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SUBJECT : GUIDE SPECIFICATION FOR A COMBINATION FOAM AND DRY CHEMICAL AIRCRAFT FIRE AND RESCUE TRUCK

1. PURPOSE. The guide specification was developed by the Federal Aviation Administration (FAA) to assist airport management in the development of local procurement specifications. It is not addressed to any regulatory requirements of 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. REFERENCE. AC 150/5210-6, Aircraft Fire and Rescue Facilities and Extinguishing Agents.
3. GENERAL.
 - a. The vehicle is primarily intended for use in rescuing trapped personnel and combating aircraft fires resulting from an aircraft ground emergency. The vehicle may also be used for other fire protection assignments necessary in airport operations.
 - b. The guide specification describes a vehicle possessing the minimum performance capabilities recommended for an acceptable aircraft fire and rescue truck. This vehicle is capable of carrying 300 pounds of a foam compatible dry chemical extinguishing agent, 600 gallons of water and foam concentrate, and the necessary auxiliary equipment to combat either aircraft or structural fires. The pump is capable of discharging 250 gallons per minute (GPM) of water and foam liquid at 150 pounds per square inch (PSI) net pump pressure when drafting from the vehicle tanks or from an outside source when pumping from a hydrant. This quantity and rate will meet limited structural firefighting requirements.

- c. This specification may be modified, as desired, to require additional vehicle capabilities, trim, or accessories. So that the purchaser may select certain components with characteristics which better meet individual requirements, alternates have been included in the specification. Accordingly, it will be necessary to specify which of the production options specified in paragraph 7 are desired.
- d. In Publication No. 414, "Aircraft Rescue and Fire Fighting Vehicles," the National Fire Protection Association (NFPA) lists suitable components which, when correctly selected and assembled, will provide an aircraft rescue and fire fighting truck that should satisfy the determined requirement. To date, the NFPA publications do not cover a combination truck similar to the one described in this advisory circular. It is recommended that a truck of this type will provide aircraft fire and rescue protection at Indexes IV and V airports as indicated in AC 150/5210-6.
4. HOW TO OBTAIN THIS PUBLICATION AND THE REFERENCED CIRCULAR. Obtain additional copies of this publication, AC 150/5220-5, Guide Specification for a Combination Foam and Dry Chemical Aircraft Fire and Rescue Truck, and the referenced circular, AC 150/5210-6, Aircraft Fire and Rescue Facilities and Extinguishing Agents, from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590.



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TABLE OF CONTENTS

	<u>Page</u>
1. SCOPE	1
2. APPLICABLE SPECIFICATIONS AND STANDARDS AND SOURCE OF SUPPLY	1
3. REQUIREMENTS	1
a. Vehicle	1
b. Materials	2
c. Design	2
d. Construction	2
e. Performance	3
f. Details of Chassis Design and Components	4
g. Details of Sheet Metal Components	11
h. Details of Firefighting Equipment and Components	12
i. Radio Interference Suppression	17
j. Treating and Painting	17
k. Tools	17
l. Name and Instruction Plates	17
m. Lubrication and Hydraulic Fluids	18
n. Technical Publications	18
o. Quality Assurance Provisions	18
4. INSPECTION AND TEST PROCEDURES	18
a. Operational Tests	18
b. Pump Tests	19
c. Gradability	19
d. Brake Tests	20
e. Radio Interference	20
5. PREPARATION FOR DELIVERY	20
a. Domestic Shipment	20
b. Overseas Shipment	20
c. Marking	20
6. WARRANTY	20
7. PRODUCTION OPTIONS	21

1. SCOPE. This specification covers an all-wheel drive, gasoline or diesel engine-driven, combination, light-duty, high mobility aircraft fire and rescue truck, having as the primary extinguishing agents dry chemical and mechanical foam systems.

2. APPLICABLE SPECIFICATIONS AND STANDARDS AND SOURCE OF SUPPLY. Only the applicable portions of the referenced paragraphs of the following specifications and standards form a part of this specification. These standards and specifications may be obtained from the addresses listed below:
 - a. Specification for Motor Fire Apparatus, Publication No. 19 - National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts 02110.

 - b. Military Specification, MIL-R-8491, Ram and Pump Kit - Hydraulic Emergency Rescue, Type A-1 - Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

 - c. Federal Standard No. 595, Color - Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, D.C. 20407.

 - d. Motor Carrier Safety Regulations - Interstate Commerce Commission, Bureau of Motor Carriers, Washington, D.C. 20427.

 - e. Tire and Rim Association Yearbook - Tire and Rim Association, Inc., 2001 First National Tower, Akron, Ohio 44308.

 - f. Standard for Mill Products - The Aluminum Association, 420 Lexington Avenue, New York, New York 10017.

3. REQUIREMENTS.
 - a. Vehicle. The vehicle shall consist essentially of a gasoline or diesel engine-driven chassis of the enclosed cab type, with both dry chemical and mechanical foam systems mounted on the vehicle chassis. The dry chemical system shall consist of a container for a minimum of 300 pounds of foam compatible dry chemical, the necessary auxiliary equipment to discharge the dry chemical, and one hose line with nozzle having a discharge rate of 350 pounds per minute. The foam system shall consist of tankage for 500 gallons of water and 100 gallons of foam concentrate, pump capable of delivering 250 GPM at 150 PSI net pump pressure, turret(s), nozzle(s), hose line(s), ground sweep nozzles, and all necessary valves and controls for the efficient operation of the system. The vehicle shall be equipped with a complement of auxiliary equipment listed in paragraph 3g(13) and suitable warning devices such as siren and lights to facilitate movement through traffic.

- b. Materials. Material shall be as specified herein. Materials not definitely specified shall be of the best quality used for the purpose in commercial practice. Materials shall be free from all defects and imperfections that might affect the serviceability of the finished product.
- c. Design. The equipment design and accessory installations shall permit accessibility for use, maintenance, and service. All components and assemblies shall be free of hazardous protrusions, sharp edges, cracks, or other elements which might cause injury to personnel or equipment. All oil, hydraulic, and air tubing lines and electric wiring shall be located in protective positions, properly clipped to the frame or body structure and shall have protective loom or grommets at each point where they pass through structural members, except where a through-frame connector is necessary.
- (1) Gross Vehicle Weight. The gross vehicle weight (GVW) including weight of the complete chassis and cab with all attachments, accessories, and equipment required by this specification, body, rated payload, full complement of fuel, lubricants, coolant, and operating personnel (400 pounds), shall be not more than 20,000 pounds. The gross vehicle weight rating shall not exceed the sum of the axle manufacturer's certified load ratings for the axles used. The manufacturer's advertised gross vehicle weight rating shall not be arbitrarily raised to meet the requirements of this specification.
- (2) Weight Distribution. The weight of the vehicle shall be distributed so that 33 percent is on the front axle and 67 percent is on the rear axle. Center of gravity shall be kept as low as possible under all conditions of loading. The vehicle shall be capable of resting on a side slope equivalent to a 30 percent grade without danger of overturning.
- d. Construction. The vehicle shall be constructed so that no part can work loose in service. The vehicle shall be built to withstand the strains, jars, vibrations, and other conditions incident to service intended. Design of the vehicle shall produce the necessary clearances to permit the satisfactory use of tire chains on all wheels when traversing adverse terrain.

- e. Performance. The vehicle fully equipped and provided with fuel, lubricants, operating personnel, and extinguishing agents shall be designed to possess capabilities for:
- (1) Accelerating from a standing start to a speed of 50 miles per hour (MPH) in 40 seconds on a dry level pavement, free from loose materials, having a friction coefficient of 0.6.
 - (2) Maintaining a cruising speed of not less than 50 MPH when operating on dry paved roadway having grades not in excess of 1.5 percent.
 - (3) Maintaining a speed on dry paved roadway of not more than 2.5 MPH at an engine speed that does not result in rough, irregular operation.
 - (4) Ascending a dry paved incline having an 8 percent grade for a distance of one-quarter mile at a speed of not less than 20 MPH.
 - (5) Ascending a dry hard surface incline having a 50 percent grade at not less than 2.5 MPH.
 - (6) Operating on side slopes, right or left, up to 20 percent and longitudinal slopes up or down to 50 percent.
 - (7) Operating continuously for 25 miles at speeds up to 15 MPH over all types of terrain encountered in cross-country travel, including surfaced and unsurfaced roads, and on grades normally encountered in this type of operation. During this performance requirement, the vehicle shall be operated in all-wheel drive. At least 5 miles of this operation shall be cross-country travel.
 - (8) Bringing the fully loaded vehicle, using the service brakes, to 5 complete successive stops within 30 feet from a speed of 20 MPH on dry hard pavement free from loose materials and controlling the vehicle on all grades encountered in cross-country operation.
 - (9) Bringing the fully loaded vehicle, using the hand brake, to a complete stop on a level road and holding the vehicle on the grades encountered (up to 30 percent) in cross-country operation.
 - (10) Negotiating muddy and sandy terrain as usually required of wheeled vehicles designed for off-highway use.

- (11) Operating over rough roads and adverse terrain at speeds up to 15 MPH without exposing operating personnel to injury or causing damage to the vehicle or firefighting equipment.
- (12) Exerting a ground pressure on any wheel of not greater than 52 PSI based on the gross contact area of the tires at zero penetration.

f. Details of Chassis Design and Components.

