam tank.

(12) Total and record the amount of liquid discharged from the foam tank from the time of initial fill.

(13) Refill both tanks and repeat ~~6.3.1.2(6)~~ 6.3.3.2(6) through ~~6.3.1.2(11)~~ 6.3.3.2(11) with the vehicle parked in the following attitudes:

(a) 20 percent side slope, left side up

(b) 20 percent side slope, right side up

(c) 30 percent slope, ascending

(d) 30 percent slope, descending

(14) After pumping on a slope, with the vehicle in each of the four slope conditions, return the vehicle to level ground to measure the water volume discharged.

(15) Divide the volume of liquid discharged from each tank on the four slope conditions by 0.85 and record.

6.3.3.3

The rated or usable water tank capacity shall be the lesser of the volumes calculated in ~~6.3.1.2(10)~~ 6.3.3.2(10) or ~~6.3.1.2(14)~~ 6.3.3.2(14) .

6.3.3.4

The rated or usable foam tank capacity shall be the lesser of the volumes calculated in ~~6.3.1.2(12)~~ 6.3.3.2(12) and ~~6.3.1.2(14)~~ 6.3.3.2(14) .

6.3.4* Cornering Stability.

6.3.4.1

A calibrated speedometer and a means of indicating steering wheel angle shall be required.

6.3.4.2

The vehicle shall be tested in its fully loaded condition.

6.3.4.3

A speed as outlined in Table 4.1.1.2(a) and Table 4.1.1.2(b) shall be obtained and maintained for one full revolution of the circle in accordance with SAE J2181, as follows:

(1) Slowly drive the vehicle around the 30.5 m (100 ft) radius circle while keeping the centerline of the front of the vehicle directly over the marked line.

(2) Establish a reference position on the steering wheel position indicator at a slow speed.

(3) Gradually increase the speed until the maximum speed is reached.

(4) Record the maximum speed and the corresponding position of the steering wheel.

(5) Repeat ~~6.3.2.3(1)~~ 6.3.4.3(1) through ~~6.3.2.3(4)~~ 6.3.4.3(4) while driving the vehicle in the opposite direction.

6.3.4.4

The speed achieved shall be in accordance with Table 4.1.1.2(a) and Table 4.1.1.2(b).

6.3.4.5

A double lane change test shall be conducted as follows:

(1) The vehicle shall be driven through the cones at a 40 kph (25 mph) speed in two directions.

(2) This test shall be accomplished for all prototype first article vehicles only.

(3) The vehicle shall be fully loaded and equipped for this test.

6.3.4.5.1 Test Conditions.

Wind speed shall be ≤3 m/s (≤6.7 mph).

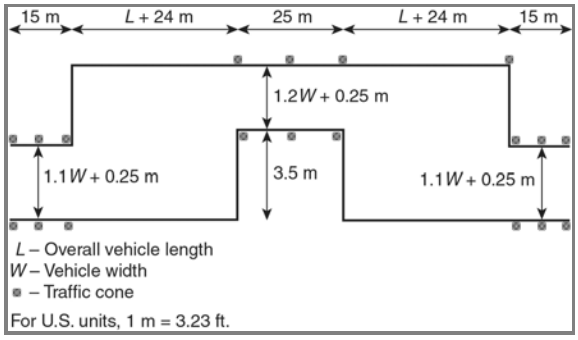
6.3.4.5.2 Test Surface.

The test surface shall be a large uniform paved surface that is hard and level with a slope of ≤2 percent in all directions with a coefficient of friction of ≥0.7 and shall be dry, clean of debris, and large enough to ensure test area safety.

6.3.4.5.3 Test Track Dimensions.

The double lane change track dimensions shall be as shown in ~~Figure 6.3.2.5.3~~ Figure 6.3.4.5.3 , and traffic cones shall mark the corners as shown in ~~Figure 6.3.2.5.3~~ Figure 6.3.4.5.3 .

Figure 6.3.4.5.3 Lane Change Test Course.



6.3.4.5.4 Test Procedure.

The test procedure shall be as follows:

(1) The operator shall drive through the first section, keeping the speed as steady as possible while driving the entire test track.

(2) The operator shall repeat the test at various speed increments until one of the following occurs:

(a) The maximum speed for the test as specified in Table 4.1.1.2(a) and Table 4.1.1.2(b) is completed.

(b) The limit of the vehicle's stability is attained.

(c) It becomes impossible to cross the test track without knocking the traffic cones down.

(3) The parameters and the vehicle's behavior during the test shall be recorded.

(4) The test shall be repeated in the opposite direction.

(5) The entire test shall be repeated by a different driver.

6.3.4.5.5 Data Documentation.

The following data from the test shall be documented:

(1) Characteristics of the test surface and the test dimensions

(2) Test number

(3) Direction of test

(4) Speed of test

(5) Vehicle behavior

(6) Number and position of the cones knocked down

6.3.4.6

The vehicle shall demonstrate the ability to traverse the "J" turn test in both directions on smooth, level pavement without the brakes being applied.

6.3.5* Vehicle Dimensions.

6.3.5.1

Test equipment shall consist of a tape measure and a protractor.

6.3.5.2

The vehicle shall be tested in its fully loaded condition with tires inflated to their recommended operating pressure.

6.3.5.3

The following vehicle dimensions shall be measured in accordance with their definitions, with the vehicle positioned on the flat pad:

(1) Angle of approach

(2) Angle of departure

(3) Interaxle clearance angle

(4) Underbody clearance

(5) Underaxle clearance

6.3.5.4

Linear dimensions shall be rounded down to the nearest 12.7 mm (½ in.), and angular dimensions shall be rounded down to the nearest ½ degree.

6.3.6* Driver Vision Measurement.

6.3.6.1

Test equipment shall consist of a plumb bob, a tape measure, and a protractor or an inclinometer.

6.3.6.2

The vehicle shall be tested in its fully loaded condition, with tires inflated to their recommended operating pressure.

6.3.6.3

The driver's range of visibility shall be determined as follows:

(1) Adjust the driver's seat to its mid position with respect to height, weight, and fore and aft adjustments.

(2) Place a structure on the seat cushion for locating an eye height of 806.5 mm (31¾ in.) and a position 304.8 mm (12 in.) forward from the seat back. Place the seat back in a vertical position.

(3) Establish the features that limit the upward and downward line of vision that are located directly in front of the driver’s seat.

(4) Measure and record the angle above the horizon at which upward vision is obstructed from the eye height point established in ~~6.3.4.3(2)~~ 6.3.6.3(2) .

(5) Establish the lowest possible line of vision below the horizon directly in front of the eye height point and project this line forward of the cab until it intersects with the ground. Project this line of vision by using a light beam, or, if the windshield is removed, use a string line. Measure and record the distance from this intersection with the ground and the front face of the bumper at the front of the truck.

(6) Stretch a line from the eye height point laterally across the cab in order to establish and record the 90 degree line of vision to the left and right of the straight ahead position. Note obstructions within these angles.

6.3.6.4

The recorded values for the distance at which the line of vision meets the ground in front of the truck and the angle of vision above the horizon shall equal or exceed the vehicle's specification.

6.3.6.5

Obstacles within the 90 degree horizontal line of vision to the right or left shall not create an obstruction of more than ~~5~~ 7 degrees per obstruction.

6.3.7* Pump and Roll on a 40 Percent Grade.

6.3.7.1

Test equipment shall consist of the following:

(1) Calibrated speedometer

(2) Vehicle-equipped pump pressure gauge

(3) Load cell accurate to within ±227 kg (±500 lb) (applicable only to the alternate drawbar method)

(4) Variable load dynamometer sled (applicable only to the alternate drawbar method)

6.3.7.2

The vehicle shall have had its primary turret(s) discharge rate and pressure verified, with vehicle in its fully loaded condition with tires inflated to their recommended operating pressure, prior to beginning this test to ensure that the turret(s) discharges at or above the minimum rate specified.

6.3.7.3

The capability of the vehicle to ascend, stop, start, and continue ascent on a 40 percent grade without interruption in the discharge rate shall be demonstrated either on an actual grade or by means of an equivalent drawbar test as follows:

(1) Fill both the water and foam tanks with water and add dye to the foam tank.

(2) Set the agent system to discharge in the foam mode and set the system discharge pressure for optimum performance.

(3) Position the vehicle at the bottom of a 40 percent grade and initiate discharge at full output through the primary turret nozzles. Verify that dye is apparent in the discharge stream throughout the test.

(4) Initiate the vehicle's ascent of the grade and achieve a speed of at least 1.6 kph (1 mph). During the ascent, bring the vehicle to a stop and resume the ascent at a speed of at least 1.6 kph (1 mph) without interruption in the discharge stream. Record the vehicle speed and any variation in discharge pressure.

(5) If an actual 40 percent grade is not available, repeat ~~6.3.5.3(1)~~ 6.3.7.3(1) through ~~6.3.5.3(4)~~ 6.3.7.3(4) with the vehicle coupled to a 40 percent grade equivalent drawbar load determined as follows:

(a) A 40 percent grade — 21.8 degree angle

(b) The loaded vehicle weight × sin 21.8 degrees (0.371), which equals the necessary drawbar pull to simulate ascending a 40 percent grade

(c) The area of the load cell, which can be determined at the time of the test

(d) The load cell reading, in kPa (psi), that simulates a 40 percent grade, which can be calculated by the following:

$$\text{load cell reading} = \frac{\sin 21.8 \text{ degrees} \times \text{vehicle weight}}{\text{area of load cell}}$$

[~~6.3.5.3~~ 6.3.7.

6.3.7.4

The vehicle shall negotiate the grade or drawbar pull smoothly while maintaining an operating pressure of at least 50 percent of the specified design pressure for the primary turret(s) at speeds of at least 1.6 kph (1 mph).

6.3.8* Electrical Charging System.

6.3.8.1

Test instrumentation shall consist of the following:

(1) A laboratory-quality voltmeter with a scale range compatible with the design voltage of the vehicle's electrical system~~. The scale on the voltmeter shall be graduated to allow reading voltages with a ±0.1 volt accuracy.~~

(2) The scale on the voltmeter graduated to allow reading voltages with a ±0.1 volt accuracy

(3) A laboratory-quality ammeter with a scale range compatible with the anticipated electrical load present on the vehicle~~. The ammeter shall be graduated to allow reading current flow within a ±3 percent accuracy.~~

(4) The ammeter graduated to allow reading current flow within a ±3 percent accuracy

(5) Confirmation that the ~~The~~ tachometer is installed in the vehicle.

6.3.8.2

The test vehicle shall be tested with the following:

(1) A fully charged set of batteries

(2) Fully operational electric and charging systems

(3) Testing temperature ranges of 10°C to 32.2°C (50°F to 90°F)

6.3.8.3 Electrical System ~~Peformance~~ Performance Tests.

6.3.8.3.1

The fire apparatus low voltage electrical system shall be tested as required by this section, and its subsections. [**1901:**13.14.1]

6.3.8.3.2

Tests shall be performed when the air temperature is between –18°C and 43°C (0°F and 110°F ~~(-18°C and 43°C~~). [**1901:**13.14.2]

6.3.8.3.3 Test Sequence.

6.3.8.3.3.1*

The three tests defined in ~~6.3.6.3.3.2~~ 6.3.8.3.3.2 through ~~6.3.6.3.3.4(D)~~ 6.3.8.3.3.4(D) shall be performed in the order in which they appear. [**1901:**13.14.3.1]

(A)

Before each test, the batteries shall be fully charged until the voltage stabilizes at the voltage regulator set point and the lowest charge current is maintained for 10 minutes. [**1901:**13.14.3.1.1]

(B)

Failure of any of these tests shall require a repeat of the sequence. [**1901:**13.14.3.1.2]

6.3.8.3.3.2 Reserve Capacity Test.

(A)

The engine shall be started and kept running until the engine and engine compartment temperatures are stabilized at normal operating temperatures and the battery system is fully charged. [**1901:**13.14.3.2.1]

(B)

The engine shall be shut off, and the minimum continuous electrical load shall be activated for 10 minutes. [**1901:**13.14.3.2.2]

(C)

All electrical loads shall be turned off prior to attempting to restart the engine. [**1901:**13.14.3.2.3]

(D)

The battery system shall then be capable of restarting the engine. [**1901:**13.14.3.2.4]

(E)

Failure to restart the engine shall be considered a test failure of the battery system. [**1901:**13.14.3.2.5]

6.3.8.3.3.3 Alternator Performance Test at Idle.

(A)

The minimum continuous electrical load shall be activated with the engine running at idle speed. [**1901:**13.14.3.3.1]

(B)

The engine temperature shall be stabilized at normal operating temperature. [**1901:**13.14.3.3.2]

(C)

The battery system shall be tested to detect the presence of battery discharge current. [**1901:**13.14.3.3.3]

(D)

The detection of battery discharge current shall be considered a test failure. [**1901:**13.14.3.3.4]

6.3.8.3.3.4 Alternator Performance Test at Full Load.

(A)

The total continuous electrical load shall be activated with the engine running up to the engine manufacturer’s governed speed. [**1901:**13.14.3.4.1]

(B)

The test duration shall be a minimum of 2 hours. [**1901:**13.14.3.4.2]

(C)

Activation of the load management system shall be permitted during this test. [**1901:**13.14.3.4.3]

(D)

An alarm sounded by excessive battery discharge, as detected by the warning system required in 13.3.4 [of NFPA 1901], or a system voltage of less than 11.8 V dc for a 12 V nominal system, 23.6 V dc for a 24 V nominal system, or 35.4 V dc for a 42 V nominal system for more than 120 seconds shall be considered a test failure. [**1901:**13.14.3.4.4]

6.3.8.3.4 Low Voltage Alarm Test.

6.3.8.3.4.1

The following test shall be started with the engine off and the battery voltage at or above 12 V for a 12 V nominal system, 24 V for a 24 V nominal system, or 36 V for a 42 V nominal system. [**1901:**13.14.4.1]

6.3.8.3.4.2

With the engine shut off, the total continuous electrical load shall be activated and shall continue to be applied until the excessive battery discharge alarm activates. [**1901:**13.14.4.2]

6.3.8.3.4.3

The battery voltage shall be measured at the battery terminals. [**1901:**13.14.4.3]

6.3.8.3.4.4

The test shall be considered a failure if the alarm does not sound in less than 140 seconds after the voltage drops to 11.70 V for a 12 V nominal system, 23.4 V for a 24 V nominal system, or 35.1 V for a 42 V nominal system. [**1901:**13.14.4.4]

6.3.8.3.4.5

The battery system shall then be able to restart the engine. [**1901:**13.14.4.5]

6.3.8.3.4.6

Failure to restart the engine shall be considered a test failure. [**1901:**13.14.4.6]

6.3.8.3.5 Documentation.

The manufacturer shall deliver the following with the fire apparatus:

(1) Documentation of the electrical system performance tests

(2) A written electrical load analysis, including the following:

  (a) The nameplate rating of the alternator

  (b) The alternator rating under the conditions specified in 13.3.2 [of NFPA 1901]

  (c) Each of the component loads specified in 13.3.3 [of NFPA 1901] that make up the minimum continuous electrical load

  (d) Additional electrical loads that, when added to the minimum continuous electrical load, determine the total continuous electrical load

  (e) Each individual intermittent electrical load

[**1901:**13.15]

6.3.8.4

The electrical system performance shall be compared as follows:

(1) Against the specification at engine idle

(2) Also at 50 percent of engine rpm

6.3.8.5

The measured voltage of the batteries shall remain above 13 volts (for a 12-volt system) and 26 volts (for a 24-volt system) at all times while the alternator is running.

