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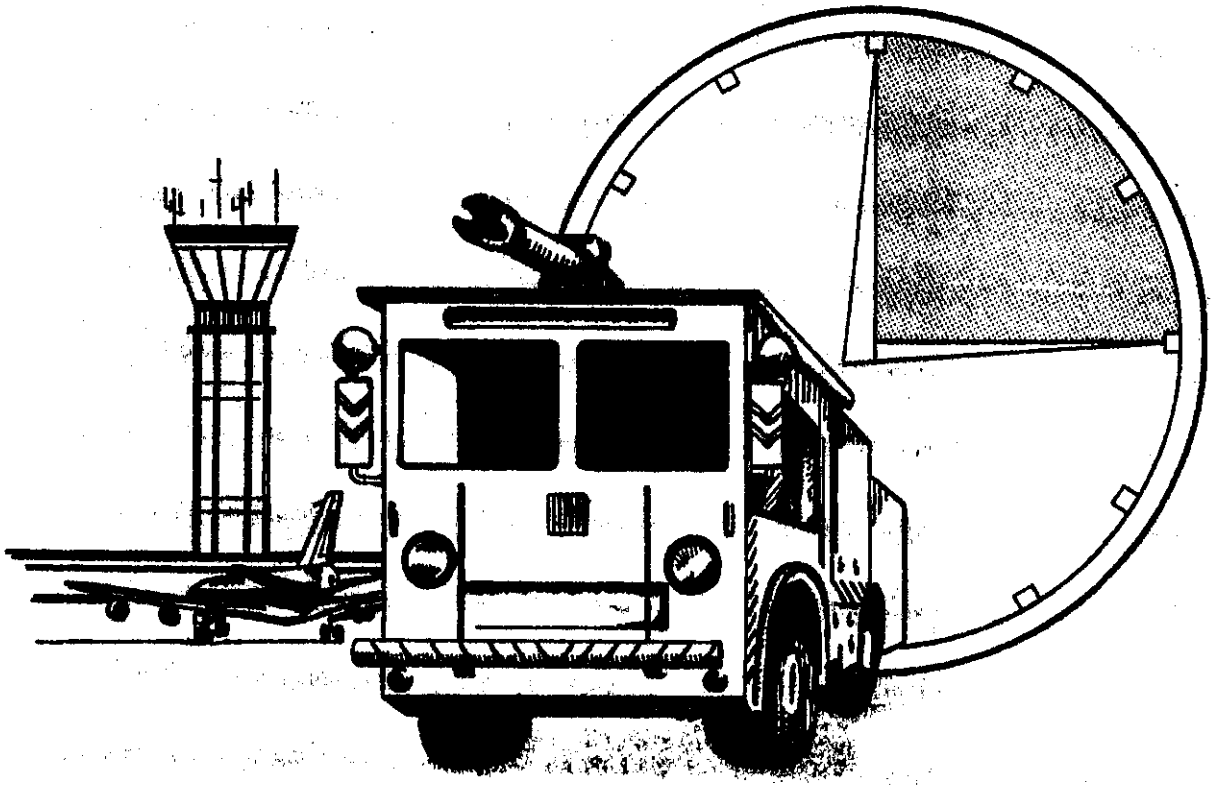
ADVISORY CIRCULAR

AIRPORT FIRE AND RESCUE VEHICLE

SPECIFICATION GUIDE



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Initiated by: AAS-100

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: AIRPORT FIRE AND RESCUE VEHICLE SPECIFICATION GUIDE | **Date:** 2/25/85 | **Initiated by:** AAS-100 | **AC No:** 150/5220-14A | **Change:**

1. PURPOSE. This guide specification was developed to assist airport management in the development of local procurement specifications. It is not addressed to any regulatory requirements of the Federal Aviation Administration (FAA) but is promulgated for general use. The word "shall" is not to be construed as a mandatory requirement of FAA. It is specifically included so that portions of this guide specification may be copied verbatim by local specification writers.

2. APPLICATION. This guidance is intended for use by airport owners/operators.

3. CANCELLATION. Advisory Circular 150/5220-14, Airport Fire and Rescue Vehicle Specification Guide, dated March 15, 1979, is cancelled.

4. RELATED READING MATERIAL.

a. National Fire Protection Association (NFPA) No. 412, Evaluating Foam Fire Equipment on Aircraft Rescue and Fire Fighting Vehicles.

b. NFPA No. 414, Aircraft Rescue and Fire Fighting Vehicles.

c. MIL-STD-1472, Human Engineering Design Criteria for Military Systems, Equipment and Facilities.

d. 40 Code Federal Regulations, Part 84, Chapter 1, Environmental Protection Agency; Section R "Exclusions and Exemption of Motor Vehicles and Motor Vehicle Engines."

e. FAA-AAP-78-1, A Review of Certificated Airport Crash Fire Rescue Service Criteria.

5. HOW TO ORDER.

a. NFPA No. 412 and NFPA No. 414 may be obtained by writing to the National Fire Protection Assocaition, Batterymarch Park, Quincy, Massachusetts 02269.

b. Military Standard MIL-STD-1472 may be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

c. 40 Code Federal Regulations, Part 84, may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

d. FAA-AAP-78-001 may be obtained from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161. The NTIS order number is ADA-053110.

Leonard E. Mudd

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Director, Office of Airport Standards

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CHAPTER 1. INTRODUCTION

1. SCOPE. This specification guide covers a combination agent, rapid intervention vehicle.

   a. Intended Use. This vehicle is primarily intended for use in rescue operations and in combating fires resulting from an aircraft ground emergency. It may also be used for other fire protection assignments necessary in airport operations.

   b. Fire Suppression Characteristics. This vehicle possesses the mobility and fire suppression system performance capabilities recommended for an acceptable rapid intervention vehicle. It is capable of carrying 500 lbs. (227 kg) of dry chemical, 1,000 gallons (3800L) of water, and sufficient aqueous-film-forming foam (AFFF) concentrate for two loads of water. It is capable of dual or single agent discharge through a twinned agent turret and a twinned agent handline.

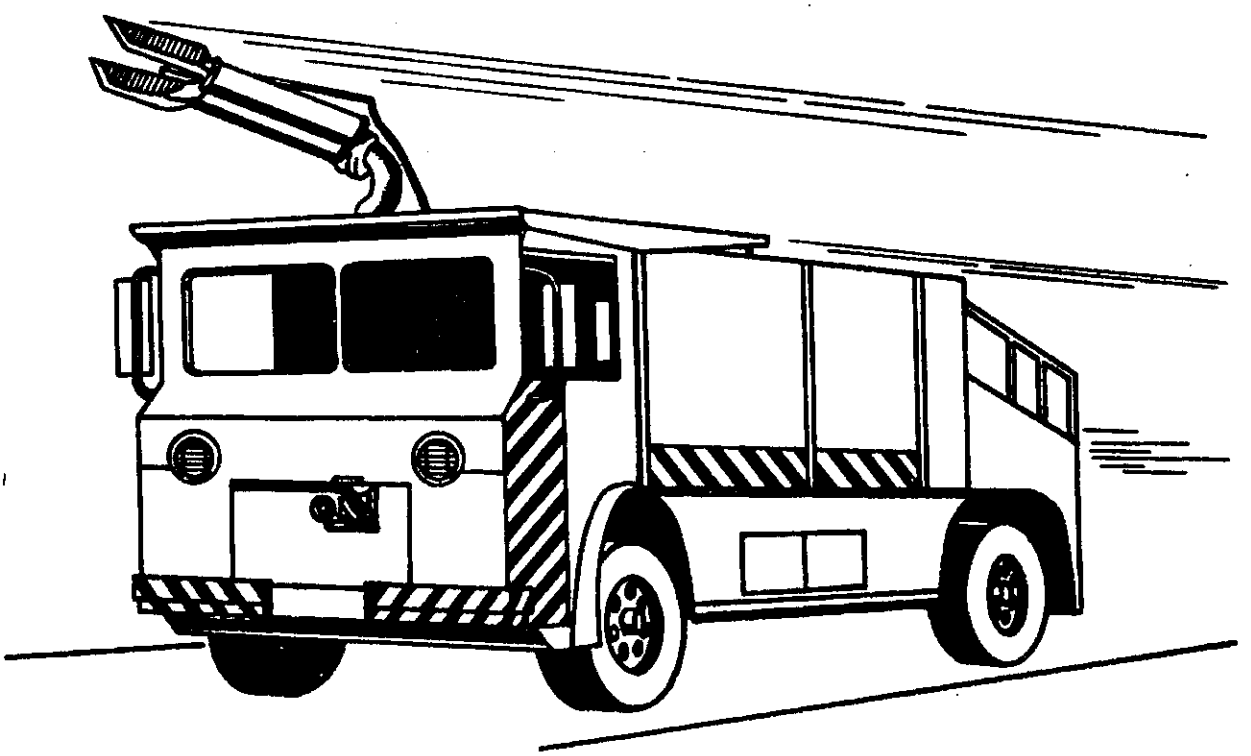
   NOTE: The "500-lb. (227kg) unit" specified is a general term that is intended to allow for a smaller amount of the less dense, more effective agents, such as Purple K and Monnex. The intent is to allow the use of standard, commercially available dry chemical system hardware.

2. GENERAL.

   a. Modifications and Options. This guide may be modified as desired to specify additional vehicle capabilities, trim or accessories. However, the primary function of the vehicle described in this specification guide is to provide an improved level of fire suppression capability for airports with limited manpower at the lowest practical long-term cost. Therefore, the purchaser should be extremely frugal in the selection of nice to have options which may tend to overload the vehicle, increase its cost and degrade its mobility characteristics and its fire suppression capabilities.

   b. Intent. The FAA has developed this guide specification describing a complete combination agent truck which, when used in conjunction with other types of fire fighting apparatus, will provide the fire protection capabilities recommended for most airports by AC 150/5210-6B.

CHAPTER 2. PERFORMANCE REQUIREMENTS



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CHAPTER 2. PERFORMANCE STANDARDS

SECTION 1. GENERAL VEHICLE DESCRIPTION

3. CLASS. This vehicle incorporates the rescue and response characteristics of a class 1 vehicle with the fire suppression capabilities of a class 2 vehicle as defined in the National Fire Protection Association (NFPA) Standard 414.