- (1) Vehicle Chassis. The vehicle chassis, complete with cab, shall be of the 4 x 4 type front wheel steer, gasoline or diesel engine-driven. Parts and accessories necessary for the safe operation of the vehicle shall be provided as required by and shall conform to applicable provisions of the Interstate Commerce Commission (ICC) Motor Carrier Safety Regulations, Part 193. The vehicle and all components shall be new and unused.
- (2) Vehicle Dimensions and Clearances. The vehicle shall conform to the following dimensions and clearances:
 - (a) The overall height shall not exceed 130 inches.
 - (b) The overall length shall be held to a minimum but shall not exceed 260 inches.
 - (c) The vehicle width shall not exceed 96 inches.
 - (d) The wheelbase shall be held to a minimum but shall not exceed 154 inches.
 - (e) The angle of approach shall be not less than 30°.
 - (f) The angle of departure shall be not less than 30°.
 - (g) The under chassis clearance shall be not less than 12 inches.
 - (h) The under axle clearance shall be not less than 10 inches.
 - (i) The diameter of the outside tire centerline track shall be not greater than three times the overall length of the vehicle, and the maximum cramping angle shall be at least 28°.

(3) Engine and Components.

- (a) The vehicle engine shall be of the internal combustion, four-stroke cycle, or two-stroke cycle, gasoline or diesel type, having not less than six cylinders. The vehicle engine shall develop the torque and horsepower to provide the speed and gradability of the vehicle as specified in paragraphs 3e(1) through 3e(7) without the engine exceeding a "no load" governed speed at the peak of a certified gross brake horsepower (BHP) curve. The engine shall operate satisfactorily and shall be capable of demonstrating the performance characteristics specified herein with fuel conforming to regular commercial grade.
- (b) Cooling systems of the circulating water type shall maintain a cooling water temperature of not more than 210°F nor less than 140°F when operated in ambient temperatures of -20°F to 125°F. The system shall be provided with a bypass to permit coolant circulation in the engine block, with thermostat closed, until normal operating temperature is reached. A thermostat of good commercial quality having a temperature range as recommended by engine manufacturer shall be provided. The cooling system shall be capable of withstanding an internal pressure of 7 PSI. Drain cocks shall be installed at the low point of the cooling system and at such other points as may be necessary to completely drain the system. A coolant temperature indicator shall be provided on the cab instrument panel.
- (c) The fuel system shall be complete and so installed as to preclude the possibility of vapor lock and shall include: a carburetor(s) or injector(s); manual or automatic choke; parallel-piped dual fuel pumps, one mechanically and one electrically powered; fuel strainer; oil bath air cleaner; all piping; valves; fittings; fuel lines; and all other accessories. The fuel tank shall have a minimum of 20-gallon capacity and be manufacturer's standard production. The fuel tank shall be equipped with an accessible drain plug. Filler pipe opening shall be accessibly located outside the cab or body.
- (d) 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's recommended by the engine manufacturer for the intended service.

- (e) The engine and chassis lubricating systems shall be the manufacturer's current standard productions. The engine's oil filter shall be full-flow type or bypass type with replaceable element.
 - (f) The vehicle shall be equipped with an efficient exhaust system and muffler. The tailpipe shall be of such a size as to avoid undue increase in back pressure and shall be located in such a manner that entrance of exhaust gases into the cab shall be minimized under all conditions of operation and so that the exhaust does not disperse the foam blanket. The muffler shall be aluminized or ceramic coated.
- (4) Drive Line Components.
- (a) The clutch shall be the manufacturer's standard for the size engine used and shall be certified as being suitable for use with the specific engine by the clutch manufacturer.
 - (b) The transmission shall be of the interrupted, constant mesh or synchromesh, selective sliding gear type providing for maximum ease of shifting in all speeds. Input torque capacity shall be at least equal to the maximum net torque delivered by the engine. Gears shall be heat treated and properly finished to insure quiet operation and long life. The transmission shall provide at least four speeds forward and one speed in reverse with manual control shift. The transmission shall be certified as suitable for use in this vehicle by the transmission manufacturer.
 - (c) The transfer case shall be of a single- or two-speed type as required to meet the performance requirements specified in paragraph 3e(5). The transfer case shall be equipped with a manual front axle disconnect, a center differential with manual or automatic lockout, or an overriding clutch to compensate for difference in travel between front and rear wheels. The case may be a unit with the transmission or a separate unit mounted independently and shall be certified as suitable for use in this vehicle by the transfer case manufacturer.

- (d) The axles furnished shall be certified as being suitable 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 and shall be at least equal to the load imposed at the ground when vehicle is loaded to its rated gross vehicle weight; each axle to be provided with no spin or other retarding type differential lock to assure a torque transfer to each wheel retaining traction. If manual lockout is required, the lockout control shall be located in the vehicle cab.
- (e) A braking system which meets the ICC requirements for similar type vehicles 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 mechanism shall be readily accessible for external adjustment.
 - 1 The service brakes shall be of the hydraulic type provided on all wheels and equipped with power assist and shall be capable of meeting the brake tests specified in paragraph 4d(1).
 - 2 A parking brake operated by a control readily accessible to the driver shall be provided.
- (f) The vehicle chassis shall be equipped with a standard hydraulic power assist steering mechanism operable from the driver's seat. Means shall be provided for rapid and easy adjustment of lost motion in the steering gear. The steering mechanism shall be capable of easily controlling the direction of the fully loaded vehicle under all operating conditions.
- (g) Vehicles shall be equipped with manufacturer's current suspension system having a rated capacity at least equal to the imposed load, measured at the ground, with 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.
- (h) The wheels shall be either disc or spoke type as currently furnished by the vehicle manufacturer.

- (i) Rim contours and size shall conform to the current practices of the Tire and Rim Association, Inc., as recommended for use in the design of new vehicles.
 - (j) Each tire, at 45 PSI inflation pressure, shall have a rated carrying capacity at least equal to the gross load normally imposed on it by the fully loaded vehicle. The load rating capacity of the tires shall conform to the tables of the Tire and Rim Association, Inc., current yearbook. Tire treads shall be of the military or lug type with center rib. Tires and tubes shall meet the firstline commercial grade requirements.
 - (k) A spare wheel or rim with tire and tube included shall be provided when all tires are of the same size. Facilities to mount the wheel or rim on the vehicle shall not be provided.
- (5) 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 to support gross weight of the body and load, power plant, pump, filled water tank, and all other equipment under operating conditions specified herein. No alterations shall be made to the frame which shall reduce its designated strength. Two towing hooks or eyes shall be attached directly to the chassis frame at the front and one or two on the rear of the vehicle.
- (6) Cab. The cab shall be the manufacturer's standard. Gutters of sufficient width to prevent water and foam from dripping on the windshield shall be included. The cab roof, floorboards, and partition separating the vehicle engine from the cab shall be fully insulated.
- (a) Cabs of the forward type configuration shall have all work areas on the cab roof provided with four-way safety plate and protected with safety railings.
 - (b) Cabs of the tilt type configuration with turret mounted on the cab roof shall be designed so that the cab may be tilted without disconnecting the turret piping.
 - (c) A cab heater and windshield defroster shall be provided which shall be capable of maintaining a cab temperature of 50°F at ambient temperatures of -20°F.

- 9 At least one 8-inch backup light installed at the rear of the body. Light shall automatically light up when transmission is shifted into reverse.
- 10 A rotating, flashing, 4-bulb, red or alternating red-and-white beacon, not less than 10 inches in diameter, suitably installed away from operating components. Control switch shall be installed on the instrument panel for control of the beacon.
- 11 Siren installed with a foot-operated switch located for use by the truck driver and crewman.

g. Details of Sheet Metal Components.

- (1) Body. Body shall be fabricated from aluminum or steel designed to provide the lightest weight consistent with the strength necessary for operation over rough terrain. Body shall fully enclose dry chemical system and water tank. Self-tapping bolts shall not be used in construction of the apparatus body.
- (2) Steps and Running Boards. Steps and running boards located on each side, at the cab, and at the rear shall be provided as required for ascending or descending from the vehicle. All steps and running boards shall be of four-way safety tread design.
- (3) Walkways. All walkways shall be similarly constructed of four-way safety tread design.
- (4) Handrails. Rigidly attached handrails or guardrails of suitable metal tubing not less than $1\frac{1}{2}$ inches in diameter shall be provided as required for personnel safety at all steps, walkways, and stations.
- (5) Compartments. The body shall have built-in compartments that are of dustproof and rainproof construction equipped with doors having continuous piano-type hinges with brass pins and snap-type locks with semiflush handles.
 - (a) At least one equipment compartment, to the extent the design shall permit, on each side of the vehicle.
 - (b) One two-way radio compartment.

h. Details of Firefighting Equipment and Components.