6.3.9* Radio Suppression.

6.3.9.1

Test equipment shall be in accordance with SAE J551/1 or the equivalent standard being used.

6.3.9.2

The vehicle shall be configured with all standard electrical features mounted and operational.

6.3.9.2.1

During the tests, all vehicle engines shall be operated at idle.

6.3.9.2.2

All vehicle-mounted electrical devices functioning at the crash site shall be turned on with the following stipulations:

(1) All vehicle lighting shall be on.

(2) All heating, defrosting, and air-conditioning systems, or as many systems as possible, shall be on with their respective fans adjusted to the maximum speed setting.

(3) Complementary power-generating devices (where applicable) shall be running.

(4) Intermittent warning devices, such as hazard flashers, warning buzzers, and horns, shall be turned off.

6.3.9.3

The vehicle shall be tested in accordance with SAE J551/1 or the equivalent standard being used.

6.3.9.4

The results of the test shall be evaluated in accordance with SAE J551/1 or the equivalent standard being used.

6.3.10* Gradability Test.

6.3.10.1

Test equipment shall consist of the following:

(1) Load cell accurate to within ±227 kg (±500 lb) (applicable only to the alternate drawbar method)

(2) Variable load dynamometer sled (applicable only to the alternate drawbar method)

6.3.10.2

The vehicle shall be tested in its fully loaded condition with tires inflated to their recommended operating pressure.

6.3.10.3

The capability of the fully loaded vehicle to ascend a 50 percent grade shall be demonstrated either on an actual grade or by means of an equivalent drawbar pull test. If an actual 50 percent grade is not available, then the vehicle shall be coupled to a 50 percent equivalent drawbar load, determined as follows:

(1) A 50 percent grade — 26.57 degree angle

(2) The loaded vehicle weight × sin 26.57 degrees (0.447), which equals the necessary drawbar pull to simulate ascending a 50 percent grade

(3) The area of the load cell, determined at the time of the test

(4) The load cell reading, in kPa (psi), that simulates a 50 percent grade, which can be calculated by the following:

$$\text{load cell reading} = \frac{\sin 26.57 \text{ degrees} \times \text{vehicle weight}}{\text{area of load cell}}$$

[~~6.3.8.3~~ 6.3.10

6.3.10.4

The vehicle shall negotiate the grade or draw pull smoothly.

6.3.11* Body and Chassis Flexibility Test.

6.3.11.1

Test equipment shall consist of two to four 355.6 mm (14 in.) ramps with flat tops large enough for the tire footprint and graduated on both sides to allow the vehicle to ascend and descend.

6.3.11.2

The vehicle shall be tested in its fully loaded condition with tires inflated to their recommended operating pressure.

6.3.11.3

The vehicle shall be tested as follows:

(1) For a 4 × 4, drive the fully loaded vehicle onto 355.6 mm (14 in.) blocks positioned under the diagonally opposite front and rear wheels. For a 6 × 6, block positions correspond to axle 1 and axle 3. For an 8 × 8, block positions correspond to axle 1 and axle 4.

(2) With the vehicle in the position given in ~~6.3.9.3(1)~~ 6.3.11.3(1) , take the following steps:

(a) Inspect the vehicle thoroughly to ensure that there are no sheet metal interferences and that all moving parts are free to function.

(b) Demonstrate all systems to ensure that they function, including discharge from all orifices.

(3) For vehicles with bogie-type construction, add a block under the second wheel of the bogie axle(s) so that both wheels on one side of the bogie are elevated simultaneously and diagonally opposite front and rear, and then repeat ~~6.3.9.3(2)~~ 6.3.11.3(2) (a) and ~~6.3.9.3(2)~~ 6.3.11.3(2) (b).

(4) Switch the blocks to the opposite sides of the truck and repeat ~~6.3.9.3(1)~~ 6.3.11.3(1) through ~~6.3.9.3(3)~~ 6.3.11.3(3) .

6.3.11.4

No moving part shall interfere with another.

6.3.11.4.1

If component contact should occur, it shall in no way damage the component or detract from the vehicle's ability to carry out its mission.

6.3.11.4.2

No clearance shall be permitted between any tire and its supporting surface.

6.3.12* Service/Emergency Brake Test.

6.3.12.1

Instrumentation shall consist of the following:

(1) Calibrated fifth-wheel-type speed measuring device that is accurate to within ±0.8 kph (±0.5 mph) or ±0.5 percent of the actual vehicle speed

(2) Ground speed readout device controlled by the fifth wheel

(3) Trigger device that detects brake pedal movement

(4) Strip chart recording distance traveled, vehicle speed, and the point at which actuation of the brake system occurs

6.3.12.2

The vehicle shall be tested in its fully loaded condition with the brakes adjusted and the tires inflated to the vehicle manufacturer's specifications.

6.3.12.2.1

The brakes shall have been burnished to ensure repeatable results.

6.3.12.3

The service and emergency brake stopping distances shall be determined in the following manner:

(1) While traveling down the center of the lane established by the width of the vehicle plus 1.2 m (4 ft), attain a speed slightly above the desired test speed and release the throttle.

(2) With the strip chart recorder running, at the instant that the vehicle reaches the desired test speed, actuate the brake pedal as if in a panic stop and continue applying the brakes until the vehicle comes to a complete stop. While stopping, modulate the brake pedal as necessary to maintain vehicle control. Record the distance traveled from the time that the brake pedal is applied to the time that the vehicle comes to rest.

(3) Observe whether or not the vehicle leaves the established lane during the brake stop.

(4) Repeat ~~6.3.10.3(1)~~ 6.3.12.3(1) through ~~6.3.10.3(3)~~ 6.3.12.3(3) for a total of five stops from each test speed.

(5) Repeat ~~6.3.10.3(1)~~ 6.3.12.3(1) through ~~6.3.10.3(4)~~ 6.3.12.3(4) to obtain results at speeds of 32.2 kph (20 mph) and 64.4 kph (40 mph).

(6) Disable the front service brakes and repeat ~~6.3.10.3(1)~~ 6.3.12.3(1) through ~~6.3.10.3(4)~~ 6.3.12.3(4) at a test speed of 64.4 kph (40 mph).

(7) Reconnect the front service brakes and disable the rear service brakes and repeat ~~6.3.10.3(1)~~ 6.3.12.3(1) through ~~6.3.10.3(4)~~ 6.3.12.3(4) at a test speed of 64.4 kph (40 mph).

6.3.12.3.1

Items ~~6.3.10.3(6)~~ 6.3.12.3(6) and ~~6.3.10.3(7)~~ 6.3.12.3(7) shall not be applicable to commercial chassis.

6.3.12.4

Each of the recorded stops shall be within the specified distance without any part of the vehicle leaving the established test lane.

6.3.13* Service/Parking Brake Grade Holding Test.

6.3.13.1

Test equipment shall consist of the following:

(1) Load cell accurate to within ±227 kg (±500 lb) (applicable only to the alternate drawbar method)

(2) Variable load dynamometer sled (applicable only to the alternate drawbar method)

6.3.13.2

The vehicle shall be tested in its fully loaded condition with the brakes adjusted and the tires inflated to the vehicle manufacturer's specifications.

6.3.13.2.1

The brakes shall have been burnished to ensure repeatable results.

6.3.13.3

The capability of the vehicle's parking brake to hold the vehicle stationary on a 20 percent grade shall be demonstrated either on an actual grade or by means of an equivalent drawbar pull test. If an actual 20 percent grade is available, the tests shall be conducted as follows:

(1) Drive the vehicle in a forward direction onto the 20 percent grade, stop, and set the parking brake.

(2) Shift the transmission to neutral, and release the service brakes and verify that there is no wheel rotation.

(3) Repeat (1) and (2) with the vehicle facing the opposite direction.

6.3.13.3.1

If an actual 20 percent grade is not available, the tests shall be conducted as follows:

(1) Drive the vehicle onto the level test pad. Shift the transmission to neutral.

(2) Couple the vehicle to the horizontal force device so that forward drawbar force can be generated. Release the parking brake.

(3) Pull the vehicle forward at a speed of at least 1.6 kph (1 mph). As the vehicle is being pulled, apply the parking brake until a 20 percent equivalent drawbar is generated. A 20 percent equivalent drawbar load is determined as follows:

(a) A 20 percent grade — 11.31 degree angle

(b) The loaded vehicle weight × sin 11.31 degrees (0.196), which equals the necessary drawbar pull to simulate holding on a 20 percent grade

(c) The area of the load cell, determined at the time of the test

(d) The load cell reading, in kPa (psi), that simulates a 20 percent grade, calculated by the following:

$$\text{load cell reading} = \frac{\sin 11.31 \text{ degrees} \times \text{vehicle weight}}{\text{area of load cell}}$$

[~~6.3.11.3.1~~ 6.3

6.3.13.4

The capability of the vehicle's service brake to hold the vehicle stationary on a 50 percent grade shall be demonstrated either on an actual grade or by means of an equivalent drawbar pull test. If an actual 50 percent grade is available, the tests shall be conducted as follows:

(1) Drive the vehicle in a forward direction onto the 50 percent grade, apply the service brakes, and shift the transmission to neutral.

(2) Verify there is no wheel rotation.

(3) Repeat ~~6.3.11.4(1)~~ 6.3.13.4(1) and ~~6.3.11.4(2)~~ 6.3.13.4(2) with the vehicle facing the opposite direction.

6.3.13.4.1

If an actual 50 percent grade is not available, the tests shall be conducted as follows:

(1) Drive the vehicle onto the level test pad. Shift the transmission to neutral.

(2) Couple the vehicle to the horizontal force device so that forward drawbar force can be generated. Release the parking brake.

(3) Pull the vehicle forward at a speed of at least 1.6 kph (1 mph). As the vehicle is being pulled, apply the service brakes until a 50 percent equivalent drawbar is generated. A 50 percent equivalent drawbar load is determined as follows:

(a) A 50 percent grade — 26.57 degree angle

(b) The loaded vehicle weight × sin 26.57 degrees (0.447), which equals the necessary drawbar pull to simulate holding on a 50 percent grade

(c) The area of the load cell, determined at the time of the test

(d) The load cell reading, in kPa (psi), that simulates a 50 percent grade, calculated by the following:

$$\text{load cell reading} = \frac{\sin 26.57 \text{ degrees} \times \text{vehicle weight}}{\text{area of load cell}}$$

[~~6.3.11.4.1~~ 6.3

(4) Repeat ~~6.3.11.4.1(1)~~ 6.3.13.4.1(1) through ~~6.3.11.4.1(3)~~ 6.3.13.4.1(3) with a drawbar force applied in the rearward direction.

6.3.13.5

The capability of the vehicle's service brake to hold the vehicle stationary on a 20 percent grade shall be demonstrated either on an actual grade or by means of an equivalent drawbar pull test. If an actual 20 percent grade is available, the tests shall be conducted as follows:

(1) Drive the vehicle in a forward direction onto the 20 percent grade, apply the service brakes, and shift the transmission to neutral.

(2) Verify that there is no wheel rotation.

(3) Repeat ~~6.3.11.5(1)~~ 6.3.13.5(1) and ~~6.3.11.5(2)~~ 6.3.13.5(2) with the vehicle facing the opposite direction.

6.3.13.5.1

If an actual 20 percent grade is not available, the tests shall be conducted as follows:

(1) Drive the vehicle onto the level test pad. Shift the transmission to neutral.

(2) Couple the vehicle to the horizontal force device so that forward drawbar force can be generated. Release the parking brake.

(3) Pull the vehicle forward at a speed of at least 1.6 kph (1 mph). As the vehicle is being pulled, apply the service brakes until a 20 percent equivalent drawbar is generated. A 20 percent equivalent drawbar load is determined as follows:

(a) A 20 percent grade — 11.31 degree angle

(b) The loaded vehicle weight × sin 11.31 degrees (0.196), which equals the necessary drawbar pull to simulate holding on a 20 percent grade

(c) The area of the load cell, determined at the time of the test

(d) The load cell reading, in kPa (psi), that simulates a 20 percent grade, calculated by the following:

$$\text{load cell reading} = \frac{\sin 11.31 \text{ degrees} \times \text{vehicle weight}}{\text{area of load cell}}$$

[~~6.3.11.5.1~~ 6.3

(4) Repeat ~~6.3.11.5.1(1)~~ 6.3.13.5.1(1) through ~~6.3.11.5.1(3)~~ 6.3.13.5.1(3) with a drawbar force applied in the rearward direction.

6.3.13.6

The brakes shall lock the wheels and hold the vehicle stationary on both the 20 percent and 50 percent grade (or the brakes shall generate an equivalent drawbar pull), with the vehicle pointed either uphill or downhill.

6.3.14* Steering Control Test.

6.3.14.1

Test equipment shall consist of a steering wheel and a torque meter or a spring scale.

6.3.14.2

The vehicle shall be tested in a fully loaded condition with tires inflated to their operating pressure.

6.3.14.3

The vehicle shall be tested as follows:

(1) Set the road wheels in the straight-ahead position; engage neutral, and release the brakes, ensuring that there is no vehicle movement.

(2) With the engine at idle speed, measure and record the force applied to the steering rim that is necessary to turn the steering linkage from stop to stop.

6.3.14.4

The measured force shall not exceed the manufacturer's design specifications.

6.3.15* Vehicle Clearance Circle Test.

6.3.15.1

A tape measure, markers or a marking device, and a calculator shall be required.

6.3.15.2

The vehicle's steering system shall be fully operational, with the steering linkage stops adjusted within the manufacturer's specified production tolerance limits.

6.3.15.3

The vehicle shall be tested as follows:

(1) Drive the vehicle to the end of steering travel, making a left or right turn as necessary, in at least one complete circle to fully "settle" the wheels into their steady-state condition.

(2) Slowly drive the vehicle in the full cramp turn.

(3) Stop the vehicle in three locations around the turning circle, applying the brake smoothly and gradually.

(4) At each stop, mark the outermost projected point of the vehicle on the ground.

(5) Measure and record the straight line distances between the marks for each of the stop locations (length 1, length 2, and length 3).