4. MATERIALS. Materials not specifically covered by this specification or applicable referenced specifications or standards shall be of the best quality currently used in commercial practice for crash fire rescue (CFR) vehicle fabrication.

   a. Metals. All metal parts and components, except the engine, which are normally in contact with the fire fighting agents and coolant liquid for extended periods of time shall be fabricated of copper, brass, bronze, or stainless steel.

   b. Dissimilar Metals. The use of dissimilar metals in contact with each other shall be avoided. Metal plating or metal spraying of dissimilar base metals to provide similar or suitable abutting surfaces will be permitted. The use of dissimilar metals separated by suitable insulating material will be permitted except in systems where bridging of insulation materials by the fluid will occur.

   c. Protective Treatment. Materials that are subject to deterioration when exposed to weather and operational conditions normally encountered during service shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements. Protective coatings that are known to chip, crack, or scale with age or extremes of climatic conditions or on exposure to heat shall not be used.

   d. The use of proven nonmetalic materials is permitted in lieu of metal if the use will contribute to reduced weight, lower cost or less maintenance and if it will not degrade performance or increase long-term operations and maintenance costs.

5. DESIGN. The truck design shall incorporate only the controls and special features required to provide safe operation of the truck and to meet the specified performance requirements. Mechanical controls shall be used wherever practicable. The parts shall be of such size, material, and strength as to sustain the allowable loads imposed upon them during operation. The truck shall be constructed so that parts will not work loose in service. All liquids, including fire fighting agents, coolants, and lubricants shall not spill or leak under normal operational conditions.

All components shall be built and mounted to withstand the strains, shocks, vibrations, and other detrimental conditions incident to operation, maintenance, shipping, and storage. The overall configuration shall limit strictly asthetic panelling, trim, and accessories in favor of weight and cost reductions. Insofar as it is consistent with other requirements, the vehicle shall have smooth rounded corners and no protruding objects.

a. Maintainability. The truck shall be designed to:

(1) Use the fewest number of different parts consistent with the specified performance.

(2) Limit the amount of special training required for an experienced mechanic to locate trouble sources, disassemble, perform maintenance, reassemble and to perform routine servicing. Where practical, parts and components shall be located or positioned for rapid and simple inspection and recognition of excessive wear or potential failure.

(3) Permit routine operational adjustments, servicing, and daily preventive maintenance by personnel wearing heavy gloves or mittens and bulky clothing with minimum disturbance to other equipment parts or components. Locking devices, controls, and fasteners which can be easily overtorqued by operators lacking tactile sensitivity due to heavy gloves or numbness shall not be used. Frequently serviced parts and components shall be located for convenient access unless performance shall be appreciably degraded by the accessible location. If physical or visual interference between items cannot be avoided due to functional or operational requisites, the item predicted to require the most maintenance shall be located for best accessibility.

(4) Permit maintenance with general purpose tools and equipment normally available commercially. Use of special purpose tools and equipment shall be subject to approval by the procuring activity.

(5) Reduce number of tools and variety of spare parts required for maintenance by such design practices as reducing the variety of bolthead sizes, light bulb sizes, wire gages, tubing and pipe sizes consistent with safety and performance requirements.

(6) Use disconnect plugs, receptacles, junction boxes, bus bars, multiple line connectors in the electrical systems, and readily detachable and attachable fittings in hydraulic and pneumatic systems, as applicable, with all disconnect points clearly indicated.

(7) Include pilots, guides, slides, carriages, or other features where such provisions will add significantly to the ease of removal and installation or attachment of components or parts.

(8) Use quick disconnect fastenings on all cover plates which must be removed for component adjustment or for component or part removal.

(9) Operate when lubricated with standard commercial lubricants. Wherever practicable, lubricated for life components or components not requiring lubrication shall be used. Grease and oil seals shall be designed and located to provide accessibility for inspection, servicing, and replacement. Panels which must be opened for access to lubrication points shall be hinged. Lubrication fittings shall be located in accessible, protected positions. Extended fittings shall be provided to lubricate parts or assemblies which are not readily accessible for direct lubrication or which are likely to be overlooked because of inaccessibility. All filler caps shall be attached to the filler neck with a safety chain to prevent loss.

(10) Locate drains, filler plugs, grease fittings, hydraulic lines, bleeders, and checkpoints so that they are readily accessible and do not require special tools for proper servicing.

b. Foolproofness. Whenever it is consistent with the performance requirements, each major component part shall be so designed that it can be installed only in its proper operating position.

c. Fastening Devices. All screws, pins, bolts, and similar parts shall be installed with an adequate means for preventing loss of proper tightness and adjustment. When subject to removal, replacement, or adjustment, attaching hardware for any component shall be easily removable and shall not be swaged, peened, staked, or otherwise permanently deformed. Sheet metal screws shall not be used.

d. Insulation and Waterproofing.

(1) The insulation shall be fire and water resistant and shall be of a type that will not pack or settle. Provision shall be made to drain any water present between the walls by gravity flow. The average heat loss per square foot per degree Fahrenheit shall not exceed 0.24 BTU(.76W/m^2) per hour. All insulated areas exposed to abrasion or damage due to equipment storage and occupation by operating or maintenance personnel shall be adequately protected.

(2) All components shall be so designed and protected that their normal functioning will not be impaired by heavy rains, road splash, formation of condensation, spillage of extinguishing agents from nozzles and fittings, recharging operations, and leaks in the piping system.

e. Flexibility. The truck shall be so constructed and major components so mounted that blocks to raise the wheel to at least the height of the tire cross-section diameter can be placed under any wheel or any combination of two wheels without interference or part failure. The truck shall be fully equipped and loaded with its rated payload and the front wheels cramped at any angle for this test.

6. FIRE FIGHTING SYSTEM. The fire fighting system employed on the vehicle shall consist of two major components, i.e., AFFF and dry chemical.

a. The AFFF system shall consist of the following: a tank suitable for holding 1,000 gallons (3800 L) of water, a reservoir for AFFF (six or three percent as preferred by the purchaser), a pump, and a roof-mounted turret with variable pattern nozzle. A handline with variable pattern nozzle, a dual hose reel, and appropriate piping and valves to connect these components shall also be provided.

b. The dry chemical system shall consist of the following: a container conforming to American Society of Mechanical Engineers' standards for unfired pressure vessels for storing and dispensing 500 lbs (227 kg) of a dry chemical extinguishing agent; Interstate Commerce Commission approved container(s) for storing sufficient dry nitrogen to dispense the dry chemical at the required rates and to purge the dry chemical system; a roof-mounted turret with nozzle; a handline with appropriate nozzle, a dual hose reel; and appropriate piping, pressure regulator and valves to connect these components.

c. The turrets shall be physically linked to provide coordinated agent application by one operator. The turret and agent activation controls shall be operable from the driver's seat. The agent control system shall be designed so that each agent may be discharged separately or in a combined discharge. Turrets shall be capable of being rotated at least 60° to each side (total traverse at least 120°).

d. The handline shall be designed for automatic activation when hose is fully unreeled and for manual activation by a single valve handle extension located close to or in the twinned hose reel storage area. Quick opening valves shall energize both lines to the nozzle valves. A common hose reel shall contain 100 feet (30 m) (single length) of one-inch (30 m x 2.5 cm) and 100 feet (30 m) (single length) 3/4-inch ID (30 m x 1.9 cm) twinned hoses. The nozzles shall be independently operable, manually operated liquid agent and dry chemical agent discharge nozzles physically linked for use by a single operator.

7. SAFETY FEATURES.

a. All space which is occupied or in which work is performed during operation, servicing, and maintenance of the truck shall be free from hazardous protrusions, edges, cracks, or other elements which might cause injury to personnel. Safety features, such as steps with antiskid treads, catwalks, antiskid deckplates, handrails and guards, shall be provided at all points where the protection of personnel is in question. The height between steps shall be less than 20 inches (50 cm). The lower steps shall be less than 24 inches (60 cm) from the ground. The tread of the bottom steps shall be not less than eight inches (20 cm) in width and succeeding steps not less than 16 inches (40 cm) in width. All steps shall be not less than six inches (15 cm) in depth. Entrances and exits from the cab shall not be obstructed by component or equipment location.

b. Catwalks and deckplates will be constructed and supported to withstand the loads imposed by service requirements and shall provide access to all equipment mounted on the top of the truck. The catwalks and deckplates shall be raised at least one inch (2.5 cm) above the surrounding surface and shall be constructed of expanded metal with nondirectional projection mesh.

c. All rotating or reciprocating parts and all parts subject to high operational temperatures or that are electrically energized, that are of such a nature or so located as to be a hazard to the safety of operating and maintenance personnel shall be insulated, enclosed or guarded.

d. The Visibility Requirements. The design and arrangement of the cab and components shall optimize visibility for control of the truck for the performance of fire fighting operations. The driver shall have a lateral field of vision at least 270°. The ground must be visible to the driver at a point not greater than 15 feet (4.5 m) from from the truck through the left two-thirds of the included angle of vision and 30 feet (9 m) from the truck through the right third of the included angle.