- (1) Pump. The pump shall be of centrifugal type designed to provide both the capacity and high-pressure discharge required. When operating from the water tank as an aircraft firefighting unit, the pump shall be capable of discharging 250 GPM of foam solution at 150 PSI minimum net pressure.
- (2) Pump Drive. The pump shall be driven by a power take-off attached either to the transmission or transfer case. It shall be possible to operate both the pump and the vehicle with only a momentary loss of pressure when the transmission gears are shifted.
- (3) Pump Connections.
 - (a) Suction. At least one outside 2½-inch National Standard Fire Hose Thread (NSFHT) suction inlet with strainer, cap, and suction connection to the water tank shall be provided.
 - (b) Discharge. The pump shall be provided with a minimum of two discharge gates with 1½-inch NSFHT adapters and caps. The discharge to the turret shall be controlled from both inside and on the roof of the cab. The discharge to hose reels shall be controlled at the reels. The discharge to the ground-sweep nozzles and to the under-truck nozzles, as specified, shall be controlled within the cab; these controls shall be accessible both to the driver and a crewman when seated in their respective seats in the cab.
- (4) Heat Exchanger. A closed system heat exchanger and churn line to prevent overheating of water in pump when pump is operating at zero discharge, automatic or cab controlled, shall be provided.
- (5) Pump and Engine Controls.
 - (a) Control Panel. The pump control panel shall be located on the forward portion of the body at the suction intake immediately to the rear of the cab. This panel shall include the discharge gate controls, primer, water and foam tank valve controls, and the following pumping unit instruments and controls:

Pump pressure gauge	Pump compound gauge
Throttle (Vernier style)	Coolant temperature gauge
Oil pressure gauge	Foam tank level gauge
Water tank level gauge	

- (b) Pressure Regulator. The automatic pressure regulator shall be adjustable to maintain working pressures from 75 to 250 PSI with an adjustment control.
- (c) Remote Controls. Remote controls, in addition to those included in the control panel specified in paragraph 3h(5)(a), shall be located in the vehicle cab. They are to be so situated that all manually operated switches and control levers can be easily reached from either the driver's or crewman's seat. They are to include:

Throttle (Vernier style)	Water tank level gauge
Pump pressure gauge	Ground-sweep control
Under-truck nozzle control (if specified)	Foam tank and churn valve controls
Water tank valve control	Power take-off shift

- (6) Water Tank. The water tank shall have a 500-gallon capacity. The tank shall be of a welded construction, using metal best suited to provide minimum weight to gallonage ratio or glass fiber reinforced plastic and baffled so that capacity of each compartment shall not exceed 100 gallons. If steel or aluminum is used, the interior surface shall be treated with an anticorrosive coating. If any aluminum alloy is used, it shall be the Aluminum Association No. 5052-H34 or equal.
- (a) The construction and connection shall be made to prevent the possibility of chemical corrosion of dissimilar metals.
- (b) The tank shall be equipped with removable manhole covers or a removable top to permit access within each baffled compartment of the tank. It shall also have a deep sump with an antiscwirl baffle, a 2-inch drain valve, and two filler openings with gasketed caps. Filler opening diameter shall not be less than 4 inches.

- (c) The tank outlet and the suction piping to the pump shall be 3 inches in diameter to allow a flow of 250 GPM to the pump. The control valve installed in the line between tank and pump shall be of the quick-acting, quarter turn type capable of operation from within the cab.
 - (d) 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.
 - (e) The tank shall be provided with an overflow connection(s) which shall prevent excess pressure being applied to the tank during filling operations.
- (7) Tank Filler Connection. A 2½-inch 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. It shall terminate in a 2½-inch NSFHT swivel female hose connection. All water fill openings shall be provided with strainers.
- (8) Foam Proportioning System. A Balanced Pressure Proportioning System to automatically control the ratio of foam concentrate to the quantity of water being fed to the pump shall be provided. This system shall include one of the following:
- (a) A bladder type foam concentrate tank(s), a metering (percentage selector) valve, and an orifice plate in the pump suction line.
 - (b) A rigid foam concentrate tank and a pressure control valve.
- (9) Foam Concentrate Storage.
- (a) When bladder type foam concentrate tanks are used, they shall be mounted within the water tank and of 100-gallon total capacity. Tank outlets shall be manifolded to permit continuous flow of the foam concentrate.

- (b) When a rigid foam concentrate tank is to be used together with a pressure control valve, the tank shall be of 100-gallon capacity. This tank may be constructed of glass fiber reinforced plastic or mild steel. Steel tanks shall be sand blasted and lined with not less than 30 mils cohesively applied neoprene tank lining or similar noncorrosive material. The foam tank shall be equipped with a readily accessible 3/4-inch or larger drain, an airtight filler cap, and a pressure vacuum vent valve. Foam filler pipe shall extend to within one inch of tank bottom and discharge opening cut at a 45° angle. Tank shall be securely mounted on the upper surface of the water tank.
 - (c) A reinforced glass fiber plastic or mild steel fill pan equipped with a 1/4-inch mesh steel screen and one stainless steel can opener to permit emptying a 5-gallon foam concentrate can shall be provided. This fill pan shall be connected to the foam storage tank(s) with a 2-inch pipe for filling the storage tank(s). The storage tank(s) shall be equipped with a suitable vent to expedite filling.
 - (d) Provisions shall be made for flushing all of the foam system piping with clear water from the pump discharge.
- (10) Turret. There shall be one turret designed to discharge a total of 200 GPM of a foam solution, water, or water fog.
- (a) Necessary controls shall be provided to permit the selection of the foam solution, water, or water fog from both inside the cab and on the cab roof. The turret shall be aimed by a single direct connected control lever. The control lever shall be designed to permit manual operation. The turret shall also have a complete set of controls to permit operation from the top of the cab roof.
 - (b) The turret shall have a discharge pattern which is infinitely variable from a flat pattern of 25-foot width and 50-foot range to a solid stream of foam with a minimum of 120-foot range. The resulting foam shall have a minimum expansion ratio of 8 to 1 with not more than 25 percent drainage in 5 minutes. All foam patterns listed herein shall be at an operating pressure of 150 PSI.
- (11) Handline Reels and Nozzles. Two manual rewind hose reels, one on each side of the vehicle, shall be provided. Each reel shall be located on or over the water tank and shall be provided with vertical and horizontal captive type rollers.

- (a) Each reel shall have a capacity for, and be equipped with, a minimum of 150 feet of 1-inch, 800-pound test rubber-lined hose. Each reel shall be equipped with a friction brake to provide a positive control for unreeling of the hose.
 - (b) Each reel shall be equipped with a manual quarter turn pull type valve located so the hose can be charged in the bed position.
 - (c) Each hose shall be equipped with a shutoff type nozzle designed for selection of discharging of foam, water, or water fog at a rate of 50 gallons per minute. Each nozzle shall have a fog foam discharge pattern with a 20-foot range to a solid stream of foam with a minimum 45-foot range. The resultant foam shall have a minimum expansion ratio of 8 to 1 with not more than 25 percent drainage in 5 minutes. Foam patterns shall be at a nozzle operating pressure of 100 PSI.
- (12) Dry Chemical System. A stationary type 300-pound dry chemical system, listed and approved by a recognized testing laboratory for fire extinguishing systems, shall be mounted directly behind the vehicle cab. The system shall be complete with tank, pressurization facilities, and 100 feet of 3/4-inch hose with nozzle of manufacturer's latest design.
- (13) Auxiliary Equipment. The following auxiliary equipment shall be provided properly mounted on the vehicle or secured in a compartment:
- (a) Extension ladder, fire department type, one 2-section, capable of being extended to 18 feet; this ladder to be of light-weight alloy 18 inches wide, 12-inch spacing between rungs, and mounted in quick release brackets on side of vehicle.
 - (b) One hydraulic rescue kit. This kit shall be in accordance with Military Specification, MIL-R-8491.
 - (c) Two portable, electric, 500-watt floodlights complete with 50-foot waterproof cable terminating with connectors.

- (d) Two electric hand lanterns, 6V battery, to throw 1000-foot beam.
 - (e) Two axes, fire pickhead, 6-pound, with serrated blade.
 - (f) One adjustable hydrant wrench.
 - (g) Two 1-inch spanner wrenches.
- i. Radio Interference Suppression. The vehicle shall be adequately radio interference suppressed to permit positive radio communications under normal airport operating conditions.
- j. Treating and Painting.
- (1) All parts of the vehicle shall be cleaned, treated, and primed prior to assembly.
 - (2) After the vehicle is completely assembled, except for bright trim parts, the entire unit shall be primed, puttied, water sanded, and painted with not less than three coats of red enamel (Red No. 11136 of Federal Standard No. 595).
 - (3) The finished paint shall be free from "orange peel" (pebbly finish), runs, and other imperfections which detract from the vehicle's appearance.
- k. Tools. Any tools peculiar to the servicing of the vehicle, the fire suppression system, and any of the auxiliary equipment shall be furnished with the vehicle.
- l. Name and Instruction Plates. All name and instruction plates shall be metal or plastic with the information engraved, stamped, or etched thereon. If metal, they shall be made of a noncorrosive material, chrome plated or nickel silvered. Plates shall be attached with screws, bolts, or rivets. Each plate shall be mounted in a conspicuous place.
- (1) Plastic plates shall not be used in an exposed position where they are subject to weathering.
 - (2) Name plates shall show make, model, serial number, and such other data as to positively identify the item.