(6) Calculate the vehicle clearance circle radius (R) as follows:

$$R = \frac{(\text{length 1})(\text{length 2})(\text{length 3})}{4\,[S\ (S - \text{length 1})\ (S - \text{length 2})\ (S - \text{length 3})]^{1/2}}$$

[~~6.3.13.3~~ 6.3.1

where:

S = (length 1 + length 2 + length 3)/2

(7) Repeat ~~6.3.13.3(1)~~ 6.3.15.3(1) through ~~6.3.13.3(6)~~ 6.3.15.3(6) while turning the vehicle in the opposite direction.

6.3.15.4

The vehicle's clearance circle diameter ($2R$) shall be less than three times the maximum overall length of the vehicle.

6.3.16* Agent Pump(s)/Tank Vent Discharge Test.

6.3.16.1

Test equipment shall consist of a liquid level measuring device accurate to within ±1.0 percent.

6.3.16.2

Each discharge nozzle on the vehicle shall have been individually verified as discharging at a flow rate at or above the minimum rate specified when the agent system is operated at the recommended pressure.

6.3.16.3

The test shall be conducted as follows:

(1) Fill the water tank and the foam tank to the top.

(2) Set the foam proportioning system to proportion foams at the concentration specified, and set the agent selector for the foam mode.

(3) Set the agent system pressure relief to the recommended pressure.

(4) Engage the agent pumps, and operate them at maximum pumping speed with all discharge outlets closed.

(5) Simultaneously initiate discharge of the primary turret(s), primary handlines, ground sweeps/bumper turret, and undertruck nozzles. After approximately 75 percent of the contents from the water tank has been discharged, simultaneously stop discharge through all nozzle outlets. Record the time of discharge.

(6) Measure and then add together the total amount of liquid discharged from the water tank and the foam tank. Calculate the average discharge rate using the discharge time from ~~6.3.14.3(5)~~ 6.3.16.3(5) .

(7) Calculate the quantity of liquid used from the foam tank as a percentage of the total liquid discharged.

6.3.16.4

The measured total discharge rate shall be equal to at least the sum of the minimum specified discharge rates of the nozzles used during the test.

6.3.16.5

The calculated average foam concentration shall be within the tolerance permitted in NFPA 412, Section 5.2.

6.3.17* Water Tank Fill and Overflow Test.

6.3.17.1

Instrumentation shall consist of calibrated mechanical or electronic pressure measuring devices with an accuracy of ±3 percent and a stopwatch.

6.3.17.2

The water tank shall be empty, and the water tank fill and vent system shall be fully operational for this test.

6.3.17.3

The water tank fill and vent system shall be tested as follows to verify that the tank can be filled in 2 minutes or less:

(1) Park the vehicle on level ground.

(2) Attach one pressure measuring device at the inlet to the tank fill piping, and attach the other pressure measuring device to the tank body or an extension of the tank body.

(3) Simultaneously initiate flow to the tank and start the stopwatch. The water supply pressure shall be maintained at 551.6 kPa (80 psi) throughout the test.

(4) At the moment water begins to flow from the overflow piping, stop the watch and record the elapsed time.

(5) While maintaining a 551.6 kPa (80 psi) supply pressure and an overflow condition, record the internal tank pressure. After recording this pressure, shut off the water supply.

6.3.17.4

The results of this test shall be evaluated as follows:

(1) The time to fill the tank to the overflow condition shall be 2 minutes or less.

(2) The internal tank pressure shall not exceed the tank design pressure.

6.3.18* Flushing System Test.

6.3.18.1

No special instrumentation shall be required for this test.

6.3.18.2

The vehicle's agent system and flushing system shall be fully operational for this test.

6.3.18.3

The vehicle's flushing system shall be tested as follows:

(1) Fill the water tank and foam tank with clean water, and add dye to the foam tank.

(2) Discharge agent through each discharge orifice on the vehicle while operating in the foam mode until dye is present in the discharge stream.

(3) Mark the liquid level in the foam tank.

(4) Set the agent system in the flush mode, and discharge through each discharge orifice until clear water is present in the discharge stream.

(5) Shut the agent system down, and drain the piping.

(6) Recheck the foam tank level.

6.3.18.4

Failure to develop a clear water stream through each nozzle shall be considered evidence that the flushing system is not working.

6.3.18.5

There shall be no evidence of feedback of clear water into the foam tank.

6.3.19* Primary Turret Flow Rate Test.

6.3.19.1

Test equipment shall consist of the following:

(1) Calibrated sight gauge

(2) Liquid volume measuring device accurate to within ±1.0 percent

(3) Calibrated pressure gauge, if not already provided on the truck

(4) Alternative: A stopwatch and a scale capable of measuring total vehicle weight accurate to within ±1.0 percent of the scale capacity

6.3.19.2

It shall have been verified that the vehicle's pumping system is capable of operating at full rate.

6.3.19.3

The primary turret discharge rate shall be determined as follows:

(1) Set the primary turret pattern for straight stream operation.

(2) Fill the water tank completely.

(3) Engage the pump, and operate it at design speed.

(4) Open the turret flow control valve.

(5) If necessary, at this stage perform the following procedures:

(a) If flow meters are used, read and record the flow rate once the discharge pressure stabilizes.

(b) If a sight gauge is used, read and record the tank volume in gallons while simultaneously starting a stopwatch after the discharge pressure stabilizes. Read and record the tank volume in liters (gallons) when the watch is stopped after allowing flow for at least 1 minute. Determine the flow rate in L/min (gal/min) by dividing the difference in gallons by the time of discharge.

(c) If a scale is used, record the vehicle weight prior to discharge. Start a stopwatch, and discharge water at stabilized pressure for 1 minute. Record the vehicle weight after discharge and calculate the flow rate.

(6) Reset the primary turret pattern to the dispersed setting and repeat ~~6.3.17.3(2)~~ 6.3.19.3(2) through ~~6.3.17.3(5)~~ 6.3.19.3(5) .

(7) Reset the primary turret to the half flow rate setting (if applicable) and repeat ~~6.3.17.3(1)~~ 6.3.19.3(1) through ~~6.3.17.3(6)~~ 6.3.19.3(6) .

6.3.19.4

The measured turret flow rates shall equal the specified flow rate within a tolerance of +10 percent/~~-0~~ –0 percent.

6.3.20 Primary Turret Pattern Test.

The primary turret pattern test shall be conducted in accordance with the requirements of NFPA 412.

6.3.21* Primary Turret Control Force Measurement.

6.3.21.1

Test equipment shall consist of a spring scale that can be attached to the end of the turret control handle or a torque measuring device that can be attached to the rotational axis of the turret.

6.3.21.2

The water tank shall be filled prior to starting the test.

6.3.21.2.1

The water tank shall have been verified that the vehicle pump system is capable of operating at design flow and pressure.

6.3.21.2.2

The test shall be conducted with the primary turret at the full flow rate setting.

6.3.21.2.3

The turret power-assist system, if applicable, shall be fully operational.

6.3.21.3

The test shall be conducted as follows:

(1) Set the turret pattern control for straight stream, and, where applicable, engage the power assist.

(2) Engage the pump, and operate it at design speed.

(3) Open the turret flow control valve.

(4) Using a spring scale attached to the end of the turret aiming handle, rotate the turret to the right and to the left, recording the needed force for each direction. Again, using the spring scale attached to the end of the turret aiming handle, elevate and depress the turret, and record the force needed to elevate and depress.

(5) Repeat ~~6.3.19.3(2)~~ 6.3.21.3(2) through ~~6.3.19.3(4)~~ 6.3.21.3(4) with the pattern control set at the maximum dispersed position after refilling the water tank as necessary.

6.3.21.4

The forces recorded shall not exceed the forces specified in 4.19.4.

6.3.22* Primary Turret Articulation Test.

6.3.22.1

The test equipment shall consist of a tape measure, a level, and a protractor.

6.3.22.2

The water tank shall be filled prior to the test.

6.3.22.2.1

The turret power-assist system, if applicable, should be fully operational.

6.3.22.3

The test shall be conducted as follows:

(1) With the turret pointed ahead, raise the turret barrel to the maximum elevated position. With a level held horizontal at the vertical rotation axis, measure the angle between the level and the turret barrel with the protractor and record.

(2) Rotate the primary turret barrel to the right and left to the angle needed.

(3) Place a marker 9.1 m (30 ft) in front of the vehicle. Aim the turret straight ahead with the rate control at full flow, with the pattern control in the maximum dispersed position and with the turret in the maximum depressed position. When water discharges, observe whether water strikes the marker or strikes closer to the vehicle.

6.3.22.4

Turret articulation shall be considered as passing if the measurements meet or exceed the specifications.

6.3.23* Handline Nozzle Flow Rate Test.

6.3.23.1

Test equipment shall consist of the following:

(1) Calibrated sight gauge

(2) Liquid volume measuring device accurate to within ±1.0 percent

(3) Calibrated pressure gauge, if not already provided on the truck

(4) Alternative: A stopwatch and a scale capable of measuring total vehicle weight accurate to within ±1.0 percent

6.3.23.2

The vehicle's pumping system shall be verified to be capable of operating at full rate.

6.3.23.3

The handline nozzle flow rate shall be determined as follows:

(1) Set the handline nozzle pattern for straight stream operation.

(2) Fill the water tank completely.

(3) Engage the pump and operate it at design speed.

(4) Open the handline nozzle flow control valve.

(5) If necessary, at this stage perform the following procedures:

(a) If flow meters are used, read and record the flow rate once the discharge pressure stabilizes.

(b) If a sight gauge is used, read and record the tank volume in gallons while simultaneously starting a stopwatch after the discharge pressure stabilizes. Read and record the tank volume in liters (gallons) when the watch is stopped after allowing flow for at least 5 minutes. Determine the flow rate in L/min by dividing the difference in gallons by the time of discharge.

(c) If an open-top calibrated tank is used, discharge through the nozzle until the pressure stabilizes, and then simultaneously direct the stream into the tank while starting the stopwatch. Stop the stopwatch when the tank is full, and remove or shut off the nozzle. Determine the flow rate by dividing the tank volume in liters (gallons) by the fill time in minutes.

(d) If a scale is used, record the vehicle weight prior to discharge. Start a stopwatch, and discharge water at stabilized pressure for 1 minute. Record the vehicle weight after discharge, and calculate flow rate.

(6) If the nozzle is the non-air-aspirated type, repeat ~~6.3.21.3(2)~~ 6.3.23.3(2) through ~~6.3.21.3(5)~~ 6.3.23.3(5) with the nozzle pattern setting in the fully dispersed position.

6.3.23.4

The measured handline nozzle flow rates shall equal the specified flow rate within a tolerance of +10 percent/~~-0~~ –0 percent.

6.3.24 Handline Nozzle Pattern Test.

The handline nozzle pattern test shall be conducted in accordance with the requirements of NFPA 412.

6.3.25* Ground Sweep/Bumper Turret Flow Rate Test.

6.3.25.1

Test equipment shall consist of the following:

(1) Calibrated sight gauge

(2) Liquid volume measuring device accurate to within ±1.0 percent

(3) Calibrated pressure gauge, if not already provided on the truck

(4) Alternative: A stopwatch and a scale capable of measuring total vehicle weight accurate to within ±1.0 percent

6.3.25.2

The vehicle's pumping system shall be verified to be capable of operating at full rate.

6.3.25.3

The ground sweep/bumper turret discharge rate shall be determined as follows:

(1) Set the ground sweep/bumper turret pattern for straight stream operation.

(2) Fill the water tank completely.

(3) Engage the pump and operate it at design speed.

(4) Open the ground sweep/bumper turret flow control valve.

(5) If necessary, at this stage perform the following procedures:

(a) If flow meters are used, read and record the flow rate once the discharge pressure stabilizes.

(b) If a sight gauge is used, read and record the tank volume in gallons while simultaneously starting a stopwatch after the discharge pressure stabilizes. Read and record the tank volume in liters (gallons) when the watch is stopped after allowing flow for at least 1 minute. Determine the flow rate in L/min by dividing the difference in gallons by the time of discharge.

(c) If a scale is used, record the vehicle weight prior to discharge. Start a stopwatch, and discharge water at stabilized pressure for 1 minute. Record the vehicle weight after discharge, and calculate the flow rate.

(6) If the ground sweep/bumper turret is the non-air-aspirated type, repeat ~~6.3.23.3(2)~~ 6.3.25.3(2) through ~~6.3.23.3(5)~~ 6.3.25.3(5) with the nozzle pattern setting in the fully dispersed position.

6.3.25.4

The measured flow rates shall equal the specified flow rate within a tolerance of +10 percent/~~-0~~ –0 percent.

6.3.26 Ground Sweep/Bumper Turret Pattern Test.

The ground sweep/bumper turret pattern test shall be conducted in accordance with the requirements of NFPA 412.

6.3.27* Undertruck Nozzle Test.

6.3.27.1

Markers shall be available for use in defining the pattern boundaries.

6.3.27.2

The vehicle's pump system shall be verified to be capable of operating at full rate.

6.3.27.2.1

The agent tanks shall be filled with water and foam, respectively.

6.3.27.3

The test shall be conducted as follows:

(1) Set the agent system to operate in the foam mode.

(2) Engage the agent pump and operate it at design speed.

(3) Open the undertruck nozzles to discharge simultaneously, and continue to discharge until a definite pattern outline is apparent.

(4) Close the discharge and mark and record the boundaries of the pattern.

6.3.27.4

The pattern shall be considered acceptable if the foam spray covers the outline created by the vehicle on the ground and wets the inside of all tires.

6.3.28* Foam Concentration/Foam Quality Test.

6.3.28.1

The test equipment described in NFPA 412 shall be used for this test.

6.3.28.2

Each discharge nozzle on the vehicle shall have been individually verified as discharging at a flow rate within the tolerance specified.

6.3.28.2.1

The agent system shall have been verified as capable of operating at full rate.

6.3.28.3

The test shall be conducted as follows:

(1) Fill the water tank and the foam tank to the top, and refill as necessary throughout the test.

(2) Set the foam proportioning system to proportion foams at the concentration specified, and set the agent selector for the foam mode.

(3) Set the agent system pressure relief to the recommended pressure.

(4) Engage the agent pumps, and operate them at maximum pumping speed with all discharge outlets closed.

(5) Test each foam delivery system first for the individual nozzle/flow rate specified in the following list and then for a total combined simultaneous discharge in accordance with NFPA 412:

(a) Primary turret(s) full rate

(b) Primary turret(s) half rate

(c) Ground sweep/bumper turret

(d) Handline nozzles

(e) Undertruck nozzles

6.3.28.4

The foam concentrations measured shall fall within the permitted tolerances specified in NFPA 412 for each nozzle and for the combined simultaneous discharge.

6.3.28.4.1

The foam expansion and drainage time measurements shall equal or exceed those specified in NFPA 412 for each nozzle.

6.3.29* Warning Siren Test.