NOTE: Visibility range may be modified for a center-mounted driver's seat. The angle of visibility above the horizontal for the driver through the specified horizontal angle of vision shall be at least 15°. The restriction of the horizontal angle of vision by obstructions, such as window frames, corner and door posts, etc., shall not exceed 7° each. Forward vision for the driver through the windshield between the forward corner posts of the cab shall be unobstructed. A center post is permissible if the center post width is restricted to that width (in all cases under two inches (5 cm)) which imposes no blind area at a distance of 40 feet (14 m) from the vehicle when viewed by the driver using both eyes sitting in a fixed normal operating position.

e. All oil, hydraulic, and air system tubing and all electrical lines shall be located in protected positions. They shall be securely clipped to the frame or body structure and, except where a through-frame connector is necessary, shall be furnished with metal protective looms or grommets at each point where they pass through panel or structural members.

f. All radiator grills, louvers, lamps, tie rods, drive shafts, piping, and other vulnerable components shall be protected by component locations or guards to prevent damage to the components from brush, stones, logs, etc., likely to be encountered by the truck during off-road performance.

g. The truck shall possess riding qualities that will permit safe operation over rough roads and adverse terrain at speeds up to 15 mph without exposing operating personnel wearing seat belts to injury or causing damage to the vehicle or fire fighting equipment.

h. All components and systems shall be so designed that all operations can be performed without exertion of effort by operating personnel in excess of the limits specified in MIL-STD-1472. Any fire fighting equipment controls located outside the truck shall be high enough to preclude operator stooping but shall be no higher than 66 inches (165 cm) above the ground, catwalks, or deckplates as applicable.

i. Only those instruments and warning lights required for and consistent with the safe, efficient operation of the vehicle and the fire suppression system shall be provided. Instruments shall be used where practicable instead of warning lights. Provision shall be made to readily test the condition of all warning light bulbs. All instruments and warning lights shall be displayed in a panel or panels in such a way that they will be most useful, convenient and visible to the driver. The panel or panels shall either be easily removable as units or hinged for back access by the employment of quick disconnect fittings for all electrical, air and hydraulic circuits. All instruments shall be illuminated by backlighting.

j. The cab shall have all the necessary controls within easy reach of the driver for the full operation of the vehicle and for activating the fire fighting system. The controls for the fire fighting system shall also be within easy reach of a second crew station.

k. Lighting equipment as specified in paragraph 36, page 26.

l. Backup warning device meeting current safety standards. This device and the backup lights shall be activated automatically when transmission is shifted into reverse.

m. A warning siren shall be provided having a sound output of not less than 95 decibels at 100 feet (30 m) directly ahead of the siren and not less than 90 decibels at 100 feet (30 m) measured at 45 degrees on either side. The siren shall be mounted to permit maximum forward sound projection but shall be protected from foam dripping from the turret or water splashed up by the tires. The siren control(s) shall be located for use by both the driver and a second crew member.

n. An electric or air horn shall be provided. The horn shall be mounted for optimum sound projection to the front of the vehicle with control button or ring located at the steering wheel.

o. Provision shall be made for mounting a two-way radio as specified by the purchaser. Operation of the radio shall be from the cab and shall be mounted to permit quick servicing or replacement.

8. PERFORMANCE. The vehicle shall be powered by an a diesel engine capable of developing sufficient power under normal operating conditions to achieve the required performance characteristics when fully loaded in accordance with paragraph 10a. The approximate gross horsepower per 1000 lbs. (455 KG) of gross vehicle weight (GVW) shall be in the range of 12 to 15.

a. Environmental Conditions. The truck shall be capable of withstanding the following conditions without detrimental effect to subsequent operation:

(1) Ambient temperature ranging from -40° to +125° F (-40° to 52°C). (See paragraph 13.b. for optional winterization kits.)

(2) Relative humidity up to 100 percent, as well as driven snow, sleet and rain.

(3) Exposure to salt fog.

(4) Fungus growth as encountered in tropical climates.

(5) Dust particles as encountered in desert areas.

b. Mobility. The fully loaded and equipped truck shall be capable of meeting the following requirements in daily operation:

(1) Accelerate from a standing start to 50 miles per hour (80 KPH) on dry pavement free from loose material within 25 seconds. The above acceleration time shall be achieved in ambient temperatures varying from 0°F to 110°F (-18°C to 44°C) and at elevations up to 2000 feet (600 m) above sea level, unless a higher elevation is specified.

(2) Maintain maximum allowable traffic speeds up to at least 60 mph (95 KPH) on typical dry paved highway surfaces continuously for a minimum distance of 20 miles (32km) without showing overheat symptoms in any portion of the cooling systems or power train.

(3) Operate continuously for 25 miles (40km) at speeds up to 15 mph (24KPH) over all types of terrain encountered in cross-country travel, including paved and unpaved roads, and on grades normally encountered in this type of operation. During this performance evaluation, the vehicle shall be operated in all wheel drive. At least five miles (8km) of this operation shall be cross-country travel.

(4) Operate on smooth, dry level pavement through a range from one mph (1.6KPH) to at least 10 mph (16KPH) while discharging agents from twinned turrets simultaneously at rated maximum capacity without interruption.

(5) Ascend a smooth, dry, paved road having a 20 percent grade at a maintained speed of at least eight mph (13 KPH).

(6) Ascend, stop, start, and continue ascending; and descend, stop, start, and continue descending on a 20 percent grade at a speed of at least two mph (3.2KPH) with extinguishing agents being discharged at maximum rated capacity from twinned turrets simultaneously without interruption.

(7) Ascend and descend a dry, hard surface incline having a 50 percent grade at not less than three mph (4.8 KPH).

(8) Operate in both directions on a 20 percent side slope with extinguishing agents being discharged in any direction of turret azmuth at maximum rated capacity from twinned turrets simultaneously without interruption. While stationary and headed in either direction, the steering shall be capable of being moved to maximum turning angle both right and left without any vehicle instability.

(9) Negotiate pooled water to a depth of two inches for a distance of at least 150 feet (45m) at a speed of at least 40 mph (65KPH).

(10) Be held and controlled by the service brakes on an incline of 50 percent when headed either up or down.

(11) Be brought to five successive complete stops by the service brakes under any load condition within 35 feet (10.5m) from a speed of 20 mph (32KPH) on a dry, paved, approximately level road, free from loose material.

(12) The service brake system shall have the capability to deliver 70 percent full braking capacity to the brakes when applied at a rate of three applications per minute with transmission in high gear and engine at maximum governed speed.

(13) The service brakes shall be capable of full recovery with three normal applications as required for panic stop from 40 mph (65KPH) after operation for at least 150 feet (45m) in water to a depth of two inches at 40 mph (65KPH).

(14) The parking brakes shall hold the fully loaded truck motionless on a 20 percent grade when headed either up or down and of stopping the vehicle within 120 feet (36m) from a speed of 20 mph (32KPH) on dry, hard, approximately level road free of loose material.

(15) Climb a vertical wall at least 12 inches (30cm) high and negotiate terrain which will deflect the opposite wheels of the truck in alternatively contrary directions of at least 10 inches.

(16) Wall to wall turning clearance diameter of the fully loaded vehicle shall not be greater than three times its overall length.

(17) Maintain a speed on dry, paved roadway of not more than two mph (3.2 KPH) at an engine speed that does not result in rough, irregular operation.

(18) Ascend a dry, paved incline having an eight percent grade for a distance of one-quarter mile (.4km) at a speed of not less than 20 mph (32KPH).

c. Off-Pavement Mobility.

(1) General Considerations.

(a) Approximately 75 to 85 percent of the air carrier accidents requiring CFR services occur off runways and away from other paved surfaces. Thus, CFR vehicles are required to have off-pavement mobility capabilities while retaining the other highway vehicle performance requirements specified in paragraphs 8a and 8b above.

(b) Airports bordered by swamplands or bodies of water may require the specification of other than wheeled vehicles, i.e., tracked, amphibious, or air cushion types. Areas

not suitable for use by wheeled vehicles on all airports should be predefined and the airport fire department personnel specifically advised as to the operational limitations of their wheeled vehicles.

(c) The off-pavement performance characteristics of any ground supported vehicle must consider the capabilities of the driver, the soil trafficability, and the vehicle's total geometric, inertial and mechanical characteristics as well as tire selection.

(2) Tire Selection.

(a) Tire diameter, width, inflation pressure, and deflection as related to the loads imposed are important basic elements. The use of treads designed to provide traction and skid resistance is an allied consideration.

(b) The CFR vehicle manufacturer shall consult with tire manufacturers on the selection of tires to optimize vehicle acceleration, speed, braking, and maneuvering capabilities for both on and off-pavement performance.

(3) Soil Trafficability.

(a) The vehicle cone index (VCI) is a method of estimating the probability of a vehicle of given characteristics successfully operating off-pavement. This method was developed by the U.S. Army Corps of Engineers at the Waterways Experiment Station at Vicksburg, Mississippi.

(b) VCI is a means of determining vehicle weight bearing requirements as compared to soil strength (cone index) in a particular situation. Calculated VCI number for the vehicle should be less than the measured soil strength in a particular situation to assure successful operation. Vehicles operating on different types of soil will exhibit different levels of traction performance; therefore, separate computations are used to predict soil-vehicle performance for fine-grained and coarse-grained soils.

(c) In general the vehicle having the lowest VCI will have the highest probability of negotiating a given off-pavement condition. Manufacturers can easily provide the VCI for their specific CFR vehicle design.

d. The fire suppression system shall have sufficient energy to discharge either or both agents in accordance with the following criteria:

(1) The "twinned" turrets designed to dispense dry chemical and AFFF shall be capable of individually discharging their agent in accordance with Table 1.

TABLE 1

AGENT	MINIMUM DISCHARGE RATE	STRAIGHT STREAM		FULLY DISPERSED OR SPRAY		
		FAR POINT AT LEAST	NEAR POINT NO CLOSER THAN	FULL WIDTH AT LEAST	FULL WIDTH EXTENDED OUT AT LEAST	MAXIMUM SOLUTION DENSITY
AFFF	250-500 gpm	150 ft.	50 ft	30 ft	45 ft	.32 gpm/ft^2
	950-1900 Lpm	45 m	15 m	9 m	14.5 m	1.2 Lpm/m^2
Dry Chemical	15 lb/sec	100 ft	--	17 ft	--	--
	4.5 kg/sec	30 m	--	5 m	--	--

NOTE: When dry chemical turret barrel is in the horizontal position, the AFFF turret barrel shall be permanently adjusted so that the stream pattern falls to the ground just behind the dry chemical stream pattern when used for combination agent application.

(2) The twinned handline when equipped with nozzles suitably designed to dispense dry chemical and AFFF shall be capable of discharging AFFF at the rate of 60 gpm (225 Lpm) and dry chemical at the rate of 5 lbs/sec (2.2 kg/sec). Agent application rates are applicable to simultaneous or single-stream operation of the handline. The foam pattern shall have a variable foam discharge pattern from a flat 15-foot (4.5 m) width with a 10-foot (3.1 m) range to a solid stream of foam with a range of at least 50 feet (15 m).