(3) Instruction plates shall be on each handle (exclusive of door handles), valves, or component parts which necessitate actuation or identification or important instructions to be followed in operating or servicing the vehicle or equipment. These instruction plates shall include warnings or cautions and shall be so located and of sufficient size to be effective.

m. Lubrication and Hydraulic Fluids. 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. Prior to delivery, the vehicle shall be lubricated with lubricants suitable for use in the temperature ranges where the vehicle is to be placed in service. All hydraulic systems shall be filled to the proper operating level with the correct grade of hydraulic fluid for the same temperature range.

n. Technical Publications. The contractor shall furnish two sets of the following publications in accordance with standard commercial practices applicable to the vehicle (including body and special 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.

o. Quality Assurance Provisions. The contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the contractor may utilize his own or any other inspection facilities and services. Records of inspections and tests shall be maintained by the contractor. Copies of these records shall be provided the purchaser. The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure contractor compliance with the specification requirements.

4. INSPECTION AND TEST PROCEDURES. (To be conducted at purchaser's location by the vehicle manufacturer's delivery engineer.)

a. Operational Tests. The vehicle shall be fully loaded as to its rated GVW as specified in 3c(i) and shall be operated as follows:

(1) Twenty miles over hard surfaced roads at maximum speeds not less than 40 MPH.

- (2) Ten miles over dirt surfaced roads at maximum road speeds up to 25 MPH.
- (3) Ten miles off highway at speeds up to 15 MPH with ground and grade conditions requiring all-wheel drive.
- (4) One hour at not more than 3 MPH over all types of terrain encountered in cross-country travel.
- (5) Accelerate from 0 to 50 MPH in 40 seconds on dry level pavement free from loose materials.

During this test the functioning of the engine, power train, hydraulic system, brakes, steering, lighting system, controls, and instruments shall be noted.

b. Pump Tests.

- (1) Pressure and Capacity. The pump shall be tested to determine conformance with paragraph 3h(1). 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) Foam Tests. The contractor shall provide one complete change of foam concentrate which may be used in conducting the following tests:
 - (a) Tests shall be conducted to determine the capability of the turret(s) and nozzle(s) to discharge foam, water and water fog as described in paragraphs 3h(10), 3h(11)(c), and, if applicable, 7c and 7d.
 - (b) Foam discharge patterns and drainage characteristics shall meet the criteria contained in the referenced paragraphs.

c. Gradability.

- (1) Negotiate an 8 percent grade at a speed of not less than 20 MPH. The purchaser may elect to accept a certified performance chart from the contractor showing the vehicle performance in all gear ratios at all engine RPM's above 1000 RPM.
- (2) The loaded vehicle shall negotiate side slopes left and right of 20 percent grade.

d. Brake Tests.

- (1) Bring the fully loaded vehicle to 5 complete, successive stops within 30 feet from 20 MPH, using the service brakes only, on dry hard pavement free from loose materials.
- (2) Bring the fully loaded vehicle to a complete stop from 20 MPH and hold the vehicle on the maximum grades up to 30 percent at the airport, using parking brake only.

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.

5. PREPARATION FOR DELIVERY.

- a. Domestic Shipment. The vehicle and its accessories, spare parts, and tools shall be packed in such a manner as to insure acceptance and 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.

6. WARRANTY. The contractor shall warrant each new apparatus manufactured or assembled by him to be free from defects in material and workmanship under normal use and service. His obligation under this Warranty is limited to making good at his factory any part or parts thereof, including all equipment or trade accessories (except tires, storage batteries, electric lamps, and other devices subject to normal deterioration) supplied by him. Parts developing defects within one year after making delivery of such vehicle to the original purchaser must be returned to him with transportation charges prepaid and which on examination by the manufacturer shall disclose to his satisfaction to have been thus defective.

7. PRODUCTION OPTIONS. Alternate production options and components, which purchasers may wish to consider, are described below. These options are written so that the descriptive material may be added to or substituted for the applicable paragraph of the specification.
- a. Add to paragraph 3f(4)(a), "The clutch shall be actuated by a power assist throwout mechanism."
 - b. Add to paragraph 3f(4)(j), "The rear tires shall be of the duplex type to improve operating characteristics of the vehicle."
 - c. Add to paragraph 3h as paragraph 3h(14), "Under-Truck Nozzles. Under-truck nozzles shall be furnished. These nozzles shall be located so that their discharge effectively blankets the ground under the full length of the vehicle with foam. The nozzle control shall be readily accessible from the driver's seat. Nozzles shall have a minimum range of 10 feet."
 - d. Add to paragraph 3h as paragraph 3h(15), "Ground-Sweep Nozzle(s). Ground-sweep nozzle(s) shall be provided capable of discharging 60 GPM in a pattern 12 feet wide with a 25-foot range. The resultant foam shall have a minimum expansion ratio of 8 to 1 with not more than 25 percent drainage in 5 minutes. The nozzle control shall be readily accessible from the driver's seat."
 - e. Add to paragraph 3j as paragraph 3j(4), "The vehicle shall be undercoated with a fibrous, reinforced asphaltic compound of the manufacturer's standard sandless commercial material. The coating shall be 1/16 to 1/8-inch thick and be applied to clean dry surfaces, except engine, transmission drive shafts, axles, brakes, and steering and suspension components."

Federal Aviation Agency

AC NO : AC 150/5220-2

AIRPORTS

EFFECTIVE :

7/24/64

ADVISORY CIRCULAR

SUBJECT : GUIDE SPECIFICATION FOR 1,800-GALLON
AIRCRAFT FIRE AND RESCUE TRUCK

1. PURPOSE. The guide specification was developed by the Federal Aviation Agency to assist airport management in the development of local procurement specifications. It is not addressed to any regulatory requirements of FAA but is promulgated for general use. The words "shall" and "will" are not to be construed as mandatory requirements of FAA. They are specifically included so that portions of this sample specification may be copied verbatim by local specification writers.
2. VEHICLE DESCRIPTION.
 - a. The vehicle is primarily intended for use in rescuing trapped personnel and combating aircraft fires resulting from an aircraft ground emergency. The vehicle will also be used for other fire protection assignments necessary in airport operations.
 - b. The guide specification describes a vehicle possessing the minimum performance capabilities recommended for an acceptable aircraft fire and rescue truck. This vehicle is capable of carrying 1,800 gallons of extinguishing agent and the necessary auxiliary equipment to combat either aircraft or structural fires. The pump is capable of discharging 800 GPM of water and foam liquid at 250 PSI net pump pressure when drafting from the vehicle tanks or from an outside source and when pumping from a hydrant in the quantity and rate necessary to meet limited structural fire fighting requirements.
 - c. This specification may be modified, as desired, to require additional vehicle capabilities, trim, or accessories. So that purchasers may select certain components with characteristics which better meet their individual requirements, alternates have been included in the paragraphs below. Accordingly, it will be necessary to designate the:
 - (1) Type of transmission desired; interrupted selective type or continuous drive type with or without constant mesh planetary gearing. Paragraph 3e(4)(b).

7/24/64

- (2) Use of single or dual tires. Paragraph 3e(4)(j).
 - (3) Type of foam proportioning system desired. Paragraph 3e(18).
 - (4) Type and number of turrets (manually or remotely controlled.) Paragraph 3e(20).
 - (5) Whether or not undercoating is desired. Paragraph 3e(27).
 - (6) Whether or not the vehicle engine is used to power both the vehicle and the fire pump; if it is, then the vehicle engine must be capable of developing sufficient power to meet the requirements of both vehicle and pump performance characteristics described in paragraph 3e(3)(a) and 3e(15)(a). It must be linked in a manner that permits engaging the pump while the vehicle is moving and pumping at constant pressure while starting, stopping, or maneuvering the vehicle, with momentary pressure drops of not more than 40 PSI.
3. HOW TO OBTAIN THIS PUBLICATION. Obtain additional copies of this publication, AC 150/5220-2, "Guide Specification for 1,800-Gallon Aircraft Fire and Rescue Truck," from Federal Aviation Agency, Distribution Unit, HQ-438, Washington, D. C. 20553.


Cole Morrow, Director
Airports Service

Cancelled 5220-10
Federal Aviation Agency

AC NO: AC 150/5220-2
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GUIDE SPECIFICATION FOR 1,800
GALLON AIRCRAFT FIRE AND RESCUE TRUCK

TABLE OF CONTENTS

	<u>Page</u>
1. SCOPE.	1
2. APPLICABLE DOCUMENTS AND SOURCE OF SUPPLY.	1
3. REQUIREMENTS.	1
a. Description.	1
b. Materials.	1
c. Design and Construction.	1
d. Performance.	3
e. Details of Components.	4
4. INSPECTION AND TEST PROCEDURES.	21
a. Operation Test.	21
b. Pump Test.	21
c. Gradability.	22
d. Brake Tests.	22
e. Radio Interference.	22
5. PREPARATION FOR DELIVERY.	22
a. Domestic Shipment.	22
b. Overseas Shipment.	22
c. Marking.	22
6. WARRANTY.	22