6.3.29.1

Test equipment shall consist of the following:

(1) Sound level meter that meets the requirements of ANSI S1.4 for Type 1 or S1A meters and has been calibrated by a certified testing laboratory within the previous 12 months

(2) Tape measure

6.3.29.2

The capability of the warning siren on the vehicle to project sound forward and to the sides shall be determined as follows:

(1) Set the sound level meter to the A-weighing network, “fast” meter response, and position the meter directly ahead of the vehicle at a distance of 30.5 m (100 ft) from the front bumper, with the microphone at ear level of a 95th percentile male.

(2) Energize the siren and record the meter reading.

(3) Repeat ~~6.3.27.2(1)~~ 6.3.29.2(1) and ~~6.3.27.2(2)~~ 6.3.29.2(2) with the sound level meter 30.5 m (100 ft) from the vehicle, first at a position 45 degrees to the right and then at 45 degrees to the left of the longitudinal centerline of the vehicle.

6.3.29.3

The recorded noise level shall equal or exceed the specifications.

6.3.30* Propellant Gas.

6.3.30.1

Test equipment shall consist of a calibrated scale or load cell with an accuracy of ±1.0 percent.

6.3.30.2

The vehicle extinguishing agent piping system shall be operational.

6.3.30.2.1

The agent tank(s) shall be empty.

6.3.30.2.2

The propellant gas tank(s) shall be fully charged to the rated pressure.

6.3.30.2.3

A means of lifting the agent tanks for weighing without loss of agent shall be provided.

6.3.30.2.4

As an alternative, the extinguishing agent tank(s) shall be permitted to be tested outside of the vehicle.

6.3.30.2.5

Where the alternative in ~~6.3.28.2.4~~ 6.3.30.2.4 is used, the test shall be conducted with the agent tank(s) and related piping, fittings, valves, hose, and nozzle(s) in the same configurations in which they are installed on the vehicle.

6.3.30.3

The test for each of the extinguishing agents shall be conducted in the following manner:

(1) Weigh the empty tank(s) and record as tare weight.

(2) Using the manufacturer's recommended filling procedure, charge the tank(s) with the manufacturer's recommended extinguishing agent to the upper fill weight/volume tolerance. Reweigh and record this as gross filled weight.

(3) Ensure that all fill caps are tightened, all propellant gas lines are connected, the discharge nozzle(s) is in the closed position, and all fittings and connections are tight.

(4) Pressurize the agent tank(s) using the manufacturer's recommended procedure.

(5) Simultaneously, fully open all discharge nozzles, and keep open until only the pressurizing gas is expelled.

(6) Shut down the propellant gas supply.

(7) Reweigh the agent tank(s) and record this as post-discharge weight.

(8) Calculate and record the total agent discharged as follows:
Gross filled weight – post-discharge weight = total agent discharge

6.3.30.4

There shall be a supply of propellant gas to purge all discharge lines as evidenced by the emission from each nozzle of gas only.

6.3.31* Pressure Regulation.

6.3.31.1

Test equipment shall consist of a calibrated pressure gauge or transducer capable of reading the recommended tank top discharge pressure and possessing an accuracy of ±34.5 kPa (±5.0 psi).

6.3.31.2

The vehicle extinguishing agent system shall be piped to all discharge outlets with the tank(s) empty.

6.3.31.2.1

The propellant gas tank(s) shall be fully charged and at pressure.

6.3.31.2.2

A means for mounting a pressure gauge or transducer somewhere between the downstream (low-pressure) side of the regulator and the agent tank top shall be provided.

6.3.31.2.3

As an alternative, the extinguishing agent tank(s) shall be permitted to be tested outside of the vehicle.

6.3.31.2.4

Where the alternative in ~~6.3.29.2.3~~ 6.3.31.2.3 is used, the test shall be conducted with the agent tank(s) and related piping, fittings, valves, hose, and nozzle(s) in the same configuration in which they are installed on the vehicle.

6.3.31.3

The test for each of the extinguishing agents shall be conducted in the following manner:

(1) Using the manufacturer's recommended filling procedure, charge the tank(s) with the manufacturer's recommended extinguishing agent to the upper fill weight/volume tolerance.

(2) Install a pressure gauge or transducer between the downstream (low-pressure) side of the regulator and the agent tank top.

(3) Ensure that all fill caps are tightened, all propellant gas lines are connected, the discharge nozzle(s) is in the closed position, and all fittings are tight.

(4) Pressurize the agent tank(s) using the manufacturer's recommended procedure. Record the agent tank pressure.

(5) Simultaneously, fully open all discharge nozzles, and keep open until only the pressurizing gas is expelled.

(6) During agent discharge, monitor agent tank pressure and record at 5-second or shorter intervals.

(7) Once the gas point has been reached for all discharge nozzles, shut down the gas supply.

6.3.31.4

The pressure regulation system shall be capable of maintaining pressure throughout the discharge.

6.3.31.4.1

At no time shall pressure fall below or exceed the design range specified by the manufacturer.

6.3.32* AFFF Premix Piping and Valves.

6.3.32.1

Test equipment shall consist of the following:

(1) Calibrated scale or load cell with an accuracy of ±1.0 percent

(2) Stopwatch

6.3.32.2

All vehicle foam discharge piping shall be operational, and the premix tank shall be empty.

6.3.32.2.1

The propellant gas tank(s) shall be fully charged and within pressure.

6.3.32.2.2

A means of lifting the agent tank(s) for weighing without loss of agent shall be provided.

6.3.32.2.3

As an alternative, the system shall be permitted to be tested outside of the vehicle.

6.3.32.2.4

Where the alternative in ~~6.3.30.2.3~~ 6.3.32.2.3 is used, the test shall be conducted with the premix tank and related piping, fittings, valves, hose, and nozzle(s) in the same configuration in which they are installed on the vehicle.

6.3.32.3

The test shall be conducted in the following manner:

(1) Weigh the empty premix tank and record as tare weight.

(2) Using the manufacturer's recommended filling procedure, charge the tank with water or premix solution. Reweigh and record as gross filled weight.

(3) Ensure that all fill caps are tightened, all propellant gas lines are connected, the discharge nozzle(s) is in the closed position, and all fittings and connections are tight.

(4) Pull all handline hose from the reel(s) or hose compartment(s).

(5) Pressurize the system using the manufacturer's recommended procedure.

(6) Simultaneously, start the stopwatch and fully open the turret(s), undertruck nozzles, and handline(s).

(7) After discharging for at least 30 seconds, simultaneously stop the stopwatch and close the turret(s), undertruck nozzles, and handline(s). Record the elapsed time on the stopwatch as discharge time.

(8) Following the manufacturer's instructions, shut off the propellant gas supply, and blow down the system.

(9) Reweigh the premix tank and record this as post-discharge weight.

(10) Add the recommended flow rates from each discharge nozzle and record this sum as the designed total flow rate.

(11) Calculate the actual total flow rate (TFR) as follows:

$$\text{TFR} = \frac{\text{gross filled weight} - \text{post-discharge weight}}{(\text{density}) \times \frac{(\text{elapsed time in seconds})}{60}}$$

[~~6.3.30.3~~ 6.3.3

6.3.32.4

The actual TFR shall equal the specified flow rate designed within a tolerance of +10 percent/~~-0~~ –0 percent.

6.3.33* Pressurized Agent Purging and Venting.

6.3.33.1

No special test equipment or instrumentation shall be required to conduct the test(s).

6.3.33.2

The vehicle extinguishing agent system(s) shall be fully operational.

6.3.33.2.1

The agent tank(s) shall be fully charged with the manufacturer's recommended agent.

6.3.33.2.2

The propellant gas tank(s) shall be fully charged to the rated pressure.

6.3.33.2.3

As an alternative, the extinguishing agent tank(s) shall be permitted to be tested outside of the vehicle.

6.3.33.2.4

Where the alternative in ~~6.3.31.2.3~~ 6.3.33.2.3 is used, the test shall be conducted with the fully charged agent tank(s) and related piping, fittings, valves, hose, and nozzle(s) in the same configuration in which they are installed on the vehicle.

6.3.33.3

The test for each of the pressurized extinguishing agent systems shall be conducted in the following manner:

(1) Pressurize the agent tank(s) using the manufacturer's recommended procedure.

(2) Pull all hose from the reel(s) or compartment(s).

(3) Fully open all discharge devices.

(4) After approximately 5 seconds to 20 seconds, close all discharge devices.

(5) Purge all discharge lines, and vent the agent tank(s) using the manufacturer's recommended procedure.

6.3.33.4

Any agent beyond the tank outlet shall be purged from the discharge piping and hose as evidenced by the discharge from each nozzle of gas only.

6.3.33.4.1

The depressurization or venting of the agent tank shall allow only minimal quantities of agent to escape.

6.3.34* Complementary Agent Handline Flow Rate and Range.

6.3.34.1

Test equipment shall consist of the following:

(1) Calibrated scale or load cell with an accuracy of ±1.0 percent

(2) Stopwatch

(3) Tape measure or other device for measuring distance

(4) Calibrated anemometer

(5) Pan containing at least 0.09 m^2 (1 ft^2) of motor or aviation gasoline

(6) Agent tank (if equipped with an agent tank) with a liquid level gauge with accuracy of ±1.13 kg (2.5 lb)

6.3.34.2

All vehicle agent piping shall be operational.

6.3.34.2.1

The agent tank shall be empty.

6.3.34.2.2

The propellant gas tank(s) shall be fully charged and within pressure.

6.3.34.2.3

A means of lifting the agent tank(s) for weighing without loss of agent shall be provided.

6.3.34.2.4

As an alternative, the system shall be permitted to be tested outside of the vehicle.

6.3.34.2.5

Where the alternative in ~~6.3.32.2.4~~ 6.3.34.2.4 is used, the test shall be conducted with the agent tank and related piping, fittings, valves, hose, and nozzle(s) in the same configuration in which they are installed on the vehicle.

6.3.34.3

The test shall be conducted in the following manner:

(1) Using the manufacturer's recommended agent and filling procedure, charge the agent tank.

(2) If weight discharged will be based on liquid level gauge readings, record liquid level gauge reading in 9 kg (20 lb) increments, based on weighing of agent supply cylinder, as tank is initially filled.

(3) Ensure that all fill caps are tightened, all propellant gas lines are connected, the discharge nozzle(s) is in the closed position, and all fittings and connections are tight.

(4) Pull all handline hose from the reel(s).

(5) Pressurize the system using the manufacturer's recommended procedure, and open all handline nozzles until agent flow is observed. Close the nozzles.

(6) Activate system and purge handline of air by opening the handline nozzle for approximately 1 second.

(7) Weigh or note weight based on liquid level gauge reading, and record the agent tank as the “initial weight.”

(8) Position the handline nozzles at least 6.1 m (20 ft) from the fire pan so that they can be discharged onto a flat grade with no stream obstructions. Ignite the fuel.

(9) Select one of the handline nozzles (nozzle 1). While holding it in a position 0.9 m to 1.2 m (3 ft to 4 ft) above ground level, simultaneously start the stopwatch and fully open the nozzle; then discharge agent onto the fire.

(10) After at least 50 percent of the contents of the tank has been discharged, shut down the nozzle and stop the stopwatch. Record the time as “elapsed discharge time no. 1.”

(11) Reweigh the agent tank, and record as “weight after first discharge.”

(12) If a second nozzle (nozzle 2) is provided, repeat ~~6.3.32.3(1)~~ 6.3.34.3(1) through ~~6.3.32.3(8)~~ 6.3.34.3(8) .

(13) While holding the two handline nozzles in a fixed horizontal position 0.9 m to 1.2 m (3 ft to 4 ft) above ground level, simultaneously start the stopwatch and fully open both nozzles.

(14) After at least 50 percent of the contents of the tank has been discharged, simultaneously shut down both nozzles, and stop the stopwatch. Record the time as “elapsed discharge time no. 2.”

(15) Reweigh the agent tank, and record as “weight after second discharge.”

(16) Calculate the flow rate (FR) from nozzle 1 as follows:

$$FR = \frac{\text{initial weight (test 1)} - \text{initial weight (test 2)}}{\text{(elapsed discharge time no. 1)}}$$

[~~6.3.32.3a~~ 6.3.

(17) Calculate the flow rate (FR) from nozzle 2 as follows:

$$FR = \frac{\text{weight after first discharge} - \text{weight after second discharge}}{2 \times \text{(elapsed discharge time no. 2)}}$$

[~~6.3.32.3b~~ 6.3.

(18) If nozzle 2 is of a different configuration, repeat the fire test for this nozzle.

6.3.34.4

Test results shall be evaluated as follows:

(1) The flow rate from each nozzle shall meet the requirement.

(2) The range from each nozzle shall meet or exceed the requirements as evidenced by extinguishment of the fire(s).

(3) When discharged simultaneously, the flows from nozzle 1 and nozzle 2 shall be within 10 percent of each other.

6.3.35* Dry Chemical Turret Flow Rate and Range.

6.3.35.1

Test equipment should consist of the following:

(1) Calibrated scale or load cell with an accuracy of ±1.0 percent

(2) Stopwatch

(3) Tape measure or other device for measuring distance

(4) Calibrated anemometer

6.3.35.2

All dry chemical discharge piping shall be operational.

6.3.35.2.1

The dry chemical tank shall be empty.

6.3.35.2.2

The propellant gas tank(s) shall be fully charged to the rated pressure.

6.3.35.2.3

A means of lifting the agent tank(s) for weighing without loss of agent shall be provided.

6.3.35.2.4

As an alternative, the system shall be permitted to be tested outside of the vehicle.

6.3.35.2.5

Where the alternative in ~~6.3.33.2.4~~ 6.3.35.2.4 is used, the test shall be conducted with the agent tank and related piping, fittings, valves, hose, and nozzle(s) in the same configuration in which they are installed on the vehicle.

6.3.35.3

The test shall be conducted in the following manner:

(1) Using the manufacturer's recommended agent and filling procedure, charge the tank.

(2) Ensure that all fill caps are tightened, all propellant gas lines are connected, the discharge nozzle(s) is in the closed position, and all fittings and connections are tight.

(3) Pressurize the system using the manufacturer's recommended procedure, and open the turret discharge valve until agent is observed. Close the valve.

(4) Weigh and record the agent tank as the "initial test weight."

(5) Position the dry chemical turret so that it can be discharged onto a flat grade with no stream obstructions. Position the turret to obtain maximum straight stream reach.

(6) Simultaneously, start the stopwatch and fully open the turret.

(7) During discharge, place markers at the far point where dry chemical strikes the ground (range marker) and at either side of the widest part of the pattern (width markers), following these procedures:

(a) The operator(s) placing the markers shall wear safety equipment for this task.

(b) The agent manufacturer's material safety data sheet shall be consulted.

(8) After discharging at least 75 percent of the contents of the tank, simultaneously stop the stopwatch and shut down the turret. Record the elapsed time in seconds as discharge time.