(3) The foam produced by either the handline or the turret should have a minimum expansion of five and a minimum 25 percent drainage time of four minutes as tested under NFPA No. 412.

SECTION 2. DETAILS OF CHASSIS

9. VEHICLE CHASSIS. The vehicle chassis, complete with cab, shall be four-wheel drive, front-wheel steering, diesel engine driven. Parts and accessories necessary for the safe operation of the vehicle shall be provided as required by and shall conform to those Federal, state and local regulations that may be applicable to this type of vehicle at the time of its manufacture.

NOTE: On a case-by-case basis, manufacturers may apply to the specific state or Federal regulatory agency (Federal Highway Administration (FHWA), Environmental Protection Agency (EPA), etc.) for exemptions to existing regulations for vehicles manufactured specifically for airport crash, fire and rescue services.

10. VEHICLE DIMENSIONS AND CLEARANCES. The vehicle shall conform to the following:

a. The rating of the chassis shall equal or exceed the actual gross weight of the fully equipped vehicle. The GVW, including the weight of the complete chassis, cab with all attachments, accessories, and equipment; the body with rated payload, including a full complement of fuel, lubricant, coolant; and two fully equipped operating personnel, shall not exceed 31,999 lbs (14,545 kg).

b. The weight shall be distributed as equally as possible over the axles and tires under all conditions of loading. The variations in weight between any two tires on any one axle shall not exceed five percent right and left, or ten percent between any two axles. The center of gravity of the vehicle shall be kept as low as possible under all conditions of loading. The vehicle shall be capable of operations on a 20 percent side slope in both directions and shall not roll over while stationary on a 50 percent side slope.

c. The maximum overall width of the truck and equipment shall not exceed 115 inches (2.9m).

NOTE: Under special circumstances where high flotation tires are required for a specific airport, overall width may be increased to allow for special tires.

d. The wheelbase shall be the shortest practicable. It shall not exceed 185 inches (4.6m).

e. The overall length shall not exceed 325 inches (9.3m).

f. The overall height, including turret in its stowed position, shall not exceed 144 inches (3.6m).

g. The angles of approach and departure shall be not less than 30°.

h. The interaxle clearance angle shall be not less than 12°.

i. The minimum ground clearance shall be not less than 12 inches (.3m).

11. FRAME. The chassis frame shall be of riveted, bolted, or welded construction and shall be provided with adequate cross members, exclusive of engine supports, so designed and constructed as to support gross weight of the body and load, powerplant, pump, filled agent tank(s), and all other equipment under specified operating conditions. No alterations shall be made to the frame which will reduce its designed strength. Two towing hooks shall be attached directly to the frame rails at the front and rear of the vehicle.

NOTE: As an option, a pintle hook may be attached to the rear frame cross member of the vehicle if its presence will not interfere with other components necessary for required performance.

SECTION 3. DETAILS OF ENGINE

12. ENGINE. The vehicle engine shall be of the internal combustion diesel type, having not less than six cylinders. The vehicle engine shall be capable of developing the torque and horsepower to provide the performance characteristics of the vehicle as specified in paragraph 8 without the engine exceeding a "no load" governed speed at the peak of a certified gross brake horsepower (bhp) curve. The engine shall operate on and shall be capable of demonstrating the specified performance characteristics with fuel conforming to a regular commercial grade.

13. ENGINE COOLING SYSTEM AND TRUCK WINTERIZATION.

a. The vehicle cooling system shall:

(1) Be of the circulating liquid type with a thermostatic control appropriate to maintain a coolant temperature consistent with the engine manufacturer's recommendations when operating under the intended service conditions.

(2) Be designed so that upon failure of the thermostatic controls, the engine may continue normal operation without overheating from restricted engine coolant circulation or the restriction of air flow through the radiator shutters. A manual shutter override may be used.

(3) Provide a bypass to permit coolant circulation in the engine block, with thermostat closed, until normal operating temperature is reached.

(4) Have draincocks installed at the low point of the cooling system and at such other points as may be necessary to drain the system completely.

(5) Provide a coolant temperature gauge on the cab instrument panel.

b. Winterization - Optional.

(1) Vehicles purchased for use in areas where it is common industrial practice to winterize vehicles shall be provided with a winterization kit designed for quick start and safe operation of both the vehicle and fire suppression system down to -40°F (-40°C).

(2) The winterization system shall permit satisfactory operation of the truck and fire fighting systems and provide required heating in ambient temperatures as low as -40°F/C. The winterization system shall be powered by the truck electrical system and shall be designed to provide the required performance during all phases of truck and fire fighting operations regardless of truck engine speeds. The system shall also provide the required performance when the truck engines are shut off and the vehicle battery charge is being maintained from an external 110-volt A.C. power source.

(3) The system design and installation shall include the necessary coolant flow shutoff features to permit removal and reinstallation of the major components of the system without requiring the draining of coolant from the system and loss of coolant in excess of the capacity of the component being removed.

(4) The winterization system shall be so installed and the vehicle so insulated that, after stabilization of operating temperatures, the system when operating in temperatures as low as -40°F/C can be shut down for a period of at least two hours without requiring the draining of the agent system and without freeze damage to the truck and its components. Incorporation of the winterization features shall not detract from the performance of the truck or fire fighting systems in normal or high ambient temperatures up to 125°F (52°C).

14. FUEL SYSTEM. The fuel system for the truck engine shall be so installed as to minimize the potential of vapor lock. It shall include but not

be limited to injector(s), fuel pumps, fuel strainers, all necessary piping, valves, fittings, fuel lines, and all other necessary accessories to make up a complete system. The fuel tank shall be equipped with an accessible drain plug. The filler pipe opening shall be located in an accessible location outside of the cab and shall be at least four inches (10cm) in diameter. The fuel tank(s) shall contain a minimum of 40 gallons (150L) and shall be mounted so that it will not be damaged by distortion of the chassis and will not be affected by external heat, or heat from the engine or exhaust.

15. GOVERNOR. An engine governor which will not adversely affect engine performance shall be provided and set to limit engine speed so that it shall not exceed the maximum rpm recommended by the engine or driveline component manufacturers.

16. LUBRICATING SYSTEMS.

a. The engine transmission and chassis lubricating systems shall be the manufacturer's current standard productions. The engine's oil filter shall be full-flow type with replaceable element. The transmission shall operate efficiently and without detrimental affect to any components when lubricated with standard commercially available lubricants in accordance with recommendations of the transmission manufacturer.

b. Lubrication Fittings. All moving parts requiring lubrication shall have means provided for such lubrication. Pressure lubrication fittings shall not be provided where their normal use would damage grease seals or other parts.

c. Delivery Preparation. Prior to delivery, the vehicle shall be serviced with lubricants and hydraulic fluids suitable for use in the temperature ranges where the vehicle is to be placed in service.

17. EXHAUST SYSTEM AND MUFFLER. The vehicle shall be equipped with an efficient exhaust system and muffler equipped with a securely attached spark arrestor. The tailpipe shall be of such a size as to avoid back pressure in excess of that recommended by the engine manufacturer. The tailpipe shall be so located as to prevent entrance of exhaust gases into the cab under all conditions of operation. The exhaust exit shall be designed so as not to disperse the foam blanket. The exhaust exit design shall also avoid the recirculation of exhaust gases into the engine air intakes.

SECTION 4. DETAILS OF DRIVELINE AND CONTROLS

18. TRANSMISSION.

a. The transmission shall be a continuous drive system either hydrostatic, hydrostatic/automatic or automatic powershift transmission type incorporating a torque converter with suitable torque ratio. If necessary, the vehicle shall be equipped with a transfer case to achieve the required performance. The transmission control shall include a range selector lever with reverse, neutral, and forward positions all clearly identified. The continuous drive transmission shall be certified as suitable for use in this vehicle by the transmission manufacturer. Torque capacity of the transmission components shall be adequate to transmit the maximum gross torque of the engine through all gear reductions or torque multiplications. Drivelines shall be designed to require a minimum number of joints and all components should be of the same power ratings, i.e., no reduction in shaft size to transfer through bulkheads.

b. The hydraulic system shall include oil pumps, easy service oil filter and screens, hydraulic control system, and an oil cooling system capable of limiting the transmission temperature to that recommended by the transmission manufacturer.

c. The transmission shall have sufficient range to provide a top speed in highest range of 60 mph (95KPH) and enough reduction in lowest range to produce the tractive effort needed for the fully loaded vehicle to ascend a 50 percent grade. Spacing of intermediate ranges shall provide an adequate number of speeds for all operating conditions without excessive overlap.

19. TRANSFER CASE.

a. The transfer case shall be of a single or two-speed type as required to meet the performance requirement specified in paragraph 8. The transfer case may be equipped with a front axle disconnect, a center differential with automatic lockout, or an overriding clutch to compensate for difference in travel between front and rear wheels.

b. The transfer case may be either separate or integral with the transmission. It shall incorporate a drive to the front and rear axles which is engaged at all times during the intended airport service and which will not allow the vehicle to stall as long as the tires of any axle have traction.

20. AXLES.

a. The axles furnished shall be certified as being suited for use in this vehicle by the axle manufacturer. Axle manufacturer's published rating shall not be raised to conform to the requirements of this specification.

b. Front and rear axles shall have adequate capacity to carry the maximum imposed load under all intended operating conditions. The variations in axle tread shall not exceed 20 percent of the tire sectional width at rated load.

c. Positive drive to each wheel is required to negotiate soft ground, unimproved surfaces, snow or ice. Positive wheel drive may be achieved by use of torque proportioning differentials or other suitable automatic devices provided the performance requirements of paragraph 8 are met which will insure that each wheel of the vehicle is driven independently of the other wheels.

d. Front axles shall be equipped with steering drive ends of the constant velocity type or other provision shall be made to eliminate objectionable cyclical fluctuations in angular velocity of the wheels when they are cramped in either left or right turn.