1. SCOPE. This specification covers an all-wheel drive, gasoline-driven, heavy-duty, high-mobility aircraft fire and rescue truck, having a mechanical foam system to be used in dispensing foam as the primary extinguishing agent.
2. APPLICABLE DOCUMENTS AND SOURCE OF SUPPLY. Standards and publications of the issue in effect on date of invitation to bid form a part of this specification.
 - a. Federal Standard No. 595, Color, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.
 - b. Motor Carrier Safety Regulations, Interstate Commerce Commission, Bureau of Motor Carriers, Washington, D. C. 20423.
 - c. Tire and Rim Association Yearbook, Tire and Rim Association, 2001 Fire National Tower, Akron, Ohio.
 - d. Specification for Motor Fire Apparatus, Pamphlet No. 19, National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts.
 - e. Standards for Mill Products, The Aluminum Association, 420 Lexington Avenue, New York, New York.
3. REQUIREMENTS.
 - a. Description. The vehicle shall consist essentially of a gasoline engine driven chassis of the enclosed cab-ahead type and a mechanical foam system mounted on the chassis. This system shall consist of tankage for 1,500 gallons of water and 300 gallons of foam concentrate, an engine driven pumping unit capable of delivering 800 GPM at 250 PSI net pump pressure, turret(s) nozzle(s), hose lines, ground sweep and under truck nozzles and all necessary valves and controls for the efficient operation of the system. The vehicle shall be equipped with a complement of auxiliary equipment listed in paragraph 3e(24) and suitable warning devices such as siren and lights to facilitate movement through traffic,
 - b. Materials. Material shall be as specified herein. Materials not definitely specified shall be of the best quality used for the purpose in commercial practice. Materials shall be free from all defects and imperfections that might affect the serviceability of the finished product.
 - c. Design and Construction.
 - (1) Design. The design of the equipment shall be in accordance with the best engineering practices. The equipment design and accessory installations shall permit accessibility for use, maintenance, and service. All components and assemblies

7/24/64

- shall be free of hazardous protrusions, sharp edges, cracks, or other elements which might cause injury to personnel or equipment. All oil, hydraulic and air tubing lines, and electric wiring shall be located in protective positions, properly clipped to the frame or body structure and shall have protective loom or grommets at each point where they pass through structural members, except where a through-frame connector is necessary.
- (2) Construction. The vehicle shall be constructed so that no part will work loose in service. The vehicle shall be built to withstand the strains, jars, vibrations, and other conditions incident to service intended. Design of the vehicle shall produce the necessary clearances to permit the satisfactory use of tire chains on all wheels when traversing adverse terrain.
- (3) Gross Vehicle Weight. The gross vehicle weight (GVW) including weight of the complete chassis and cab with all attachments, accessories, and equipment required by this specification, body, rated payload, full complement of fuel, lubricants, coolant, and operating personnel (525 pounds), shall be not less than 38,000 pounds nor more than 45,000 pounds. The vehicle gross weight rating shall not exceed the sum of the axle manufacturer's certified load ratings for the axles used. The manufacturer's advertised gross vehicle weight rating shall not be arbitrarily raised to meet the requirements of this specification.
- (4) Weight Distribution. The weight of the vehicle shall be distributed so that the actual load is evenly distributed over all tires under all conditions of loading (both loaded and empty). The heaviest load on any tire shall not exceed 10 per cent of the lightest load on any tire. Center of gravity shall be kept as low as possible under all conditions of loading. The vehicle shall be capable of resting on a side slope equivalent to a 30 per cent grade without danger of overturning.

NOTE. The weight distribution for various chassis designs shall be as follows:

Chassis 4 wheel-4 wheel drive (4x4), single tires, 50 per cent front axle, 50 per cent rear axle.

Chassis 6 wheel-6 wheel drive (6x6), single tires, 33 per cent on front axle, 67 per cent on rear bogie.

Chassis 4 wheel-4 wheel drive (4x4), dual tires rear, 33 per cent front axle, 67 per cent rear axle.

7/24/64

Chassis 6 wheel-6 wheel drive (6x6), dual rear tires, 20 per cent front axle, 80 per cent rear bogie.

- d. Performance. The vehicle fully equipped and provided with fuel, lubricants, operating personnel, extinguishing agents, shall be designed to possess capabilities for:
- (1) Accelerating from a standing start to a speed of 50 MPH in 60 seconds on a dry level pavement, free from loose materials, having a friction coefficient of 0.6.
 - (2) Maintaining a cruising speed of not less than 50 MPH when operating on dry paved roadway having grades not in excess of 1.5 per cent.
 - (3) Maintaining a speed of not more than 2.5 MPH at an engine speed that does not result in rough, irregular operation.
 - (4) Ascending a dry paved incline having an 8 per cent grade for a distance of $\frac{1}{2}$ mile at a speed of not less than 20 MPH.
 - (5) Ascending a dry hard surface incline having a 50 per cent grade at not less than 2.5 MPH.
 - (6) Operating on side slopes, right or left, up to 20 per cent and longitudinal slopes up or down to 50 per cent.
 - (7) Operating continuously for 25 miles at speeds up to 15 MPH over all types of terrain encountered in cross-country travel including surfaced and unsurfaced roads, and on those grades normally encountered in this type of operation. During this performance requirement the vehicle shall be operated in all-wheel drive. At least 5 miles of this operation shall be cross-country travel.
 - (8) Bringing the fully loaded vehicle, using the service brakes, to five complete successive stops within 30 feet from a speed of 29 MPH on dry hard pavement free from loose materials and controlling the vehicle on all grades encountered in cross-country operation.
 - (9) Bringing the fully loaded vehicle, using the hand brake to a complete stop on a level road and by holding the vehicle on the grades encountered (up to 30 per cent) in cross-country operation.
 - (10) Negotiating muddy and sandy terrain as usually required of wheeled vehicles designed for off-highway use.

- (11) Operating over rough roads and adverse terrain at speeds up to 15 MPH without exposing operating personnel to injury or causing damage to the vehicle or fire fighting equipment.
- (12) Exerting a ground pressure on any wheel of not greater than 45 PSI based on the gross contact area of the tires at zero penetration.

e. Details of Design and Components.

Vehicle Chassis. The vehicle chassis, complete with cab, shall be of the 4x4 or 6x6 type front wheel steer, gasoline engine driven. Parts and accessories necessary for the safe operation of the vehicle shall be provided as required by, and conforming to applicable provisions of the Interstate Commerce Commission (ICC) Motor Carrier Safety Regulations, Part 193. The vehicle and all components shall be new and unused.

- (2) Vehicle Dimensions and Clearances. The vehicle shall conform to the following dimensions and clearances:
 - (a) The over-all height shall not exceed 144 inches.
 - (b) The over-all length shall be held to a minimum; not exceeding 360 inches.
 - (c) The basic vehicle width shall not exceed 100 inches. Removable equipment may extend width to 104 inches.
 - (d) The wheel base shall be held to a minimum; not exceeding 192 inches.
 - (e) The angle of approach shall be not less than 30°.
 - (f) The angle of departure shall be not less than 30°.
 - (g) The under chassis clearance shall be not less than 18 inches.
 - (h) The under axle clearance shall be not less than 12 inches.
 - (i) The diameter of the outside tire centerline track shall not be greater than three times the over-all length of the vehicle and the minimum cramp angle shall be not less than 24°.

(3) Engine and Components.

- (a) The vehicle engine shall be of the internal combustion, four stroke cycle, liquid cooled, gasoline type, having not less than six cylinders. The vehicle engine shall develop the torque and horsepower to provide the speed and grade ability of the vehicle as specified in paragraphs 3d(1) through 3d(7) without the engine exceeding a no load governed speed at the peak of a certified gross brake horsepower (BHP) curve. The engine shall operate satisfactorily and shall be capable of demonstrating the performance characteristics specified herein with gasoline conforming to regular commercial grade.
- (b) The cooling system shall be of the circulating water type and shall maintain a cooling water temperature of not more than 210°F nor less than 140°F when operated in atmospheric temperatures of -20°F to +125°F. The system shall be provided with a bypass to permit coolant circulation in the engine block, with thermostat closed, until normal operating temperature is reached. A 160°F thermostat of good commercial quality shall be provided. The cooling system shall be capable of withstanding an internal pressure of 7 PSI. Drain cocks shall be installed at the low point of the cooling system and at such other points as may be necessary to completely drain the system. A coolant temperature indicator shall be provided on the cab instrument panel.
- (c) The fuel system shall be complete and so installed as to preclude the possibility of vapor lock, and shall include a carburetor, manual or automatic choke, dual fuel pumps one mechanically and one electrically powered, parallel piped fuel strainer, oil bath air cleaner, all piping, valves, fittings, fuel lines, and all other accessories. The fuel tank shall have a minimum of 50-gallon capacity and be manufacturer's standard production. The fuel tank shall be equipped with an accessible drain plug. Filler pipe opening shall be accessibly located outside the cab or body. The fuel tank shall conform to ICC requirements.
- (d) A mechanical engine governor shall be provided and set to limit engine speed so that it will not exceed the maximum RPM's recommended by the engine manufacturer for the intended service.