(9) Measure the distance from the turret to the range marker and record as the far point range.

(10) Measure the distance between the width markers and record as the pattern width.

(11) Reweigh the agent tank and record as the weight after discharge.

(12) Calculate the flow rate (FR) as follows:

$$FR = \frac{\text{initial test weight - weight after discharge}}{\text{elapsed discharge time}}$$

[~~6.3.33.3~~ 6.3.3

6.3.35.4

The stream range and pattern width shall equal or exceed the requirements.

6.3.35.4.1

The discharge flow rate shall equal the requirements in Table 4.1.1.2(a) and Table 4.1.1.2(b).

6.3.36* Cab Interior Noise Test.

6.3.36.1

Test equipment shall consist of a sound level meter that meets the requirements of ANSI S1.4 for Type 1 or S1A meters.

6.3.36.1.1

The sound level meter shall have been calibrated by a certified testing laboratory within the previous 12 months.

6.3.36.2

The vehicle shall be tested in its fully loaded condition with tires inflated to their recommended inflation pressure.

6.3.36.2.1

The cab doors, windows, and hatch openings shall be closed during this test.

6.3.36.2.2

The vehicle shall be driven long enough to bring the drivetrain components up to their operating temperatures prior to starting the test.

6.3.36.2.3

Thermostatically controlled shutters or cooling fans, or both, shall be allowed to function.

6.3.36.2.4

The vehicle agent system(s), the communications system, and the audible warning system and emergency warning system shall be inactive during this test.

6.3.36.3

The interior noise level of the cab shall be determined as follows:

(1) Set the sound level meter to the A-weighing network, “fast” meter response, and position the meter adjacent to the driver’s ear.

(2) Bring the vehicle up to a road speed of 80.5 kph (50 mph) and maintain that speed while recording the noise measurements.

(3) Repeat ~~6.3.34.3(1)~~ 6.3.36.3(1) and ~~6.3.34.3(2)~~ 6.3.36.3(2) until four readings have been taken, bringing the vehicle to rest between each measurement. If any of the noise measurements differ from the others by more than 2 dBA, they should be replaced by another measurement, since they could be the result of extraneous ambient noises or equipment/measurement error.

(4) Average the four readings.

6.3.36.4

The average of the recorded noise readings shall be less than or equal to the cab interior noise level specification specified in 4.12.3.3.

6.3.36.4.1

Halon 1211 systems shall not be tested.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 18 10:04:07 EDT 2017

Committee Statement

Committee Statement: The committee has added this new text for prototype vehicles in order to provide the end user with further clarification relating to what factors trigger when a vehicle is to be considered a prototype vehicle.

Response Message:

First Revision No. 23-NFPA 414-2017 [Section No. 6.4.1.2.1]

6.4.1.2.1

A ballast that is fastened in each seat shall be used in place of the crew for safety.

Submitter Information Verification

Submitter Full Name: Ken Holland
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Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:47:02 EDT 2017

Committee Statement

Committee Statement: By requiring the ballast to be fastened into the seat it ensures the proper weight distributions in the cab of the vehicle. This will eliminate sand bags being placed on the floor or in step wells affecting the CG of the vehicle. The requirement to properly secure the weight to the seat will eliminate the potential for damaging equipment in the cab should the ballast shift during the higher angles of the tilt table test.

Response Message:

Public Input No. 34-NFPA 414-2017 [Section No. 6.4.1.2.1]

First Revision No. 24-NFPA 414-2017 [Section No. 6.4.2.2.1]

6.4.2.2.1

Ballast shall be used for the crew, agent, and equipment as necessary.

Submitter Information Verification

Submitter Full Name: Ken Holland
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City:
State:
Zip:
Submittal Date: Tue Aug 29 19:49:12 EDT 2017

Committee Statement

Committee Statement: The fire fighting agent weight allowance must be considered. This also draws this requirement in line with the definition of fully loaded vehicle.

Response Message:

Public Input No. 33-NFPA 414-2017 [Section No. 6.4.2.2.1]

First Revision No. 39-NFPA 414-2017 [Section No. 6.4.13]

6.4.13 Piercing/~~Penetration~~ Nozzle Testing.

6.4.13.1*

The manufacturer shall demonstrate the ability to penetrate a sandwiched metal sample of two pieces of 0.090 5052 grade soft aluminum material with the ~~penetration device~~ piercing nozzle in under 3 seconds.

A.6.4.13.1

This demonstration need not have the ~~penetration device~~ piercing nozzle mounted to the finished boom system. This demonstration is a laboratory test to show that the manufacturer understands the requirements of the penetration task requirement.

6.4.13.2*

The manufacturer shall demonstrate the ability to penetrate a sandwiched metal sample of two pieces of 0.090 2024–T3 grade aircraft aluminum with the piercing nozzle in under 3 seconds.

A.6.4.13.2

This demonstration need not have the ~~penetration device~~ piercing nozzle mounted to the finished boom system. This demonstration is a laboratory test to show that the manufacturer understands the requirements of the penetration task requirement.

Submitter Information Verification

Submitter Full Name: Ken Holland
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City:
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Zip:
Submittal Date: Fri Sep 01 14:23:36 EDT 2017

Committee Statement

Committee Statement: The committee has made these changes for document consistency.
Response Message:

First Revision No. 40-NFPA 414-2017 [Section No. A.3.3.62.2]

A.3.3.63.2 Primary Turret.

Extinguishing agents are discharged from ARFF vehicles in several ways depending on the fire-fighting scenarios. In order to establish common terminology in the field, the following information is provided.

A nozzle is the final piece of hardware in the extinguishing agent delivery system that disperses the extinguishing agent in a manner that effectively extinguishes the fire or serves another purpose such as provides cooling to protect a piece of equipment. A “primary turret nozzle” is one that is mounted on a turret and complies with the primary turret nozzle discharge requirements of Table 4.1.1.2(c) and Table 4.1.1.2(d). A “single agent nozzle” is one that only discharges one type of extinguishing agent such as foam or dry chemical. “Parallel multiple agent nozzles” are nozzles that are joined in parallel and discharge more than one type of extinguishing agent either together or separately. An “entrained multiple agent nozzle” is a nozzle that is designed to discharge multiple entrained fire extinguishing agents. ~~A “piercing nozzle” is a nozzle with a point that can penetrate through the aircraft fuselage to discharge a fire extinguishing agent(s) into the interior of an aircraft.~~

A turret is a pivoted and revolvable device that holds the nozzle. Turrets are either primary or auxiliary depending on discharge rate and method of attack. Bumper turrets are mounted on the front bumper and are remotely operated from the cab of the vehicle. Boom turrets are mounted on articulating booms and located on the front end or top deck of the vehicle. Roof turrets are mounted on a vehicle roof and are manually or remotely operated

There are several types of booms. The “single axis boom” is remotely operated on a single axis. A “single axis extendable boom” is remotely operated and is capable of being moved on a single axis that can also be extended. A “multiple axis extendable boom” is capable of being extended and operated on both a horizontal and a vertical axis. Manufacturers of vehicles with booms should provide a diagram to the purchaser depicting the capabilities of the boom showing the side and top views of the vehicle. Figure A.3.3.63.2(a) and Figure A.3.3.63.2(b) are examples of the format that could be used.

Figure A.3.3.63.2(a) Sample of Side View to Show Boom Capabilities.

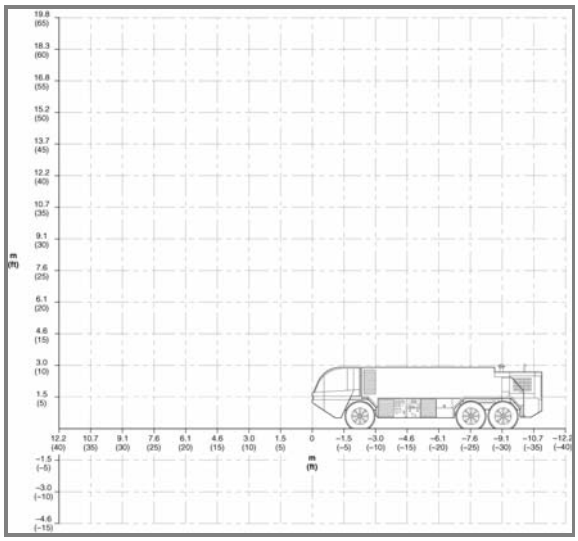
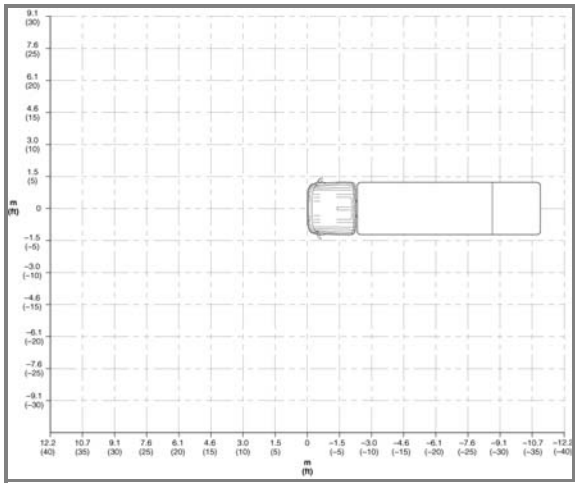


Figure A.3.3.63.2(b) Sample of Top View to Show Boom Capabilities.



Submitter Information Verification

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Submittal Date: Fri Sep 01 14:26:36 EDT 2017

Committee Statement

Committee Statement: The committee has deleted this text as it is a definition of a piercing nozzle and it should be in the main body of the document, which the committee has also addressed in FR 31
Response Message:

First Revision No. 25-NFPA 414-2017 [Section No. A.4.11.3]

A.4.11.3

A rear-wheel steering (RWS) system can be used on vehicles to improve the vehicle clearance circle radius and reduce tire wear.

Submitter Information Verification

Submitter Full Name: Ken Holland
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City:
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Zip:
Submittal Date: Tue Aug 29 19:50:53 EDT 2017

Committee Statement

Committee Statement: language correction to introduce further definition
Response Message:

Public Input No. 54-NFPA 414-2017 [Section No. A.4.11.3]

First Revision No. 26-NFPA 414-2017 [Section No. A.5.4.2]

A.5.4.2

Other means than a ladder (~~i.e.~~ e.g. , ramp or stairway) ~~is~~ are more easily traversed by ARFF~~s~~ personnel in full PPE carrying equipment and/or an incapacitated victim.

Submitter Information Verification

Submitter Full Name: Ken Holland
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:58:24 EDT 2017

Committee Statement

Committee Statement: The committee has made this change as it is editorial in nature and the submitter of the PI will provide more information in the form of a comment.
Response Message:

Public Input No. 14-NFPA 414-2017 [Section No. A.5.4.2]

First Revision No. 49-NFPA 414-2017 [Section No. A.6.4]

A.6.4

Due to the high tilt-table angle that is required in this standard per SAE J2180, testing to 30 degree tilt angle, vehicle slipping on the table surface can occur. Research has shown that an “open grid deck” product specified as follows resists vehicle traction slippage without impacting the tilt-table angle achieved: IKG Greulich 5 in., 4-way, standard open steel grid with 4183# main bars @ 645 mm (7.5 in.) on center, 6.35 mm × 50.8 mm (¼ in. × 2 in.) crossbars @ 95.3 mm (3.75 in.) on center, on 6.35 mm × 25.4 mm (¼ in. × 1 in.) diagonal and supplemental bars.

This product is available from IKG Industries, Harsco Company, ~~P.O. Box 100930, 860 Visco Drive, Nashville, TN 37224-0930; (615)782-4794; (800)467-2346; fax: (615)256-7881~~ 1514 S. Sheldon Road, Channelview, TX 77530, United States; phone (281) 452-6637; fax (713) 378-3987 .

Submitter Information Verification

Submitter Full Name: Ken Holland
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Submittal Date: Wed Oct 04 10:55:01 EDT 2017

Committee Statement

Committee Statement: Updating company information.
Response Message:

First Revision No. 50-NFPA 414-2017 [Chapter B]

Annex B Line Voltage Electrical Systems

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

The following material is extracted from Chapter 22 of the ~~2009~~ 2016 edition of NFPA 1901 and is included here as a convenience for users of this standard.

B.1 Application.

Where any part of a line voltage electrical system is provided as a fixed installation, the applicable requirements of this chapter shall apply. [**1901:**22.1]

B.2 General Requirements. [1901:22.2]

B.2.1 Stability. [1901:22.2.1]

B.2.1.1

Any fixed line voltage power source producing alternating current (ac) shall produce electric power at 60 Hz ±3 Hz when producing power at all levels between no load and full rated power. [**1901:**22.2.1.1]

B.2.1.2

Any fixed line voltage power source shall produce electric power at the rated voltage ±10 percent when producing power at all levels between no load and full rated power. [**1901:**22.2.1.2]

B.2.2

The maximum voltage supplied to portable equipment shall not exceed 275 volts to ground. Higher voltage shall be permitted only when used to operate fixed wired, permanently mounted equipment on the apparatus. [**1901:**22.2.2]

B.2.3 Conformance with ***National Electrical Code***®. [1901:22.2.3]

B.2.3.1

All components, equipment, and installation procedures shall conform to *NFPA 70* except where superseded by the requirements of this chapter. [**1901:**22.2.3.1]

B.2.3.2

Where the requirements of this chapter differ from those in *NFPA 70*, the requirements in this chapter shall apply. [**1901:**22.2.3.2]

B.2.4

When available, line voltage electrical system equipment and materials included on the apparatus shall be listed and used only in the manner for which they have been listed. [**1901:**22.2.4]

B.2.5

All equipment and materials shall be installed in accordance with the manufacturer's instructions. [**1901:**22.2.5]

B.2.6 Location Ratings. [1901:22.2.6]

B.2.6.1

Any equipment used in a dry location shall be listed for dry locations. [**1901:**22.2.6.1]

B.2.6.2

Any equipment used in a wet location shall be listed for wet locations. [**1901:**22.2.6.2]

B.2.6.3

Any equipment, except a PTO-driven generator, used in an underbody or underchassis location that is subject to road spray shall be either listed as Type 4 or mounted in an enclosure that is listed as Type 4. [**1901:**22.2.6.3]

B.2.6.4

If a PTO-driven generator is located in an underbody or underchassis location, the installation shall include a shield to prevent road spray from splashing directly on the generator. [**1901:**22.2.6.4]

B.3 Grounding and Bonding. [1901:22.3]

B.3.1 Grounding.