21. BRAKING SYSTEM. A braking system shall be furnished complete with all necessary equipment to safely control the fully equipped and loaded or unloaded vehicle under all operating conditions. The brake system shall be readily accessible to external adjustment and shall include the following:

a. Service brakes shall be of the all-wheel, air-mechanical type. A brake chamber shall be provided for each wheel and shall be mounted so that no part of the brake chamber projects below the axle.

b. Foot control suspended or treadle type.

c. Limiting valve for front brakes combined with quick-release valve.

d. Quick-release valve for rear brakes.

e. Moisture ejector or moisture elimination system.

f. Auxiliary Air Supply Inlet. The female portion of a quick disconnect coupling shall be mounted adjacent to the auxiliary electric power supply inlet near the driver's door. The inlet shall be fitted with a self-closing weather/dust cover that will not interfere with the quick disconnect feature of the fixture. The matching male portion of the coupling shall be furnished with the vehicle.

g. An unloader head-type air compressor shall meet the following criteria:

(1) It shall be engine driven, having a capacity sufficient to increase air pressure in the supply and service reservoirs from 85 to 100 lbs. per square inch (psi) (5.8 - 6.9 kg/sq cm) when the engine is operating at the vehicle manufacturer's maximum recommended revolutions per minute (rpm) in 25 seconds or less.

(2) If reservoir volume is greater than minimum required, proportionately longer buildup time is allowed using the following formula:

$$\frac{\text{Actual Reservoir Capacity X 25}}{\text{Required Reservoir Capacity}}$$

h. The total reservoir volume must be at least 12 times total combined brake chamber volume at full stroke. Reservoirs shall be equipped with drain and safety valves. Provision for quick buildup of pressure shall be furnished, with quick buildup tank having a minimum capacity of 800 cubic inches (13,000cc). Quick buildup of tank pressure from five psi to the pressure regulating valve setting shall be accomplised within 12 seconds.

i. The parking or emergency brake system shall be an entirely independent mechanical system. It may be connected to the same brake shoes as the service brakes but must be through an entirely separate mechanical means. The parking brakes shall be of the spring set type. Spring set parking brakes shall be integrally mounted with the service air brake chambers of the rear axle and shall be automatically applied should the vehicle air pressure fall below 30 psi (2.1kg/sq cm). Provision shall be made for release of the spring brakes in an emergency when the air system is inoperative.

22. STEERING MECHANISM. All chassis shall be equipped with power assisted steering. The steering mechanism shall be so designed as to permit manual steering sufficient to bring the fully loaded vehicle to safe stop in the event of failure of power assist. The power assisted steering shall have sufficient capacity so that no more than 15 lbs.(6.8kg). pull is required on the steering wheel in order to turn the steering wheel from lock to lock with the stationary vehicle wheels on dry level pavement and the engine idling. Stops shall be provided which will accurately limit the turning angle to the maximum intended.

23. SUSPENSION SYSTEM. The suspension system shall be designed to allow the vehicle, loaded or unloaded, to travel at highway speeds over improved road surfaces, and at moderate speeds over rough, unimproved

terrain. Special consideration shall be given to the need for cushioning road shocks, providing adequate wheel motion, and reducing unsprung weight.

a. Design of the axles and suspension system shall be such that the total unsprung weight of the vehicle will not be greater than 20 percent of the gross weight of the vehicle when fully loaded.

b. Suspension design shall be such that at least three inches (7.5cm) of spring deflection remains before bottoming of suspension on the axle stops or bumpers when the vehicle is fully loaded and on level ground.

c. Double acting hydraulic shock absorbers shall be furnished on all axles.

d. Stops shall be installed to prevent damage to axles, drive shafts, engine oil pan, or any other portions of the chassis which may be damaged by bottoming.

e. Vehicles shall be equipped with manufacturer's current suspension system having a rated capacity at least equal to the imposed load, measured at ground level, with the vehicle loaded to its rated GVW. When spring capacity is rated at the spring pads, unsprung weight shall be deducted. Ratings shall not be raised to conform to the requirements of this specification, and suspension shall evidence no overload or permanent set.

24. WHEEL AND TIRE ASSEMBLY. The wheels shall be either disc or spoke type as currently furnished by the vehicle manufacturer. Rim contours and size shall conform to the current recommended practices of the Tire and Rim Association, Inc., for the type of vehicle and the intended service.

a. Wheels shall be single rim type and all four shall be of identical size. All tires shall be of the same size and tread design.

b. Selection criteria shall optimize off-pavement mobility performance on the terrain encountered at the intended airport while retaining suitability to operate on the highway five or more miles at sustained speeds above 30 mph (48KPH).

NOTE: An aggressive tire tread is recommended for general service. Tire manufacturers should be consulted for tire designs to meet special terrain conditions.

SECTION 5. DETAILS OF CAB

25. GENERAL. The cab shall have seats for at least two crew members complete with approved seat belts. The driver's seat shall be individually adjustable. Adequate space shall be provided for the instruments, radios, controls, and the safety equipment required by two firefighters without hindering crew operations. Wide opening doors shall be provided on each side of the cab with necessary steps and handgrabs to permit rapid and safe entrance and exit from the cab. The cab shall be provided with wide gutters to prevent foam and water from dripping on the windshield and side windows.

26. CONSTRUCTION. The cab shall be constructed of metal or fiberglass reinforced plastic, adequately reinforced to ensure the safety of the crew. The cab shall be rainproof and drip-proof and shall be fully insulated with a fire resistant insulating material. The cab shall be a separate unit, flexibly mounted on the main vehicle frame.

27. WINDOWS. All glass shall be of the laminated safety plate type, free of all imperfections which would affect visibility requirements as described in paragraph 7d.

28. MIRRORS. Two outside rear view mirrors having an area of not less than 60 square inches each shall be provided (390sq cm).

29. INSTRUMENTS AND WARNING LIGHTS. All instruments shall be illuminated by backlighting. The following instruments and/or warning lights shall be provided as applicable:

Speedometer/Odometer
Engine Tachometer(s)
Fuel Level
Air Pressure
Low Air Pressure Warning
Engine Coolant Temperature
Engine Oil Pressure
Engine Generator Indicator
Headlight Beam Indicator
Transmission Oil Temperature
Transmission Oil Pressure
Differential Lock Indicator
Water Tank Level
AFFF Tank Level
Pump Pressure
Dry Chemical Propellant Pressure
Dry Chemical Tank Pressure

30. CONTROLS. The following cab mounted controls shall be provided:

Accelerator Pedal
Brake Pedal
Parking Brake Control
Steering Wheel, with self-canceling direction signal, dimmer control and horn control
Headlight Switch
Panel Light Switch
Siren Switch w/microphone
Ignition Switch
Dry Chemical System Activation
Remote Turret Controls
Starter Switch
Equipment Light Switches
Spotlight Switches
Engine Shutdown Switch

Differential Lock Control/ Indicator
Transmission Range Selector
Liquid Agent Tank Control Valve
Master Electrical Disconnect Switch
Flashing Beacon Switch
Windshield Wiper and Washer Controls
Heater/Defroster Controls
Cab Dome Light Switch

31. EQUIPMENT. The following equipment shall be provided in or on the cab as may be applicable:

Heater/defroster with 200 BTU output per cubic foot ($.03m^3$) of cab space, with blower capacity per minute equal to cab volume, with fresh air intake, and with defroster ducts to windshield
Driver's seat three-way adjustable bucket type with seat belts
Siren
Two or more windshield washers
Two or more windshield wipers
Two or more sun visors
Two outside rear view mirrors
Cab dome light with manual and door activated switches
Crew seat(s) with seat belts

SECTION 6. DETAILS OF ELECTRICAL SYSTEM

32. GENERAL. All components such as alternator, starting device, circuit breakers, etc., shall be of waterproof type, accessibly mounted and protected against excessive heat. All electrical circuit wiring shall be made with stranded conductors of a carrying capacity commensurate with the anticipated maximum circuit loading with insulation in accordance with the recommended standards of the Society of Automotive Engineers (SAE). Overall covering of conductors shall be of weatherproof type. All connections shall be made with lugs or terminals mechanically secured to the conductors. Wiring shall be thoroughly secured in place and suitably protected against heat, oil, and physical injury. Circuits shall be provided with circuit breaker overload protection.

33. POWER SUPPLY. The vehicle shall be provided with a 12-volt D.C. electrical system complete with built-in battery conditioner.

a. An electric alternator shall be provided. It shall have an output adequate to service the full operational electrical load and be provided with fully automatic regulation.

NOTE: Provisions to handle the additional load imposed by the winterization kit must be included when appropriate.

b. A weatherproof, polarized male plug suitable for receiving 110-volts A.C. from an outside electrical supply shall be mounted near the driver's door. This plug shall be wired to the built-in battery conditioner and shall have sufficient current carrying capacity to supply the power requirements of the optional winterization kit. The matching female receptacle shall be furnished with the vehicle.

34. BATTERIES.

a. A dual capacity battery system shall be provided. There shall be two 12-volt batteries connected in parallel, 200 ampere hour capacity each at 20 hour rate.

NOTE: Additional batteries or larger capacity batteries may be required on vehicles equipped with the optional winterization kit.

b. Batteries shall be securely mounted and adequately protected against physical injury, water spray, and engine and exhaust heat. If an enclosed battery compartment is provided, it shall be adequately ventilated and the batteries shall be readily accessible for examination, test, and maintenance.

35. STARTING DEVICE.

a. An electrical starting device shall be provided. Its characteristics shall be such that when operating under maximum load, the current draw will not introduce a voltage drop sufficient to adversely affect function of the ignition system or other electrical equipment required to be functional during the start-up process.

b. An engine coolant preheating device shall be provided as an aid to rapid starting and high initial engine performance.

36. LIGHTING SYSTEM. The lighting system, including reflectors and clearance lights, shall be the manufacturer's current standard provided the equipment shall meet the applicable state and Federal safety regulations. The system shall include:

a. Two or more sealed beam headlights with upper and lower driving beams.

b. A Front Mounted Quartz Light.

c. Dual taillights and stoplights.

d. Turn signals, front and rear, with self-canceling control, a visual indicator, and a four-way flasher switch.

e. A sealed beam spotlight on both left and right sides of the windshield, hand adjustable type, with controls for beam adjustment inside the truck cab.

f. Reflectors, markers, and clearance lights shall be furnished and installed in conformance with the NFPA No. 414.

g. Engine compartment lights, nonglare type, arranged to illuminate both sides of the engine with individual switches located in the engine compartment.

h. Two swivel-mounted pickup lights, with six-inch minimum diameter, clear lens and individual switches, to be mounted for optimum equipment lighting.

i. Two backup lights installed at the rear of the vehicle.

j. At least one flashing red beacon or alternate red and white flashing light shall be mounted on the vehicle so as to be visible 360 degrees in the horizontal plane. Mounting of the beacon shall also provide good visibility from the air.