- (e) The engine and chassis lubricating systems shall be the manufacturer's current standard production. The engine oil filter shall be full-flow type or by-pass type with replaceable element.
 - (f) The vehicle shall be equipped with an efficient exhaust system and muffler. The tailpipe shall be of such size as to avoid undue increase in back pressure and shall be located in such a manner that entrance of exhaust gases into the cab shall be minimized under all conditions of operation and so that the exhaust does not disperse the foam blanket. The muffler shall be aluminized or ceramic coated.
- (4) Drive Line Components.
- (a) The clutch (if use is required with the transmission) shall be the manufacturer's standard for the size engine used and shall be certified as being suitable for use with the specific engine by the clutch manufacturer. When clutch is required, the purchaser should consider the inclusion of a power actuated clutch throw-out assist.
 - (b) The transmission shall be of the interrupted or continuous drive type, as selected by the purchaser and in accordance with the following:
 - 1 The interruption drive transmission shall be a selective type providing for maximum ease of shifting in all speeds. Input torque capacity shall be at least equal to the maximum net torque delivered by the engine. Gears shall be heat treated and properly finished to insure quiet operation and long life. The transmission shall provide at least four speeds forward and one speed in reverse with manual control shift. The top three gears shall be constant mesh type (gears may be equipped with synchronizers if specified by purchaser). The transmission may be equipped with power assist shift if specified by purchaser. The transmission shall be certified as suitable for use in this vehicle by the transmission manufacturer.
 - 2 The continuous drive transmission shall include a torque converter providing forward and reverse ranges and a suitable torque ratio to stall. The design shall include a lock-up clutch for direct mechanical drive. The hydraulic system shall include oil pumps, easy service oil filter and screens, hydraulic control

system, retarder, and an oil cooling system. The transmission control shall include a range selector lever with reverse, neutral, and forward positions, all clearly identified. The transmission shall operate efficiently and without detrimental effects to any components with lubrication in accordance with recommendation of the transmission manufacturer. The continuous drive transmission shall be certified as suitable for use in this vehicle by the transmission manufacturer. The purchaser, if desired, may require the continuous drive transmission to be equipped with a constant mesh planetary gear train providing forward or reverse ranges, power operated hydraulic clutches, power shift in all forward speed ranges, and manual selection of the hydraulic clutch engaging reverse drive.

- (c) The transfer case will be of a single-or two-speed type as required to meet the performance requirements specified in paragraph 3d(5). The transfer case will be equipped with a manual front axle disconnect, a center differential with manual or automatic lockout, or an over-riding clutch to compensate for difference in travel between front and rear wheels. The case may be a unit with the transmission or a separate unit mounted independently and shall be certified as suitable for use in this vehicle by the transfer case manufacturer.
- (d) The axles furnished shall be certified as being suitable 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, and shall be at least equal to the load imposed at the ground when vehicle is loaded to its rated gross vehicle weight; each axle to be provided with no spin or other retarding type differential lock to assure a torque transfer to each wheel retaining traction. If manual lockout is required, the lockout control shall be located in the truck cab. The rear bogie on all 6x6 vehicles shall be of the four-wheel type complete with axles, springs, torque rods, and all other necessary parts. The bogie shall be provided with means permitting differential action between the two axles.
- (e) A braking system which meets the ICC requirements for similar type trucks 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 mechanism shall be readily accessible to external adjustment.

7/24/64

- 1 The service brakes shall be of the full air or air over hydraulic type and shall be provided on all wheels. The air compressor shall be designed to include an unloader head to prevent a buildup of excessive air pressure in the system when the compressor is not in operation. It shall be engine driven having a capacity sufficient for the intended service but of not less than 12 cubic feet per minute capacity. The compressor intake shall be provided with a suitable air cleaner. An adequate air storage reservoir shall be furnished and provided with a low pressure indicator of the buzzer type. The system shall be of the quick pressure buildup type with the air compressor connected to a small reservoir having a minimum 800 cubic inch capacity which is pressure relieved into the larger reservoir(s), when the minimum pressure is reached for maximum operation of the brake system. The total cubic storage capacity of the reservoir shall be not less than 13 times the volume of the brake actuating chambers.
- 2 A parking brake operated by a control readily accessible to the driver shall be provided.
- (f) The vehicle chassis shall be equipped with a standard hydraulic power assist steering mechanism operable from the driver's seat. Means shall be provided for rapid and easy adjustment of lost motion in the steering gear. The steering mechanism shall be capable of easily controlling the direction of the fully loaded truck under all operating conditions.
- (g) Vehicles shall be equipped with manufacturer's current suspension system having a rated capacity at least equal to the imposed load, measured at the ground, with 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.
- (h) The wheels shall be either disc or spoke type as currently furnished by the vehicle manufacturer.
- (i) Rim contours and size shall conform to the current practices of the Tire and Rim Association, Inc., as recommended for use in the design of new vehicles.

- (j) Each tire, at 45 PSI inflation pressure, shall have a rated carrying capacity at least equal to the gross load normally imposed on it by the evenly and fully loaded vehicle. The load rating capacity of the tires shall conform to the tables EM-3D and WEM-1 of the Tire and Rim Association, Inc., yearbook. Use of single tires is normally recommended; however, the use of dual tires is not precluded. Tires, including spare, shall be interchangeable and of the same size. An aggressive tire tread of the military or lug type with center rib is recommended for general service. Tires and tubes shall be first line commercial grade requirements.
 - (k) A spare wheel or rim with tire and tube included shall be provided; however, provisions shall not be made to mount the wheel or rim on the vehicle.
- (5) 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, power plant, pump, filled water tank, and all other equipment under operating conditions specified herein. No alterations shall be made to the frame which will reduce its designated strength. If frameless integral body construction is used, the manufacturer shall certify that the design meets the above requirements. Two towing hooks or eyes shall be attached directly to the chassis frame at the front and one or two on the rear of the vehicle.
- (6) Cab. An all metal or fiberglass constructed cab of the forward design shall be furnished. The roof and floor of the cab shall be insulated. The engine and driver's compartment shall be separated by insulation. The cab roof around turret(s) and all working areas and steps on cab and body are to be four-way safety tread plate pattern. The cab roof is to be provided with suitable safety railings and with gutters to drain nozzle drippings.
- (a) A cab heater and windshield defroster shall be provided which will be capable of maintaining a cab temperature of 50° at ambient temperatures of -20°F.
 - (b) Seating shall be provided for at least three men including the driver. The driver's seat shall have a contour back and be easily adjustable up and down, fore and aft a minimum of 3 inches. Seats shall be fully upholstered with a good quality plastic type upholstery over foam rubber cushions.

7/24/64

- (c) Three approved, properly installed, seat belts one for the driver and each passenger, shall be provided.
 - (d) A windshield washer of the 2-gallon size shall be provided and properly installed.
 - (e) Two sunvisors shall be provided and installed.
 - (f) The windshield shall be equipped with dual, two speed electric or air wipers which shall sweep a clear view for both the driver and the passengers.
 - (g) Two outside rear view mirrors, of the extension arm westcoast type having an area of not less than 60 square inches, shall be provided; one mounted on either side of the cab.
 - (h) All glass shall be of the laminated safety plate type, free of all imperfections which would affect visibility.
 - (i) The cab instrument panel or board shall include, but not be limited to, panel lights, speedometer with recording odometer, engine heat indicator, carburetor choke when required, ammeter, lighting switches, fuel, oil pressure, and air pressure gauges, ignition switch, and a tachometer having engine hour meter or engine revolution counter.
- (7) Electrical System. The vehicle shall be provided with a complete good commercial quality electrical starting, lighting, and ignition system. The ignition switch shall be keyless or the ignition key shall be permanently secured in the ignition switch. The ignition system shall have a 12 volt potential with not less than a 100 ampere alternator. All control switches shall be within easy and convenient reach of the operator. Two 12-volt or four 6-volt storage batteries with a capacity of not less than 150 amperes each at a 20 hour rate shall be furnished. Batteries shall carry a 24 month guarantee. The batteries shall be wired to permit their selective use or to permit starting on both batteries in accordance with the criteria contained in paragraph 2230, National Fire Protection Association Publication No. 19. A waterproof polarized male plug for charging connection to battery shall be provided on the rear of the truck complete with matching female receptacle. Lighting equipment and permanently installed safety lighting reflector devices shall be manufacturer's current standard provided the equipment shall meet the ICC Motor Carrier Safety Regulations and local State Highway requirements.

- (8) Lighting System. Lighting system shall include the following:
- (a) Two or more sealed-beam headlights with upper and lower driving beams and a foot controlled switch for beam selection.
 - (b) Dual taillights and dual stoplights.
 - (c) Turn signals, front and rear, conforming to Society of Automotive Engineers (SAE) Turn Signal Units, Type 1, Class A, shall have self-cancelling control with a visual and audible indicator and switch to flash all lights.
 - (d) Six-inch chrome plated spotlight on both left and right sides of the windshield, hand adjustable type, with controls for beam adjustment inside the vehicle cab.
 - (e) Two swivel type chrome plated, 6-inch sealed beam pickup lights with waterproof switches. Lights to be mounted at rear.
 - (f) Reflectors and marker and clearance lights shall be installed in conformance to ICC Motor Carrier Safety Regulations. Clearance lights shall be equipped with red lenses and shall be of the commercial fire truck type.
 - (g) Engine compartment lights, two or more arranged to adequately illuminate both sides of the engine, with switches located in the engine compartment.
 - (h) Pump compartment light or lights, with shields to prevent glare. Control switches to be mounted on pump panel.
 - (i) At least one 8-inch backup light installed at the rear of the body. Light shall automatically light up when transmission is shifted into reverse.
 - (j) A rotating flashing red beacon shall be suitably installed away from operating components. A control switch shall be installed on the instrument panel for control of the beacon.
- (9) Siren. Siren shall be installed and foot operated and located for use by the truck driver and crewman.
- (10) Body. Body to be fabricated from aluminum or steel, designed to provide the lightest weight consistent with the strength necessary for operation over rough terrain. Body to fully enclose pumping unit. Self-tapping bolts shall not be used in construction of the apparatus body.