Grounding shall be in accordance with Section 250.34(A) and 250.34(B) of *NFPA 70*. [**1901:**22.3.1]

B.3.1.1

Ungrounded systems shall not be used. [**1901:**22.3.1.1]

B.3.1.2

Only stranded or braided copper conductors shall be used for grounding and bonding. [**1901:**22.3.1.2]

B.3.1.3

The grounded current-carrying conductor (neutral) shall be insulated from the equipment-grounding conductors and from the equipment enclosures and other grounded parts. [**1901:**22.3.1.3]

B.3.1.4

The neutral conductor shall be colored white or gray in accordance with 200.6, “Means of Identifying Grounded Conductors,” of *NFPA 70*. [**1901:**22.3.1.4]

B.3.1.5

Any bonding screws, straps, or buses in the distribution panelboard or in other system components between the neutral and equipment-grounding conductor shall be removed and discarded. [**1901:**22.3.1.5]

B.3.2 Bonding. [1901:22.3.2]

B.3.2.1

The neutral conductor of the power source shall be bonded to the vehicle frame. [**1901:**22.3.2.1]

B.3.2.2

The neutral bonding connection shall occur only at the power source. [**1901:**22.3.2.2]

B.3.2.3

In addition to the bonding required for the low-voltage return current, each body and each driving or crew compartment enclosure shall be bonded to the vehicle frame by a copper conductor. [**1901:**22.3.2.3]

B.3.2.3.1

The conductor shall have a minimum amperage rating, as defined in Section 310.15, “Ampacities for Conductors Rated 0–2000 Volts,” of *NFPA 70*, of 115 percent of the rated amperage on the power source specification label. [**1901:**22.3.2.3.1]

B.3.2.3.2

A single conductor that is sized to meet the low voltage and line voltage requirements shall be permitted to be used. [**1901:**22.3.2.3.2]

B.3.3 Ground Fault Circuit Interrupters. [1901:22.3.3]

B.3.3.1

In special service vehicles incorporating a lavatory, sink, toilet, shower, or tub, 120 V, 15 or 20 A receptacles within 6 ft (1.8 m) of these fixtures shall have ground fault circuit interrupter (GFCI) protection. [**1901:**22.3.3.1]

B.3.3.2

GFCIs integrated into outlets or circuit breakers or as stand-alone devices shall be permitted to be used in situations other than those described in B.3.3.1. [**1901:**22.3.3.2]

B.4 Power Source General Requirements.

The following requirements in B.4.1 through B.4.10 shall apply to all line voltage power sources. [**1901:**22.4]

B.4.1

All power source system mechanical and electrical components shall be sized to support the continuous duty nameplate rating of the power source. [**1901:**22.4.1]

B.4.2

The power source shall be shielded from contamination that would prevent the power source from operating within its design specifications. [**1901:**22.4.2]

B.4.3 Power Source Rating. [1901:22.4.3]

B.4.3.1

For power sources of 8 kW or larger, the power source manufacturer shall declare the continuous duty rating that the power source can provide when installed on fire apparatus according to the manufacturer's instructions and run at ~~120°F (49°C)~~ 49°C (120°F) air intake temperature at ~~2000 ft (600 m)~~ 600 m (2000 ft) above sea level. [**1901:**22.4.3.1]

B.4.3.2

The rating on the power source specification label shall not exceed the declared rating from the power source manufacturer. [**1901:**22.4.3.2]

B.4.4

Access shall be provided to permit both routine maintenance and removal of the power source for major servicing. [**1901:**22.4.4]

B.4.5

The power source shall be located such that neither it nor its mounting brackets interfere with the routine maintenance of the fire apparatus. [**1901:**22.4.5]

B.4.6 Instrumentation. [1901:22.4.6]

B.4.6.1

If the power source is rated at less than 3 kW, a “Power On” indicator shall be provided. [**1901:**22.4.6.1]

B.4.6.2

If the power source is rated at 3 kW or more but less than 8 kW, a voltmeter shall be provided. [**1901:**22.4.6.2]

B.4.6.3

If the power source is rated at 8 kW or more, the following instrumentation shall be provided at an operator's panel:

(1) Voltmeter

(2) Current meters for each ungrounded leg

(3) Frequency (Hz) meter

(4) Power source hourmeter

[**1901:**22.4.6.3]

B.4.6.4

The instrumentation shall be permanently mounted at an operator's panel. [**1901:**22.4.6.4]

B.4.6.4.1

The instruments shall be located in a plane facing the operator. [**1901:**22.4.6.4.1]

B.4.6.4.2

Gauges, switches, or other instruments on this panel shall each have a label to indicate their function. [**1901:**22.4.6.4.2]

B.4.6.4.3

The instruments and other line voltage equipment and controls shall be protected from mechanical damage and not obstructed by tool mounting or equipment storage. [**1901:**22.4.6.4.3]

B.4.7

An instruction plate(s) that provides the operator with the essential power source operating instructions, including the power-up and power-down sequence, shall be permanently attached to the apparatus at any point where such operations can take place. [**1901:**22.4.7]

B.4.8 Operation. [1901:22.4.8]

B.4.8.1

Provisions shall be made for placing the generator drive system in operation using controls and switches that are identified and within convenient reach of the operator. [**1901:**22.4.8.1]

~~**B.4.8.2**~~

~~Where the generator is driven by the chassis engine and engine compression brakes or engine exhaust brakes are furnished, they shall be automatically disengaged for generator operations. [**1901:** 22.4.8.2]~~

B.4.8.2

Any control device used in the generator system power train between the engine and the generator shall be equipped with a means to prevent unintentional movement of the control device from its set position in the power generation mode. [**1901:**22.4.8.3]

B.4.9

If there is permanent wiring on the apparatus that is designed to be connected to the power source, a power source specification label that is permanently attached to the apparatus at the operator's control station shall provide the operator with the information detailed in Figure B.4.9. [**1901:**22.4.9]

Figure B.4.9 Power Source Specifications Label. [1901:Figure 22.4.9]

Power Source Specifications	
Operational Category	**Continuous Duty Rating**
Rated voltage(s) and type (ac or dc)	
Phase	
Rated frequency	
Rated amperage	
Continuous rated watts	
Power source engine speed	

B.4.10

The power source, at any load, shall not produce a noise level that exceeds 90 dBA in any driving compartment, crew compartment, or onboard command area with windows and doors closed, or at any operator's station on the apparatus. [**1901:**22.4.10]

B.5 Power Source Type Specific Requirements. [1901:22.5]

B.5.1 Direct Drive (PTO) Generators.

If the generator is driven by any type of PTO, it shall meet the requirements of B.5.1.1 through ~~B.5.1.5~~ B.5.1.3 . [**1901:**22.5.1]

B.5.1.1

The transmission's PTO port and PTO, or the split shaft PTO, and all associated drive shaft components shall be rated to support the continuous duty torque requirements of the generator's continuous duty rating as stated on the power source nameplate. [**1901:**22.5.1.1]

~~**B.5.1.2**~~

~~Where the generator is driven by the chassis engine and transmission through a split shaft PTO, the driving compartment speedometer shall register when the generator drive system is engaged. [**1901:** 22.5.1.2]~~

~~**B.5.1.3**~~

~~Where the generator is driven by the chassis engine and transmission through a split shaft PTO and a chassis transmission retarder is furnished, it shall be automatically disengaged for generator operations. [**1901:** 22.5.1.3]~~

B.5.1.2

The direct drive generator shall be mounted so that it does not change the ramp breakover angle, angle of departure, or angle of approach as defined by other components, and it shall not extend into the ground clearance area. [**1901:**22.5.1.4]

B.5.1.3

The direct drive generator shall be mounted away from exhaust and muffler areas or provided with a heat shield to reduce operating temperatures in the generator area. [**1901:**22.5.1.5]

B.5.2 Hydraulically Driven Generators.

If the generator is driven using hydraulic components, it shall meet the requirements of B.5.2.1 through B.5.2.5. [**1901:**22.5.2]

B.5.2.1

The means can be a mechanical, hydraulic, or electronic device. [**1901:**22.5.2.1]

B.5.2.2

If the hydraulic generator system is not capable of output as stated on the power source specification label at all engine speeds, an automatic engine speed control system shall be provided. [**1901:**22.5.2.2]

B.5.2.3

If the apparatus is equipped with a fire pump driven by the chassis engine, the generator shall be capable of output as stated on the power source specification label with the engine at idle. [**1901:**22.5.2.3]

B.5.2.4 Hydraulic Components. [1901:22.5.2.4]

B.5.2.4.1

A hydraulic system filter and strainer shall be provided and shall be located in a readily accessible area. [**1901:**22.5.2.4.1]

B.5.2.4.2

Hydraulic hose shall meet the hydraulic pump manufacturer's recommendations for pressure, size, vacuum, and abrasion resistance. [**1901:**22.5.2.4.2]

B.5.2.4.3

Hydraulic fittings shall meet the hydraulic pump manufacturer's recommendations for pressure, size, and the type of hose used. [**1901:**22.5.2.4.3]

B.5.2.5

Where the hydraulic hose comes into contact with other surfaces, the hose shall be protected from chafing. [**1901:**22.5.2.5]

B.5.3 Fixed Auxiliary Engine–Driven Generators.

If the generator is driven by a fixed auxiliary engine, it shall meet the requirements of B.5.3.1 through B.5.3.9.4. [**1901:**22.5.3]

B.5.3.1

The generator shall be installed so that fumes, vapors, heat, and vibrations do not enter the driving or crew compartment. [**1901:**22.5.3.1]

B.5.3.2

Generators rated at 8 kW or more shall be equipped with a high-temperature automatic shutdown system and a low-oil (pressure or level) automatic shutdown system. [**1901:**22.5.3.2]

B.5.3.3

The generator shall be installed in accordance with the generator manufacturer's requirements for ventilation and service accessibility. [**1901:**22.5.3.3]

B.5.3.4

If the generator is installed in a compartment and the compartment doors must be open during its operation, the generator shall be equipped with an interlock system to prevent its operation if the doors are not open, or the compartment shall be equipped with a high temperature alarm. [**1901:**22.5.3.4]

B.5.3.5

If the generator is installed in a compartment on a slide tray and the slide tray must be in the extended or out of position during operation, an interlock shall be provided to prevent operation unless the tray is in the correct position, or the compartment shall be equipped with a high-temperature alarm. [**1901:**22.5.3.5]

B.5.3.6

Permanently installed generators shall have readily accessible engine oil drain provisions or piping to a remote location for oil changing. [**1901:**22.5.3.6]

B.5.3.7

If the generator is located in a position on the apparatus where the operator cannot see the instrumentation and operate the controls while standing at ground level or positioned at a specifically designated operator station, an operating panel with the required instrumentation, start and stop controls, and other controls necessary for safe operation shall be provided at a remote operator's panel. [**1901:**22.5.3.7]

B.5.3.8 Fuel Systems. [1901:22.5.3.8]

B.5.3.8.1

Fuel lines shall be protected from chafing at all wear points. [**1901:**22.5.3.8.1]

B.5.3.8.2

If the fuel source is shared with the apparatus engine, a separate fuel pickup system shall be provided that is arranged to ensure that the generator cannot utilize more than 75 percent of the fuel tank's capacity. [**1901:**22.5.3.8.2]

B.5.3.9 Exhaust System. [1901:22.5.3.9]

B.5.3.9.1

The exhaust piping and discharge shall be located or shielded to prevent thermal damage to the apparatus or equipment. [**1901:**22.5.3.9.1]

B.5.3.9.2

The exhaust shall be piped to the exterior of the vehicle and discharged at a location away from any operator's position. [**1901:**22.5.3.9.2]

B.5.3.9.3

Where parts of the exhaust system are exposed so that they can cause injury to operating personnel, protective guards shall be provided. [**1901:**22.5.3.9.3]

B.5.3.9.4

Silencing devices shall be provided and shall not create exhaust backpressure that exceeds the limits specified by the engine manufacturer. [**1901:**22.5.3.9.4]

B.5.4 Belt-Driven Power Sources.

If the power source is belt driven, it shall meet the requirements of B.5.4.1 through B.5.4.3. [**1901:**22.5.4]

B.5.4.1

A means shall be provided to mechanically engage and disengage the generator or alternator rotation or to electronically stop the production of electricity from the generator or alternator. [**1901:**22.5.4.1]

B.5.4.2

A voltmeter shall be provided at an operator's panel for any system of this type. [**1901:**22.5.4.2]

B.5.4.3

The belt drive system shall be rated to drive the generator or alternator at the nameplate rating. [**1901:**22.5.4.3]

B.5.5 Line Voltage Power Derived from the Apparatus Low Voltage Power Supply Systems.

If the power source derives its input energy from the apparatus low voltage electrical system, it shall meet the requirements of B.5.5.1 and B.5.5.2. [**1901:**22.5.5]

B.5.5.1

The low voltage power supply system shall be installed in compliance with the requirements of NFPA 1901, Chapter 13. [**1901:**22.5.5.1]

B.5.5.2

The alternator and/or battery system shall be adequate to provide power for continuous operation for a minimum of 2 hours at full output. [**1901:**22.5.5.2]

B.5.6 Power Sources Requiring Elevated Engine Speed.

If the power source requires the chassis engine to be operating at a specific fixed speed or a specific speed range, it shall meet the requirements of B.5.6.1 through B.5.6.3. [**1901:**22.5.6]

B.5.6.1

The main propulsion engine shall have a governor capable of maintaining the engine speed within the limits required by the power source to meet the frequency control, voltage control, and power output specifications. [**1901:**22.5.6.1]

B.5.6.2

An interlock shall prevent engagement of the generator unless the parking brake is engaged and the transmission is in neutral or not connected to the drive wheels. [**1901:**22.5.6.2]

B.5.6.3

Where the chassis engine drives the generator and electronic engine throttle controls are provided, an interlock shall prevent engine speed control from any other source that would interfere with the generator while the generator is operating. [**1901:**22.5.6.3]

B.5.7 Power Sources Requiring the Chassis Transmission to Be in a Specific Gear.

If the power source requires the chassis transmission be in a specific gear when producing line voltage power, it shall meet the requirements of B.5.7.1 and B.5.7.2. [**1901:**22.5.7]

B.5.7.1

A label indicating the chassis transmission shift selector position to be used for generator operation shall be provided in the driving compartment and located so that it can be read from the driver's position. [**1901:**22.5.7.1]

B.5.7.2

Interlocks shall be provided that prevent advancement of the engine throttle for generator operation unless the transmission is in the correct gear. [**1901:**5.7.2]

B.5.8 Generators.

If the power source is mechanically driven, it shall comply with Article 445, “Generators,” of *NFPA 70*. [**1901:**22.5.8]

B.5.9 Chassis Engine–Driven Generators.