SECTION 7. DETAILS OF BODY COMPONENTS

37. GENERAL. Body shall be fabricated from materials designed to provide the lightest weight consistent with the needs for strength, heat and corrosion resistance. Self-tapping bolts shall not be used in construction of the apparatus body.

38. STEPS, WALKWAYS AND RUNNING BOARDS. Steps, walkways and running boards located on each side, at the cab, on top and at the rear shall be provided as required for ascending, descending or servicing the vehicle. All steps, walkways and running boards shall be of open mesh safety tread design.

39. HANDRAILS. Rigidly attached handrails or guardrails of suitable metal tubing shall be provided as required for personnel safety at all steps, walkways, and stations. Tubing will be provided with a corrosion-resistant, low-maintenance, durable finish.

40. COMPARTMENTS. The compartments shall be of dustproof and rainproof construction equipped with closures. They shall be accessible from the ground by personnel of average height without the aid of steps or ladders.

a. One general purpose equipment compartment shall be installed in the vehicle skirting.

b. Sufficient compartments specifically designed to contain the auxiliary equipment listed in Chapter 3 shall be installed on the vehicle.

c. One hose reel compartment shall be built into the vehicle in such a manner as to optimize handline deployment in the forward direction.

SECTION 8. DETAILS OF FIRE FIGHTING EQUIPMENT

41. PUMP DRIVE. The pump shall be driven by the vehicle engine through a full torque power takeoff or proportioner which will permit operation of the pump and the simultaneous operation of the vehicle. The pump shall not be affected by changes in transmission ratios or the actuation of clutches in the vehicle drive, except insofar as these changes or actuations may affect engine speeds. The design of the drive system and controls shall prevent damage to the drive or lurching of the vehicle when the vehicle drive is engaged while pumping operations are in process. The pump drive system shall be capable of absorbing the maximum torque delivered by the engine to the pump and withstand engagement of the pump at all engine speeds and under all operating conditions.

42. PUMP.

a. The pump shall be of centrifugal type designed to provide both the specified capacity and discharge pressure. When operating from the water tank as an aircraft fire fighting unit, the pump shall be capable of discharging the straight stream or dispersed water/foam pattern over the performance range specified in paragraph 8d.

b. The pump shall be gravity primed from the vehicle tank.

c. A backup device/method shall be provided to overcome an air-locked gravity prime.

43. PUMP CONNECTIONS, PIPING, COUPLING AND VALVES.

a. Suction. One 4½-inch (11.3 cm) outside National Standard Fire Hose Thread (NSFHT) suction inlet with a strainer, cap, and suction connection to the water pump shall be provided. The suction system shall be designed for efficient flow at the designed pumping rates. There shall be a drain at the lowest point with a valve for draining all of the liquid from the pumping system when desired.

b. An appropriate adapter shall be furnished where local authority normally uses a different inlet size. A gated wye that would allow two smaller lines to supply the 4½-inch (11.3 cm) suction inlet shall be furnished.

c. The pump shall be provided with a 2½-inch (6.3 cm) side discharge gate with NSFHT adapter and cap. The discharge to the turret shall be controlled from inside the cab. The discharge to hose reel shall be controlled at the reel.

d. Piping shall be securely mounted and provided with flexible couplings in areas of stress. Union or flexible type couplings shall be provided where required to facilitate removal of piping.

e. All valves should be quick opening type, selected for ease of operation and freedom from leakage.

f. All water system piping shall be tested on suction side of pump for leakage. All water and AFFF solution discharge piping shall be tested at 50 percent above system operating pressure for leakage.

44. CHURN LINE. A closed system churn line shall be provided from the pump discharge to a heat exchanger at the tank bottom to prevent overheating of water in the pump while operating at zero discharge. The churn line valve shall be automatic.

45. PUMP AND ENGINE CONTROLS.

a. The exterior pump and engine control panel shall be located on the left side of the vehicle. This panel shall contain only the number of controls, gauges and switches required to provide for control over the engine and the safe operation of the suction inlet and the water/foam side discharge. It will include but not be limited to provisions for:

(1) Emergency engine shutdown.

(2) Monitoring oil pressure.

(3) Monitoring coolant temperature.

(4) Suction inlet control.

(5) Side discharge control.

(6) Suction and side discharge pressure control.

b. A means of pressure regulation shall be provided that is adjustable to maintain working pressures from 75 to 300 psi (5.3 to 21 kg/cm^2). An adjustment control shall be located on the control panel.

46. WATER TANK AND FILLER CONNECTIONS.

a. The tank shall have a working capacity of not less than 1000 gallons (3800 L). It shall have longitudinal and transverse baffles to prevent water surge during high speed operations. In-line baffle openings will not be allowed. Individual baffled compartments shall not exceed 250 gallons (950 L). The tank shall be constructed of a material which is resistant to deterioration by the water common to the purchaser's location.

b. The tank construction and piping connections shall be made to prevent the possibility of chemical and galvanic corrosion.

c. The tank shall be equipped with removable manhole covers, plates or removable top to permit access to the sump and each baffled compartment of the tank. It shall also have a deep sump with an anti-swirl baffle, a low point drain valve, and a top water filler opening with a screen and gasketed cap. Filler opening diameter shall not be less than eight inches (20 cm).

d. The suction piping from the tank to the pump shall have a control valve installed in the line between tank and pump which shall be of the quick-acting, quarter-turn type. The tank outlet and suction piping shall be of sufficient size to allow a flow of 500 gpm (1900 Lpm) from the turret and 60 gpm (225 Lpm) from the handline.

e. The tank shall be mounted in a manner which limits transfer of the torsional strains of off-pavement driving from the chassis frame to the tank. The tank shall be separate and distinct from the body and easily removable as a unit.

f. The tank shall be adequately vented to the atmosphere to permit rapid and complete filling and overfilling without pressure buildup and to permit agent discharge at the maximum design flow rate without danger of tank collapse.

g. A tank filler connection shall be provided at the rear of the apparatus in a position where it can be reached from the ground. The connection shall be so constructed that water shall not be lost from the tank when connection or disconnection is made. All water fill openings shall be provided with strainers. The tank water filler piping shall be 2½ inches (6.3 cm) and shall terminate in a 2½ inch (6.3 cm) NSFHT swivel female hose connection.

47. FOAM LIQUID CONCENTRATE RESERVOIR.

a. The reservoir shall have a working capacity sufficient for two tanks of water. It may be of either rigid or flexible type.

(1) A flexible reservoir shall be nylon reinforced ethylene propylene terpolymer (EPT), nylon reinforced neoprene, or nylon reinforced Buna N. These elastomers should be compounded for liquid use.

(2) A rigid reservoir shall be either metal or fiberglass reinforced plastic (FRP).

(a) Metal reservoirs shall be fabricated from 304 or 316 stainless steel and welded to prevent crevice corrosion.

(b) FRP reservoirs shall be fabricated using isophthalic type polyester resins. An interior gel coat with a minimum thickness of 15-20 mils (.38-.50 mm) of isophthalic type polyester resins shall be applied. If the concentrate tank is a part of the water tank and is exposed to the water, a gel coat of 15-20 mils (.38-.50 mm) minimum thickness of isophthalic type polyester shall also be applied to the water side of the tank.

(c) Rigid reservoirs shall be equipped with a removable manhole or a removable tank top to permit access within each baffled compartment of the tank.

b. The reservoir shall be mounted in a manner which limits transfer of the torsional strains of off-pavement driving from the chassis frame to the reservoir or from the motion of the water within the water tank. The reservoir shall be separate and distinct from the body and easily removable as a unit.

c. The outlet(s) should be arranged so as to permit the use of the full capacity of the tank with the vehicle level and at least 75 percent of the tank capacity with the vehicle inclined on a 20 percent side slope or ascending or descending a 30 percent grade. A low point drain shall be provided.

d. A fill trough shall be provided and equipped with stainless steel ¼-inch (.6 cm) mesh screen and can openers. The fill trough shall be of sufficient size and openers sufficient in number to permit rapid emptying of five gallon (19 L) foam liquid concentrate containers into the reservoir two at a time. The trough shall be connected to the reservoir with a fill line designed to introduce foam liquid concentrate into the tank so as to minimize in-tank foaming.

e. Provisions shall be made for flushing all of the system piping exposed to foam agent or foam/water mixture with clear water.

48. FOAM PROPORTIONING SYSTEM.

a. The foam liquid proportioning system shall provide control of the ratio of foam liquid concentrate to the quantity of water being discharged.

b. A maximum tolerance of plus or minus five percent of the proportioning setting shall be permitted at the maximum flow rate at the turret or the handline.

NOTE: A premixed water and AFFF system may be specified for use where the operational concept will permit and the simpler system will add to the overall effectiveness of the purchaser's total crash fire rescue service.

49. TURRET AND PATTERN CONTROL.

a. One dual agent turret designed for control from the driver's seat shall be provided.

b. Controls will be provided to permit the selection of the flow rate and the variation of pattern from inside the cab. The turret shall be controlled by a single, direct connected power assisted control level.

c. The turret discharge pattern, rate, and range shall conform to paragraph 8d for both water/AFFF and dry chemical.