7/24/64

- (11) Steps and Running Boards. Steps and running boards located on each side, at the cab, and at the rear shall be provided as required for ascending or descending from the vehicle. All steps and running boards shall be constructed with a four-way safety tread design.
- (12) Walkway. Walkway on top and running full length of body shall be of nonskid safety plate.
- (13) Handrails. Handrails or guard rails of suitable metal tubing not less than $1\frac{1}{2}$ inches in diameter shall be provided and rigidly attached to all steps, walkways, and stations as required. Handrails or guard rails of a material other than stainless steel shall be chrome plated.
- (14) Compartments. The body shall have built-in compartments as described below:
 - (a) Construction shall be dust proof and rain proof. The doors shall be hinged with continuous piano type hinges having brass pins. Chrome plated snap type locks with semiflush handles shall be furnished.
 - (b) An equipment compartment on one side of the apparatus in the vehicle skirting.
 - (c) Two hose reel compartments, one on each side in the vehicle skirting.
 - (d) A two-way radio compartment.
- (15) Fire Fighting Equipment.
 - (a) Pump Engine. An independent pump engine of not less than 6 cylinders, having sufficient power to meet the pump performance requirements as listed in paragraph 3e(15)(b) without the engine exceeding the no load governed speed at the peak of a certified gross BHP curve, shall be provided. The engine shall have a 12-volt ignition system, oil bath air cleaner, full-flow or by-pass type replaceable element oil filter, full pressure lubrication system and overspeed governing device to prevent damage to engine if under power when tank is exhausted. The engine shall be provided with either a supplementary heat exchange cooling system in addition to the standard radiation, which will circulate cold water from the tank through the heat exchanger and back to tank; or with a shrouded radiator of adequate capacity to cool the engine when operated continuously under full load up to 100°F ambient temperature.

(b) Pump. The pump shall be of centrifugal type designed to provide both the capacity and high pressure discharge required. When operating from the water tank as an aircraft fire fighting unit the pump shall be capable of discharging 800 GPM of a foam solution at 250 PSI minimum net pressure.

(c) Pump Connections.

- 1 Suction. At least one outside 4½-inch suction inlet with a strainer, cap, and suction connection to the water tank shall be provided.
- 2 Discharge. The pump shall be provided with a minimum of two discharge gates with 2½-inch National Standard Fire Hose Thread (NSFHT) adapters and caps. The discharge to the turret shall be controlled from both inside and on the roof of the cab. The discharge to hose reels shall be controlled at the reels. The discharge to the groundsweep nozzles and to the underbody nozzles shall be controlled within the cab; these controls shall be accessible both to the driver and a crewman when seated in their respective seats in the cab.

(d) Pump and Engine Controls.

1 Control Panel. The main pump and engine control panel shall be located on the forward portion of the body at the suction intake, immediately to the rear of the cab. This panel shall include the discharge gate controls, governor, primer, cooler, water and foam tank valve controls, churn valve control and the following pumping unit instruments and controls:

Ignition switch	Tachometer
Starter button	Coolant temperature gauge
Pump pressure gauge	Oil Pressure gauge
Pump compound gauge	Recording engine hourmeter
Throttle (Vernier Style)	Foam tank level gauge
Choke (if manual)	Turret hydraulic pressure gauge
	Water tank level gauge

- 2 Pressure Regulator. The automatic pressure regulator shall be adjustable to maintain working pressures from 75 to 300 PSI with an adjustment control located on the control panel.
- 3 Priming Device. The priming device to exhaust air from the pumps and the suction hose for operating at draft will be of the positive displacement type.

7/24/64

- 4 Remote Controls. Remote controls, in addition to those included in the control panel specified in paragraph 3e(15)(d)1, shall be located in the vehicle cab. They are to be so situated that all manually operated switches and control levers can be easily reached either from the driver's or crewman's seat. They are to include:

Ignition switch with pilot light (preferably green)	Foam tank level gauge
Starter button	Turret hydraulic pressure gauge
Tachometer	Water tank level gauge
Throttle (Vernier type)	Pump pressure gauge
Choke (if manual)	Ground sweep control
	Under truck nozzle control
	Foam tank and churn valve controls
	Water tank valve control

- (16) Water Tank. The water tank shall have a 1500-gallon capacity. The tank shall be of a welded construction, using metal best suited to provide minimum weight to gallonage ratio and baffled so that capacity of each compartment shall not exceed 100 gallons. If steel is used the interior surface will be treated with an anticorrosive coating. If any aluminum alloy is used, it shall be the Aluminum Association No. 5052-H34 or equal.
- (a) The construction and connections shall be made to prevent the possibility of chemical corrosion of dissimilar metals.
- (b) The tank shall be equipped with removal manhole covers or a removable top to permit access within each baffled compartment of the tank. It shall also have a deep sump with an antiscirl baffle and drain valve, and two filler openings with gasketed caps. Filler opening diameters to be not less than 4 inches.
- (c) The tank outlet and the suction piping to the pump shall be 5-inch diameter to allow a flow of 800 GPM to the pump. The control valve installed in the line between tank and pump will be of the quick acting quarter turn type capable of operation from within the cab.
- (d) The tank shall be mounted in a manner which limits transfer of the torsional strains of off-runway driving from the chassis frame to the tank. The tank shall be separate and distinct from the body and easily removable as a unit.

- (17) Tank Filler Connection. A 3-inch tank filler connection shall be provided at the rear of the apparatus in a position where it can be reached from the ground. It shall include an automatic valve means for shutting off the flow of water when the tank is 75 to 80 per cent full and for reopening the valve as the tank empties. The connection shall be so constructed that water will not be lost from the tank when connection or disconnection is made. It shall terminate in a 2½-inch NST swivel female hose connection. All water fill openings will be provided with strainers.
- (18) Foam Proportioning Systems. The following types of foam proportioning systems are considered satisfactory. The purchaser shall select the type system desired.
- (a) A pump Discharge Side Balanced Pressure Proportioning System to automatically control the ratio of foam concentrate to the quantity of water being discharged. This system will consist of:
- 1 A pump to deliver the foam concentrate at a slightly higher pressure than that of the water on the discharge side of the pump.
 - 2 A pressure control valve to automatically by-pass sufficient foam concentrate back to the storage tank to produce and maintain a foam concentrate pressure exactly equal to the water pump discharge pressure.
 - 3 A calibrated metering valve in the foam concentrate line which can be set to maintain any percentage from 0 to 10 per cent.
 - 4 One or more ratio flow or proportioning controllers, located in the supply to booster lines and turret(s) to insure good mixing of foam concentrate and water, to obtain accurate proportioning.
- (b) A Balanced Pressure Suction Side System to automatically control the ratio of foam concentrate to the quantity of water being fed to the pump. This system shall include a tank, described in 1 and 2 below:
- 1 A bladder type foam concentrate tank(s), a metering (percentage selector) valve and an orifice plate in the pump suction line.
 - 2 A rigid foam concentrate tank and a pressure control valve.

- 3 A closed system heat exchanger and churn line to prevent overheating of water in pump when pump is operating at zero discharge. This system may be automatic or cab controlled.

(19) Foam Concentrate Storage.

- (a) A foam concentrate tank of 300-gallon capacity shall be provided for the Pump Discharge Side Balanced Pressure Proportioning System. It shall be securely mounted and constructed of molded fiberglass or mild steel. Steel tanks shall be sand blasted and lined with not less than 30 mils cohesively applied neoprene tank lining or similar noncorrosive material. The foam tank shall be equipped with a readily accessible 3/4-inch or larger drain, an air tight filler cap, and a pressure vacuum vent valve. Foam filler pipe shall extend to within 1 inch of tank bottom and discharge opening cut at a 45° angle.
- (b) When bladder type foam concentrate tanks are used with a Balanced Pressure Suction Side System, they will be mounted within the water tank and of 300-gallon total capacity. Tank outlets will be manifolded to permit continuous flow of the foam concentrate.
- (c) When a rigid foam concentrate tank is to be used with the Balanced Pressure Suction Side System, together with a pressure control valve, the tank shall be of 300-gallon capacity, constructed as described in subparagraph 3e(19) (a) and securely mounted on the upper surface of the water tank.
- (d) A reinforced fiberglass or mild steel fill pan equipped with 1/2-inch mesh steel screen and 3 stainless steel can openers to permit emptying three 5-gallon foam concentrate cans simultaneously will be provided. This fill pan will be connected to the foam storage tank(s) with a 2-inch pipe for filling the storage tank(s). The storage tank(s) will be equipped with a suitable vent to expedite filling.
- (e) Provisions shall be made for flushing all of the foam system piping with clear water from the pump discharge.

- (20) Turret. There shall be one hydraulically controlled double barrel turret designed to discharge a total of either 600 or 800 GPM of a foam solution, water, or water fog. The turret shall be valved so that the discharge may be restricted, through the use of a single barrel, to 50 per cent of these quantities.