Where the generator is driven by the chassis engine, the requirements in B.5.9.1 through B.5.9.3 shall apply. [**1901:**22.5.9]

B.5.9.1

Unless the generator is always engaged, a “Generator Engaged” indicator shall be provided in the driving compartment to indicate that the generator shift has been successfully completed. [**1901:**22.5.9.1]

B.5.9.2

Unless the generator is always engaged and operating, an “OK to Operate Generator” indicator shall be provided in the driving compartment to indicate that the generator is engaged (if not always engaged), the transmission is in the proper gear (if required, automatic transmissions only), and the parking brake is engaged (if applicable). [**1901:**22.5.9.2]

B.5.9.3

An interlock system shall be provided to prevent advancement of the engine speed in the driving compartment or at any operator's panel unless the parking brake is engaged, and the transmission is in neutral or the output of the transmission is correctly connected to a pump or generator instead of the drive wheels. [**1901:**22.5.9.3]

B.5.10 Waveform Created Electronically.

If the power output waveform is electronically created, the purchaser shall specify whether modified sine wave or pure sine wave output is required. [**1901:**22.5.10]

B.6 Portable Generator Installations.

The generator shall comply with Article 445, “Generators,” of *NFPA 70*. [**1901:**22.6]

B.6.1

Any portable generator that can be operated while mounted on the apparatus shall be as follows:

(1) Installed so that fumes, vapors, heat, excessive noise, and vibrations do not enter interior driving or crew compartments or damage the generator during operation

(2) Have the exhaust outlet located so that exhaust is directed away from any operator station located on the apparatus and guarded to protect the operator

[**1901:**22.6.1]

B.6.2

If the portable generator is remotely mounted, it shall have a remote operator's control station that shall provide a means for starting and stopping the generator and monitoring the same instrumentation as is required for fixed power sources. [**1901:**22.6.2]

B.6.3 Wiring for Portable Generator Installations.

Wiring installed for the purpose of facilitating the distribution of power from a portable generator installation to fixed wiring on the apparatus shall conform to the additional requirements of B.6.3.1 through B.6.3.5 [**1901:**22.6.3]

B.6.3.1

Circuit conductors shall be sized in relation to the power source specification label rating and shall be protected by an overcurrent device commensurate with their amperage capacities. [**1901:**22.6.3.1]

B.6.3.2

There shall be a single output connector cord with all of the conductors in the cord sized to carry a minimum of 115 percent of the nameplate amperage. [**1901:**22.6.3.2]

B.6.3.3

If there is not an overcurrent protection device at the power source, the output connector cord shall not exceed ~~72 in. (1830 mm)~~ 1830 mm (72 in.) in length and shall be connected to an overcurrent protection device. [**1901:**22.6.3.3]

B.6.3.4

The rating of an external main overcurrent protection device shall equal the rated amperage on the power source specification label or the next larger available size overcurrent protection device where so recommended by the power source manufacturer. [**1901:**22.6.3.4]

B.6.3.5

If a connecting plug is required, it shall be sized in relation to the system and conform to NEMA configurations for plugs. [**1901:**22:6.3.5]

B.7 Line Voltage Supplied from an External Source. [1901:22.7]

B.7.1

If the apparatus is equipped with a fixed power inlet (shoreline inlet), it shall be a permanently mounted inlet (male-recessed type with cover), sized in accordance with the anticipated load, and wired directly to the system or device to be powered or wired to a transfer switch where required by B.7.2. [**1901:**22.7.1]

B.7.1.1

The protective ground from the shoreline inlet shall be bonded to the vehicle frame. [**1901:**22.7.1.1]

B.7.2 Transfer Switch Switch Applications. [1901:22.7.2]

B.7.2.1

A transfer switch shall be required to isolate one power source from the other where a circuit(s) is intended to be supplied from more than one power source. [**1901:**22.7.2.1]

B.7.2.2

Transfer equipment, including transfer switches, shall operate such that all ungrounded conductors of one power source are disconnected before any ungrounded conductors of the second power source are connected. [**1901:**22.7.2.2]

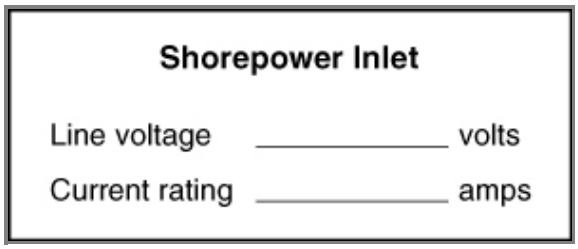
B.7.2.3

The neutral conductor shall be switched through the transfer switch. [**1901:**22.7.3]

B.7.3

The apparatus shall have a label permanently affixed at the power inlet that indicates the information shown in Figure B.7.3. [**1901:**22.7.3]

Figure B.7.3 Shorepower Inlet Label. [1901:Figure 22.7.3]



B.8 Power Supply Assembly. [1901:22.8]

B.8.1

The conductors used in the power supply assembly between the output terminals of the power source and the main overcurrent protection device shall not exceed ~~12 ft (4 m)~~ 4 m (12 ft) in length. [**1901:**22.8.1]

B.8.2

All power supply assembly conductors, including neutral and grounding conductors, shall have an equivalent amperage rating and shall be sized to carry not less than 115 percent of the amperage of the nameplate current rating of the power source. [**1901:**22.8.2]

B.8.3

If the power supply assembly connects to the vibrating part of a generator (not a connection on the base), the conductors shall be flexible cord or other fine-stranded conductors enclosed in metallic or nonmetallic liquidtight flexible conduit rated for wet locations and temperatures not less than ~~194°F (90°C)~~ 90°C (194°F) . [**1901:**22.8.3]

B.9 Overcurrent Protection.

Manually resettable overcurrent devices shall be installed to protect the line voltage electrical system components. [**1901:**22.9]

B.9.1 Power Source Protection.

A main overcurrent protection device shall be provided that is either incorporated in the power source or connected to the power source by a power supply assembly. [**1901:**22.9.1]

B.9.1.1

The size of the main overcurrent protection device shall not exceed 100 percent of the rated amperage stated on the power source specification label or the rating of the next larger available size overcurrent protection device, where so recommended by the power source manufacturer. [**1901:**22.9.1.1]

B.9.1.2

If the main overcurrent protection device is subject to road spray, the unit shall be housed in a Type 4–rated enclosure. [**1901:**22.9.1.2]

B.9.2 Branch Circuit Overcurrent Protection.

Overcurrent protection devices shall be provided for each individual circuit and shall be sized at not less than 15 amps in accordance with Section 240.4, “Protection of Conductors,” of *NFPA 70*. [**1901:**22.9.2]

B.9.2.1

Any panelboard shall have a main breaker where the panel has six or more individual branch circuits or the power source is rated 8 kW or larger. [**1901:**22.9.2.1]

B.9.2.2

Each overcurrent protection device shall be marked with a label to identify the function of the circuit it protects. [**1901:**22.9.2.2]

B.9.2.3

Dedicated circuits shall be provided for any large appliance or device (air conditioning units, large motors, etc.) that requires 60 percent or more of the rated capacity of the circuit to which it is connected, and that circuit shall serve no other purpose. [**1901:**22.9.2.3]

B.9.3

All fixed power sources shall be hardwired to a permanently mounted panelboard unless one of the following conditions exists:

(1) All line voltage power connections are made through receptacles on the power source and the receptacles are protected by integrated overcurrent devices.

(2) Only one circuit is hardwired to the power source, which is protected by an integrated overcurrent device.

[**1901:**22.9.3]

B.9.3.1

The panel shall be visible and located so that there is unimpeded access to the panelboard controls. [**1901:**22.9.3.1]

B.9.3.2

All panelboards shall be designed for use in their intended location. [**1901:**22.9.3.2]

B.9.3.3

The panel(s) shall be protected from mechanical damage, tool mounting, and equipment storage. [**1901:**22.9.3.3]

B.9.3.4

Where the power source is 120/240 V and 120 V loads are connected, the apparatus manufacturer or line voltage system installer shall consider load balancing to the extent that it is possible. [**1901:**22.9.3.4]

B.10 Wiring Methods.

Fixed wiring systems shall be limited to the following:

(1) Metallic or nonmetallic liquidtight flexible conduit rated at temperatures not less than ~~194°F (90°C)~~ 90°C (194°F) with stranded copper wire rated for wet locations and temperatures not less than ~~194°F (90°C)~~ 90°C (194°F)

(2) Type SOW, SOOW, SEOW, or SEOOW flexible cord rated at 600 V and at temperatures not less than ~~194°F (90°C)~~ 90°C (194°F)

[**1901:**22.10]

B.10.1

Electrical cord or conduit shall not be attached to chassis suspension components, water or fuel lines, air or air brake lines, fire pump piping, hydraulic lines, exhaust system components, or low-voltage wiring and shall be arranged as follows:

(1) Separated by a minimum distance of ~~12 in. (300 mm)~~ 300 mm (12 in.) from exhaust piping or shielded from such piping

(2) Separated from fuel lines by a minimum distance of ~~6 in. (150 mm)~~ 150 mm (6 in.)

[**1901:**22.10.1]

B.10.2

A means shall be provided to allow “flexing” between the driving and crew compartment, the body, and other areas or equipment whose movement would stress the wiring. [**1901:**22.10.2]

B.10.3

Electrical cord or conduit shall be supported within ~~6 in. (150 mm)~~ 150 mm (6 in.) of any junction box and at a minimum of every ~~24 in. (600 mm)~~ 600 mm (24 in.) of run. [**1901:**22.10.3]

B.10.3.1

Supports shall be made of nonmetallic materials or of corrosion-resistant or corrosion-protected metal. [**1901:**22.10.3.1]

B.10.3.2

All supports shall be of a design that does not cut or abrade the conduit or cord and shall be mechanically fastened to the apparatus. [**1901:**22.10.3.2]

B.10.4

Only fittings and components listed for the type of cord or conduit being installed shall be used. [**1901:**22.10.4]

B.10.5

Splices shall be made ~~only in a listed junction box~~ in a listed junction box or in accordance with Section 110.14(B) of NFPA 70 , and be in an accessible location that can be exposed without damaging the structure or finish of the vehicle . [**1901:**22.10.5]

B.10.6 Additional Requirements for Flexible Cord Installations. [1901:22.10.6]

B.10.6.1

Where flexible cord is used in any location where it could be damaged, it shall be protected by installation in conduit, enclosures, or guards. [**1901:** 22.10.6.1]

B.10.6.2

Where flexible cord penetrates a metal surface, rubber or plastic grommets or bushings shall be installed. [**1901:**22.10.6.2]

B.10.7 Wiring Identification. [1901:22.10.7]

B.10.7.1

Each line voltage circuit originating from the main panelboard shall be identified. [**1901:**22.10.7.1]

B.10.7.2

The wire or circuit identification either shall reference a wiring diagram or wire list or shall indicate the final termination point of the circuit. [**1901:**22.10.7.2]

B.10.7.3

Where prewiring for future power sources or devices exists, the unterminated ends shall be marked with a label showing their wire size and intended function. [**1901:**22.10.7.3]

B.11 Wiring System Components. [1901:22.11]

B.11.1

Only stranded copper conductors with an insulation rated for temperatures of at least ~~194°F (90°C)~~ 90°C (194°F) and wet locations shall be used. [**1901:**22.11.1]

B.11.1.1

Conductors in flexible cord shall be sized in accordance with Table 400.5(A) of *NFPA 70*. [**1901:**22.11.1.1]

B.11.1.2

Conductors used in conduit shall be sized in accordance with 310.15, “Ampacities for Conductors Rated 0–2000 Volts,” of *NFPA 70*. [**1901:**22.11.1.2]

B.11.1.3

Aluminum or copper-clad aluminum conductors shall not be used. [**1901:**22.11.1.3]

B.11.2

All boxes shall conform to and be mounted in accordance with Article 314, “Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Manholes,” of *NFPA 70*. [**1901:**22.11.2]

B.11.2.1

All boxes shall be accessible using ordinary hand tools. [**1901:**22.11.2.1]

B.11.2.2

Boxes shall not be permitted behind welded or pop-riveted panels. [**1901:**22.11.2.2]

B.11.2.3

The maximum number of conductors permitted in any box shall be in accordance with Section 314.16, “Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies,” of *NFPA 70*. [**1901:**22.11.2.3]

B.11.3

All wiring connections and terminations shall provide a positive mechanical and electrical connection. [**1901:**22.11.3]

B.11.3.1

Connectors shall be installed in accordance with the manufacturer's instructions. [**1901:**22.11.3.1]

B.11.3.2

Wire nuts or insulation displacement and insulation-piercing connectors shall not be used. [**1901:**22.11.3.2]

B.11.4

Each switch shall indicate the position of its contact points (i.e., open or closed) and shall be rated for the continuous operation of the load being controlled. [**1901:**22.11.4]

B.11.4.1

All switches shall be marked with a label indicating the function of the switch. [**1901:**22.11.4.1]

B.11.4.2

Circuit breakers used as switches shall be “switch rated” (SWD) or better. [**1901:**22.11.4.2]

B.11.4.3

Switches shall simultaneously open all associated line voltage conductors. [**1901:**22.11.4.3]

B.11.4.4

Switching of the neutral conductor alone shall not be permitted. [**1901:**22.11.4.4]

B.11.4.5

Line voltage circuits controlled by low-voltage circuits shall be wired through properly rated relays in listed enclosures that control all nongrounded current-carrying conductors. [**1901:**22.11.4.5]

B.11.5 Receptacles and Inlet Devices. [1901:22.11.5]

B.11.5.1 Wet and Dry Locations. [1901:22.11.5.1]

B.11.5.1.1

All wet location receptacle outlets and inlet devices, including those on hardwired, remote power distribution boxes, shall be of the grounding type, provided with a wet location cover, and installed in accordance with Section 406.8, “Receptacles in Damp or Wet Locations,” of *NFPA 70*. [**1901:**22.11.5.1.1]

B.11.5.1.2

All receptacles located in a wet location shall be not less than ~~24 in. (600 mm)~~ 600 mm (24 in.) from the ground. [**1901:**22.11.5.1.2]

B.11.5.1.3

Receptacles on offroad fire apparatus shall be a minimum of ~~30 in. (750 mm)~~ 750 mm (30 in.) from the ground. [**1901:**22.11.5.1.3]

B.11.5.2

All receptacles located in a dry location shall be of the grounding type and shall be at least ~~12 in. (300 mm)~~ 300 mm (12 in.) above the interior floor height. [**1901:**22.11.5.2]

B.11.5.3

No receptacle shall be installed in a face-up position. [**1901:**22.11.5.3]

B.11.5.4

The face of any wet location receptacle shall be installed in a plane from vertical to not more than 45 degrees off vertical. [**1901:**22.11.5.4]

B.11.5.5 Receptacle Label. [1901:22.11.5.5]

B.11.5.5.1

Each receptacle shall be marked with a label indicating the nominal line voltage (120 volts or 240 volts) and the current rating in amps of the circuit. [**1901:**22.11.5.5.1]

B.11.5.5.2

If the receptacle is dc or other than single phase, that information shall also be marked on the label. [**1901:**22.11.5.5.2]

B.11.5.6

All receptacles and electrical inlet devices shall be listed to UL 498, *Standard for Safety Attachment Plugs and Receptacles*, or other recognized performance standards. [**1901:**22.11.5.6]

B.11.5.7

Receptacles used for dc voltages shall be rated for dc service. [**1901:**22.11.5.7]

B.12 Cord Reels.