50. HANDLINE REEL AND NOZZLES.

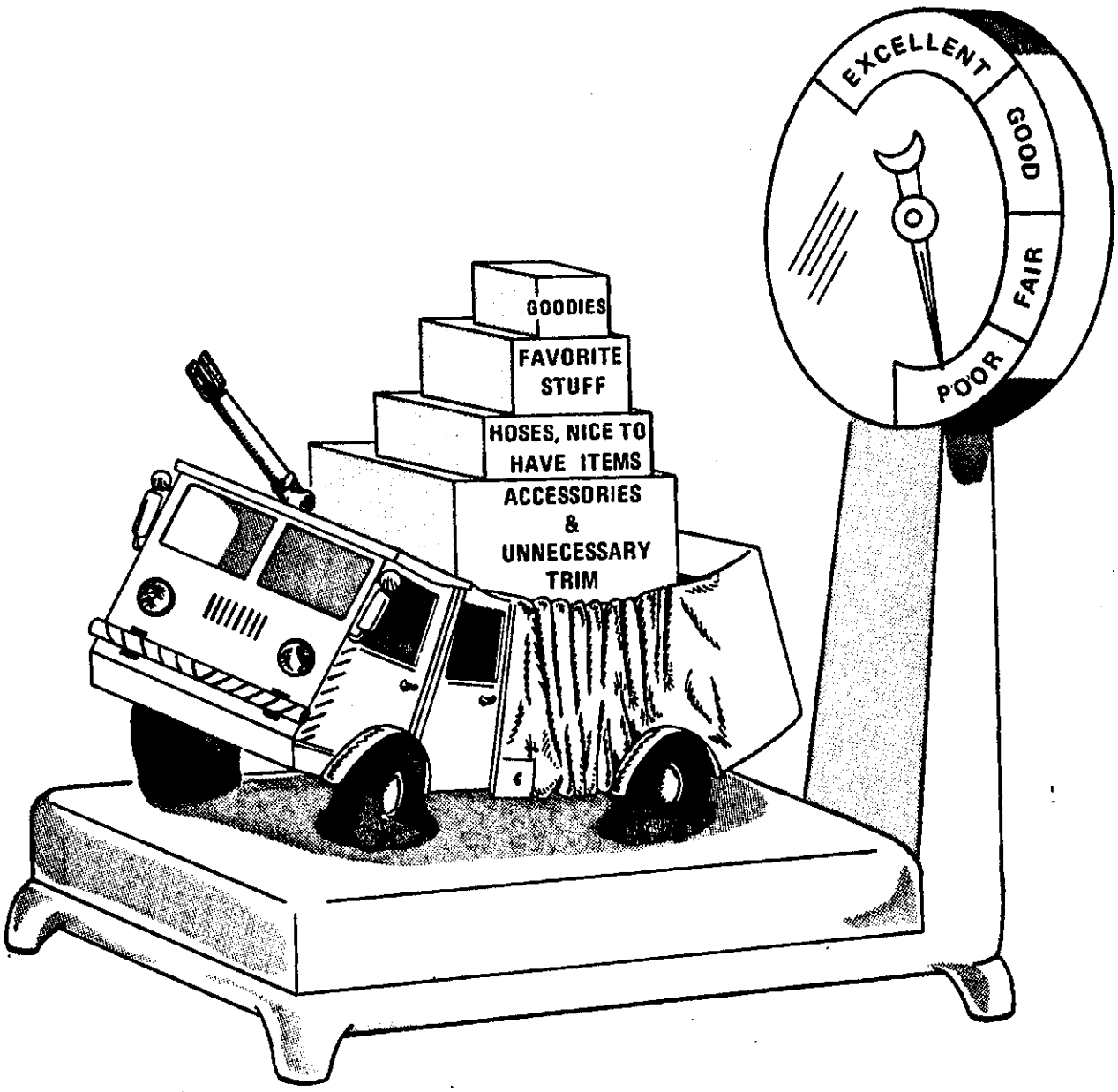
a. The reel shall carry 100-feet (30m) each of one inch (2.54 cm) and .75 inch (1.9 cm) 800 lb (55 kg/cm^2) test rubber lined hose. The reel shall be equipped with a friction brake and automatic activation to prevent hose from unreeling when not desired. Provision shall be made for electrical rewind of the hose with manual backup. The reel shall be equipped for automatic charging of the handline hose when fully unreeled. Manual override pull type valve controls shall be located in or near the compartment.

b. Hose rollers are to be provided on the left, right and bottom edges of the reel compartment. Vehicles to be delivered to areas requiring winterization kits shall have weather tight handline compartments fitted with a closure that can be secured in either the open or closed position.

c. The "twinned" hose shall be equipped with shutoff type twinned nozzles designed for selection and discharge of foam/water solution and dry chemical. Flow rates and pattern performance shall conform to the criteria given in paragraph 8d.

51. DRY CHEMICAL SYSTEM. The vehicle shall be provided with a unitized 500 lb. (2.27kg) dry chemical system listed and approved by a recognized testing laboratory for fire extinguishing systems. The system shall be complete with tank and pressurization facilities. It shall be connected by suitable piping and valves to the twinned hose reel and to the twinned turret.

CHAPTER 3.
AUXILIARY EQUIPMENT & MISCELLANEOUS DETAILS



TOO MANY GOOD THINGS

CHAPTER 3. AUXILIARY EQUIPMENT AND MISCELLANEOUS DETAILS

52. TOOLS AND SAFETY EQUIPMENT.

a. Auxiliary equipment shall be provided as follows and shall be properly mounted on the vehicle or secured in a compartment:

(1) Two electric hand lanterns, 6-volt battery, to throw 1000-foot (300 m) beam.

(2) Two axes, fire pickhead, six lb., with serrated blade.

(3) One adjustable hydrant wrench.

(4) One extinguisher, 20 BC dry chemical.

(5) One extinguisher, halon 1301, 20 lb. (8 kg) (approximate weight of agent).

(6) Two 2½-inch (6.3 cm) spanner wrenches.

(7) Two one-inch (2.5 cm) spanner wrenches.

(8) One sledge, eight lbs. (3.6 kg).

(9) One shovel, D-handle, round point.

(10) One pole, pike, 12 feet (3.6 m).

(11) One crowbar, pinch point, 60 inches (1.5 m).

(12) One hydraulic forced entry rescue kit.

(13) Two self-contained positive pressure breathing devices.

(14) Two complete reflective proximity suits, i.e. hood, coat, pants, gloves, boots.

b. Forcible entry tools, one set in a canvas roll with pockets and straps to include:

1 - Bolt cutter, 36 inches (.9 m), 9/16-inch (1.4 cm) cutting capacity

1 - Bar, wrecking, gooseneck with claw

1 - Aviation metal snips, straight cut

1 - Chisel, cold, 8x1 inches (20 x 2.5 cm)

1 - Cutter, aircraft cable; Aircraft Tool Co., AT-501C, or equal

1 - Flashlight, two cell, explosion proof, approved by a recognized testing laboratory

1 - "V" Blade/Harness knife with a Dzus fastener tool

1 - Screwdriver, double grip, 18x½ inches (45 x 1.27 cm)

6 - Blades, spare for rescue knife

1 - Axe, hand, metal cutting insulated handle

1 - Pliers, lineman's eight-inch (20 cm), insulated handles

1 - Pliers, adjustable locking, large

1 - Hammer, ball peen, 1½ lb (.56 kg)

1 - Screwdriver, common eight-inch (20 cm)

1 - Hacksaw, pistol grip, 12-inch (30 cm) with 12 assorted blades

c. Special tools as required for servicing the vehicle, fire suppression system, and any of the auxiliary equipment, shall be furnished by the vehicle manufacturer. One refractometer suitable for monitoring AFFF/water concentration shall be provided.

d. Optional items of equipment listed below may be included at the purchaser's option if they are not already available at the airport from other resources.

(1) One "A" type folding ladder with necessary brakets for mounting (ladder, fire extension - "A" Type folding, D-1; Military Specification MIL-L-4577). This item shall be included when this vehicle is the only aircraft fire and rescue truck provided on the airport.

(2) One generator, portable; gasoline driven, 2500-watt, 110-volt AC 60HZ.

(3) One drill, ½-inch (1.27 cm), variable speed, air or electric power.

(4) One floodlight, portable; electric, 500-watt, complete with a 100-foot (30 m) waterproof cable terminating with connectors.

(5) One metal cutting power tool. Blade design and power source (electric, gasoline, water, air, etc.) shall be at the purchaser's option.

(6) A skid load of 200 feet (60 m) of 1½-inch (3.8 cm) cotton jacket hose complete with variable stream nozzle suitable for AFFF/ water application. A reducer suitable for connecting the hose load to the 2½-inch (6.3 cm) side discharge will be furnished.

e. Spare Wheel and Tire Assembly. Serviceable but not vehicle mounted.

53. RADIO INTERFERENCE SUPPRESSION. The vehicle shall be adequately radio interference suppressed to permit positive understandable voice radio communications under all operating conditions.

54. TREATING AND PAINTING.

a. All parts of the vehicle shall be cleaned, treated, and primed prior to assembly.

b. After the vehicle is completely assembled, except for bright trim parts, the entire unit shall be primed, puttied, water sanded, and painted the specified color with not less than three coats.

c. The finished paint shall be free from "orange peel" (pebbly finish), runs, and other imperfections.

d. It is recommended that the vehicle color be specified as "lime yellow" DuPont #7744 UH or its equivalent. To insure contrasting visibility, the fire department name and identifying numbers should be specified as black or royal blue having a pin-striped outline in either silver or white.

55. NAMEPLATES AND INSTRUCTION PLATES.

a. All nameplates and instruction plates shall be metal or plastic which is not degraded by weathering. The information shall be engraved, stamped, or etched on the plate. If metal, they shall be made of a noncorrosive material, chrome plated, or nickel silvered. All plates shall be attached with screws, bolts, or rivets. Each plate shall be mounted in a conspicuous place.

b. Nameplates shall show make, model, serial number, and other such data as to positively identify the item.

c. Information plates shall provide important instructions to be followed in operating or servicing the vehicle or equipment. These information plates shall include warnings or cautions and shall be so located and of sufficient size to be readily seen under normal operating and/or servicing conditions.

56. TECHNICAL INFORMATION.

a. Technical Publication. The contractor shall furnish two sets of the following publications in accordance with standard commercial practices applicable to the vehicle (including body and special fire suppression equipment) furnished under the contract. Each set shall be composed of one copy each of:

(1) Operator's manual with lubrication charts.

(2) Parts manual.

(3) Maintenance and service manual.

b. Contents. These manuals will cover the complete vehicle and shall be in accordance with the following:

(1) Operating instructions shall include all information required for operation of the vehicle and main equipment, special attachments, and auxiliary equipment under the expected climatic conditions. Location and function of all controls and instruments shall be covered by illustrations and descriptions. These instructions shall also include but not be limited to the following:

(a) Complete description of the vehicle and special equipment.