- (a) Necessary controls will be provided to permit the selection of the foam solution, water, or water fog from both inside the cab and on the cab roof. This turret shall be aimed by a single, direct connected control lever. This control lever shall be designed to permit manual operation in the event of hydraulic failure. The turret shall also have a complete set of controls to permit manual operation from on top the cab roof. Controls for shifting from power to manual operation shall be lever type, installed in both cab and roof control panels, and shall be so arranged that it is visually apparent whether controls are in power or manual positions.
- (b) The turret shall have a discharge pattern which is infinitely variable from a flat pattern of 25-foot width and 60-foot range, to a solid stream of foam with a minimum of 150-foot range. The resulting foam shall have a minimum expansion of 8 with a 25 per cent drainage time of at least 5 minutes. All foam patterns listed herein shall be at an operating pressure of 200 PSI.

NOTE. When specified by the purchaser one or two turrets, either manually or remotely controlled, will be considered satisfactory. Each turret, if two are specified, shall have an individual discharge capability of 400 GPM with a discharge pattern similar to that described in paragraph 3e(20)(b).

- (21) Handline Reels and Nozzles. Two manual rewind hose reels, one on each side of the truck, shall be provided. Each reel shall be located in a compartment and mounted on a vertical hinge post permitting reel to swing out at a 70° angle to truck. A lock with a quick release shall be provided for locking in either operating or bed position.
 - (a) Each reel shall have a capacity for and be equipped with a minimum of 150 feet of 1-inch 800 pound test rubber lined hose. Each reel is to be equipped with friction brakes to prevent hose from unreeling when not required.
 - (b) Each reel shall be equipped for automatic charging of the handline hose when released from the bed position. Manual pull type valves shall be located so the hose can also be changed in the bed position.
 - (c) Each hose shall be equipped with a shut off type nozzle designed for selection of discharging of foam, water, or water fog at a rate of 60 gallons per minute. Each nozzle shall have a foam discharge pattern from a flat 15-foot width and a 20-foot range to a solid stream of foam with a minimum 50-foot range. The resultant foam shall have a

7/24/64

minimum expansion of 8, with a 25 per cent drainage time of at least 5 minutes. Foam patterns shall be at a nozzle operating pressure of 100 PSI.

- (d) Hose rollers are to be provided on the front corners of the apparatus.
- (22) Under Truck Nozzles. Two or more under truck nozzles shall be provided. These nozzles shall be located so their discharge effectively blankets the ground under the full length of the truck with foam. The nozzle control shall be readily accessible from the driver's seat. Nozzles shall have a minimum range of 10 feet.
- (23) Ground Sweep Nozzles. Ground sweep nozzle(s) shall be provided capable of discharging 100 GPM in a pattern 12 feet wide with a 25-foot range. The resultant foam shall have a minimum expansion of 8 with a 25 per cent drainage time of 5 minutes. The nozzle control shall be readily accessible from the driver's seat.
- (24) Auxiliary Equipment. The following auxiliary equipment shall be provided properly mounted on truck or secured in a compartment:
- (a) Extension ladder, one 2-section, capable of being extended to 18 feet; this ladder to be of light-weight alloy 16 inches wide, 12-inch spacing between rungs and mounted in quick release brackets on side of vehicle.
 - (b) Flat step aircraft rescue ladder, 18 feet in length, 24 inches in width; this ladder to be made of light-weight alloy and with a folding guard rail and mounted in quick release brackets on the side of the vehicle.
 - (c) Two 10-foot lengths of 4 $\frac{1}{2}$ -inch hard suction hose with chrome plated couplings and 4 $\frac{1}{2}$ -inch NSFHT.
 - (d) One chrome plated suction strainer, 4 $\frac{1}{2}$ -inch barrel type, with 4 $\frac{1}{2}$ NSFHT.
 - (e) Two electric hand lanterns, 6 V battery to throw 1000-foot beam.
 - (f) Two axes, emergency cutting and prying type with forged steel head and handle. The handle to be covered with molded rubber insulation.

- (g) One suction hose coupling, double female, 4½-inch NSFHT to local hydrant threads.
 - (h) Ten, 50-foot sections of 2½-inch double jacket rubber lined hose. (1½-inch hose with nozzles and necessary fittings may be included if desired by purchaser).
 - (i) Two nozzles, 2½-inch with NSFHT. Each nozzle to include playpipe, shutoff valve, and 3 smooth bore tips (tips to be 1, 1-1/8, 1-1/4-inches).
 - (j) One adjustable hydrant wrench.
 - (k) One 2½-inch double female connection, NSFHT.
 - (l) One 2½-inch double male connection, NSFHT.
 - (m) Two 2½-inch spanner wrenches.
 - (n) Two 1-inch spanner wrenches.
- (25) Radio Interference Suppression. The vehicle shall be adequately radio interference suppressed to permit positive radio communications under normal airport operating conditions.
- (26) 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 with not less than 3 coats of red enamel. (Red No. 11136 of Federal Standards No. 595).
 - (c) The finished paint shall be free from "orange peel" (pebbly finish), runs, and other imperfections which will detract from the vehicle's appearance.
- (27) Undercoating. The vehicle shall be undercoated with a fibrous reinforced asphaltic compound of the manufacturer's standard sandless commercial material. The coating shall be 1/16 to 1/8-inch thick and applied to clean dry surfaces except engine, transmission, drive shafts, axles, brakes, and steering and suspension components.

7/24/64

- (28) Tools. Any special tools required for servicing the vehicle, the fire suppression system, and any of the auxiliary equipment shall be furnished with the vehicle.
- (29) Name and Instruction Plates. All name and instruction plates shall be metal or plastic with the information engraved, stamped, or etched thereon. If metal, they shall be made of a noncorrosive material chrome plated or nickel silvered. Plates shall be attached with screws, bolts, or rivets. All plates shall be mounted in a conspicuous place.
- (a) Plastic plates shall not be used in an exposed position where they are subject to weathering.
 - (b) Name plates shall show make, model, serial number, and such other data as to positively identify the item.
 - (c) Instruction plates shall be on each handle (exclusive of door handles), valves, or component parts which necessitate actuation or identification or important instructions to be followed in operating or servicing the vehicle or equipment. These instruction plates shall include warnings or cautions, and be so located and of sufficient size to be effective.
- (30) Lubrication and Hydraulic Fluids. 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. Prior to delivery, the vehicle shall be lubricated with lubricants suitable for use in the temperature ranges where the vehicle is to be placed in service. All hydraulic systems shall be filled to the proper operating level with the correct grade of hydraulic fluid for the same temperature range.
- (31) Technical Publications. The contractor shall furnish the following set of publications in accordance with standard commercial practices applicable to the vehicle (including body and special equipment) furnished under the contract. A set shall be composed of one copy each of:
- (a) Operator's Manual with Lubrication Charts,
 - (b) Parts Manual,
 - (c) Maintenance and Service Manual,
- (32) Quality Assurance Provisions. The contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the contractor may utilize his own or any other inspection facilities and services. Records of inspections and tests shall be maintained by the contractor. Copies of these records shall be provided the

purchaser. The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure contractor compliance with the specification requirements.

4. INSPECTION AND TEST PROCEDURES. (To be conducted at purchaser's location by the vehicle manufacturer's delivery engineer.)

a. Operational Tests. The vehicle shall be fully loaded as to its rated GVW as specified in 3(c)(3) and operated as follows:

- (1) Twenty miles over hard surfaced roads at maximum speeds not less than 40 MPH.
- (2) Ten miles over dirt surfaced roads at maximum road speeds up to 25 MPH.
- (3) Ten miles off highway at speeds up to 15 MPH with ground and grade conditions requiring all-wheel drive.
- (4) One hour at not more than 3 MPH.
- (5) Accelerate from 0 to 50 MPH in 60 seconds.

During this test the functioning of the engine, power train, hydraulic system, brakes, steering, lighting system, controls, and instruments shall be observed.

b. Pump Tests.

- (1) Pressure and Capacity. The pump shall be tested to determine conformance with 3e(15)(b) at approximately 10-foot suction lifts. 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 truck.
- (2) Foam Tests. The contractor will provide one complete change of foam concentrate which may be used in conducting the following tests:
 - (a) Tests will be conducted to determine the capability of the turret(s) and nozzle(s) to discharge foam, water, and water fog as described in paragraph 3e(20), 3e(21), 3e(22), and 3e(23).
 - (b) Foam discharge patterns and drainage characteristics will meet the criteria contained in the referenced paragraphs.

c. Gradability.

- (1) Negotiate an 8 per cent grade at a speed of not less than 20 MPH. The purchaser may elect to accept a certified performance chart from the contractor showing the vehicle performance in all gear ratios and at all engine RPM's above 1000 RPM.
- (2) The loaded vehicle shall negotiate side slopes left and right of 20 per cent grade.

d. Brake Tests.

- (1) Bring the fully loaded vehicle to 5 successive stops within 30 feet from 20 MPH, using service brake only.
- (2) Bring the fully loaded vehicle to a complete stop from 20 MPH and hold the vehicle on the maximum grades at the airport, using parking brake only.

- 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.

5. PREPARATION FOR DELIVERY.

- a. Domestic Shipment. The vehicle and its accessories, spare parts, and tools shall be packed in such a manner as to insure acceptance and 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.

6. WARRANTY. The contractor shall warrant and guarantee the vehicle and all equipment and/or appurtenances furnished, except tires and batteries, against any defects due to design, material, or workmanship, for a period of 5 years from the date of acceptance. This guarantee shall require the immediate replacement of any defective equipment, appurtenances or chassis parts, without cost to the purchaser.