All permanently mounted cord reels shall be rated for continuous duty and installed to be accessible for removal, cord access, maintenance, and servicing. [**1901:**22.12]

B.12.1

The power rewind cord reel spool area shall be visible to the operator during the rewind operation, or the reel spool shall be encapsulated to prevent cord from spooling off the reel. [**1901:**22.12.1]

B.12.2

Rollers or guides shall be provided, where required, to prevent damage to the cord at reel spools or compartment openings. [**1901:**22.12.2]

B.12.3 Rewind Provision. [1901:22.12.3]

B.12.3.1

Manually operated reels shall have a hand crank. [**1901:**22.12.3.1]

B.12.3.2

Power rewind–type reels shall have the control in a position where the operator can observe the rewinding operation. If a reel is in an enclosure or out of direct view, the cord entry point to the enclosure shall be visible to the operator of the reel control. [**1901:**22.12.3.2]

B.12.3.3

The rewind control or crank shall not be more than ~~72 in. (1830 mm)~~ 1830 mm (72 in.) above the operator's standing position. [**1901:**22.12.3.3]

B.12.3.4

The rewind control shall be marked with a label indicating its function and shall be guarded to prevent accidental operation. [**1901:**22.12.3.4]

B.12.4

The reel shall be designed to hold 110 percent of the capacity needed for the intended cord length. [**1901:**22.12.4]

B.12.5

The wire size shall be in accordance with *NFPA 70*, Table 400.5(A), but in no case shall it be smaller than 12 AWG. [**1901:**22.12.5]

B.12.6

Electrical cord shall be Type SEOOW, Type SOOW, or Type STOOW. [**1901:**22.12.6]

B.12.7

A label that indicates the following information shall be provided in a visible location adjacent to any permanently connected reel:

(1) Current rating

(2) Current type

(3) Phase

(4) Voltage

(5) Total cord length

[**1901:**22.12.7]

B.12.8

Where a power distribution box is hardwired to the end of a cord that is stored on a fixed cord reel or other fixed storage means, the requirements in B.12.8.1 through B.12.8.6 shall apply. [**1901:**22.12.8]

B.12.8.1

The remote power distribution box shall be listed for use in a wet location. [**1901:**22.12.8.1]

B.12.8.2

The distribution box shall be as follows:

(1) Protected from corrosion

(2) Capable of being carried with a gloved hand

(3) Designed to keep the exterior electrical components above ~~2 in. (51 mm)~~ 51 mm (2 in.) of standing water

[**1901:**22.12.8.2]

B.12.8.3

Inlets, receptacles, circuit breakers, or GFCI devices shall not be mounted on the top surface of the horizontal plane. [**1901:**22.12.8.3]

B.12.8.4

Branch circuit breakers shall be installed in the remote power distribution box if the overcurrent device protecting the feed cord to the box is too large to protect the wiring supplying the devices plugged onto the distribution box. [**1901:**22.12.8.4]

B.12.8.5

Remote power distribution boxes shall have a light on the box to indicate the power is on. [**1901:**22.12.8.5]

B.12.8.5.1

The light shall be visible in a 360 degree plane from a minimum of ~~200 ft (60 m)~~ 60 m (200 ft) in complete darkness. [**1901:**22.12.8.5.1]

B.12.8.5.2

The light shall be mechanically protected to prevent damage. [**1901:**22.12.8.5.2]

B.12.8.6

The hardwired portable cord connection to the box shall have strain relief and meet the intended usage requirements. [**1901:**22.12.8.6]

B.13 Scene Lighting Systems.

Where fixed scene lights are supplied, the requirements in B.13.1 through B.13.4 shall apply. [**1901:**22.13]

B.13.1

All scene lights shall be provided with a lens or a means for preventing damage from water spray and shall be listed for wet location usage. [**1901:**22.13.1]

B.13.2 Handle on Lights. [1901:22.13.2]

B.13.2.1

If the light is adjustable, a handle shall be provided. [**1901:**22.13.2.1]

B.13.2.2

The design of the light shall not allow the temperature of the handle to exceed ~~131°F (55°C)~~ 55°C (131°F) . [**1901:**22.13.2.2]

B.13.3

The manufacturer of the device shall have the scene light tested by a nationally recognized testing laboratory and listed to UL 153, *Standard for Portable Electric Luminaires*, or UL 1598, *Luminaires*. [**1901:**22.13.3]

B.13.4

If manually operated floodlights are not operable from the ground, access steps that meet the requirements of Section 15.7 [of NFPA 1901] and handrails that meet the requirements of Section 15.8 [of NFPA 1901] shall be provided to allow the user to reach the floodlights. [**1901:**22.13.4]

B.14 Power-Operated Light Mast. [1901:22.14]

B.14.1 General. [1901:22.14.1]

B.14.1.1

The mast shall be designed to sustain the intended tip load with at least a 125 percent safety factor. [**1901:**22.14.1.1]

B.14.1.2

The mast shall withstand a minimum of a ~~50 mph (80 kph)~~ 80 kph (50 mph) wind in a raised, unguyed position. [**1901:**22.14.1.2]

B.14.2 Installation and Operational Requirements. [1901:22.14.2]

B.14.2.1

The mast shall be capable of being raised within 2 minutes. [**1901:**22.14.2.1]

B.14.2.2

Where the installation precludes the operator from seeing the light in its nested position, a means shall be provided to allow the operator to align the light for nesting when the operator is at the operator's position. [**1901:**22.14.2.2]

B.14.2.3

Appropriate warning labels on the hazards of electrocution shall be installed. [**1901:**22.14.2.3]

B.14.2.4

A means shall be provided to prevent operations that could cause damage to the power supply conductors. [**1901:**22.2.4]

B.14.2.5

In the event of a failure of the light tower's raising system while the tower is deployed or being deployed, a means shall be provided to limit the rate of descent in order to prevent injury to equipment or personnel. [**1901:**22.14.2.5]

B.14.2.6

A secondary means of control shall be provided to allow for emergency lowering of the mast. [**1901:**22.14.2.6]

B.14.2.7

Where the tower is powered by the chassis air brake system, the air supply shall be from an auxiliary air circuit that is equipped with a pressure protection valve and an auxiliary air tank(s). [**1901:**22.14.2.7]

B.14.2.8

An automatic de-energizing means shall be provided so there is no electrical power to the mast or to the light wiring when the mast is in a stowed position. [**1901:**22.14.2.8]

B.14.2.9

The hazard warning light required in Section 13.11 [of NFPA 1901] shall be illuminated whenever the light tower is not in the stowed position. [**1901:**22.14.2.9]

B.14.2.10

The operational envelope of the mast shall be automatically illuminated whenever the mast assembly is being raised, lowered, or rotated. [**1901:**22.14.2.10]

B.14.3 Labeling. [1901:22.14.3]

B.14.3.1

An instruction plate showing the operation of the mast and operational warning signs shall be provided at the operator's position. [**1901:**22.14.3.1]

B.14.3.2

A label shall be provided at the operator's position to indicate the following:

(1) Extended tower height from the ground

(2) Bulb replacement data

[**1901:**22.14.3.2]

B.15 Electrical System Testing. [1901:22.15]

B.15.1

The wiring and associated equipment shall be tested by the apparatus manufacturer or the installer of the line voltage system. [**1901:**22.15.1]

B.15.2 Dielectric Voltage Withstand Test. [1901:22.15.2]

B.15.2.1

The wiring and permanently connected devices and equipment shall be subjected to a dielectric voltage withstand test at 900 volts for 1 minute. [**1901:**22.15.2.1]

B.15.2.2

The testing shall be performed after all body work has been completed. [**1901:**22.15.2.2]

B.15.2.3

The test shall be conducted as follows:

(1) Isolate the power source from the panel board and disconnect any solid-state low-voltage components.

(2) Connect one lead of the dielectric tester to all the hot and neutral buses tied together.

(3) Connect the other lead to the fire apparatus frame or body.

(4) Close any switches and circuit breakers in the circuit(s).

(5) Apply the dielectric voltage for 1 minute in accordance with the testing equipment manufacturer's instructions.

[**1901:**22.15.2.3]

B.15.3

The electrical polarity of all permanently wired equipment, cord reels, and receptacles shall be tested to verify that wiring connections have been properly made. [**1901:**22.15.3]

B.15.4

Electrical continuity shall be verified from the chassis or body to all line voltage electrical enclosures, light housings, motor housings, light poles, switch boxes, and receptacle ground connections that are accessible to fire fighters in normal operations. [**1901:**22.15.4]

B.15.5

If the apparatus is equipped with a transfer switch, it shall be tested to verify operation and that all nongrounded conductors are switched. [**1901:**22.15.5]

B.15.6

Electrical light towers, floodlights, motors, fixed appliances, and portable generators shall be operated at their full rating or capacity for 30 minutes to ensure proper operation. [**1901:**22.15.6]

B.15.7 Certification Test of Power Source. [1901:22.15.7]

B.15.7.1

The apparatus manufacturer or installer of the power source shall perform a certification test on the power source. [**1901:**22.15.7.1]

B.15.7.2

The testing of the power source shall be witnessed, and the results of the tests of the power source shall be certified by an independent third-party certification organization. [**1901:**22.15.7.2]

B.15.7.3 Test Procedure. [1901:22.15.7.3]

B.15.7.3.1

The prime mover shall be started from a cold start condition, and the unloaded voltage and frequency shall be recorded. [**1901:**22.15.7.3.1]

B.15.7.3.2

The line voltage electrical system shall be loaded to at least 100 percent of the continuous rated wattage stated on the power source specification label. Testing with a resistive load bank shall be permitted. [**1901:**22.15.7.3.2]

B.15.7.3.3

The power source shall be operated in the manner specified by the apparatus manufacturer as documented on instruction plates or in operation manuals. [**1901:**22.15.7.3.3]

B.15.7.3.4

The power source shall be operated at a minimum of 100 percent of the continuous rated wattage as stated on the power source specification label for a minimum of 2 hours. [**1901:**22.15.7.3.4]

B.15.7.3.4.1

The load shall be adjusted to maintain the output wattage at or above the continuous rated wattage during the entire 2-hour test. [**1901:**22.15.7.3.4.1]

B.15.7.3.4.2

The following conditions shall be recorded at least every ½ hour during the test:

(1) The power source output voltage, frequency, and amperes

(2) The prime mover's oil pressure, water temperature, and transmission temperature, if applicable

(3) The power source hydraulic fluid temperature, if applicable

(4) The ambient temperature and power source air inlet temperature

[**1901:**22.15.7.3.4.2]

B.15.7.3.4.3

The following conditions shall be recorded once during the test for power sources driven by dedicated auxiliary internal combustion engines:

(1) Altitude

(2) Barometric pressure

(3) Relative humidity

[**1901:**22.15.7.3.4.3]

B.15.7.3.5

If the generator is driven by the chassis engine and the generator allows for operation at variable speeds, the chassis engine speed shall be reduced to the lowest rpm allowed for generator operation and the voltage and frequency shall be recorded. [**1901:**22.15.7.3.5]

B.15.7.3.6

The load shall be removed, and the unloaded voltage and frequency shall be recorded. [**1901:**22.15.7.3.6]

B.15.7.3.7

Voltage shall be maintained within ±10 percent of the voltage stated on the power source specification label during the entire test. [**1901:**22.15.7.3.7]

B.15.7.3.8

Frequency shall be maintained within ±3 Hz of the frequency stated on the power source specification label during the entire test. [**1901:**22.15.7.3.8]

B.15.7.3.9

The total continuous electrical loads, excluding those loads associated with the equipment defined in B.15.7.3.11.2, shall be applied during the testing unless an auxiliary engine drives the power source. [**1901:**22.15.7.3.9]

B.15.7.3.10 Concurrent Pumping. [1901:22.15.7.3.10]

B.15.7.3.10.1

If the apparatus is equipped with a fire pump, the 2-hour certification test of the power source shall be completed with the fire pump pumping at 100 percent capacity at ~~150 psi (1000 kPa)~~ 1000 kPa (150 psi) net pump pressure. [**1901:**22.15.7.3.10.1]

B.15.7.3.10.2

The test shall be permitted to be run concurrently with the pump certification test required in 16.13.1 of NFPA 1901. [**1901:**22.15.7.3.10.2]

B.15.7.3.10.3

Running the pump during testing of portable generators connected to fixed wiring on the apparatus shall not be required unless the generator is mounted in an area subjected to a rise in ambient temperature greater than ~~30°F (17°C)~~ 17°C (30°F) from the vehicle engine, pump, or other heat source. [**1901:**22.15.7.3.10.3]

B.15.7.3.11 Prime Mover–Driven Accessories. [1901:15.7.3.11]

B.15.7.3.11.1

Accessories driven by the power source prime mover shall not be functionally disconnected or otherwise rendered inoperative during the line voltage electrical tests. [**1901:**22.15.7.3.11.1]

B.15.7.3.11.2

The following devices shall be permitted to be turned off or not operating during the fixed power source test:

(1) Aerial hydraulic pump

(2) Foam pump

(3) Hydraulically driven equipment other than a hydraulically driven line voltage generator

(4) Winch

(5) Windshield wipers

(6) Four-way hazard flashers

(7) Compressed air foam system (CAFS) compressor

[**1901:**22.15.7.3.11.2]

B.15.7.3.12

If the line voltage power is derived from the fire apparatus's low-voltage system and is the primary source for line voltage, the power source shall not be shed by a load management system during the 2-hour test. [**1901:**22.15.7.3.12]

B.15.8

The results of each test shall be recorded on an appropriate form and provided with the delivery of the fire apparatus. [**1901:**22.15.8]

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E.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code®*, ~~2014~~ 2017 edition.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, ~~2013~~ 2019 edition.

NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, ~~2014~~ 2018 edition.

NFPA 412, *Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Equipment*, ~~2014~~ 2020 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety ~~and~~ , Health, and Wellness Program*, ~~2013~~ 2018 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 1931, *Standard for Manufacturer's Design of Fire Department Ground Ladders*, 2015 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, ~~2013~~ 2018 edition.

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E.1.2.3 UL Publications.

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

ANSI/UL 498, *Standard for Safety Attachment Plugs and Receptacles*, ~~2001, Revised~~ 2013, with revisions through November 16, 2012.

UL 153, *Standard for Portable Electric Luminaires,*~~2005~~ 2002 , with revisions through ~~2011~~ March 15, 2013 .

UL 1598, *Luminaires,*~~2004~~ 2008 , with revisions through October 17, 2012.

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E.3 References for Extracts in Informational Sections.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, ~~2013~~ 2019 edition.

~~NFPA 1901 , *Standard for Automotive Fire Apparatus* , 2009 edition.~~

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

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