(b) Preparation for use of the vehicle upon receipt.

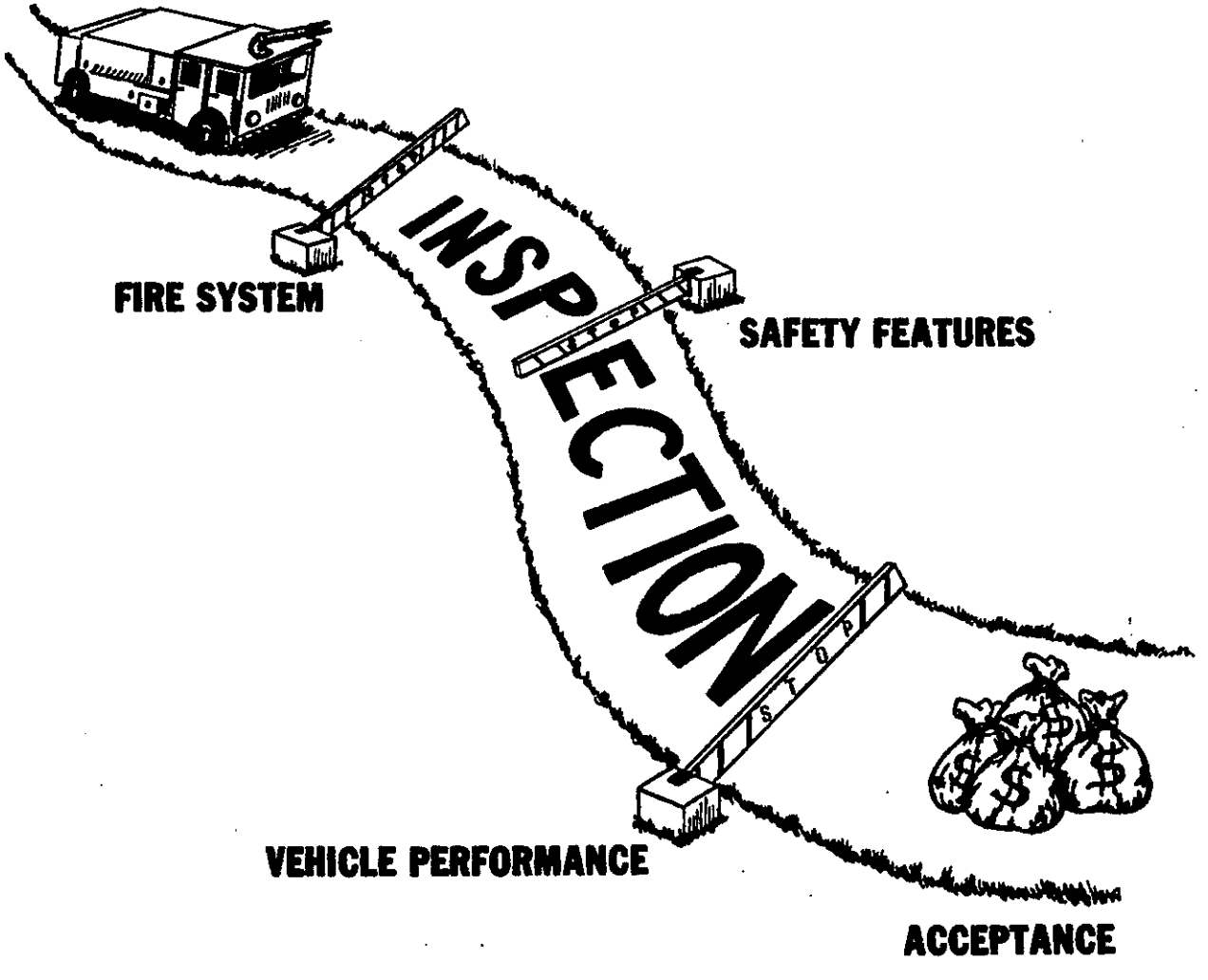
(c) Operator daily maintenance and mission readiness checks.

(d) Periodic operator inspection/maintenance.

(2) The repair and overhaul instructions shall be factual, specific, concise, and clearly worded so as to be readily understood by a qualified mechanic with no previous experience on the equipment being purchased. The instructions shall cover such typical maintenance and repair operations as troubleshooting, adjustment procedures, minor and major repairs and overhaul, removal and replacement of units, assemblies and subassemblies, and complete instructions for disassembly and reassembly of components. The instructions shall also include data listing tolerances, specifications and capacities. Illustrations, wiring diagrams and exploded views shall be used to clarify text and should appear as close to the related text as possible. Special tools required for the repair and overhaul of the equipment shall be listed and illustrated. The service manual shall contain an alphabetical subject index.

(3) The parts list shall include illustrations and exploded views necessary for the proper identification of all parts, assemblies, subassemblies and special equipment. Assemblies or components shall be shown in illustrations and be identified by reference numbers which correspond to the reference numbers in the parts list. The size, thread dimensions and special characteristics shall be given on all nonstandard nuts, bolts, washers, grease fittings and similar items. The parts identification manual shall show the description and quantity of each item used per vehicle. The parts identification manual shall contain a numerical index.

CHAPTER 4.
QUALITY ASSURANCE



CHAPTER 4. QUALITY ASSURANCE

57. VEHICLE DESIGN PRINCIPLES.

a. The vehicle design shall provide for rapid acceleration and high speed; maximum mobility on and off pavements in all seasons and under all weather conditions; ease of operation; safety; reliability; and accessibility for repairs and maintenance.

b. All wheel drive for off-pavement operation is essential and shall be achieved without sacrificing any of the attributes of high performance, high-speed vehicles. Weight shall be distributed substantially equal over all wheels with maximum tire loads designed to provide the highest practicable level of performance on soft, slippery or rough terrain.

c. Special design consideration shall be given to the saving of weight insofar as it can be accomplished while retaining safety factors on wearing and stressed members.

d. Performance requirements outlined in this standard shall be met with the vehicle in an in-service condition.

58. RESPONSIBILITY OF CONTRACTORS (SUPPLIERS).

a. The emergency nature of aircraft rescue and firefighting services requires that contractors building equipment for such service demonstrate a high level of competence, reliability, and experience. Contractors should also be required to state and/or demonstrate their intentions for parts and service support.

b. The contractor must assume complete responsibility for all component parts of the complete vehicle, even though major portions may be subcontracted. This responsibility shall include design, construction, inspection, performance test, and servicing. The purchaser should ascertain that it is the contractor's policy to remain capable of furnishing parts and technical assistance to the purchaser for the normal life of the vehicle (10 years).

NOTE: Responsibility for servicing shall not include those components supplied to the contractor by the customer, unless so specified in the contract.

c. The contractor shall also be responsible for assuring that vehicle and the fire suppression system meet the specified performance criteria. All major components shall have the manufacturer's approval/recommendation for this type service and the manufacturer's ratings shall not be exceeded by actual imposed loads. A one-year

parts and service warranty shall be supplied by the contractor. Bidders should be required to furnish with their bids a detailed description of the vehicles offered and drawings showing general arrangements, weights, and dimensions. Data similar to that provided for in the questionnaire contained in NFPA Standard 414, Part F, should also be required.

59. INSPECTIONS AND TESTS PROCEDURES. These tests will be conducted at purchaser's location by the vehicle manufacturer's delivery engineer.

a. Operational Tests. The functioning of the engine, power train, hydraulic system, brakes, steering, lighting system, controls, and instruments shall be demonstrated. The vehicle shall be fully loaded to its rated GVW as specified in paragraph 10a and shall be operated as follows:

(1) 20 miles (32 k) over paved roads at speeds not less than 50 mph (80 KPH).

(2) 10 miles (16 km) over unpaved roads at speeds up to 25 mph (40 KPH).

(3) 10 miles (16 km) off highway at speeds up to 15 mph (24 KPH) with ground and grade conditions requiring all wheel drive.

(4) One hour at not more than three mph (5 KPH) over all types of terrain encountered in cross-country travel.

(5) Accelerate from 0 to 50 mph (0 to 80 KPH) within 25 seconds on dry, level pavement free from loose materials.

b. Fire Suppression System Test.

(1) The pump shall be tested to determine conformance with paragraph 8d. Capacity of the pump shall be measured with calibrated instruments. Copies of official pump test report, certified by the inspector, shall be included with the technical publications supplied with the vehicle.

(2) The contractor shall provide two complete refills of foam concentrate and dry chemical. One refill may be used in conducting vehicle acceptance tests to determine the capability of the turret and handline to discharge water, water fog, foam/water solution, and dry chemical as described in paragraph 8d.

(3) Foam quality varified in accordance with NFPA No. 412.

c. Gradability.

(1) Negotiate an eight percent grade at a speed of not less than 20 mph (32 KPH). The purchaser may elect to accept a certified performance chart from the contractor showing the vehicle's performance in all gear ratios.

(2) The loaded vehicle shall negotiate side slopes while traveling left and right across a 20 percent grade.

d. Brake Tests.

(1) Bring the fully loaded vehicle to five complete, successive stops within 30 feet (9 m) from 20 mph (32 KPH) using service brakes only on dry, hard pavement free from loose material.

(2) Bring the fully loaded vehicle to a complete stop within 120 feet (36 m) from 20 mph (32 KPH). Hold the vehicle on the maximum negotiable grades at the airport. Use hand brakes only for these tests.

e. Radio Interference. Tests for radio interference suppression shall be conducted on the vehicle. All testing equipment, instruments, personnel for making the tests, the test location (which shall be reasonably free from radiated and conducted interference), and other necessary facilities shall be furnished by the contractor.

60. PREPARATION FOR SHIPMENT.

a. Domestic Shipment. The vehicle and its accessories, spare parts, and tools shall be packed in such a manner as to prevent pilferage and insure safe delivery to the designated point.

b. Overseas Shipment. When specified in the invitation-to-bid, the packing for shipment overseas shall be in accordance with the instructions issued by the purchaser.

c. Marking. Marking for shipment shall be in accordance with instructions issued by the purchaser.

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